Northwest Oregon

State Forests Management Plan

Revised Plan April 2010

Oregon Department of Forestry

Northwest Oregon State Forests Management Plan

January 2001 Plan
Structure Classes and Habitat Conservation Plan references revised April 2010

Oregon Department of Forestry

FINAL PLAN

"STEWARDSHIP IN FORESTRY"

List of Acronyms and Abbreviations Used

ATV	All-terrain vehicle
BAT	Best Available Technology
BLM	Bureau of Land Management
BMP	Best Management Practices
BOFL	Board of Forestry Lands
BPA	Bonneville Power Administration
CEQ	Council on Environmental Quality
CMAI	Culmination of Mean Annual Increment
CMZ	Channel migration zone
CRS	Cultural, Recreation, and Scenic Inventory System
CSC	Closed single canopy (forest stand type)
CSFL	Common School Forest Lands
CSRI	Coastal Salmon Restoration Initiative
CWA	Clean Water Act
DBH	Diameter breast height
DEQ	Oregon Department of Environmental Quality
DFC	Desired future condition
DOGAMI	Oregon Department of Geology and Mineral Industries
DSL	Oregon Division of State Lands
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FC	Federal candidate species
FE	Federal endangered species
FMP	Forest management plan
FPA	Forest Practices Act
FPFO	Forestry Program for Oregon
FT	Federal threatened species
GIS	Geographic Information System
HCP	Habitat conservation plan
IHA	Interior habitat area
IMPLAN	Impact Analysis for Planning
IP	Implementation plan
IPM	Integrated Pest Management
ISR	Independent scientific review
ITP	Incidental take permit
LWD	Large woody debris
LYR	Layered (forest stand type)
MBF	Thousand board feet
MMBF	Million board feet
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NMFS	National Marine Fisheries Service
NWOA	Northwest Oregon Area
OAR	Oregon Administrative Rules
ODA	Oregon Dept. of Agriculture
ODF	Oregon Dept. of Forestry
ODFW	Oregon Dept. of Fish and Wildlife
OFS	Older forest structure (forest stand type)
OHV	Off-highway vehicles
ONHP	Oregon Natural Heritage Program
ORS	Oregon Revised Statutes
OSCUR	State forest inventory system
PM	Particulate matter
PSD	Prevention of Significant Deterioration
REG	Regeneration (forest stand type)
RMA	Riparian management area
ROS	Recreation Opportunity Spectrum
RV	Recreational vehicle
SBM	Structure-based management
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SDI	Stand Density Index
SE	Stem exclusion (stand development process) *or* State endangered species
SHPO	State Historic Preservation Office
SI	Stand initiation (stand development process)
SIP	State Implementation Plan
SSC	State sensitive species, critical status
SSV	State sensitive species, vulnerable status
ST	State threatened species
T&E	Threatened and endangered
TMDL	Total maximum daily load
TPA	Trees per acre
TSP	Total suspended particulate
UDS	Understory (forest stand type)
UR	Understory reinitiation (stand development process)
USC	United States Code
USDA	U.S. Dept. of Agriculture
USDI	U.S. Dept. of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WRC	Oregon Water Resources Commission

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Abstract

The *Northwest Oregon State Forests Management Plan* provides management direction for all Board of Forestry Lands and Common School Forest Lands in the Northwest Oregon and Willamette Planning Regions, a total of over 615,000 acres of state forest land. This plan supersedes and replaces previous long-term management plans. It is the basis for intermediate level planning done at the district level (district implementation plans), and for annual operations plans and budgets (both biennial and annual).

This plan takes a comprehensive, multi-resource approach to forest management. It presents guiding principles, a forest vision, and resource management goals that set the direction for a new management approach. The plan describes the forest resources, explains the concepts for integrated forest management, and presents management strategies. The resource management goals and strategies are intended to achieve a proper balance between the resources and achieve the greatest permanent value through a system of integrated management.

Chapter 4 presents the resource management strategies, which are the heart of the plan. This plan is based on an approach called structure-based management. SBM is designed to produce and maintain an array of forest stand structures across the landscape in a functional arrangement that provides for the social, economic, and environmental benefits called for from these state forest lands. These include a high level of sustainable timber and revenue, diverse habitats for indigenous species, a landscape level contribution to properly functioning aquatic systems, and a forest that provides for diverse recreational opportunities.

The strategies begin with a set of integrated strategies, which include: landscape management, aquatic and riparian, and forest health strategies. There are also strategies for specific species of concern, including the northern spotted owl, marbled murrelet, and salmonids; and additional strategies for specific resources.

The planning team conducted an extensive public involvement process throughout planning. Two separate scientific reviews were also conducted.

Chapter 5 describes guidance and standards for processes and activities that will be undertaken to implement the strategies, including adaptive forest resource management.

Preface

This is a plan for special forests in northwestern Oregon and the Willamette Valley owned by the State. The plan achieves “greatest permanent value” to the citizens of the state, as defined in Oregon statute and administrative rule. Achieving “greatest permanent value” means providing a full range of social, economic, and ecological benefits, and achieving a balance between short-term and long-term economic returns.

This is a hopeful plan: It addresses people’s hopes for the future. Oregonians want their forest resources protected for future generations. At the same time, they expect a full range of economic, social, and environmental benefits today, as well as in the future. This plan achieves that balance in a public and scientifically credible way. This plan was developed with countless hours of public input, and several rigorous scientific and technical reviews. As a result, the plan is based on sound interdisciplinary science, and many people had a hand in shaping it.

This is a visionary plan: It envisions an idealized view of the future, without the constraints of the current forest condition. The forest produces sustainable and predictable forest products that generate jobs and revenues for the benefit of the state, counties, and local taxing districts. The diversity of forest structures is enhanced over time, providing for a broad range of social values important to Oregon citizens, including recreation. The diverse forest structures produced contribute to the range of fish and wildlife habitats necessary for all native species, and contribute to broad biodiversity.

This is a purposeful plan: It calls for active management across the landscape and over time to achieve its goals. It relies on integrated management of forest resources to produce a variety of values, and focuses on the compatibility of forest uses over time.

This is a flexible and adaptable plan: The plan calls for monitoring the response of the forest to strategies outlined in the plan. These responses are then evaluated against the goals of the plan, and the working hypotheses upon which the plan is built. The Board and Department of Forestry will then adapt the new information into the plan accordingly. The plan calls for major scientific, policy, and public reviews at least every ten years to provide regular periodic checkpoints to rigorously examine the scientific underpinnings, the policy environment, and the public’s view of the plan.

This is a sustainable plan: Because of the flexibility and adaptability described, this is a sustainable plan that Oregonians can embrace and support for decades. This plan will assure sustainable timber and revenue for the benefit of the Forest Trust Land Counties, and will also provide for the sustainable forest ecosystems and healthy watersheds that are important to Oregonians.

The planning document that follows is organized into five main chapters. Chapter 1 describes the state forests and planning process, and tells a little about the history of these lands to help the reader understand the forests today. Chapter 2 explains how the plan was developed using input from technical specialists and the public. This chapter contains information on forest resources, including forest products, watersheds, and wildlife. Chapter 3 describes the values, vision and goals that set the direction of the plan, and lists the working hypotheses that are the foundation for the strategic approach.

Chapter 4 is the heart of the plan, the concepts and strategies that will bring about the forest envisioned by the goals and values. Chapter 5 describes how the plan will be implemented in an adaptive management context. This chapter discusses district implementation planning, annual operations plans, asset management, monitoring and research, and continuing public involvement to shape the plan into the future.

The Department of Forestry is proud of the work and the vision that has created this new forest plan. As the plan strategies are implemented and monitored, with ongoing input from scientists and the public, thoughtful forest management will ensure predictable timber and revenues for schools and local economies, diverse habitats for wildlife and fish, and recreational opportunities. The Department encourages Oregonians to remain involved in the plan’s implementation and development into the future.

January 2001 Plan Acknowledgments

This plan has been developed through a team effort by many talented individuals from government agencies, organizations, and the general public. Through their hard work and expertise, these people have developed a plan that will guide the northwest Oregon state forests into the next century.

I extend my sincere thanks and appreciation to all who participated in the planning process. The core team, steering committee, and other resource specialists are Oregon Department of Forestry employees except where otherwise noted. Specifically I wish to thank:

Core Planning Team Members

Ross Holloway, project leader; Mike Schnee, technical project manager; Jane Hope, writing coordinator; Dave McAllister, fish and wildlife specialist (ODFW); Roy Elicker, fish and wildlife specialist; Rosemary Mannix, fish and wildlife specialist; Fred Stallard, regional coordinator Northwest Region; Jim Mair, regional coordinator Willamette Region; Logan Jones, HCP coordinator; Jenny Walsh and Jeff Brandt, monitoring and adaptive management coordinators; Cary Greenwood and Doug Decker, public involvement managers.

Steering Committee Members

Mike Bordelon (chair, 2000), Roy Woo (chair, 1999-2000) and Lee Oman (chair, 1994-1998), area directors; Ray Craig, assistant state forester; Jeff Kroft, Division of State Lands; Tim Josi, Tillamook County commissioner; Jerry Dove, Tillamook County commissioner; Dave Schmidt, Linn County commissioner; Stan Medema, Astoria district forester; Mark Labhart, Tillamook district forester; Dave Johnson, Forest Grove district forester; Mike Templeton and Bill Lafferty, West Oregon district foresters; Dan Christensen, Clackamas-Marion district forester; Darrel Spiesschaert and Rick Rogers, Western Lane district foresters.

Other Resource Specialists

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State Agency Cooperators

Ian Whitlock, Melinda Bruce, and Celeste Doyle, assistant attorneys general, Department of Justice; John Lilly, assistant director of policy and planning, Division of State Lands; Jeff Kroft, policy specialist, Division of State Lands.

Planning Forum

John Hayes, assistant professor Oregon State University; Chris Jarmer, assistant to vice president, Stimson Lumber Company; Katy Kavanagh, forestry extension agent Oregon State University; Paul Levesque, executive assistant Tillamook County; Jim McCauley, director Oregon Forest Industries Council; Greg Miller, Oregon Forest Industries Council; Jim Myron, interim conservation director Oregon Trout; Guido Rahr III, Oregon Trout; Avis Rana, woodlot owner and Sierra Club member; Doug Ray, woodlot owner and board of directors both North Coast Land Conservancy and Coast Range Association; Kathleen Williams, Oregon Trout.

Peer Reviewers

Robert Anthony, leader, Oregon Cooperative Wildlife Research Unit, Oregon State University; Andrew B. Carey, principal research biologist, Pacific Northwest Research Station, Olympia; Robert O. Curtis, principal mensurationist, Pacific Northwest Research Station, Olympia; Malcolm L. Hunter, Jr., professor, Department of Wildlife, University of Maine; Larry L. Irwin, national wildlife program manager, National Council of the Paper Industry for Air and Stream Improvement, Inc.; Bill McComb, professor, Department of Forest Science, Oregon State University; Chadwick D. Oliver, professor, College of Forest Resources, University of Washington; Thomas Spies, research forester, Pacific Northwest Research Station, Corvallis; John C. Tappeiner, National Biological Service, Corvallis.

Consultants

Val Rapp, writing consultant; John Sessions, professor of forest engineering, Oregon State University; Malcolm L. Hunter Jr., biodiversity consultant; Steven Daniels, Oregon State University, planning forum consultant.

Any attempt to acknowledge the contributions of so many people will inevitably leave someone out. I apologize to any people whose names I missed. We appreciate the contributions of everybody who participated in developing the plan.

James E. Brown
Oregon State Forester

Executive Summary

This executive summary covers key points of the *Northwest Oregon State Forests Management Plan*. References are omitted from the summary.

Chapter 1. Purpose, History, and Planning

The *Northwest Oregon State Forests Management Plan* provides management direction for all Board of Forestry Lands and Common School Forest Lands in the Northwest Oregon and Willamette Planning Regions. These two regions contain over 615,000 acres of state forest land, located in twelve northwest Oregon counties. The Board of Forestry owns 97 percent of these lands, and the State Land Board owns the other 3 percent. This plan supersedes and replaces the *Long-Range Timber Management Plan / Northwest Oregon Area Forests* (1984) and the *Long-Range Timber Management Plan / Willamette Region* (1989).

This plan takes a much more comprehensive, multi-resource approach to forest management than previous long-range plans for this region. It presents guiding principles, a forest vision, and resource management goals that set the direction for a new management approach. The plan describes each forest resource and explains the concepts for integrated forest management. Chapter 4 presents the resource management strategies, which are the heart of the plan. The resource management goals and strategies are intended to achieve a balance between the resources and achieve the greatest permanent value through a system of integrated management.

Location — Most state forest lands are in northwestern Oregon. These forests include three large blocks of land, in Tillamook, Clatsop, and Santiam State Forests. Smaller tracts of state forest land are scattered throughout the planning area. All state forest lands in the planning area total about 615,680 acres. Tillamook and Clatsop State Forests are in the northern end of the Oregon Coast Range. The city of Portland is roughly 25 miles to the southeast. Santiam State Forest is in the Cascade Range, a little more than 25 miles southeast of Salem.

Land ownership — State forests were acquired in different ways, and the two types are owned by different entities within state government. Lands owned by the Board of Forestry are known as Board of Forestry Lands (BOFL). Some state forest parcels were granted to the state by the federal government when Oregon became a state in 1859. These lands are owned by the State Land Board and are known as Common School Forest Lands (CSFL).

Each land ownership has its own set of legal and policy mandates. These mandates are discussed under the heading "Land Base and Access" in Chapter 2, and also in Appendix D. Of the total 615,680 acres in the planning area, 597,340 acres, or 97 percent, are owned by the Board of Forestry; and 18,340 acres, or 3 percent, are Common School Forest Lands owned by the State Land Board.

Origin of the state forests — The Oregon Department of Forestry was created in 1911. Its main purpose was to control forest fires, but it was also authorized to acquire forest land to manage. However, the department did not actually acquire any lands until legislative actions in 1925 and 1939 made it more feasible.

Tillamook State Forest — Much of the area that is now Tillamook State Forest was burned in a series of wildfires in the years 1933, 1939, 1945, and 1951. After the fires, many landowners allowed the forestlands to be foreclosed by the counties rather than pay taxes. Counties began to deed land in the Tillamook Burn to the Board of Forestry in 1940. Land acquisition accelerated after the Legislature authorized bonds to rehabilitate the Burn.

The Department of Forestry carried out a massive reforestation and rehabilitation project in the Tillamook Burn between the years 1948 and 1973. In June 1973, the former Tillamook Burn was dedicated as the new Tillamook State Forest. The 364,000-acre forest includes 255,000 acres from the Tillamook Burn, and other unburned forest land.

Clatsop State Forest — The Clatsop State Forest is 98 percent Board of Forestry Lands. These lands were privately owned and logged between 1910 and 1940. Clatsop and Columbia Counties foreclosed when landowners didn't pay their taxes. Eventually, the counties deeded these cutover and unmanaged forest lands to the Board of Forestry to manage as a state forest. The remaining 2 percent of the Clatsop State Forest are Common School Fund Lands.

Santiam State Forest — Much of the land now in the Santiam State Forest used to be owned by large timber companies. Some individuals and families also owned parcels of forest land. From about 1880 until 1930, most lands were logged by their owners. Forest fires burned large areas. During the Great Depression, many landowners allowed their forest lands to be foreclosed by the county in place of back taxes. Marion, Clackamas, and Linn Counties eventually deeded these lands to the Board of Forestry.

West Oregon District — During the Great Depression, most isolated farms in the West Oregon District were abandoned to Benton, Lincoln, and Polk Counties in place of back taxes. Between 1938 and 1948, most of this land was deeded to the Board of Forestry. During that same decade, several small parcels were also purchased. Currently, the West Oregon District manages approximately 38,000 acres of land. Of that total, 75 percent is Board of Forestry Lands, and 25 percent is Common School Forest Lands.

Western Lane District — In 1910, the Nelson Mountain Fire burned most areas that are now state forest lands in western Lane County. Large fires burned again in western Lane County in 1917, 1922, and 1929. With the timber gone, the Great Depression starting, and the land unsuitable for homesteading, many landowners allowed their land to revert to the county in place of back taxes. Lane County deeded these lands to the Board of Forestry in the mid-1940s. In the 1990s, two land exchanges reshaped the state forest lands in Western Lane District by exchanging one-quarter of the acres. These exchanges increased the land base by 10 percent and started to block up the state forest lands.

Management planning for state forests — Management planning for Oregon state forests involves three planning levels, and fiscal and biennial budgeting. As shown in the figure below, planning begins with broad-scale, long-range planning. Intermediate level planning is done at the district level and is documented through district implementation plans (IPs). Annual operations plans and budgets (both biennial and annual) are designed to achieve the IP objectives for shorter periods of time (1 or 2 years).

The long-range forest management plan provides overall direction for managing the state forests in the planning area. This plan is guided by legal and policy mandates and administrative rules, which are described in Chapter 1.

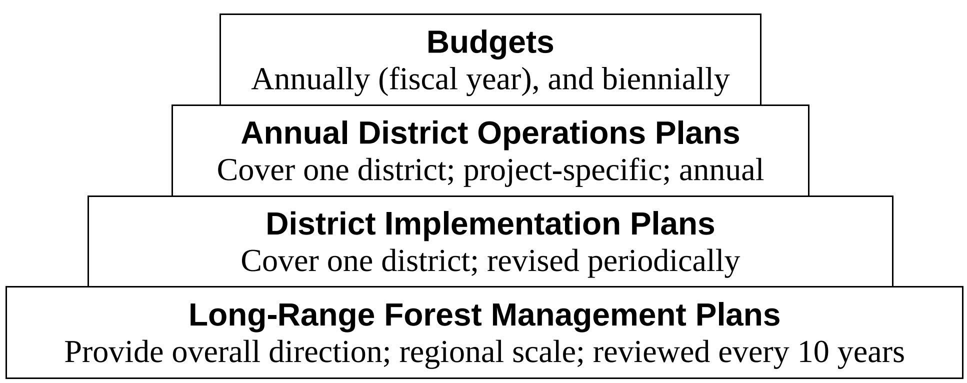


Figure S-1. Planning for Oregon State Forests

Chapter 2. Understanding the Forest: Planning and Resources

Managing a forest might be thought of as intelligent tinkering. This chapter describes the process used to develop this plan, and presents information about the forest resources.

Northwest Oregon state forests planning process — Previous long-range plans for this area were primarily timber management plans. During the late 1980s, there was growing concern about several wildlife species. The northern spotted owl was listed as a federal threatened species in 1990, and the marbled murrelet was listed in 1992, also as a federal threatened species. Recreation use was increasing. In response to these changes, in 1994 the Department of Forestry began work on a comprehensive, integrated forest management plan for the northwest Oregon state forests.

The core planning team, led by Ross Holloway, included both field and program staff from the Oregon Department of Forestry and a representative from the Oregon Department of Fish and Wildlife. The core team consulted many additional resource specialists. A steering committee provided policy direction to the core planning team, and a key link to district and program managers, the counties, and the State Land Board.

The forest management plan includes the following technical elements:

- **Guiding principles —** The overall rules, goals, and responsibilities that guide the planning process.
- **Resource descriptions —** Information about the resource's current status and future trends.
- **Resource management goals —** The goals describe broadly what we would like to achieve through the management of each resource.
- **Resource management strategies —** A set of integrated strategies, including landscape management, aquatic and riparian, and forest health strategies; strategies for specific species of concern; and additional strategies for specific resources.

Public involvement — The planning team started a comprehensive public involvement process in 1994, and continued it throughout planning. The process included public meetings, newsletters, field tours, and opportunities such as committees and public forums for interested people to get deeply involved. The eight-member planning forum represented a diverse set of public interests, and met periodically with the core team.

Two separate scientific reviews were conducted. In 1996, a limited review was done of the plan's fundamental concepts and initial set of integrated strategies. In 1998, Oregon State University coordinated a more comprehensive independent scientific review, involving twenty-six reviewers from a variety of disciplines and institutions.

The 2010 plan revision was based on the Board of Forestry's deliberation on the balance of economic, social, and environmental values provided through implementation of the Northwest Forest Management Plan (NW FMP) on the Tillamook and Clatsop State Forests. As this plan has been implemented on the three North Coast Districts (Tillamook, Forest Grove, and Astoria), the Department has refined its information and learned from its management activities. With this updated knowledge, it had become apparent the expected economic output falls short of the predicted outputs, necessitating the adaptive management discussions with the Board. The process included meetings with stakeholders and the Forest Trust Land Advisory Committee, and numerous Board of Forestry meetings where public testimony was heard. Further details on the Board of Forestry work can be found in the meeting materials prepared for each meeting.

This plan requires the approval of both the Board of Forestry and the State Land Board.

Resource descriptions — The first step in management is to know what all the cogs and wheels are. That is a huge task. Soil, water, air, lupines, bark beetles, owls, steelhead, Douglas-fir, spruce, forest fires, floods — these are all parts of the forest. The resource descriptions are a modest attempt at understanding the pieces. They are the result of our curiosity to understand the land and a beginning to intelligent tinkering.

This section of Chapter 2 provides summary information about the following resources.

- Agriculture and grazing
- Air quality
- Biodiversity and disturbance history
- Cultural resources
- Energy and mineral resources
- Fish and wildlife
- Forest health
- Geology and soils
- Land base and access
- Plants
- Recreation
- Scenic resources
- Social and economic resources
- Special forest products
- Timber
- Water resources

Information is summarized very briefly here for some key resources.

Biodiversity and disturbance history — Natural disturbance is a normal process in ecosystems. Climate cycles, forest fires, windstorms, landslides, floods, and insect and disease outbreaks have always been normal events in the dynamic landscape of the Pacific Northwest. These disturbances have caused significant changes in northwest Oregon forests by disrupting ecosystems, communities, and population structure. Native species depend on the habitats created by these disturbances and on the changing pattern of habitats across the landscape. This section describes some of the important events in the disturbance history of northwest Oregon state forests.

Several large fires burned in northwest Oregon during the last 150 years, including a series of fires that burned over 800,000 acres between the Siuslaw and Siletz Rivers in the central Oregon Coast Range between 1846 and 1853. The two largest of these fires were the Yaquina Burn and the Nestucca Burn. The Cedar Butte Fire burned 40,000 acres in 1918 and the Salmonberry Fire burned 25,000 acres in 1931. The first Tillamook Burn occurred in 1933, and reburns occurred in 1939, 1945, and 1951, burning more than 355,000 acres.

Current patterns of forest ownership are closely related to fire history. The Tillamook Burn has become the Tillamook State Forest; parts of the Nestucca Burn and Yaquina Burn have become the Siuslaw National Forest; another part of the Yaquina Burn is state forest in West Oregon District; and parts of the Nestucca Burn and Siuslaw-Siletz Burn are now Bureau of Land Management forest (Salem District).

Northwest Oregon is hit by periodic severe windstorms. The Columbus Day storm on October 12, 1962 blew down an estimated 17 billion board feet of timber in western Oregon and Washington. Other major windstorms in the last century occurred in 1880, 1951, and 1996. As is typical of most disturbances, windstorms interact with other events in many ways. After the Columbus Day storm in 1962, Douglas-fir bark beetles killed an additional 2.6 billion board feet of timber by 1965.

Western Oregon, especially the Coast Range, has frequent, intense winter rainstorms. The most severe floods, such as the flood of February 1996, are usually rain-on-snow events, when heavy rain falls on snow, swelling the streams with melted snow and rain. Heavy rains also saturate soils, particularly where other disturbances such as fires have exposed the ground. The saturated soils can give way and start landslides and debris flows. Floods are more common in the cool, wet periods of climate cycles. Over the past 150 years, major floods occurred in western Oregon in 1861, 1890, 1948, 1964, and 1996.

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

Today's forests have been greatly influenced by historic large fires, extensive logging of old growth forests, recent decades of fire suppression, and intensive forest management. Plantation forestry began as early as 1915 in the Coast Range. There are now many acres of uniform stands, mostly of the commercially valuable Douglas-fir. The forest's average age has decreased as old growth was replaced with younger trees. Many plantations were planted at a high density, which allows the efficient spread of pathogens such as root diseases and foliage diseases. Short rotations, clearcutting, and intensive site preparation (both mechanical and burning) reduced the number and size of snags and the amount of decayed wood in the forest, and also reduced the amount of hemlock dwarf mistletoe.

Fish and wildlife — Forests are more than trees. The northwest Oregon state forests provide habitats for hundreds of species of fish and wildlife. Appendix E provides lists of vertebrate species known or suspected to be found on, adjacent to, or in some cases, downstream of, state forest lands in both aquatic and terrestrial environments. In total, these lists include 270 species, of which 63 are mammals, 147 birds, 32 amphibians and reptiles, and 28 fishes.

Of the many wildlife species potentially found on the northwest Oregon state forests, three bird species are listed as threatened or endangered under either (or both) the federal and state Endangered Species Acts. Populations of some fish species are also listed.

- **Bald eagle —** State listed as threatened in Oregon. Currently, there are 13 known nesting territories on northwest Oregon state forests, and 27 additional nesting territories located within one mile of northwest Oregon state forests.
- **Marbled murrelet —** Federally listed as threatened in Oregon. The marbled murrelet is a seabird that nests in mature or old growth coniferous forests within 50 miles of the ocean. Marbled murrelets currently nest in some areas of northwest Oregon state forests in the Coast Range. Currently, 8,613 acres are in designated MMMAs (marbled murrelet management areas) in northwest Oregon state forests.
- **Spotted owl —** Federally listed as a threatened species. In 1999, there were 20 pairs and 8 resident single owls on northwest Oregon state forests, and 61 pairs and 8 resident single owls known to be adjacent to these state forests. These figures add up to a total of 97 owl sites on or adjacent to northwest Oregon state forests. In 2008, there were 119 owl sites on or adjacent to northwest Oregon state forests, including 20 pair and four resident single sites on State Forests. Increases in spotted owl numbers may be partially related to increased survey efforts, as populations have generally declined since the spotted owl was added to the federal endangered species list in the early 1990's.
- **Fish —** At least 28 fish species use habitats in the plan area for part or all of their life history, or use habitats downstream from state forests that may be influenced by state forest management. The federal government has listed some populations of coho salmon, chinook salmon, chum salmon, steelhead trout, and Oregon chub as threatened or endangered species. Not all populations of these species are listed. Only some ESUs (evolutionarily significant units) are listed or proposed.

Forest health — The most comprehensive definitions of a healthy forest are based on the premise that management objectives can be achieved only within the limits of an ecologically viable and sustainable system. The following concepts are common to most current definitions of forest health: 1) a healthy forest can vigorously renew itself across the landscape and recover from a wide range of disturbances; 2) a healthy forest provides for the human needs of values, uses, products, and services, and; 3) a healthy forest provides a diversity of stand structures that provide habitat for many native species and all essential ecosystem processes.

Key indicators of forest health include damage from insects, disease, and animals; and damage from abiotic stressors such as fire, weather extremes, and air pollutants. These disturbance agents kill trees or parts of trees, or reduce growth. Because they have a unique history, many of the northwest Oregon state forests are now at a critical point in terms of forest health. Much of the Tillamook Burn was planted or seeded with Douglas-fir from non-local seed sources, with unknown long-term consequences. The recent dramatic upswing of Swiss needle cast damage is a warning that these forests may not be as healthy as once thought.

Recreation — Statewide demand for outdoor recreation is growing faster than the population. The SCORP study (1988) found that the North Coast region and the region surrounding the Portland metropolitan area have the greatest need in the state for additional recreation facilities. These two regions need trails of all kinds (hiking, jogging, riding, biking, and off-road vehicle), and campgrounds as well.

State forest lands comprise a significant percentage of public forest lands in parts of northwest Oregon. Most of these lands lie within a two-hour drive of a major city such as Portland or Salem, and recreational use is growing rapidly. Of all the northwest Oregon state forests, the Tillamook State Forest gets the most recreational use. The Tillamook offers large areas open to OHV (off-highway vehicle) use. Motorized recreation is the most popular activity on the Tillamook, has the largest group of users, and is growing rapidly. Hiking, horse riding, and mountain biking occur in lower numbers than OHV recreation, but are also growing on the Tillamook. The Tillamook is also a destination attraction for people fishing for salmon and steelhead.

The Tillamook State Forest recreation plan was updated in 2000, and recreation plans were completed for the Clatsop and Santiam State Forests. Public participation is a key part of this planning on each state forest.

On the other northwest Oregon state forests, recreational activities include hunting, fishing, OHV use, hiking, horseback riding, camping, and visiting waterfalls. Because these other state forests have few recreational developments such as trails or campgrounds, recreational use is limited.

Social and economic resources — Northwest Oregon state forests comprise only about two percent of Oregon's forest land. However, these forests are important to local communities economically dependent on the forests' resources and important to residents who recreate in these forests. Oregon's forests are as important as ever to the economic health of the state's residents but, in addition to producing timber, they are expected to also provide recreation, clean water, and healthy populations of fish and wildlife for residents of burgeoning metropolitan areas and tourists alike.

The Lettman report (1996) estimates that each one million board feet of timber harvest in northwest Oregon state forests generates 24 jobs. The most jobs are generated in the lumber and wood products industries, and in schools and other local and state government (which receive revenues from state forest harvests). The "ripple effect" leads to additional jobs created in other employment sectors. In terms of income, the Lettman report estimates that each one million board feet of timber harvest in northwest Oregon state forests generates $1.2 million in Oregon personal income.

Revenue from state forests, almost all of which comes from timber harvest, provides large dollar sums to schools and other local governments. Total income from northwest Oregon state forests averaged $50 million per year in the 1994-1995 two-year period; in that same time period, Clatsop and Tillamook Counties received an average $30 million per year income (total for the two counties) from state forests.

Timber — Conifer forest covers most land in the northwest Oregon state forests. Hardwoods, grass, and brush cover a small percentage of the land. Before these lands became state forests, large fires and logging killed or removed most older conifer forests. In the northwest Oregon state forests today, most conifer forests are less than 85 years old. Average annual timber harvests were approximately 95 MMBF (million board feet) from 1994 to 1996.

Water resources — Water affects virtually every other resource — trees, plants, fish, wildlife, soils, recreation, and others. On the northwest Oregon state forests, water resources include surface water (streams, lakes, and wetlands), groundwater and aquifers, water supply (for instream and out-of-stream uses), riparian areas, and water quality. Roughly 400 rivers and streams flow across or near the northwest Oregon state forests. Some of the major rivers are the Nehalem, Kilchis, Wilson, Trask, Salmonberry, Klaskanine, Big Elk, and Alsea Rivers. The state forests have a few small lakes, such as Rhody Lake and the Butte Lakes on the Santiam State Forest.

Chapter 3. Guiding Principles, Vision, and Goals

Chapter 3 presents the guiding principles, forest vision, management goals, and monitoring assumptions. These values and goals set the direction for the management plan — the compass that guides our navigation.

Guiding principles — The plan's guiding principles are given in Chapter 3, along with explanations. Here, the principles are listed without the accompanying discussion.

1. The plan will recognize that the goal for management of Board of Forestry Lands is to secure the greatest permanent value to the citizens of Oregon by providing 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. The goal for management of Common School Forest Land is the maximization of income to the Common School Fund over the long term.
2. The plan will recognize that ecosystem restoration and watershed health are among the key goals that this plan must achieve, in a manner that is aligned with the policy direction for Board of Forestry and Common School Forest Lands.
3. The plan will be a comprehensive, integrated forest management plan taking into account a wide range of forest values.
4. The plan will be developed within the context of Northwest Oregon State Forests as managed forests.
5. The plan will acknowledge the protected and recognizable interest of the counties from which most of the Board of Forestry Lands were originally derived.
6. The plan will recognize that the forest is intended to be an important contributor to timber supply for present and future generations.
7. Lands will be identified and managed to provide for a sustained contribution, biological capability, and economic and social values. The plan will recognize that there will be trade-offs between revenue-producing activities and non-revenue-producing activities.
8. The plan will examine opportunities to achieve goals through cooperative efforts with other agencies, user groups, or organizations.
9. Diverse input from a variety of interested parties, including user groups, business interests, adjacent landowners, and the general public will be a high priority throughout the planning process.
10. The plan will be goal-driven.
11. The plan will view northwest Oregon state forest lands in both a local and regional context.
12. The plan will consider the overall biological diversity of state forest lands, including the variety of life and accompanying ecological process.

13. Northwest Oregon state forest lands will be managed to meet state and federal Endangered Species Acts while fulfilling the Board of Forestry's other statutory responsibilities. Management plans for threatened or endangered species will seek to complement or supplement habitat provided by other landowners to the extent that such provision of habitat is compatible with administrative rules defining greatest permanent value.
14. The plan will commit the Oregon Department of Forestry to using monitoring and research to generate and utilize new information as it becomes available, and employ an adaptive management approach to ensure that the best available knowledge is acquired and used efficiently and effectively in forest resource management programs.

Forest vision — The forest vision is a picture of northwest Oregon state forests in the future. It represents an idealized view of the future, without the constraints of the current forest condition. The strategies in Chapter 4 and the implementation plans will describe how each district can move from the current forest condition toward this future forest. The future forest will provide a diversity of forest structures, the range of fish and wildlife habitats necessary for all native species, recreation and other social values, and a sustainable and predictable level of forest products.

Resource management goals — Goals were developed for individual resources, in the context of legal and policy mandates for the management of state forests. The goals are general, non-quantifiable statements of direction. The management strategies in Chapter 4 describe how the Department of Forestry will achieve the goals.

Goals were developed for the following resources: agriculture and grazing, air quality, cultural resources, energy and minerals, fish and wildlife, forest condition (health and biodiversity), land base and access, plants, recreation and scenic resources, social and economic resources, soils, special forest products, timber, water quality, water supply, and wetlands. See Chapter 3 for the complete text of the management goals.

Working hypotheses — Our understanding about forest systems is substantial, but incomplete. We continue to learn more through monitoring and research. At the center of this plan, and fundamental to the strong adaptive management framework included in this plan, is a set of working hypotheses. These key working hypotheses are related to broader assumptions and beliefs, and are described in Chapter 3.

Chapter 4. Resource Management Concepts and Strategies

Chapter 4 presents the concepts and strategies for a broad, integrated management approach to be implemented on northwest Oregon state forests. This integrated management approach is designed to generate a range of economic, environmental, and social values from these state forests. This chapter presents an active management approach, and stresses the compatibility of uses.

Basic Concepts for Integrated Forest Management

The strategic approaches described in this chapter are based on scientific research in silviculture and wildlife biology. The basic concepts for integrated forest management focus on:

- Landscape management.
- Aquatic and riparian conservation.
- Forest health.

Landscape management concepts — This plan is based on an approach called structure-based management. SBM is designed to produce and maintain an array of forest stand structures across the landscape in a functional arrangement that provides for the social, economic, and environmental benefits called for from these state forest lands. These include a high level of sustainable timber and revenue, diverse habitats for indigenous species, a landscape level contribution to properly functioning aquatic systems, and a forest that provides for diverse recreational opportunities.

Structure-based management is designed to emulate many aspects of natural stand development patterns and to produce structural components found in natural stands, but in fewer years. By anticipating future patterns of forest development, foresters predict the potential for individual stands to produce specific characteristics such as a multi-layered canopy. Foresters can then develop appropriate silvicultural prescriptions and influence the rates of stand development and the types of structures, products, and habitats that forest stands actually produce.

Four key concepts are the foundation for landscape management under SBM.

1. **Active management for a diverse array of forest stand types.**

   A diversity of stand structures will provide for a broad range of ecosystems and biodiversity — including a wide range of wildlife habitats. The structural components associated with the range of stand structures will benefit long-term forest productivity by maintaining the key structural linkages for nutrient cycling and soil structure. The high level of biodiversity should result in a more resilient forest that will be less prone to large-scale damage from environmental or human stresses.

   The desired stand structure array presented later in this chapter emulates the diversity of stand types historically associated with conifer forests in the Coast Range and

Cascades. Studies have been done on the historical distributions of older stand types (old growth) in the Oregon Coast Range. Research suggests that the percentage of older stand types ranged from 30 to 70 percent of the landscape at any point in time. At smaller scales the variability was even greater, ranging from 15 to 85 percent of the landscape.

Once a desired future condition of stand types is achieved, individual stands on the landscape will continue to change. However, the relative abundance of the different types is expected to remain reasonably stable. At some point decades in the future, a dynamic balance will be achieved of the stand types in a desired array, and individual stands will move in and out of the various types at a relatively even rate.

2. **Landscape design to provide for a functional arrangement of the stand types in terms of habitat values.**
SBM does not consist only of achieving a specific array of stand types. Landscape planning is necessary to provide for a functional arrangement of the stands, and the forests must also have key structural components. In order to meet these needs, stands will vary in size and exist in a variety of arrangements. Landscape design includes:

- Managing biodiversity — Forest management for biodiversity is implemented at two scales, the broader landscape and the forest stand. At the landscape level, manage for a variety of stands across the landscape, emulating natural patterns. Maintain habitats of species at risk of extinction, and unique ecosystems. Provide adequate interior forest habitats. At the stand level, maintain structural features such as snags, wildlife trees, down wood, large and old trees, vertical and horizontal structure, and herb and shrub communities. Coarse-filter planning provides the foundation for protecting biodiversity. Fine filter habitat requirements are superimposed to ensure that overall biodiversity goals are reached.

- Landscape design principles — Landscape design must consider the following elements: habitat patches at different scales, the matrix or dominant landscape element, fragmentation, landscape composition and pattern, boundaries, corridors, and interior habitat areas.

- Interior habitat area principles — The plan places an initial focus on the development of mature forest patches and interior habitat areas (IHAs). All patch types are essential if habitats are to be provided for all species. However, the planning area has a limited amount of mature forest. IHAs are associated only with mature forest patches, and wildlife associated with IHAs are important in reaching wildlife diversity goals in forested landscapes. Forest stands will progress through the other patch types on their way to becoming older forests.

3. **Active management to provide for key structural components within stands and on the landscape (snags, down wood, legacy trees, etc.).**
   The key structural components within managed forests are:
   - Remnant old growth trees
   - Residual live trees
   - Snags
   - Down wood
   - Multi-layered forest canopies
   - Multiple native tree species (conifers and hardwoods)
   - Herbs and shrubs
   - Gaps

4. **Active management for social and economic benefits.**
   Structure-based management will require extensive thinning and partial cutting. These activities will produce significant volumes of lower quality timber from young stands. Final harvests of these stands will result in the harvest of high volumes of high quality wood. Maintaining a variety of stand structures provides consistent employment in silvicultural operations and in the processing of forest products. Diversified treatments can produce a range of qualities, sizes, and species of logs to match market conditions, as well as special forest products such as mushrooms, berries, or greenery.

   With the development of a variety of stand structures across the landscape, local and regional economies will benefit from opportunities for recreational hunting as well as wildlife viewing. Recreational and commercial fisheries will also be enhanced by aquatic and riparian strategies that maintain and restore properly functioning habitats. The diverse array of stand types and arrangements will provide many recreational opportunities. Activities such as hunting and off-road vehicle use will continue to be provided for at high levels, and additional opportunities will be realized for uses that are becoming increasingly popular (hiking, mountain biking, interpretive and educational programs).

Aquatic and riparian conservation concepts — Riparian and aquatic habitats will be managed to maintain or restore key functions and processes of aquatic systems. Since streams are tightly linked to the landscapes they flow through, riparian and aquatic conditions depend upon the interrelated components of the entire landscape. This plan uses a blended approach to manage riparian and aquatic habitats at both the landscape level and through site-specific prescription. Landscapes are dynamic: both structure and function change across time and space. Even with change, stability is ensured as long as ecosystem structure and function are maintained within certain bounds and all required components remain within the landscape.

The key concepts for aquatic and riparian conservation are:

- **Management for proper functioning of aquatic systems —** The overall approach in this plan is based on the following key concepts:
  - 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 greatly influenced by human activity.
- Aquatic habitats are dynamic and variable, 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 more closely emulates natural disturbance regimes.

- **The blended approach: a combination of landscape-level and site-specific strategies —** Aquatic ecosystems interact closely with the surrounding terrestrial systems. Therefore, the health of the aquatic system depends upon forest management practices that recognize, maintain, and enhance the functions and processes that compose these terrestrial-aquatic interactions. This plan uses a blended approach that applies the concepts of landscape ecology to manage riparian and aquatic habitats at both the landscape level and through site-specific prescriptions. This approach seeks to emulate natural disturbance patterns in upslope and riparian areas.

- **Use of watershed assessment and analysis to refine strategies and plan management activities during plan implementation —** Watershed analysis will characterize the riparian, aquatic, terrestrial, and cultural conditions, processes, and interactions that affect the overall watershed character, and response to management activities. Watershed analysis is a tool to guide management and policy decisions to the best possible sustainable use of a watershed's resources, and to restore and/or maintain watershed health and properly functioning aquatic systems.

Forest health concepts — The key concepts for forest health are:

- **Active management for a diverse and healthy forest ecosystem resilient to biotic and abiotic influences —** High biodiversity provides stability and resiliency to the forest, especially with regard to pests. Strategies to reduce the undesirable impacts of insects, diseases, and other agents must be based in the ecology of these ecosystems and also must be tailored to individual stands, situations, management objectives, and the landscape or regional context. Under this plan, forest health strategies are integrated with forest management.

- **Integrated pest management —** Any pest suppression activities on state forest lands must adhere to the principles of integrated pest management (IPM). IPM is a coordinated decision-making process that uses the most appropriate of all reasonably available means, tactics, or strategies, blended together to minimize the impact of forest pests in an environmentally sound manner to meet site-specific management objectives.

Resource Management Strategies

The resource management strategies are the heart of this plan. This chapter also describes adaptive management measures for the strategies, including key working hypotheses and key assumptions/questions to be addressed through monitoring. The strategies are presented under the following headings:

- ❑ Integrated forest management strategies
    - Landscape management strategies
    - Aquatic and riparian strategies
    - Forest health strategies
- ❑ Strategies for specific species of concern
- ❑ Strategies for specific resources

❑ Integrated Forest Management Strategies

The integrated strategies are the basis for managing the forest landscape as a whole. These begin with four landscape management strategies, which are the core of structure-based management. The landscape management strategies are supplemented by riparian and aquatic strategies, and forest health strategies. Together, this set of integrated strategies will apply across the landscape. They will contribute to a range of habitats that is likely to accommodate most wildlife species, and encourage broad forest biodiversity.

It will take many decades to produce the desired forest, riparian, and instream conditions. Over the short term, the integrated strategies may not provide the habitat necessary for some species of concern on state forest lands. When necessary to provide short-term habitat considerations for wildlife and fish species of concern, additional conservation tools may be used, including anchor habitats or site protection.

The integrated strategies must be viewed in an adaptive management context. As monitoring provides feedback, the plan will be fine-tuned and improved. District implementation plans (IPs) will describe the activities that will move each forest towards the vision and desired future condition.

Landscape Management Strategies

1. **Actively manage the state forest landscape and individual forest stands to produce the desired future array of stand structure types across the landscape in each Department of Forestry district and produce high levels of sustainable timber and revenue.**
   The percentages in the table below are intended to describe the direction to move the forest. They describe a long-range desired future condition, described with upper and lower limits as well as a mid-range percentage that is used for technical analysis. There is no specific timeframe for achieving the array described.

Table S-1. Stand Structure Types: Percent of the Landscape in Each District

Regeneration	15-25 percent
Closed Single Canopy	5-15 percent
Understory	30-40 percent
Layered	15-25 percent
Older Forest Structure	15-25 percent

The percentages in Table S-1 assume that such an array of stand types, properly arranged on the landscape, will contribute to the habitat needs of all native species. The Department of Forestry will conduct an ongoing review of this strategy through adaptive management. This review will evaluate the extent to which stand conditions meet the habitat needs of native species, and whether additional layered and older forest structure stands are needed to meet that goal.

2. **Develop a landscape design that arranges the forest stand types to create a variety of patch types, patch sizes, and patch placement on the state forest landscape over time.**
   Each district, through its district implementation plan, will develop a landscape design consistent with the landscape design guidelines described under this strategy in Chapter 4. The application of these principles and guidelines will be discussed in the landscape design section and desired future condition display contained within each district implementation plan. The design will describe or display how stand types will be arranged on the district landscape, in a regional context, to achieve the variety of patch types, sizes, and arrangements necessary to provide functional habitat for native species.

3. **Actively manage the state forest landscape to incorporate structural habitat components into the forest at a landscape level.**
   This strategy presents approaches for managing the habitat components listed below. These standards are meant to be general guidelines for forest managers. It is understood that individual stands may exceed or may fall below these standards, but it is expected that on a landscape-wide basis, stands will average the habitat conditions outlined by these standards. Chapter 4 gives numerical standards and/or qualitative guidelines for these components.
   - Remnant old growth trees
   - Residual live trees
   - Snags
   - Down wood
   - Multi-layered forest canopies
   - Multiple native tree species (conifers and hardwoods)
   - Herbs and shrubs
   - Gaps

4. **Develop implementation plans for each district that provide more specific information on the application of Landscape Management Strategies 1 through 3, for a ten-year period.**
   Implementation plans will be developed for each district that contain more detailed information describing how each district is moving towards achievement of the desired future condition, implementing the landscape design guidelines, and providing for the structural habitat components at the landscape level.

Aquatic and Riparian Strategies

The landscape-level component of the blended approach is comprised of the landscape management strategies just described. Over time, the application of these strategies is intended to create forest conditions on the landscape that will more closely emulate historic conditions and processes relative to aquatic systems.

The second component of this blended approach is a set of more site-specific or prescriptive strategies designed to protect key resource elements or provide for specific functional elements not necessarily addressed by the landscape strategies.

Finally, the third component is watershed assessment and analysis. Watershed analysis is critical to the evaluation and refinement of both the landscape-level and site-specific approaches. The process is designed to collect and synthesize key watershed information that will be used to further evaluate the first two components of this blended approach.

In addition to the landscape management strategies, there are seven strategies for aquatic and riparian areas.

1. **Implement watershed assessment and analysis —** Watershed assessment and analysis will be used to collect needed information at both watershed and site-specific levels, and to synthesize that information into recommendations for appropriate changes to goals and strategies. Information from watershed assessments and other inventory and assessment projects will be used in an adaptive management framework to accomplish plan objectives.

   This strategy involves development of a comprehensive watershed assessment and analysis process for state forest lands; completion of assessments and analyses on priority watersheds on state forest lands within ten years following plan adoption; cooperation with local watershed councils and adjacent landowners; and effective application of results at the appropriate planning level through the adaptive management process.

2. **Apply management standards for aquatic and riparian management areas —** Establish and maintain riparian management areas adjacent to all streams, in accordance with the standards described in Appendix J of the forest management plan (this plan), and species of concern strategies where they apply.

   Riparian management areas will contain four zones: the aquatic zone, stream bank zone, inner RMA zone, and outer RMA zone. Determination of the applicable management standards is based on a stream classification system. Streams are grouped based on the presence or absence of certain fish species (Type F or Type N), and by size (estimated annual average flow). Small non-fish-bearing streams (Type

N) are further classified according to flow pattern in normal water years, as perennial or seasonal. Some seasonal Type N streams are seasonal high energy streams or potential debris flow track reaches.

3. **Restore aquatic habitats —** Complete assessments to identify potential factors that could be contributing to undesirable aquatic habitat conditions, or that could be limiting the recovery of aquatic habitats. Road inventories and risk assessments, and aquatic habitat inventories, will contribute to this strategy.

   Identify, design, and implement projects to remedy identified problems in a timely manner. Criteria and guidelines are specified for this strategy in Chapter 4.

4. **Apply alternative vegetation treatment to achieve habitat objectives —** The term "alternative vegetation treatment" refers to the application of silvicultural tools and management techniques in riparian management areas, using standards that differ from general riparian management standards, for the purpose of changing the vegetative community to better achieve the plan's aquatic and riparian habitat objectives.

   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 not specifically described in the management standards for riparian areas. These projects 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, including depressed salmonid populations.

5. **Apply specific strategies to other aquatic habitats: wetlands, lakes, ponds, estuaries, 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. The strategies for other aquatic habitats will maintain the productivity of these habitats, maintain hydrologic functions, and contribute to conditions needed for maintaining other native wildlife species of concern. The prescriptions for other aquatic habitats are presented in Tables J-3 and J-4, in Appendix J.

6. **Slope stability management —** The Department of Forestry will use a three-level approach to manage slope stability concerns in forest planning and operations on state forest lands in the planning area. This strategy involves utilizing watershed assessment to assess landslide hazards; evaluation of alternatives to minimize, mitigate for, or avoid risk in high and moderate hazard areas; and design of operations to minimize, mitigate for, or avoid identified risks.

7. **Forest road management —** The road system will be managed to keep as much forest land in a natural, productive condition as possible; prevent water quality problems and associated impacts on aquatic resources; minimize disruption of natural

drainage patterns; provide for adequate fish passage where roads cross fish-bearing streams; and minimize exacerbation of natural mass-wasting processes.

This strategy will be accomplished by completion of a comprehensive inventory of existing roads on state forest lands; development and updating of district implementation plans and transportation planning; forest road design, construction, improvement and maintenance in accordance with processes and standards in the *Forest Roads Manual*; and identifying and prioritizing roads for closure and/or abandonment.

Forest Health Strategies

There are seven forest health strategies. The components of these strategies and guidelines are given in Chapter 4.

1. **Actively manage the forest to maintain or improve forest health.**

2. **Detect and monitor pest populations, damage levels, and trends.**

3. **Use the Integrated Pest Management (IPM) process to implement suppression or prevention actions when pest populations or damage exceed acceptable levels.**

4. **Assess and manage forest genetic resources.**

5. **Implement the State Forest Program's Swiss Needle Cast Strategic Plan (Oregon Department of Forestry 2000).**

6. **Participate in research and cooperative programs that align with our management objectives, to improve our knowledge and actively enhance forest health and biodiversity.**

7. **Cooperate with other agencies and associations to prevent the introduction of non-native pests.**

❑ Strategies for Specific Species of Concern

The integrated management strategies described in this chapter are intended over time to result in habitat conditions on the landscape and in aquatic and riparian areas that will provide functional habitat conditions for native species. As described, these more diverse and potentially functional habitats will take many decades to create. While moving the landscape toward a more diverse habitat condition, there are expected to be individual species, referred to as "species of concern," or habitats that require special consideration. Additional conservation tools will be implemented where determined necessary for species of concern, including the use of anchor habitats and site protection. Species of concern are fish and wildlife species that have been identified as being at risk due to declining populations or other factors (e.g., having a limited range).

The strategy is to develop or maintain habitat areas across the landscape for species of concern that can be readily colonized as species abundance increases or distribution expands. Anchor habitat areas are intended to provide locales where populations will receive a higher level of protection in the short-term until additional suitable habitat is created across the landscape. Anchor habitat areas are not intended to be permanent reserves; however, they will be maintained until it can be demonstrated through adaptive management that the species concerned is colonizing new areas of habitat and persisting in those areas. In addition to anchor habitats, some species of concern will be protected through site-specific management approaches. Species receiving site-specific protection will be those with habitat needs that otherwise might not be met with the provisions of this management plan, or with the anchor habitat approach. Site-specific management approaches will address both habitat protection and protection from disturbance, if applicable.

❑ Strategies for Specific Resources

Chapter 4 also includes strategies for specific resources, listed below.

- Agricultural and grazing resources
- Air quality
- Cultural resources
- Energy and minerals
- Land base and access
- Plants
- Recreation
- Scenic resources
- Soils
- Special forest products

Chapter 5. Implementation

Chapter 5 describes guidance and standards for processes and activities that will be undertaken to implement the strategies.

Implementation guidelines — This section describes who is responsible for implementing the plan, and how implementation will be carried out. It discusses responsibilities, plan scope, plan duration, implementation levels based on funding, implementation plans, annual operations plans, and the team concept in implementation.

Asset management — Assets are defined as the tangible resources and infrastructure on state forest lands. Values have not been updated since January 2001.

- The estimated total bare land value of the northwest Oregon state forests is currently $235 million.
- The total value of standing timber on the northwest Oregon state forests is currently estimated at over $5 billion.
- Populations of deer, elk, and bear support a recreational hunting industry. Populations of trout, salmon, and steelhead support a large recreational fishing industry. Both hunting and fishing have significant local and regional economic benefits.
- The northwest Oregon state forests support many recreational activities, including off-highway vehicle (OHV) use, camping, horseback riding, mountain biking, and hiking. These activities generate significant revenue for local and regional businesses. Investments in infrastructure such as interpretive centers, campgrounds, trails, and other facilities, add to the forest's net asset value.
- The streams and rivers that flow from the northwest Oregon state forests are water sources for municipal water systems, domestic water systems, agricultural uses, and fish hatcheries. In addition, these waterways support fish and recreation.
- Currently, there are approximately 3,290 miles of active forest roads on the northwest Oregon state forests. These roads and their related infrastructure such as bridges have an estimated value of $209 million.

In addition to generating annual revenues, this forest management plan is expected to increase the asset value of the land and timber. Based on the analysis conducted by Oregon State University, it is estimated that standing timber inventory will increase from approximately 17.4 billion board feet today, to 28.4 billion board feet when the desired future condition is achieved, a 63 percent increase. Values are also expected to increase for the bare land, facilities, and infrastructure.

The value of these state forests is also expected to increase, in terms of their increasing ability to provide diverse wildlife habitats, properly functioning aquatic systems, high water quality, and outdoor recreation.

Adaptive forest resource management — Adaptive management is an approach to resource assessment and management that explicitly acknowledges uncertainty about the outcomes of management policies, and deals with this uncertainty by treating management activities as opportunities for learning how to manage better. This section describes the concepts, process, and strategies of adaptive management, the importance of research and monitoring for obtaining information necessary for decision-making, the role of stakeholders in adaptive management, and the process for dealing with changes in policies and practices when needed.

Adaptive management concepts — In state forest management, adaptive management is defined as a scientifically based, systematically structured approach that tests and monitors management plan assumptions, predictions, and actions, and then uses the resulting information to improve management plans or practices. Through the application of adaptive management techniques, the Department of Forestry will continually improve management policies and practices by learning from the outcomes of operational programs. Adaptive management requires managers and decision-makers who are willing to learn by doing, and who acknowledge that making mistakes is part of learning.

Adaptive management will include public participation, in order to identify and incorporate public concerns and values into the process.

The key concepts for adaptive management are:

- Adaptive management is a systematic, rigorous approach for learning from our actions, improving management, and accommodating change.
- Adaptive management is not a replacement for decision making at any level, but a system for making better decisions.
- Successful adaptive management requires a well-designed process, including a strong monitoring program. There are six steps in adaptive management.
  - — Problem assessment.
  - — Design experiments and related monitoring plans.
  - — Implement experiments and monitoring as designed.
  - — Monitor over an extended period of time.
  - — Evaluate.
  - — Verify or update the hypotheses used, and adjust management as necessary.
- Adaptive management requires a well-defined framework for effecting change.

❑ Strategies for Implementing Adaptive Management

The following actions will be taken. Chapter 5 provides details.

1. I**mplement an adaptive management process and framework that provides for change at the appropriate planning level and in a timely manner.**
2. **Develop and implement a monitoring program designed to evaluate the working hypotheses over time. Review and update a monitoring implementation plan at least every ten years.**

Monitoring is a key element in this plan. Information from monitoring and research will be used to assess resource conditions, ecological and cultural trends, success in carrying out the strategies, the effects of the strategies on resources, and the validity of the working hypotheses.

At first, the Department of Forestry will emphasize implementation and effectiveness monitoring — are we doing what we said we would do, and is it working? Over time, the department will also do validation monitoring — are the underlying assumptions of the management strategies correct?

3. **Conduct a comprehensive review of the goals and strategies of this FMP every ten years following adoption.**

4. **Conduct a comprehensive review of the landscape management strategies, when 30% in aggregate of LYR and OFS stand types is achieved on lands in the planning area.**

   This review will evaluate the extent to which the array of stand conditions at that point in time meets the habitat needs of native species, and whether additional layered and older forest structure stands are required to meet that goal.

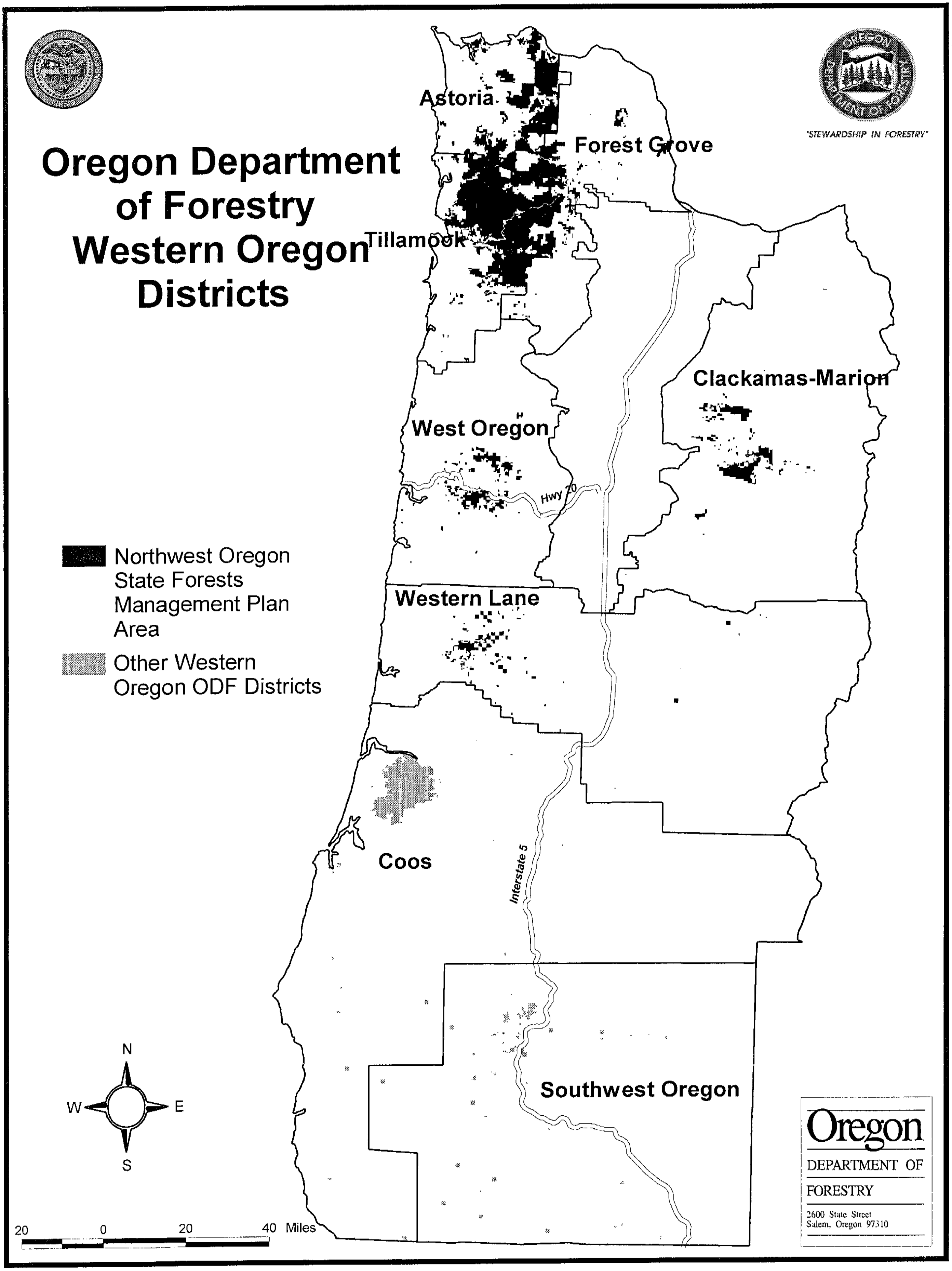
Public involvement in implementation — The Oregon Department of Forestry is committed to public participation in land management decisions. The public involvement program should be appropriate for the scale and complexity of the project. Chapter 5 describes details of public involvement in district implementation plans and annual operations plans.

Appendices

The plan includes the following appendices.

A. Glossary
B. References
C. Concepts for the Integrated Strategies
D. Legal and Policy Mandates
E. Wildlife: Species Lists, Status, and Habitat
F. Public Involvement
G. State Lands Research Policy
H. History of the Northwest Oregon State Forests
I. Decadal Analysis of Alternatives
J. Management Standards for Aquatic and Riparian Areas

Map Section


Oregon Department of Forestry Western Oregon Districts
"STEWARDSHIP IN FORESTRY"
Astoria
Forest Grove
Tillamook
Clackamas-Marion
West Oregon
Hwy 20
Western Lane
Coos
Interstate 5
Southwest Oregon
Northwest Oregon State Forests Management Plan Area
Other Western Oregon ODF Districts
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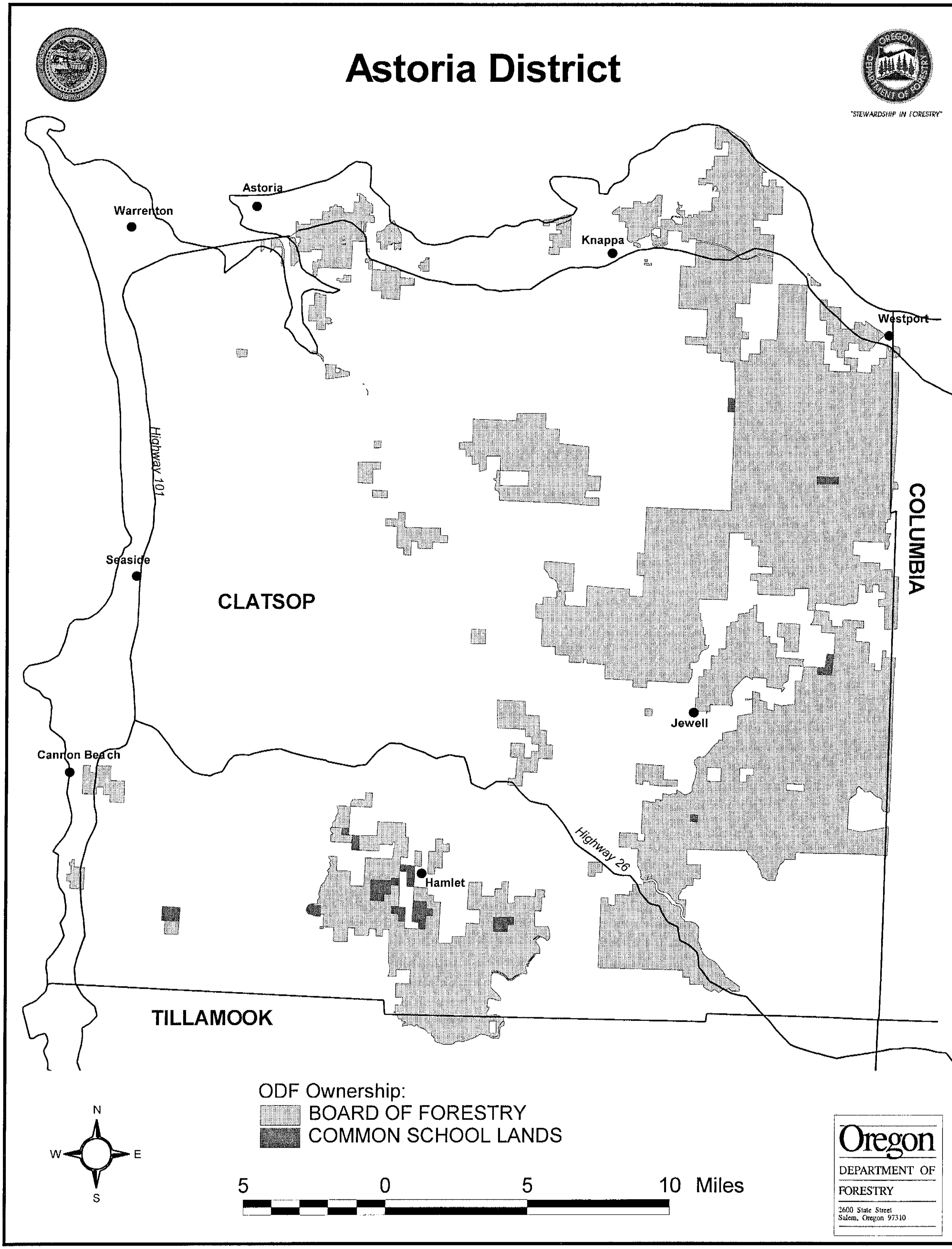
Oregon
DEPARTMENT OF FORESTRY
2600 State Street
Salem, Oregon 97310

Astoria District



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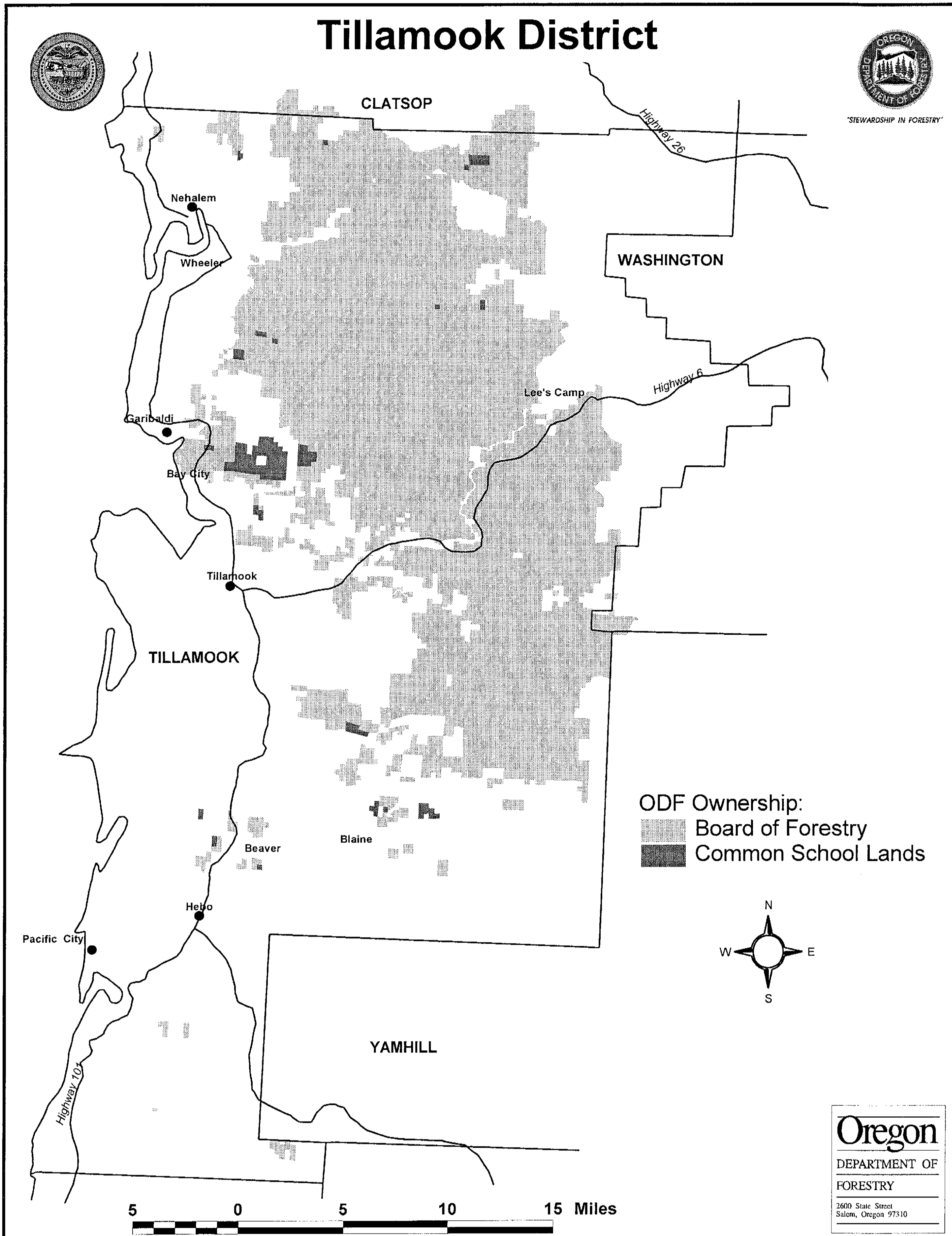

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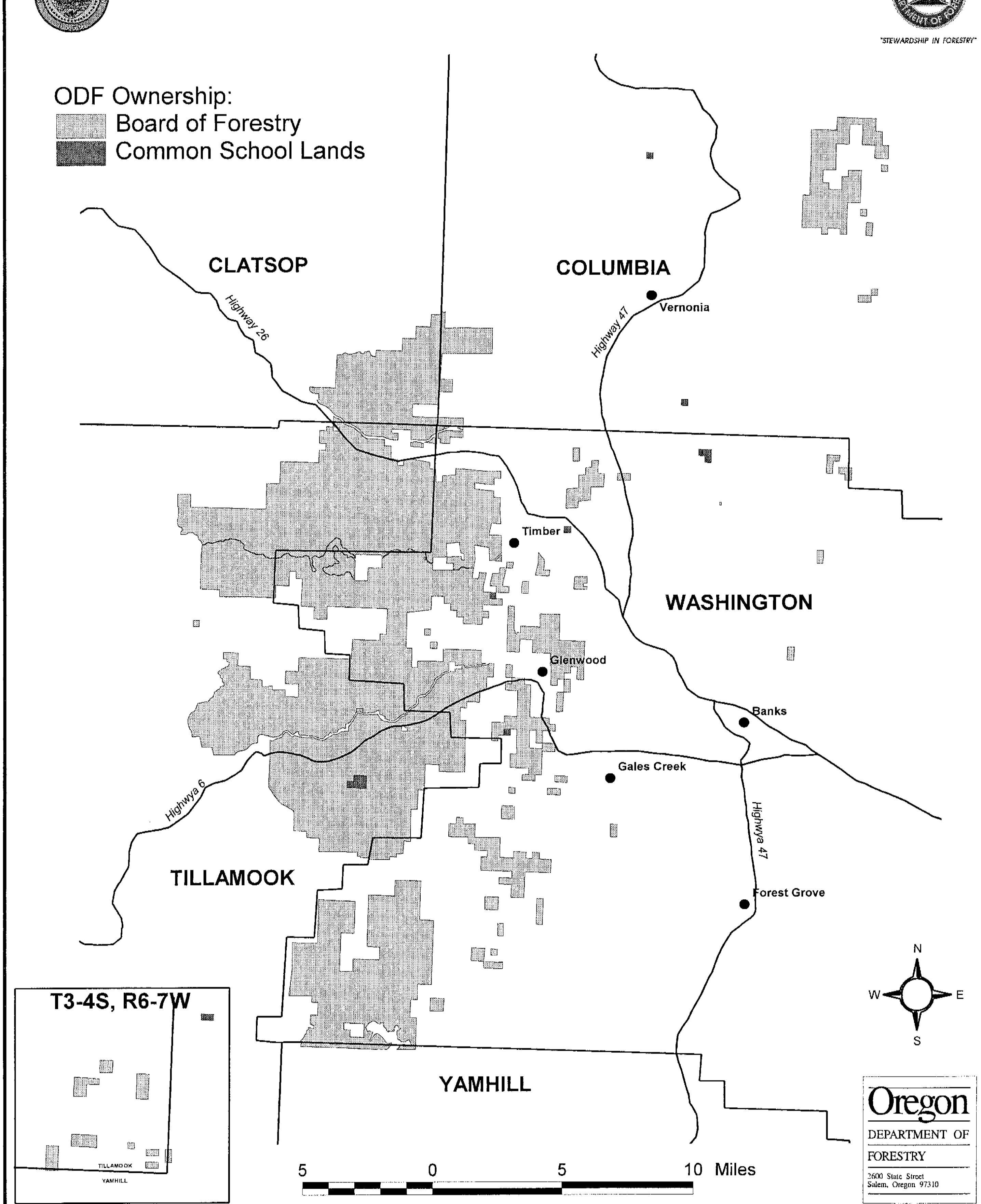

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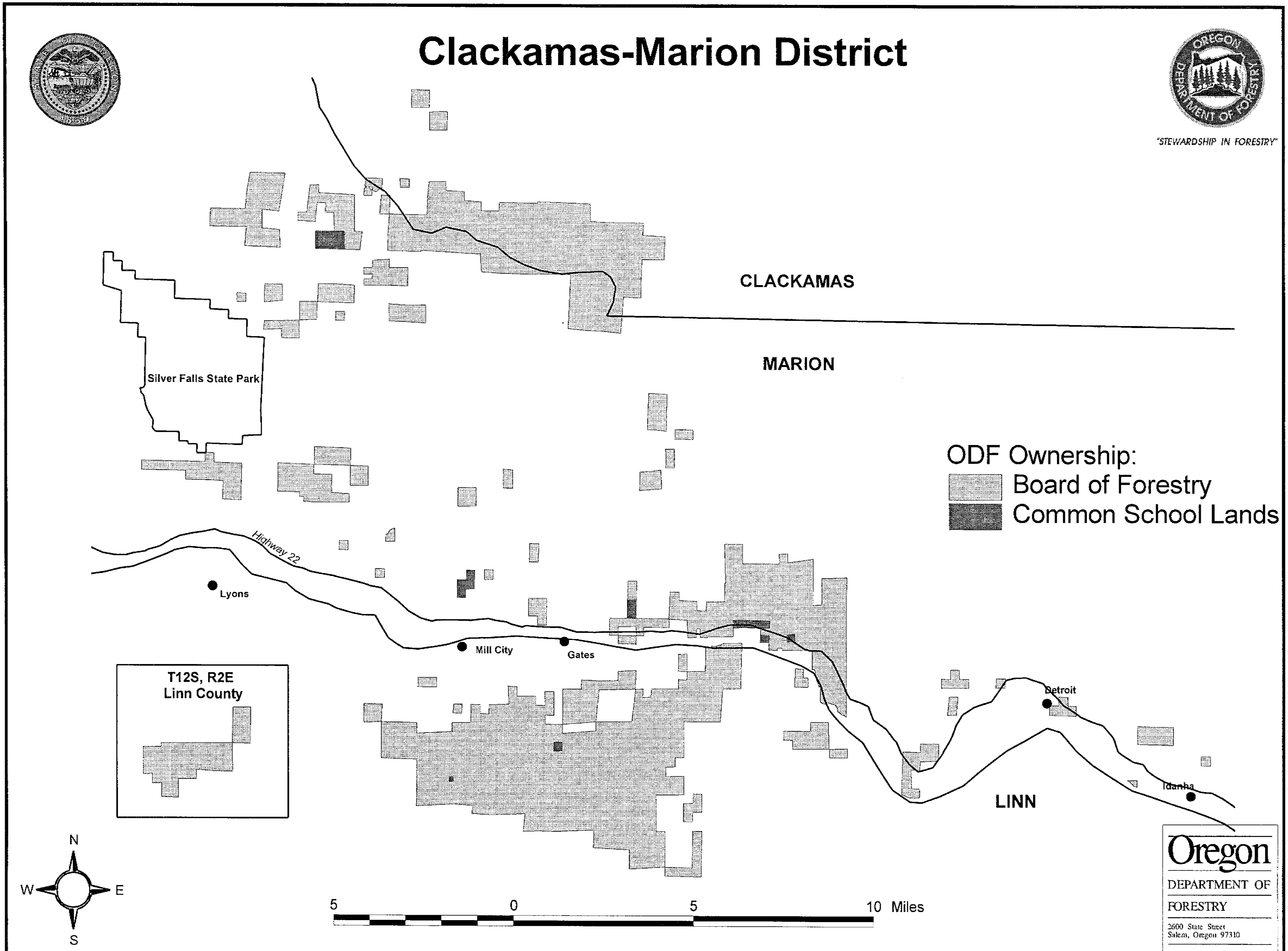
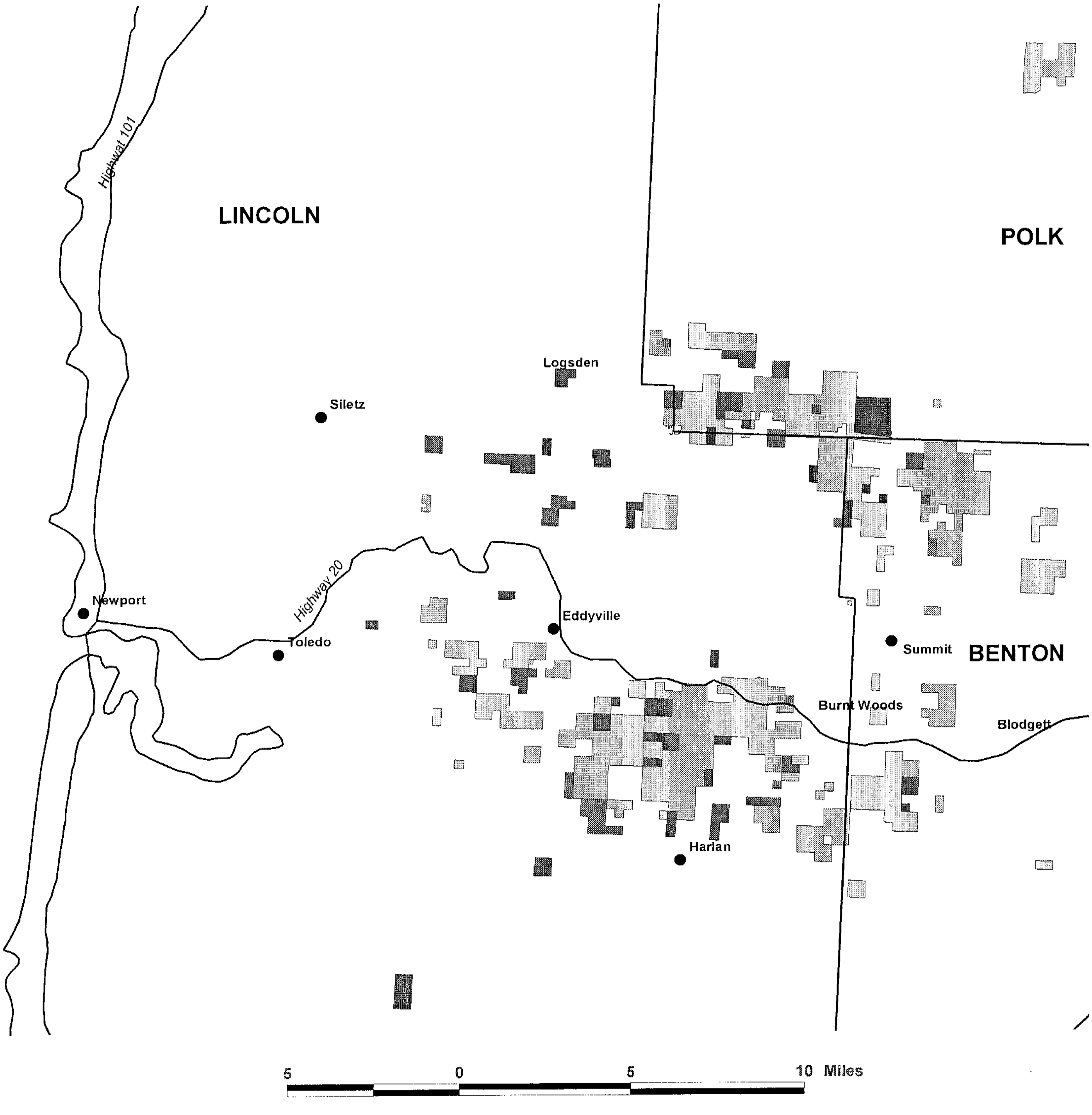


West Oregon District



"STEWARDSHIP IN FORESTRY"

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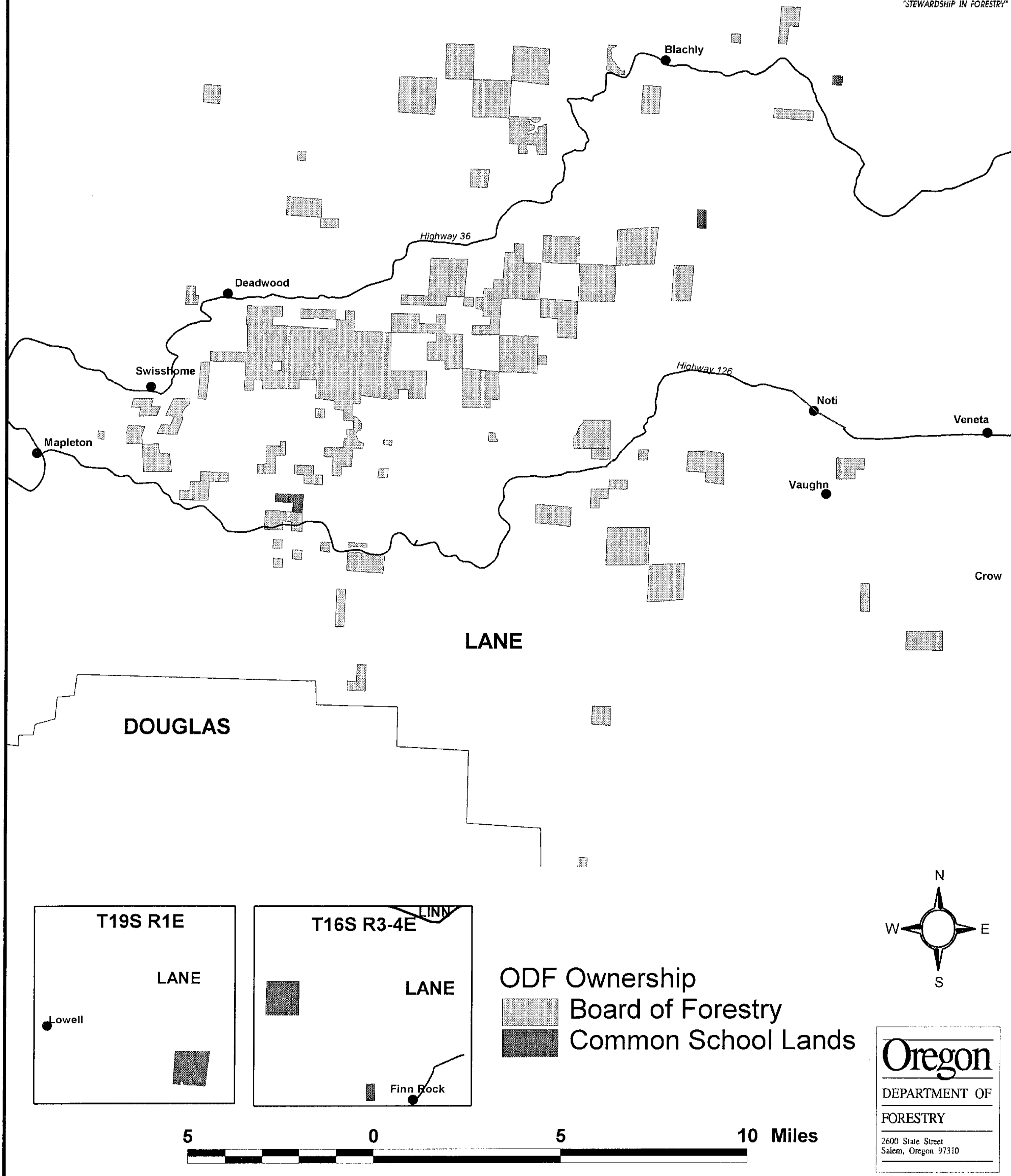
Salem, Oregon 97310

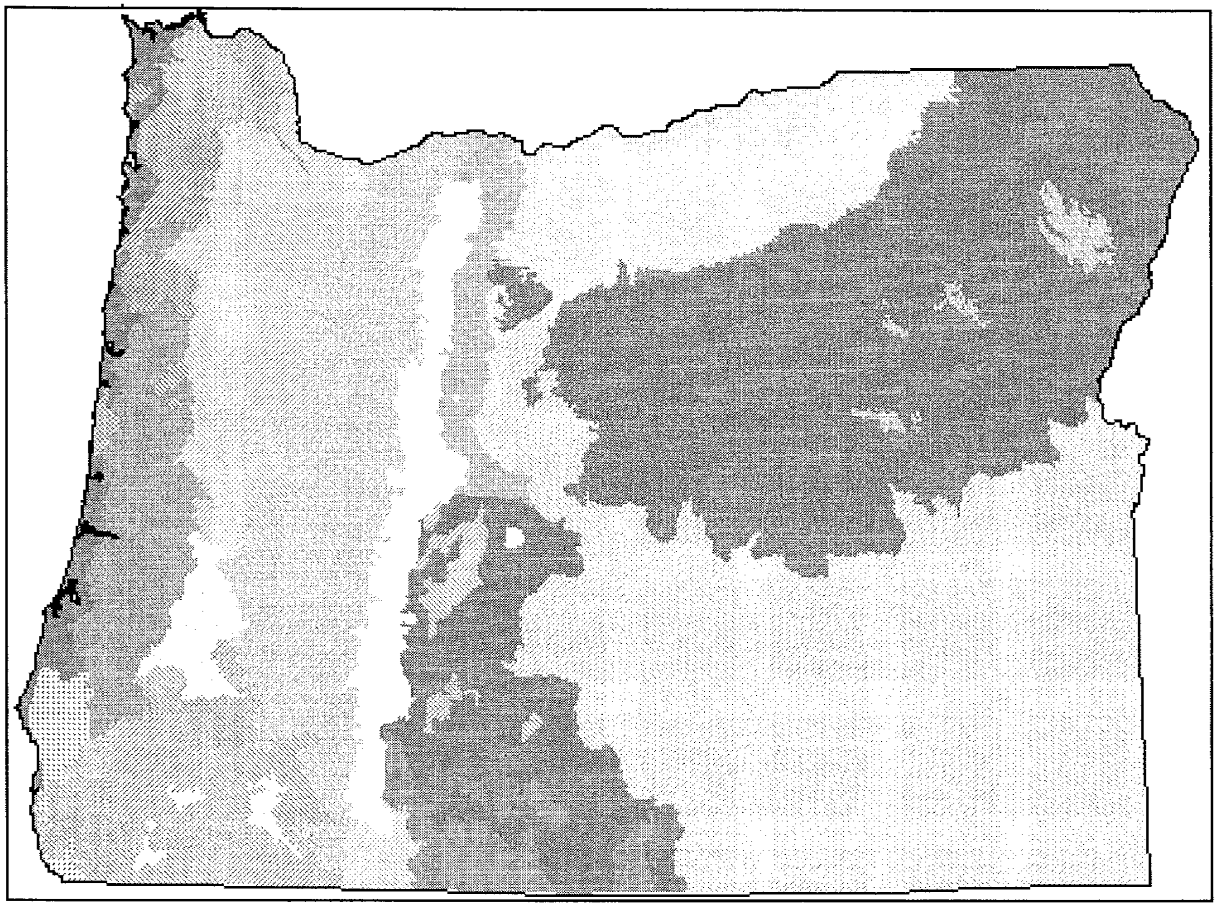
Western Lane District

"STEWARDSHIP IN FORESTRY"



Oregon
DEPARTMENT OF
FORESTRY
2600 State Street
Salem, Oregon 97310

Oregon Ecoregions
ODFW Aquatic Inventories Project



ECOREGIONs:
Coast Ranges
- Sitka Spruce
- Astoria-Willapa
- Volcanic
- Sedimentary
- Umpqua & Rogue Ranges
- Cal. Coast Ranges

Willamette Valley
- Plains and Foothills

Cascades
- Western: North/Central/South
- High
- Eastern
  - North
  - South
  - Lake Basins
  - Marshes

Columbia Plateau
- Plains
- Tablelands and Uplands

Blue Mountains
- Upland and Valleys & Basins
- Non-Alpine Forests and High Mountains

High Desert
- Uplands & Mountains and Fresh Water Basins

Adapted from Omernick1994

by Rebecca Flitcroft 12/4/97

Chapter 1
Purpose, History, and Planning

Purpose and Scope

The *Northwest Oregon State Forests Management Plan* provides management direction for all Board of Forestry Lands and Common School Forest Lands in the Northwest Oregon and Willamette Planning Regions. These two regions contain over 615,000 acres of state forest land, located in twelve northwest Oregon counties. The Board of Forestry owns 97 percent of these lands, and the State Land Board owns the other 3 percent. This plan supersedes and replaces the *Long-Range Timber Management Plan / Northwest Oregon Area Forests* (1984) and the *Long-Range Timber Management Plan / Willamette Region* (1989).

This plan takes a much more comprehensive, multi-resource approach to forest management than previous long-range plans for these two regions. It includes a description of each forest resource, and information about current management programs for these resources. The resource management goals and strategies are intended to achieve a proper balance among the resources and achieve the greatest permanent value through a system of integrated management. For example, the key set of management strategies seeks to concurrently achieve more desirable fish and wildlife habitats and improved forest biological diversity; and to produce revenue through harvesting of forest products.

This chapter sets the stage for the *Northwest Oregon State Forests Management Plan*, with a brief history of the forests, and a description of state forest planning. The main headings in this chapter are:

Location and Terminology

Location

Most state forest lands are in northwestern Oregon. These forests include three large blocks of land, the Tillamook, Clatsop, and Santiam State Forests. Smaller tracts of state forest land are scattered throughout the planning area. All state forest lands in the planning area total about 615,000 acres. The vicinity map in the map section shows the location of these lands.

Tillamook and Clatsop State Forests are in the northern end of the Oregon Coast Range. The city of Portland is roughly 25 miles to the southeast. The Columbia River sweeps around the Oregon Coast Range on the east and then on the north. The Pacific coast is a few miles to the west. The communities closest to the Tillamook and Clatsop State Forests are Forest Grove on the east, Astoria to the northwest, and Tillamook to the west.

Santiam State Forest is in the Cascade Range, a little more than 25 miles southeast of Salem. The closest communities are Mill City and Scotts Mills.

The smaller, scattered tracts of state forest lands are located throughout northwestern Oregon. A number of these tracts are concentrated in the Coast Range between Newport and Corvallis. Farther to the south, there are also a number of tracts of state forest land between Florence and Eugene in the Coast Range, scattered in a checkerboard pattern.

Note on Terminology

Throughout this document, the term “northwest Oregon” is used to describe the planning area, as shown on the vicinity map. “Northwest Oregon State Forests” is used to describe the state forests within the planning area. The term “Northwest Oregon Area” is used to describe a Department of Forestry administrative area that includes most, but not all, of the planning area.

Terminology

The state forest lands in northwestern Oregon can be described in various ways — in terms of districts, state forests, land ownership, or biological areas. The northwestern Oregon state forests are described briefly below from each of these perspectives.

Areas and Districts

The Oregon Department of Forestry divides Oregon into three administrative areas — Northwest, Eastern, and Southern Oregon Areas. Each area contains a number of districts. Area directors, district foresters, and their staffs carry out all field activities of the department in their sections of the state. This management plan covers state forest lands in all districts of the Northwest Oregon Area, and in three districts of the Southern Oregon Area. The districts are listed below. State forest lands in South Cascade District are managed by staff from Western Lane District.

Districts in the Northwest Oregon Area	Districts in the Southern Oregon Area
Astoria	Western Lane
Tillamook	South Cascade
Forest Grove	
North Cascade	
West Oregon	

State Forests

The lands covered by this management plan include several large blocks of state forest lands, and other isolated tracts of state forest lands. The smaller, isolated tracts of state forest land do not have individual names. These smaller tracts are scattered throughout the planning area, and are known simply as "scattered state forest lands." The large blocks of land are designated as state forests, and are listed below. More information about these forests can be found under the heading "History", starting on page 1-5. The state forests overlap district boundaries.

Tillamook State Forest — Tillamook is the largest state forest. It is nearly 364,000 acres, and is on both the Tillamook and Forest Grove Districts. The Tillamook State Forest was created in 1973, and includes much of the former Tillamook Burn.

Clatsop State Forest — Clatsop is the second largest state forest. Located on Astoria District, the Clatsop has 154,000 acres. Clatsop State Forest was created in 1937.

Santiam State Forest — Santiam is a smaller state forest, dedicated in 1974, with 48,000 acres. Santiam State Forest is located on North Cascade District.

Land Ownership

State forests consist of Board of Forestry Lands and Common School Forest Lands. The State of Oregon acquired the two types of land in different ways, and the two types are owned by different entities within state government. The Board of Forestry Lands are owned by the Board of Forestry, and the Common School Forest Lands are owned by the State Land Board. Each land ownership has its own set of legal and policy mandates. These mandates are discussed under the heading "Land Base and Access" in Chapter 2 (page 2-54), and also in Appendix D. The guiding principles in Chapter 3 provide more information about how state forests of both ownerships will be managed under this management plan.

The majority of state forest lands in northwestern Oregon are owned by the Board of Forestry. Only a small part of the lands are Common School Forest Lands.

Biological Areas

The state forest lands in northwestern Oregon are within two distinct biological areas. These areas are distinguished by differences in geology, climate, and ecosystems, and are described briefly below (Franklin and Dyrness 1973; USDA Forest Service et al., 1994a).

Coast Range — The Coast Range generally has steep, highly dissected slopes with narrow ridges. The underlying rock includes both sedimentary and volcanic rocks. Annual rainfall ranges from 45 to 100 inches, and even more in some spots. This area is dominated by forests of Douglas-fir, western hemlock, and western redcedar, with Sitka spruce in a narrow coastal strip. Due to extensive wildfires and logging during the last century, there are few old growth forests in this area.

Western Cascades — The western Cascades have ridge crests at generally similar elevations, separated by steep, highly dissected valleys. The underlying rock is volcanic. Annual precipitation ranges from 45 to 80 inches, with some precipitation falling as snow. This area is dominated by forests of Douglas-fir and western hemlock at low to mid-elevations, and silver fir and mountain hemlock at higher elevations. Areas of old growth forest are generally fragmented.

History

The history of the state forests helps us to understand the state forests today, and provides us a context for making decisions about the future. The writer Wallace Stegner once said, “If you don’t know where you are, you don’t know who you are.”

History can help us understand the development of the forest ecosystems, the patterns of natural resource use over time, the communities near the state forests, and the interests that people have in management of the state forests. It would take a long book to tell the complete story of northwestern Oregon. The next few pages tell the story very briefly. Appendix H gives a more detailed history, and the references cited provide more detail.

History of Northwestern Oregon

Early History — Native Americans, Explorers, Traders, and Settlers

Many tribes and bands of Native Americans lived in northwestern Oregon. The Clatsops and Clatskanies lived around the Columbia estuary. The northern coastal river valleys were inhabited by a number of bands known collectively as the Tillamooks, and the central Oregon coast was inhabited by the Siletz, Yaquina, Alsea, and Siuslaw tribes. The Kalapuyans lived in the Willamette Valley, with several distinct bands. Along the west slopes of the Cascades lived the Molallas, who had many bands, including the Clackamas and Santiam bands. (Zucker et al. 1987, Minor et al. 1980)

Native Americans relied on the natural resources around them for their survival. They managed these resources to benefit their fishing, hunting, and gathering lifestyle. One of their most important tools was fire. The Native Americans burned large areas of the Willamette Valley and coastal valleys annually, in late summer or fall. The fires maintained grasslands and open savannahs of pine and oak. The young grasses and forbs attracted waterfowl and game, and the open country made hunting easier. (Pyne 1982, Zybach 1993)

Outside the river valleys, forest fires came from two sources: lightning and Native American fires. In the Coast Range, forest fires were relatively infrequent, but could be very large. In the Cascades, more lightning led to moderate fire frequencies. Fire severity was often high. (USDA Forest Service et al., 1994a)

Early European-American exploration began in the 1700s. The Spanish sailed up the coast from their settlements in California. British and American ships explored the coast later in the century. By the end of the 1700s, Spanish, British, and American explorations had mapped the Pacific Northwest coast. They had met the native peoples and "introduced to them smallpox, tuberculosis, and trade goods." (Beckham et al. 1982)

The Lewis and Clark Expedition was the first European-American group to reach Oregon by coming overland. They reached the lower estuary of the Columbia River in November, 1805. They built Fort Clatsop, spent the winter there, and left for St. Louis in the spring. During the 1830s and 1840s, the Hudson's Bay Company built small forts and trading posts at key spots along coastal rivers. (Minor et al. 1980)

The Native Americans had little resistance to many illnesses carried by the European-American people. From 1830 to 1833, an epidemic of an unidentified fever killed as many as 80 percent of the Native Americans of the Willamette Valley and Columbia River. A great deal of Native American culture was lost as a result of this epidemic. By the 1840s, Native Americans had adopted white dress, although they still depended on traditional food sources and continued to fish for salmon at Willamette Falls. (Minor et al. 1980)

During the 1830s and 1840s, the European-Americans shifted from exploration and trade to settlement. Their early settlements in northwestern Oregon were on the broad plains along the lower Columbia River and in the Willamette Valley. These areas were easily reached by water, had level land for farming, and had plenty of water and good soil (Minor et al. 1980).

The rate of European-American settlement increased in the 1840s after the Oregon Trail was established. By the late 1840s, a few people began to settle in Clatsop Plains, Tillamook Bay, and other desirable areas along the northern Oregon coast. Settlers began moving into the mid-Willamette Valley in the 1840s, and in 1845 new settlements were started in the Corvallis and Kings Valley areas. (Zucker et al. 1987)

Oregon's first lumber mills were established in the 1830s and 1840s in the Willamette Valley. Although there were lots of trees, the industry developed slowly at first due to a lack of markets. The influx of settlers in the 1840s and the California gold rush in 1849 created demand for lumber. Eventually the timber industry emerged as a major industry. (Minor et al. 1980)

Settlers logged the most easily reached trees first. They cut trees and let the logs slide or roll into rivers and coastal bays, then floated the logs to sawmills. Later horses and oxen were used to move logs, and sawmills were set up farther inland.

Settlement and Development: 1850s to the Turn of the Century

Although fire was already part of the northwestern Oregon landscape, the evidence indicates that the frequency of large fires increased in the 1840s, with the increasing number of European-American settlers (Pyne 1982). Between 1846 and 1853, a series of large fires burned over 800,000 acres in the central Oregon Coast Range. The largest fire, known as the Yaquina Burn, covered 480,000 acres, including an area that is now state forest land (West Oregon District). It is not known whether the fires were caused by lightning, Native Americans, or settlers.

Congress passed the Oregon Donation Land Act in 1850. The act allowed settlers in Oregon to receive up to one square mile of land free. The Palmer Treaty on January 4, 1855, ended most Native American land claims. Two Native American reservations were created in northwestern Oregon.

The Siletz Reservation was established in 1855. The original reservation was 1,382,400 acres, and included a large chunk of the northwest Oregon Coast Range. The reservation reached from Lookout Point in Tillamook County to a point south of the Siuslaw River, a distance of nearly 125 miles; and from the coast to the crest of the Coast Range. Tillamook, Siletz, Alsea, Yaquina, Siuslaw, and Lower Umpqua tribes were placed here. The federal government later moved in bands from southwest Oregon. (Beckham et al. 1982)

The Grand Ronde Reservation was established in 1857. It was east of the Siletz Reservation, at the northern end, and was much smaller, at 60,000 acres. The Native Americans brought to this reservation were from the Clackamas, Santiam, Tualatin, Luckiamute, Mary's River, Yamhill, and other tribes. (Beckham et al. 1982)

The federal government removed lands from the Siletz Reservation several times under pressure from European-American settlers. In 1865, the federal government opened a corridor across the Coast Range from Corvallis to what is now Newport for a railroad and a European-American settlement. Yaquina Bay was removed from the reservation in 1866. In 1875, the entire southern end of the reservation was opened for European-American settlement, as well as an area at the northern end. (Minor et al. 1980)

The Oregon Donation Land Act of 1850 and the Homestead Act of 1862 encouraged more people to come to Oregon and begin farming. Portland, Oregon City, Salem, Albany, and Corvallis emerged as trade centers that could ship or process the commodities produced on farms.

As Oregon's population increased and the valleys filled up, people had to go deeper into the forested valleys and foothills to find sites for new homesteads. Not until the 1870s, and from then to roughly 1900, did people begin to settle the hill country, where they saw the dense forests as an obstacle to be cleared so farming could begin. Homesteaders worked hard to make a living from their "stump farms." (Minor et al. 1980)

Several factors helped Oregon's timber industry grow in the last half of the nineteenth century. The growing population in the cities provided a market for lumber. By the 1870s, railroads were linking the Pacific Northwest and making it possible for lumber produced in valley mills to be sold on a regional or world market. By the late 1800s, the development of extensive logging railroad systems enabled loggers to reach timber in the mountains that was previously inaccessible. Now logs could be moved easily "from hills to mills", and the finished products from mills to markets. (Minor et al. 1980)

Meanwhile, people in the Willamette Valley had survived the first generation of homesteading and settled into comfortable farms and cities. These people now had the leisure to seek recreation in the mountains on both sides of the Willamette Valley. The children and grandchildren of the first homesteaders enjoyed camping, fishing, hiking, and hunting as recreational activities, not as survival necessities. (Minor et al. 1980)

The Twentieth Century

Life was hard for Native Americans on the Siletz and Grand Ronde Reservations. At both reservations, the death rate exceeded the birth rate throughout the 1800s. The population on the Siletz Reservation dropped from 2,026 people in 1856 to only 483 in 1900. The population at the Grand Ronde Reservation fell from 1,826 in 1857 to 298 in 1902. Not until the 1920s did the Native American populations stabilize. (Minor et al. 1980)

By then the reservations were gone. The Dawes Act of 1887 established a new federal policy called allotment. The idea was to allot land parcels to individual Native Americans, end the reservations, and assimilate Native Americans into the dominant white culture. By 1892, just before the lands were allotted, the Siletz Reservation had 225,280 acres left. After allotment, Native Americans had 46,000 acres. Allotment was carried out on the Grand Ronde Reservation in 1904. At the Grand Ronde, 33,148 acres were allotted to Native Americans, and 26,111 acres ceded to the federal government. (Zucker et al. 1987)

After 1917, the coastal tribes tried to get compensation for the land taken from them in the 1800s. Some claims were denied, and some claims resulted in modest settlements. In 1956, Congress terminated official federal recognition of 44 Native American tribes and bands in western Oregon. The Native Americans of northwestern Oregon were no longer recognized legally. (Zucker et al. 1987)

Between 1890 and 1910, the region's timber industry changed. Lumbermen from midwestern and southern states came to Oregon, invested in timberlands of the Coast Range and lower slopes of Cascades, and marketed Oregon lumber on a vast scale. The industry changed from small, locally-owned mills to large sawmills, with hundreds of loggers in the field. In 1910, the mills in Portland alone milled 700 million board feet. Logging was a seasonal occupation, but sawmills operated year-round.

The lower Columbia River, including Clatsop County, was the first major source of logs. Next, loggers turned to the Clackamas area, Tillamook County, and Columbia Gorge. The timber around Tillamook Bay was logged shortly after a railroad was built into the area in the early twentieth century. Logging began in the Cascade foothills in the 1880s and

1890s, and increased in the early twentieth century, especially in the Silverton and Sweet Home areas. As areas around the northern Willamette Valley were logged, the rate of logging increased in the southern Willamette Valley. In the 1940s and 1950s, logging trucks replaced logging railroads and chainsaws replaced crosscut saws.

After forest areas of gentle and moderate topography were logged, they were generally converted to farmland, grazing land, or towns. Even into the 1940s, many farmers burned off the “fir brush” to improve or maintain grazing conditions. Despite the forest fires and agricultural conversions, there were always enough forests for timber to be a major industry in northwestern Oregon. The timber supply seemed unlimited. Loggers burned the slash after harvest to reduce the fire hazard, but did not plant trees. Many acres of timberland were allowed to go tax-delinquent after timber harvest. This practice increased during the Great Depression, and was common in areas burned by forest fires, such as the Tillamook Burn (Fick and Martin 1992).

In the final decades of the twentieth century, northwestern Oregon continued to grow and change. The population grew slowly in coastal areas, and rapidly in the cities of the Willamette Valley. High tech industries such as computer chip factories located in Portland, Salem, and Eugene, creating an important regional industry. Pacific Rim trade grew, and included agricultural products, wood products, and manufactured goods.

In 1977, the Siletz Restoration Act established the Siletz as an officially recognized tribe again. Later, 3,000 acres of federal lands were restored to them as a new reservation. (Zucker et al. 1987) In 1983 the Grande Ronde Tribe was restored to official recognition, and in 1988, the Tribe regained 9,811 acres of the original reservation. With restoration and reestablishment of the reservation, tribal efforts have focused on rebuilding tribal institutions and creating a viable, self-sufficient community. (Tiller 1996).

The landscape of the Coast Range and western Cascades today is different from the landscape that trappers explored in the early 1800s. Most Coast Range forests in northwestern Oregon are second growth or even third growth forests, due to logging and fires during the last 150 years. In the western Cascades, areas of old growth forest are generally found in patches. Salmon, steelhead, and trout populations in the region have declined. The declining salmon and steelhead fisheries led to very restricted or even closed commercial fishing seasons in the early 1990s.

Mountains, forests, rivers, and natural resources are still important to the people of northwestern Oregon. The timber industry is still an important part of the region’s economy. Forest management continues to evolve. The Oregon Forest Practices Act regulates logging on private and state forest lands, and requires that loggers use practices that protect soils, streams, and wildlife trees, and that they reforest an area after logging. Forest management on privately owned timberlands is focusing on managing second and third growth forests, and using smaller diameter trees. Concerns about endangered species, old growth forests, and fisheries have led to a reduction of logging on federal lands in northwestern Oregon.

People from all parts of northwestern Oregon continue to use a large variety of wood products in their daily lives, from lumber for construction, to paper for laser printers. Oregonians also use their forests for recreation, with the number of people hiking, camping, fishing, and hunting steadily growing. As the economy of northwestern Oregon continues to diversify, a smaller percentage of the population works in natural resource-related jobs. Many people also collect special forest products for extra income or personal use, collecting products such as firewood, cascara bark, ferns, and edible mushrooms.

The Origin and Development of the State Forests

The Oregon Department of Forestry was created in 1911. Its main purpose was to control forest fires. The 1925 Legislature passed a law allowing the Board of Forestry to accept gifts or donations of forest land. The State Forests Acquisition Act of 1939 created procedures for the Board of Forestry to acquire tax-delinquent forest lands from the counties, manage the land, and return most net revenues from the land to the counties. In later years, amendments fine-tuned the distribution of revenues and legal direction for forest management on these lands (Fick and Martin 1992). Lands owned by the Board of Forestry are known as Board of Forestry Lands (BOFL), and are actively managed in a sound environmental manner to provide sustainable timber harvest and revenues to the state, counties, and local taxing districts.

Some land in the state forests is owned by the State Land Board, which consists of the Governor, the Secretary of State, and the State Treasurer. When Oregon became a state in 1859, the federal government granted sections 16 and 36 of every township to the new state for the use of schools. Oregon’s grant included 3.5 million acres of grazing and forest lands. Eventually, much of the land was either sold for the benefit of schools or lost through fraudulent land deals. The state also exchanged some lands in order to consolidate land in larger blocks. The remaining forest lands owned by the State Land Board are known as Common School Forest Lands (CSFL). Eventually, the State Land Board signed a contract with the Department of Forestry, authorizing the Department to manage the Common School Forest Lands, with the goal of generating income for the Common School Fund. For more information on legal and policy mandates for CSFL and BOFL, see Appendix D.

The specific events that led to the establishment of the state forests in northwestern Oregon are described below, organized by forest and district names.

Tillamook State Forest

Much of the area that is now Tillamook State Forest burned in a series of wildfires. The first and biggest Tillamook Fire burned 240,000 acres of mostly old growth forest in August 1933.

In what seemed to be a six-year jinx, new fires burned across the area in 1939, 1945, and 1951. Each fire reburned some previously burned area, and consumed green forest too. By the end of 1945, a total of 355,000 acres had been burned over and 13.1 billion board feet of timber killed. Some areas had reburned two or three times. Although some burned timber had been salvaged, much of the Tillamook Burn, as it was now known, was hillsides of snags, turned white over the years. In many places the soil had been so severely burned that nothing grew there for many years. Streams and fisheries were severely affected by the loss of forest cover and erosion after the fires.

Before 1933, almost all of the land that became the Tillamook Burn was privately owned. After the fires, many landowners allowed the forestlands to be foreclosed by the counties rather than pay taxes. Counties began to deed land in the Tillamook Burn to the Board of Forestry in 1940, and about 255,000 acres eventually came under state ownership. Most of the remaining 100,000 acres is owned by private timber companies and BLM (Bureau of Land Management). These owners have also carried out rehabilitation on their land. The statistics below are for state forest land only.

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

In 1948 Oregonians approved a bond issue to finance rehabilitation of the Tillamook Burn. The Department of Forestry carried out a massive rehabilitation project in the burn between the years 1948 and 1973. Over the next 24 years, tree planting crews planted 72 million Douglas-fir seedlings. A total of 36 tons of Douglas-fir seeds were spread on the burn through aerial seeding, pioneering the first use of helicopters in aerial seeding.

In June 1973, the former Tillamook Burn was dedicated as the new Tillamook State Forest. The 364,000 acre forest includes 255,000 acres from the Tillamook Burn, and other unburned forest land. (Oregon Department of Forestry 1993b)

In recent years, Swiss needle cast, a native fungal disease, has increasingly affected Douglas-fir stands near the coast. The reasons for this are not fully known, but it may be connected to the widespread reforestation of the burn with Douglas-fir from other areas, which introduced trees poorly adapted to coastal conditions. The Department is exploring a strategy of replacing severely affected Douglas-fir with other tree species, such as hemlock.

The first timber sale in the former Tillamook Burn, a commercial thinning, took place in 1983. As the young trees on this forest grow larger, there will be increasing opportunities to use silvicultural techniques to develop a diversity of stand structures for forest products and wildlife habitat.

Clatsop State Forest

The Clatsop State Forest is 98 percent Board of Forestry Lands. These lands were privately owned, logged between 1910 and 1940, and then became tax-delinquent. Clatsop and Columbia Counties foreclosed when landowners couldn't pay their taxes, and ownership reverted to the county. Many landowners went broke and lost their land during the Great Depression. Eventually, the counties deeded these cutover and unmanaged forest lands to the Board of Forestry to manage as a state forest. According to the agreement, the Department of Forestry would replant the lands, protect them from fire, and manage the new forest. Then, as timber was harvested, the counties would receive two-thirds of the net revenue. The remaining 2 percent of the Clatsop State Forest is Common School Fund Land.

Today, Clatsop State Forest has mostly second growth Douglas-fir, from 30 to 70 years old. The forest has been progressively consolidated through a land exchange program that began in the mid-1940s. District staff are still actively pursuing land exchanges, working on a priority list of exchanges with several private landowners in the area.

Santiam State Forest

Much of the land now in the Santiam State Forest used to be owned by large timber companies, who typically owned railroad interests also. Some individuals and families also owned forest land. From about 1880 until 1930, most lands were logged. These lands were of little value to the owners once the timber was removed. Forest fires burned large areas. During the Great Depression, many landowners allowed their forest lands to be foreclosed by the county in place of back taxes. Marion, Clackamas, and Linn Counties suddenly owned thousands of acres of timberland.

The counties eventually deeded these lands to the Board of Forestry. Santiam State Forest land in Linn County was acquired by the Board of Forestry between 1939 and 1949. Marion County lands were acquired between 1940 and 1953, and Clackamas County lands between 1942 and 1950. Some land was also acquired from individuals through both charitable donations and purchases, between 1943 and 1952.

Natural regeneration successfully reforested most of the Santiam State Forest. However, a fire in 1951 burned nearly half the forest, and the Department of Forestry replanted the most damaged areas. In the early 1950s, the Department of Forestry's management activities were conducted by foresters working out of the Salem offices. In 1968 the current office was built in Mehama. The Santiam State Forest was dedicated in 1974.

West Oregon District

During the Great Depression, most isolated farms in the West Oregon District were abandoned to the counties in place of back taxes. Some more desirable parcels of land were bought by T. J. Starker, John Thompson, and others who saw the land's value for timber production. But by the late 1930s, Benton, Lincoln, and Polk Counties had many parcels of land that they couldn't sell or manage. Between 1938 and 1948, most of this land was deeded to the Board of Forestry. During that same decade, several small parcels were also purchased. Currently, the West Oregon District manages approximately 38,000 acres of land. Of that total, 75 percent is Board of Forestry Lands, and 25 percent is Common School Forest Lands.

Western Lane District

The Nelson Mountain Fire was one of many large fires in 1910 that motivated people to start the Department of Forestry. The fire burned most areas that are now state forest lands in western Lane County. Large fires burned again in western Lane County in 1917 and 1922. Then in 1929, a number of large fires burned most of the central Coast Range in Lane County, covering nearly 80,000 acres. The fires reburned some previously burned areas, and burned green forest as well. With the timber gone, the Great Depression starting, and the land unsuitable for homesteading, many landowners allowed their land to revert to the county in place of back taxes. Lane County deeded its timberlands to the Board of Forestry in the mid-1940s.

The land base remained constant for the next 50 years except for 5 small land exchanges in the 1950s. In the early 1990s, 2 larger exchanges reshaped the state forest lands in the Western Lane District by exchanging one-quarter of the acres. These exchanges increased the land base by 10 percent and started to block up the state forest lands. Today, state forest lands in Western Lane District are mostly covered by a 50- to 60-year-old forest.

Management Planning for State Forests

State forest lands acquired in the different ways described in the last section are managed today according to direction found in the Oregon Constitution (for Common School Forest Lands) and statutory and administrative rules (for Board of Forestry Lands).

Management planning for Oregon state forests involves three planning levels, and fiscal and biennial budgeting. As shown in the figure below, planning begins with broad-scale, long-range planning. Intermediate level planning is done at the level of ODF administrative districts and is documented through district Implementation Plans (IPs). Annual operations plans and budgets (both biennial and fiscal) are designed to achieve the objectives of the IP for short-term periods of time (1 or 2 years).

Budgets
Annually (fiscal year), and biennially

Annual District Operations Plans
Cover one district; project-specific; annual

District Implementation Plans
Cover one district; revised periodically

Long-Range Forest Management Plans
Provide overall direction; regional scale; reviewed every 10 years

Figure 1-1. Planning for Oregon State Forests

The Long-Range Forest Management Plan

The long-range forest management plan provides overall direction for managing the state forests in the planning area. It takes a broad, integrated resource management approach to planning. This plan presents goals and strategies for managing resources found on state forest lands. Further, it advances a specific set of strategies designed to integrate the management of several key resources (timber, fish and wildlife, and forest health). It is based on the premise that these are not mutually exclusive resources that must be traded off against each other; these are interrelated resources that can be managed in an integrated manner to achieve multiple benefits.

The following legal and policy mandates and information sources guide the development of the goals and strategies in long-range forest management plans for state forests:

- Statutory and administrative rules for management of Board of Forestry Lands.
- Oregon Constitution mandates for management of Common School Forest Lands.
- Oregon Supreme Court rulings.
- Advice from Oregon's Attorney General.
- Policies of the State Land Board, the Board of Forestry, and the State Forester.
- Agency obligations under the state and federal Endangered Species Acts.
- Guiding principles for the *Northwest Oregon State Forests Management Plan*.
- Resource assessments and available resource data.
- The most current scientific information available, supplemented by input from a comprehensive independent scientific review.
- Consultation with the Forest Trust Lands Advisory Committee (required by statute).
- Advice and recommendation from other state and federal natural resource agencies.
- Input from comprehensive public involvement in the planning process.

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

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

The rules also require the following key elements to be included in the management plan.

- **Guiding principles —** These include legal mandates and Board of Forestry policies. Taken together, these principles shall guide development of the management plan.
- **Resource descriptions —** Resources on state forest lands are assessed. Resources on surrounding land are considered, to provide a landscape context.
- **Forest resource management goals —** The goals are statements of what the State Forester believes is desirable to achieve for each forest resource within the planning area, consistent with OAR 629-035-0020.
- **Management strategies —** The strategies describe how the State Forester will manage the forest resources to achieve the plan's goals. The strategies shall identify management techniques the State Forester may use to achieve the plan's goals.
- **Asset management —** This section states general guidelines for asset management, which provide overall direction on investments, marketing, and expenses.
- **Implementation, monitoring, research, and adaptive management —** These sections provide general guidelines for these items.

The administrative rules specify that the State Forester shall be guided by the following stewardship principles in developing and implementing forest management plans:

- The plans shall include strategies that provide for actively managing forest land in the planning area.

- The plans shall include strategies that:

  — Contribute to biological diversity of forest stand types and structures at the landscape level and over time: a) through application of silvicultural techniques that provide a variety of forest conditions and resources; and b) through conserving and maintaining genetic diversity of forest tree species.

  — Manage forest conditions to result in a high probability of maintaining and restoring properly functioning aquatic habitats for salmonids, and other native fish and aquatic life; and protecting, maintaining, and enhancing native wildlife habitats, recognizing that forests are dynamic and that the quantity and quality of habitats for species will change geographically and over time.

  — Provide for healthy forests by: a) managing forest insects and diseases through an integrated pest management approach; and b) utilizing appropriate genetic sources of forest tree seed and tree species in regeneration programs.

  — Maintain or enhance long-term forest soil productivity.

  — Comply with all applicable provisions of ORS 496.171 to 496.192 and 16 USC § 1531 to 1543 (1982 & supp 1997) concerning state and federally listed threatened and endangered species.

- The plans shall include strategies that maintain and enhance forest productivity by:
  - — Producing sustainable levels of timber consistent with protecting, maintaining, and enhancing other forest resources.
  - — Applying management practices to enhance timber yield and value, while contributing to the development of a diversity of habitats for maintaining salmonids and other native fish and wildlife species.

- The plans shall include strategies that utilize the best scientific information available to guide forest resource management actions and decisions by:
  - — Using monitoring and research to generate and use new information as it becomes available.
  - — Employing an adaptive management approach to ensure that the best available knowledge is acquired and used efficiently and effectively in forest resource management programs.

District Implementation Planning

The long-range plan provides overall management direction and establishes specific strategic approaches for meeting the resource management goals of the plan. Each district in the planning area develops an implementation plan, which describes in more detail how the management strategies will be applied on that district. These plans are designed to describe forest management activities for a ten-year period, and they will be revised at least every ten years. However, new technical information or changing conditions may call for updates to individual district IPs within a shorter time frame. A more specific description of the type of information that will be included in IPs under the Northwest Oregon State Forests Management Plan is provided in Chapter 5.

Annual Operations Planning

The third level of planning is annual operations planning. Each district prepares annual operations plans, which show the exact location and nature of management activities that are proposed for a given fiscal year. These documents are the most detailed level of planning conducted by the Oregon Department of Forestry.

Initial operations plans are developed by district staff. These initial plans are then reviewed by resource specialists from the program staff and the area staff to ensure consistency with the relevant district implementation plan and also with the goals and strategies of the forest management plan. Resource specialists involved in plan review include the geotechnical specialist, silviculturist, forest engineer, wildlife and fisheries biologists, recreation coordinator, and others on a case by case basis.

Final plans are submitted to the program staff in Salem for review and comment, and ultimately approved by the district forester.

Budgeting

Budgeting is accomplished at two levels: fiscal year and biennial (two-year). Biennial budgets are prepared every two years and submitted to the Legislature, through the Governor's Office, for legislative approval. Biennial budgets are designed to provide sufficient spending authorization to implement the forest management plan, which is done through the more specific programs in the district implementation plans. However, since the state lands program operates entirely on a fixed percentage of the revenue received from management of the lands, actual expenditures year to year are managed through preparation of fiscal year budgets.

Fiscal year budgets are prepared annually, and are a detailed assessment of the actual resources needed to accomplish the annual operations plans. Periodic revenue estimates are used to project the level of expenditure that can be supported for a given fiscal year, within the overall biennial authorization. If revenues are lower than what was anticipated during the biennial budgeting process, then an individual fiscal budget may reflect lower expenditure levels.

Chapter 2

Understanding the Forest: Planning and Resources

Managing a forest might be thought of as intelligent tinkering. This chapter describes the specific process used to develop this plan (on pages 2-3 to 2-10), and presents information about the forest resources (page 2-11 and following). The main headings in this chapter are listed on the next page.

The planning process involved many people, including the local communities, regional community, agency specialists, and scientists. This inclusive process was based on the belief that public awareness and public involvement would lead to the best management plan. The next few pages describe the steps of the planning process; Appendix F describes the public involvement in detail.

The first step in management is to know what all the cogs and wheels are. That is a huge task. Soil, water, air, lupines, bark beetles, owls, steelhead, Douglas-fir, spruce, forest fires, floods are just a few examples of parts of the forest. The resource descriptions are a modest attempt at understanding the pieces. They are the result of our curiosity to understand the land and a beginning to intelligent tinkering.

"To keep every cog and wheel is the first precaution of intelligent tinkering."
(Aldo Leopold 1953)

The main headings in this chapter are:

The Northwest Oregon State Forests Planning Process

Previous long-range forest management plans for this area were adopted in 1984 (Northwest Region) and 1989 (Willamette Region). These plans were primarily timber management plans, with other resource values considered mainly as constraints on timber management and revenue production for the counties and local taxing districts. These environmental influences, while well considered, were not transparent to the public.

During the late 1980s, there was growing concern about the status of several wildlife species. The northern spotted owl was listed as a federal threatened species in 1990. In response, the Department of Forestry began to survey for the presence of owls in and near existing and planned timber harvest units. Many owl sites were located, and many sold timber sale contracts were affected. Following federal guidelines for take avoidance (since rescinded), the Department of Forestry established circles with a 1.5 mile radius around each owl site, and severely limited management activities within the circles. The result was a net reduction in the acres available for sustainable timber production and a corresponding reduction in the harvest objectives for each district with owl sites.

The marbled murrelet was listed as a federal threatened species in 1992. This new listing resulted in a similar process of surveying, establishing habitat areas around occupied sites, and reducing the acres available for timber production and also district harvest objectives. Thus, the objectives established by the 1984 and 1989 plans were reduced twice in subsequent years, in order to protect owl and murrelet habitat.

Recreation use on the Tillamook State Forest had been increasing for many years. The department's first program to manage recreation had been cut back in the early 1980s due to the recession and reduced revenue available for management. In 1991, the legislature passed House Bill 2501, directing the department to prepare a comprehensive recreation management plan for the Tillamook State Forest. The Board of Forestry and the Parks and Recreation Commission adopted the *Tillamook State Forest Comprehensive Recreation Plan* in 1993.

After these changes for wildlife, timber, and recreation, the Department of Forestry saw that there was a need to develop a comprehensive, integrated forest management plan for the northwest Oregon state forests. The planning process is described in this section.

Planning Team, Resource Specialists, and Consultants

The core planning team consisted of both field and program staff of the Department of Forestry, and a representative of the Oregon Department of Fish and Wildlife. The core team was directly responsible for managing all aspects of the planning process.

Ross Holloway was the project leader. The core team included foresters, fish and wildlife biologists, and other specialists. These professionals had expertise in habitat biology, fish biology, forestry, silviculture, threatened and endangered species, monitoring and adaptive management, public involvement, and technical writing.

The core team consulted many additional specialists in fields such as geotechnical studies, geology, hydrology, air quality, soils science, geographic information systems (GIS), forest technical analysis, forest pathology, forest inventory, forest economics, special forest products, botany, cultural resources, and recreation resources.

A steering committee was formed to provide overall policy direction to the core planning team, and to provide a key link to the district level and program managers, the counties, and the State Land Board. From the Oregon Department of Forestry, the committee included the Northwest Oregon Area Director, the assistant state forester, state forests program director, and the district foresters in the planning area. Other committee members were one county commissioner each from Tillamook and Linn counties, and a policy specialist from the Division of State Lands.

In 1995, the planning team formed another group, the planning forum, whose members represented a diverse set of interests, including the counties, forest industry, environmental interest groups, academics, and the general public. The planning forum met periodically with the core team throughout the planning process. (See page 2-9.)

Technical Planning Elements

The purpose of the technical planning process was to develop an integrated set of goals and strategies for managing the forest resources, and to develop specific processes and procedures for district-level implementation of the strategies.

Guiding Principles

Guiding principles are the overall rules, goals, and responsibilities that guide the planning process for the northwest Oregon state forests. The guiding principles are listed in the next chapter, on pages 3-2 to 3-8. The principles are derived from the following sources.

- **State and federal laws and administrative rules —** Statutes and mandates governing state forest management include the direction found in ORS 530.050 to manage the lands "so as to secure the greatest permanent value of such lands to the state." Other laws recognize the special interests of the counties, local governments, and Common School Fund, and address the importance of salmon and other native species.
- **Board and state agency policies —** These include policies of the Board of Forestry, State Land Board, and State Forester.

- **Other sources —** These include recommendations from planning team members, resource specialists, and the public, consistent with good stewardship of the forests.

An initial draft of the guiding principles was reviewed in a series of public meetings, and with members of the planning forum. (The planning forum is described later in this section, under the heading “Public Involvement.”) The guiding principles were revised, based on these comments, and reviewed by the Board of Forestry, before the planning team developed goals and strategies.

Resource Descriptions

Technical specialists developed initial assessments for each resource. After these assessments were evaluated and more information gathered, the specialists wrote final resource descriptions. This chapter provides summaries of these resource descriptions, beginning on page 2-11, including information about the resource’s current status and future trends. More detailed information is available in the appendices and supporting documents for this plan.

Development of Goals

The resource goals in Chapter 3 (pages 3-12 to 3-17) describe broadly what it is we would like to achieve through the management of each resource. They are intended to be qualitative, not quantitative in nature. Draft goal statements were developed initially from several different sources, including the following.

- **State and federal laws and administrative rules —** Some goal statements identify the relevant legal standard pertaining to that resource and state that the specific law will be followed in managing that resource.
- **Board and state agency policies —** These include policies of the Board of Forestry, State Land Board, State Forester, and other natural resource agencies participating in the planning process.
- **Other sources —** These include recommendations from planning team members, resource specialists, and the public. These goals are not mandated in law or policy, but are believed to be consistent with good stewardship of the forests.

An initial draft of the goals was reviewed in public meetings, with members of the planning forum, and by resource specialists. The goals were revised, based on these comments, and reviewed by the Board of Forestry before the team proceeded with strategy development.

Development of Strategies

Using input from resource specialists and the public, and the guiding principles, the planning team prepared draft strategies for achieving the goals. They were assisted by the planning forum, which met several times to review and comment on interim drafts.

A large component of these initial strategies was a set of integrated strategies, termed “structure-based management”. This set of integrated strategies was subjected to a limited scientific review, involving professors with expertise in forest science, wildlife science, ecology, and silviculture. The public also had a chance to review this first draft. Based on comments from the scientists and the public, the strategies were revised.

The revised draft was reviewed again by the public and the planning forum. Because the strategies were a significant departure from past management, the planning team coordinated an exercise in prototype implementation planning with the districts. The purpose was to determine if the strategies could be clearly understood and applied operationally at the district level. The strategies underwent further revision and again were reviewed with the public, along with the results of the implementation exercise.

The final draft of the strategies was then subjected to a more comprehensive independent scientific review. This final draft received additional public review. Final revisions were then made, based on comments received. The FMP strategies are in Chapter 4.

Balancing the Goals

The goals for one resource may compete to some degree with the goals for one or more of the other resources. Any such potential conflicts were resolved in the strategy development phase of the planning process. The strategies attempt to achieve a reasonable balance between the goals for the various resources. It is important to recognize that not all goals carried equal weight in the balancing process.

The highest priority was placed on meeting goals related to specific laws or administrative rules. The next priority was on goals based on current policy direction, within the following hierarchy:

- Board of Forestry and State Land Board policy
- State Forester's policies
- Other state agency policies

The lowest priority was placed on meeting goals that are not mandated in law or policy. In the case of conflicts at this level, the conflicts were resolved by developing strategies that provided the best balance between the goals, in the judgment of the planning team.

Consideration of Alternative Strategies

This draft forest management plan itself does not present a range of alternative approaches to managing the northwest Oregon state forests. Rather, it proposes a set of integrated strategies designed to concurrently achieve high levels of outputs for several key resources. The integrated strategies approach is a departure from more traditional approaches to forest planning, which have tended to focus on the trade-offs between competing resources.

Many people are more familiar with the federal planning processes used in recent years than with the state's approach. Federal agencies follow a process mandated by federal laws such as NEPA (National Environmental Policy Act) and NFMA (National Forest Management Act). These laws require an alternative-based approach. The federal plans have a range of alternatives that display various management approaches, with various levels of trade-offs among resource outputs.

The Department of Forestry is not bound by the federal planning laws, and the state's approach is much different from the more familiar federal approach. While developing the integrated management strategies, the planning team considered a variety of approaches. After a great deal of analysis, the team focused on the integrated management of multiple resources through active management, and on a balance among resources that is based on the goals for the key resources.

Although we have not presented detailed alternative strategies in this document, the Department of Forestry contracted with Oregon State University to conduct an analysis of harvest scheduling model outputs and the associated economic benefits for a variety of forest management approaches, including the approach proposed in this plan. A description of this analysis is contained in the section that follows.

Modeling and Analysis of Alternative Approaches

Following development of the integrated management approach and strategies described in this plan, the Department of Forestry contracted with Dr. John Sessions of Oregon State University to conduct harvest schedule modeling and economic analysis for a variety of alternative forest management approaches. The purpose of this modeling effort was to provide broad comparisons between different possible management approaches, and to compare a variety of alternative assumptions within each approach. Three primary approaches were used to compare the range of management alternatives:

- The integrated management approach proposed in this draft plan (structure-based management), combined with species-specific strategies considered necessary to obtain an approved habitat conservation plan. This alternative is referred to as "SBM with HCP."

- Forest management to emphasize economic efficiency as measured by the net present value of potential revenues from timber harvest. This approach was designed to emulate the type of management commonly associated with private, industrial forest lands, and is referred to as the "Emphasize NPV" alternative.

- Forest management focused on achieving habitat goals through a reserve-based approach that included short-term management to develop complex stands. This approach was designed to emulate the key elements of alternatives advanced by several conservation groups during the course of the planning process. It is referred to as the "50% Reserve" alternative.

In addition to these three alternatives, additional alternatives and variations were analyzed for the North Coast portion of the planning area (Astoria, Tillamook and Forest Grove Districts). These additional model runs were made to evaluate the effect of variations in the desired future condition amounts of older stand structures, the effect of proposed HCP strategies versus a "take avoidance" approach, variations in the discount rate used to calculate net present value, non-declining even flow of harvest over time versus departure from even flow, and the outcomes associated with a "no management" or 100 percent reserve approach. A summary of the results of these model runs is presented in Appendix I. A detailed description of the harvest schedule model, data inputs, key assumptions used, and the detailed outputs for all of the alternative runs is presented in a separate reference document titled "Decadal Analysis of Alternatives for

Draft Northwest Oregon State Forests Management Plan and Draft Western Oregon State Forests Habitat Conservation Plan" (Oregon Department of Forestry, 2000e).

The outputs summarized in Appendix I are intended to provide relative comparisons between alternative management approaches and assumptions. The absolute numbers presented, including harvest levels and stand structure percentages were generated by the model. Actual harvest levels will vary based on actual conditions on the ground and the analytical process used to develop district implementation plans. Actual future stand conditions will vary as a result of a variety of influences that cannot be accurately modeled, such as the effects of insects and disease, fires, wind, and other natural disturbances.

The Harvest Scheduling Model used by the ODF to evaluate policy alternatives for State Forests has been significantly improved through two major projects since the adoption of the Northwest Oregon State Forest Management Plan in 2001: the Harvest and Habitat Model Project (2004 through 2006); and the Clatsop and Tillamook State Forests Strategies for the Achievement of the Board of Forestry Performance Measures (2008 and 2009). These model projects evaluated a range of alternatives similar to those examined when the FMP was initially developed. These updated models informed the Board of Forestry's deliberations on the balance of economic, social, and environmental values provided through implementation of the Northwest Forest Management Plan on the Tillamook and Clatsop State Forests. The Board of Forestry's discussions led to it directing a revision to this plan in 2009.

Adaptive Forest Management

Monitoring and adaptive management are key elements of the draft plan. A properly constructed monitoring program, combined with effective adaptive management, will provide the necessary information to assess the strategies' effectiveness in achieving the goals, and the flexibility to modify the strategies and management techniques as new information comes to light. In fact, the integrated strategies and their associated standards need to be viewed as a reasonable starting point. They will be changed over time as we learn more. Over the long term, the strategies could result in a variety of possible outcomes as adaptive management occurs. (See Adaptive Forest Resource Management, pages 5-13 through 5-34).

Public Involvement

Public involvement provides the planning team with a wider range of information and ideas, and is also critical to gaining public understanding, acceptance, and support for planned actions. The planning team started a comprehensive public involvement process at the same time they started the forest planning in 1994, and adapted the process to meet changing needs for public involvement as planning proceeded.

The public involvement process had three important objectives:

- Seek appropriate insight, opinion, and data on planned management actions for northwest Oregon state forests.
- Foster understanding, acceptance, and support for the management planning process and the management plan.

- Capitalize on important opportunities to inform the public about forest systems, forest stewardship, and management of state forests.

The public involvement process included public meetings, newsletters, and field tours, and offered additional opportunities such as committees and forums for interested people to get deeply involved in the forest planning. The public involvement process is summarized below, and described in detail in Appendix F.

Public Meetings and Tours

Public meetings were held at each major step of the planning process, including guiding principles, draft goals, draft strategies, and draft implementation plans. The meetings were publicized in the newsletters, through press releases and media coverage, and letters to the *Horizons* mailing list. Written comments were accepted after the meetings.

Meetings were held in the following locations: Astoria, Eugene, Forest Grove, Philomath, Portland, Salem, Stayton, Tillamook, and Veneta.

The planning team also sponsored several tours for the general public. These tours focused primarily on the Tillamook State Forest due to its proximity to the Portland area. The planning team also participated in many tours sponsored by other organizations that focused on the planning process and management of the state forest lands. These included tours by the Board of Forestry, the Fish and Wildlife Commission, local Chamber of Commerce tours, and tours sponsored by individual interest groups.

Planning Forum

In 1995, the planning team formed another group, the planning forum. This eight-member group was comprised of individuals representing a diverse set of interests, including the counties, forest industry, environmental interest groups, academic perspectives, and the general public. The planning forum met periodically with the core team throughout the planning process to offer their comments on specific draft products, and to provide a sounding board for ideas being considered by the planning team.

During the planning process, the planning forum met a number of times. The group reviewed and commented on the following components of the plan:

- Resource goals
- Forest vision statement
- Resource strategies
- Concepts of structure-based management
- Implementation plans
- Monitoring and adaptive management plan

Horizons and *Forest Log* Newsletters

The *Horizons* newsletter was developed specifically to communicate information on the planning process and related topics to interested people. *Horizons* was published at intervals throughout the planning process. The initial mailing list for the newsletter was created from several mailing lists related to previous forest planning. Names were added from public meeting sign-up sheets and other public contacts, and the list continued to grow throughout the process.

The Oregon Department of Forestry publishes a newsletter, the *Forest Log*, which covers all of the department's activities. Approximately 3,500 copies are mailed every two months to interested individuals, organizations, businesses, and agencies. Throughout the planning period, the *Forest Log* had regular articles about the planning process and related issues.

Toll-Free Information Line

A toll-free information and message line (1-800-482-6866) was put into service in 1994 and maintained throughout the process. This message line provided information to callers on current planning activities and upcoming meetings, and provided an opportunity for callers to leave a message for the planning team.

Independent Scientific Review

Two separate scientific reviews were conducted during the planning process. The first consisted of a limited review, which focused on the concepts of structure-based management and the initial set of integrated strategies. This review was coordinated by the Department of Forestry in 1996 and involved ten college professors and scientific researchers, with expertise in wildlife biology, silviculture, and wildlife ecology. Comments from these reviewers were used to prepare a second draft of the integrated strategies.

A more comprehensive independent scientific review, coordinated by Oregon State University, was conducted in the spring of 1998. This review, involving twenty-six reviewers from a variety of disciplines and institutions, addressed questions related to all of the technical resource management strategies in the plan. Comments received from this broader scientific review were used to prepare the final set of strategies presented in this forest management plan.

Plan Approval

The provisions of this plan are intended to satisfy the legal and policy framework for managing Board of Forestry and Common School Lands. The Department of Forestry also has a contractual obligation with the State Land Board to prepare management plans for Common School Forest Lands. Accordingly, this plan requires the approval of both the Board of Forestry and the State Land Board.

Resource Descriptions

The northwest Oregon state forests have a wealth of resources. Summaries of the resource descriptions are given here.

Summary information is provided about the following resources.

- Agriculture and grazing
- Air quality
- Biodiversity and disturbance history
- Cultural resources
- Energy and mineral resources
- Fish and wildlife
- Forest health
- Geology and soils
- Land base and access
- Plants
- Recreation
- Scenic resources
- Social and economic resources
- Special forest products
- Timber
- Water resources

For each resource, the summary covers past use and management of the resource, current condition and management, and trends. Appendix D has additional information about legal and policy mandates for the various resources.

Agriculture and Grazing

The northwest Oregon state forests have limited potential for agriculture and grazing. Although state laws permit agriculture and grazing on state forest lands as long as they are compatible with other forest resources, the topography of the state forests is generally not suitable for most agricultural uses.

Agriculture

Currently, the only two agricultural uses on northwest Oregon state forests are Christmas tree harvest and beekeeping. Christmas trees have been grown sporadically in conjunction with tree plantations or on land under power lines. Due to market conditions and the number of Christmas trees grown in the Willamette Valley, there has been little demand for Christmas tree leases on state forest lands. Currently, there is one Christmas tree lease in Forest Grove District. The lease brings in annual revenues of $500.

Occasionally beekeepers take out leases to place beehives on state forest lands, in order to take advantage of the fireweed that grows after fires. Fireweed honey is said to have superior taste. Bear damage to hives and vandalism prevent this activity from being more widespread. Currently, there is one lease for honeybee hives on Astoria District. This lease brings in annual revenues of $300.

Grazing

Grazing is almost nonexistent on northwest Oregon state forests. Historically, all the districts in northwest Oregon allowed grazing on burned or logged areas, under the open range laws. As forests were re-established, grazing diminished. Open range grazing ended in the early 1980s.

Currently, there is only one grazing lease on the northwest Oregon state forests, for ten acres in the Astoria District.

Air Quality

The air we breathe affects our health, and Oregon's clear, blue skies are part of the state's high quality environment. Two activities on northwest Oregon state forests have the potential to affect air quality: wildfire and prescribed fire.

History

In 1933, the Tillamook Burn created huge smoke columns that towered like thunderheads over northwest Oregon. The smoke was so thick that coastal towns had to turn on their streetlights during the day. In the 1930s, 1940s, and 1950s, other smaller fires on state lands also filled the air with smoke. There have been no large fires on the northwest Oregon state forests since the 1950s, and the Department of Forestry's fire management program aims to prevent fires, and keep any fires that do occur small. The success of this program has meant that despite its potential, wildfire has actually had very little effect on air quality since the 1950s.

As foresters began professional management of the northwest Oregon state forests, they recognized that some of fire's effects on forests were desirable, and that controlled fire, also known as prescribed fire, could be used as a forest management tool. Prescribed fire has been used to reduce wildfire potential by reducing the amount of wood slash, a potential fuel, left on the ground after logging; to control brush before planting trees; and to improve deer and elk forage areas.

During the mid-1980s, prescribed burning costs increased, smoke management became more restrictive, and the potential for escaped fires was higher. In addition, more small diameter wood was used and less slash left on units. Other slash treatments became available. For all these reasons, the number of acres burned has declined considerably since 1985. The Department of Forestry adheres closely to the Oregon Smoke Management Program guidelines and instructions. As a result, prescribed burning has also had very little effect on air quality in recent years.

Key Terms

Ambient — Surrounding.

DEQ — Oregon Department of Environmental Quality.

EPA — Environmental Protection Agency. This federal agency administers the Clean Air Act, among other responsibilities.

NAAQS (National Ambient Air Quality Standards) — Developed by the Environmental Protection Agency, these standards establish the maximum concentration for various pollutants that may be present in the ambient (surrounding) air. Standards are measured on a short-term (1, 3, 8, or 24 hours), quarterly, or annual basis.

Prescribed burning — Controlled fire burning under specified conditions in order to accomplish planned objectives; also called slash burning, as a frequent objective is to reduce the amount of slash left after logging.

Current Condition

The federal Clean Air Act is the main law regulating air quality. Under the law, the Environmental Protection Agency (EPA), a federal agency, sets air quality standards, known as NAAQS.

The authority to implement the law is delegated to the states. In Oregon, the Department of Environmental Quality (DEQ), a state agency, develops and carries out programs to meet the national air quality standards. Two air quality plans affect forest management directly: the Oregon Smoke Management Plan and the Oregon Visibility Protection Plan.

The Oregon Smoke Management Plan regulates prescribed burning on all forest lands in Oregon, including federal, state, and privately owned lands. Some of its objectives are to protect public health, minimize smoke intrusions into designated population areas, reduce emissions from prescribed burning in western Oregon, and protect visibility in Class I areas during high use periods. Appendix D has more information on laws and programs affecting air quality.

In the past ten years, prescribed burning on northwest Oregon state forests has declined significantly, as shown below. It is estimated that prescribed burning on state lands is responsible for much less than one percent of the air pollution in northwest Oregon cities.

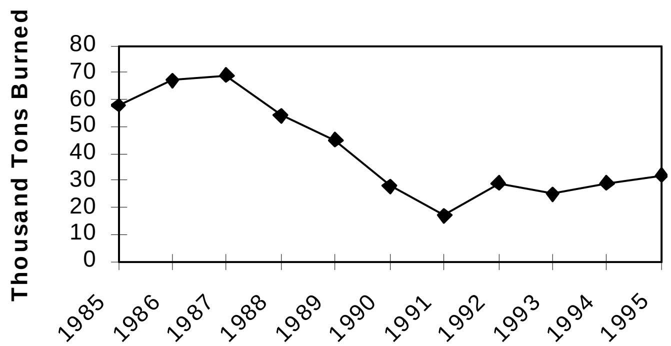


Figure 2-1. Prescribed Burning Trend on Northwest Oregon State Forests: Tons of Fuel Burned

The amount of fuel burned each year on northwest Oregon state forests has declined about 60 percent since 1985.

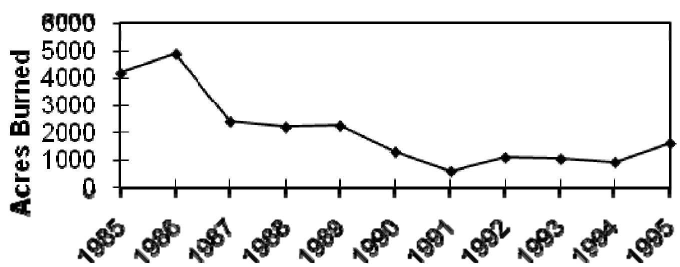


Figure 2-2. Prescribed Burning Trend on Northwest Oregon State Forests: Number of Acres Burned

The acreage burned annually has declined about 70 percent.

There are a number of reasons for the decline in burning on state lands. Lower quantities of slash are associated with second- and third-growth forest. More small diameter wood is being used, also reducing the amount of debris left behind. With less slash on units, some units are not burned at all. On other units, spot burns treat just the pockets of heavy slash concentrations. “Slashbuster” machinery is often used in place of burning to prepare spots for tree planting. For units that are burned, the prescribed burns are generally scheduled during spring-like conditions when fine fuels are dry but mid-sized fuels do not burn completely through. Finally, some unwanted vegetation may be controlled with herbicides.

Biodiversity and Disturbance History

Any discussion of biological diversity or biodiversity requires a precise definition. The Society of American Foresters (1991) defines biodiversity as “the variety and abundance of species, their genetic composition, and the communities, ecosystems, and landscapes in which they occur.” Gast et al. 1991 characterizes biodiversity operationally as:

> “... the variety, function, distribution, and structure of ecosystems and their components, including all successional stages, arranged in space over time that support self-sustaining populations of all natural and desirable naturalized flora and fauna.”

Biodiversity on the Northwest Oregon State Forests

Landscape diversity may be described as inherent or induced. Inherent biodiversity results from variation in such things as climate, soils, and topography. Induced biodiversity results from disturbances such as fire, windstorms, and human activities. See the “Key Terms” box on the next page for definitions of concepts used in the following discussion.

In the northwest Oregon state forests, the amount of late successional habitat is important in achieving biodiversity goals because it is rare and has a unique ecological role within the forest. Patch size, distribution, and linkages among areas of late successional habitat may be as important as the total quantity. When late successional forests are fragmented, they lose interior habitat (habitat sheltered from other influences). Thus, fragmentation can reduce late successional habitat function well beyond the amount of actual acres of habitat lost.

Induced Biodiversity: Disturbance History

Natural disturbance is a normal process in ecosystems. Climate cycles, forest fires, windstorms, landslides, floods, and insect and disease outbreaks have always been normal events in the dynamic landscape of the Pacific Northwest. These disturbances have caused significant changes in northwest Oregon forests by disrupting ecosystems, communities, and population structure.

Key Terms

Composition — The different species of plants and animals that live in an ecosystem.

Disturbance — A force that causes significant change in an ecosystem's structure and/or composition; can be caused by natural events or human activities. Examples of natural disturbances include fire, insect outbreaks, landslides, floods, and windstorms. Examples of human-caused disturbances include timber harvest. Because disturbances are so variable in size, frequency, and severity, they create complex successional patterns and diverse, changing, ecological communities.

Fragmentation — The spatial arrangement of successional stages across the landscape as the result of disturbance; often used to refer specifically to the process of reducing the size and connectivity of late successional or old growth forests. Some species need large areas of habitat; if the pieces of suitable habitat become too small and dispersed, these populations may not remain sustainable. Other species flourish in a landscape of fragmented habitats.

Function — Activity or process that goes on in an ecosystem; some typical functions are plant growth, animal reproduction, decay of dead plants.

Induced landscape diversity — Aspects of the landscape that change as a result of disturbances such as fire, windstorms, human activities, and animals; for example, the successional stages of vegetation that occur after a wildfire.

Inherent landscape diversity — Aspects of the landscape that are relatively permanent (changing only slowly over long periods of time) in any particular landscape, but that vary among landscapes. Examples are climate, soils, topography, and aspect (such as south-facing aspect).

Landscape — A unit of land with separate plant communities or ecosystems forming ecological units with distinguishable structure, function, geomorphology, and disturbance regimes.

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.).

Seral stages — Developmental stages that succeed each other as an ecosystem changes over time; specifically, the stages of ecological succession as a forest develops.

Structure — The physical parts of an ecosystem that we can see and touch; typical structures in a forest are tree sizes, standing dead trees (snags), fallen dead trees. The juxtaposition of horizontal and vertical diversity is referred to as patchiness.

Succession — A series of changes by which one group of organisms succeeds another group; a series of developmental stages in a plant community.

Over the centuries, small and large disturbances created a diverse forest. The landscape was never homogeneous, and only part of the forest was old growth at any one time (Agee 1993). For Oregon west of the Cascades, estimates of the historical percentage of old growth range from as little as 35 to 40 percent, to as high as 70 to 80 percent.

Disturbances range from very large to very small. In forests, large-scale disturbances generally favor colonizing species such as Douglas-fir. Small-scale disturbances can create gaps where shade-tolerant understory species and herbaceous plants flourish, and also increase the supply of snags and large woody material in the forest.

Species depend on habitats created by disturbances, and on the pattern of habitats across the landscape (Pickett and White 1985). For example, trees that topple in a windstorm become, as they rot, homes to fungi, voles, mice, nitrogen-fixing bacteria, and amphibians. Big game like deer and elk need open areas of meadows or young forest to graze, but also need forest cover during winter storms or to hide from predators. Hundreds of species find homes in Pacific Northwest forests, and each species has a different set of habitat needs.

The disturbance history of the northwest Oregon state forests is given in the next few pages. The history does not attempt to give a detailed account for each area of forest, but it does describe some of the most important events.

Climate

In the Pacific Northwest, there are about one hundred years of accurate weather records. The temperature and precipitation data show that there have been four fairly distinct climatic periods in that century (Taylor and Southards 1997). These four periods were:

- 1896-1914: generally wet and cool
- 1915-1946: generally dry and warm
- 1947-1975: generally wet and cool
- 1976-1994: generally dry and warm

In any one of these four periods, the years were not all wet (or dry), but a majority of years followed the pattern. During the dry and warm periods, consecutive dry years were common, causing droughts.

Some evidence indicates that salmon returns are influenced by these long-term climatic cycles, with salmon returns increasing during the cool, wet parts of the cycles, and decreasing during warm, dry periods (Taylor and Southards 1997).

Climate cycles can affect trees directly, and they can also affect insect and pathogen populations and the trees' susceptibility to these pests. The late 1980s and early 1990s were unusually dry, and this trend appeared to be correlated with a rise in activity of some insects and some stem diseases. These fluctuations appear to recur at long intervals, and show the importance of long-term resilience in forests.

Fire

Fire was a very significant force in the development of the Pacific Northwest forests. A number of factors affected fire return intervals, including rainfall patterns, frequency of lightning, and frequency of fires started by people. In the Coast Range, large forest fires occurred infrequently, about once every 300 to 350 years in any particular spot, but were usually high-intensity, stand-replacement fires. Smaller fires were more frequent, occurring about every 50 to 100 years. In the Cascades, more lightning led to moderate fire frequencies, with the return interval ranging from 25 to 100 years. Fire effects covered a wide range, including severe, stand-replacement fires; patchy fires; and understory burns. (USDA Forest Service et al. 1994a)

Fire history of northwest Oregon — Forest fires came from two sources: lightning and Indian fires. Although fire was already part of the northwest Oregon landscape when European-American settlers arrived, the evidence indicates that the frequency of large fires increased in the 1840s, with the growing number of European-American settlers (Pyne 1982). Between 1846 and 1853, a series of large fires burned over 800,000 acres between the Siuslaw and Siletz Rivers in the central Oregon Coast Range. The largest fire, known as the Yaquina Burn, covered 480,000 acres. The Nestucca Fire burned over 300,000 acres. It is not known whether the fires were caused by lightning, Indians, or settlers. There were a number of large fires throughout the Pacific Northwest in 1868, with the largest fire in northwestern Oregon burning around Yaquina Bay.

By the early 1900s people formed fire control organizations in order to fight fires. Forest management was not possible until forest fires could be more effectively controlled. From the 1920s to the 1960s, the annual area burned by forest fires declined steadily. But the annual area burned began to increase in the 1960s, possibly due to more logging and more prescribed burning, with some prescribed fires escaping control.

Several large fires burned parts of northwest Oregon during the twentieth century. The first Tillamook Fire burned in 1933, and reburns occurred in 1939, 1945, and 1951, burning over a total of 355,000 acres. The Cedar Butte Fire burned 40,000 acres in 1918 and the Salmonberry Fire burned 25,000 acres in 1931.

Current patterns of forest ownership are closely related to fire history. The Tillamook Burn has become the Tillamook State Forest; parts of the Nestucca Burn and Yaquina Burn have become the Siuslaw National Forest; another part of the Yaquina Burn is state forest in West Oregon District, and parts of the Nestucca Burn and Siuslaw-Siletz Burn are now Bureau of Land Management forest (Salem District).

Fire's effects on forests — Because there were long intervals between fires in northwest Oregon, very old forests with large trees persisted in many areas. When major fires did occur, they generally killed most trees and covered large areas. These often dramatic fire events, which usually were associated with drought years and warm, dry winds, left large amounts of woody debris and snags in the forest (Agee 1990).

After large fires, natural regeneration depended on the fire intensity, weather patterns, source of seed, and numerous other factors. As a result many different types and compositions of stands developed. Fire intensity and fire return interval influenced what tree species were present in a forest. The coastal mountains and western hemlock/Douglas-fir forests were characterized by infrequent crown fires or severe surface fires that usually killed all trees in the stand. After the fire, western hemlock seedlings often outnumbered Douglas-fir. But Douglas-fir were usually more robust and dominated the site for 250 to 1,000 years, when the species began to disappear from the stand. Western hemlock became more common until eventually it dominated the stand.

In the Cascades, more frequent but more moderate fires often left a mosaic composed of patches of dead and surviving trees. Stands often consisted of two or more age classes, with the various age classes originating after different fires.

In all forest types, exposed soils were more likely to erode or collapse in slope failures in the years after a large fire. Slope failures deposited trees, other vegetation, boulders, and sediment in streams. These slides or debris flows damaged fish habitat in the short term, but over the long term helped to create more complex habitat. The logs and boulders created pools, gravel formed spawning beds, and structural complexity created complex habitats (Reeves et al. 1995).

Fire interacted with other disturbances such as heavy rains and windstorms. Severe fires created large open areas, which in turn increased the amount of runoff during rain-on-snow events and made floods more likely. Fires reduced the amount of fine root biomass, increasing the probability of mass soil movements on slopes. Also, the trees on the edges of fire openings were more susceptible to windthrow during storms. Finally, a variety of insects and infections attacked injured and dead trees.

In general, fire is now less prevalent on the landscape than it was before the twentieth century. When large fires do occur, fire effects can be severe because fire suppression has created more uniform stands and allowed fuel loading to increase.

Wind

Severe windstorms can blow down or snap off most trees in a stand, but usually storms blow down scattered trees over a large area. Although severe storms have dramatic effects, ultimately small-scale events have more impact on the forests because they are more common. A number of factors make trees more susceptible to wind. Root disease and stem decay are the most common biological factors contributing to blowdown. Poorly anchored trees are more likely to be uprooted by wind; trees may have shallow rooting as a result of shallow soil, bedrock, or a high water table.

In northwest Oregon, periodic severe windstorms typically occur between October and March. The Columbus Day storm on October 12, 1962 blew down an estimated 17 billion board feet of timber in western Oregon and Washington. Other major windstorms in the last century occurred on January 9, 1880 in northern Oregon; December 4, 1951 in western Oregon; and the winter of 1995-96 in western Oregon. The winters of 1949-52 and 1955-56 also had heavy winds.

As is typical of most disturbances, windstorms interact with other events in many ways. Douglas-fir bark beetles killed over 2 billion board feet of live trees between 1951 and 1959, after getting started in blowdown from the winters of 1949-52 and 1955-56. After the Columbus Day storm in 1962, beetle damage killed an additional 2.6 billion board feet of timber by 1965.

Floods and Landslides

Western Oregon, especially the Coast Range, has frequent, intense winter rainstorms. The heavy rain can cause floods. The most severe floods, such as the flood of February, 1996, are usually rain-on-snow events, when heavy rain falls on snow, swelling the streams with melted snow and rain. Heavy rains also saturate soils, particularly where other disturbances such as fires have exposed the ground. The saturated soils can give way and start landslides and debris flows.

Floods are more common in the cool, wet periods of climate cycles. Over the past 150 years, major floods occurred in western Oregon in 1861, 1890, 1948, 1964, and 1996.

Floods have different effects on complex, resilient streams and simplified streams. Complex streams have a much better ability to absorb a flood, and the impacts are more likely to be positive. Simplified streams are more likely to be scoured and damaged by the same event (Rapp 1997). Major floods can scour stream beds, move sediment and logs, and carve new channels. Scouring damages streams, but floods can bring in wood and gravel that creates new and more complex habitats.

Floods interact with fire in shaping landscapes. In a comparison of streams in the Coast Range (Reeves et al. 1995), scientists found that the stream habitat most complex and favorable to coho salmon was where catastrophic fire and landslides had occurred 160 to 180 years ago. Historically, western Oregon streams would have represented a mosaic of habitat conditions, with some streams accumulating sediment and others losing sediment (aggradation and degradation), in cycles lasting decades or centuries.

Insects and Disease

Insects and diseases are also significant disturbances in forests. Periodic insect outbreaks have impacted extensive areas of forest. See also the next heading in this chapter, “Forest Health”, for more information on insects and diseases.

The Douglas-fir bark beetle has probably killed more Douglas-fir in Oregon than any other insect. This insect builds huge populations in windthrown, fire-killed, or weakened timber. Bark beetles have killed trees comprising over two billion board feet of timber after major windstorms, at least twice in the last fifty years in western Oregon.

The hemlock looper, a pest of old growth hemlock stands, has had several major outbreaks in western Oregon this century. The looper killed trees comprising approximately 50 million board feet of timber in Tillamook County between 1919 and 1921. Other looper outbreaks occurred east of Seaside in 1944, and in the Coast Range from 1961 to 1963. The spruce aphid and hemlock sawfly can also kill significant numbers of trees in outbreaks. With the exception of the Douglas-fir beetle, most of these insects rarely cause significant damage in present-day forests.

Diseases were also common in the original forests of northwest Oregon. Stem decays were more abundant in older forests than in younger ones, largely because decay increases as trees get older. Root diseases were also common, but kept in balance by the natural processes of windthrow and colonization of disease patches by resistant or immune tree species. Hemlock dwarf mistletoe was abundant, but populations were locally diminished by periodic large fires.

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

Forest Management

Today's forests have been greatly influenced by historic large fires, extensive logging of old growth forests, recent decades of fire suppression, and intensive forest management. Plantation forestry began as early as 1915 in the Coast Range. There are now many acres of uniform stands, mostly of the commercially valuable Douglas-fir. The forest's average age has decreased as old growth was replaced with younger trees. Many plantations were planted at a high density, which allows the efficient spread of pathogens such as root diseases and foliage diseases. Short rotations, clearcutting, and intensive site preparation (both mechanical and burning) reduced the number and size of snags and the amount of decayed wood in the forest, and also reduced the amount of hemlock dwarf mistletoe.

Most reforestation was done with Douglas-fir because of the relatively low commercial value of many other species. Tree improvement programs and nursery technology advanced rapidly for Douglas-fir, so it also became the easiest to plant and manage. The long-term effect, particularly in the Coast Range, was an increase in the quantity and density of Douglas-fir, often from non-local seed sources.

In addition to market forces, other factors encouraged the extensive planting of Douglas-fir at the expense of other tree species. In the early 1900s white pine blister rust was introduced to the western United States and quickly decimated western white pine, which had been common in the Cascades and a minor component at higher elevations in the Coast Range. Foresters stopped planting it because of the disease, and it is now almost non-existent in the Coast Range. Large western redcedars have high market value, but cedar reforestation has been difficult because of animal damage. Sitka spruce also has been avoided as a reforestation species because of the Sitka spruce weevil.

In more recent years, reforestation efforts have shifted more towards a diverse mix of native conifers and hardwoods. Specific sites are more closely evaluated for the appropriate species to plant, favoring those which occur there naturally. This has resulted in a shift away from Douglas-fir as the predominant reforestation species, to greater use of species like western hemlock, western redcedar, Sitka spruce and red alder. In addition, thinning prescriptions in recent years have tended to favor opening stands up more, encouraging more diverse understory development.

Current management also acknowledges that natural disturbance agents (wind, insects and disease) helped to create a diverse and complex forest. Endemic levels of these disturbance agents can be beneficial to overall diversity across the landscape. Management is designed to minimize the risk of these agents occurring at epidemic levels. Management activities are also designed to emulate the effects of small scale disturbances in some stands. For example, gap creation has been used to provide for openings and greater horizontal diversity within stands.

Cultural Resources

Cultural resources are archaeological and historical resources. They may include objects, structures, or sites used by people in the past, and are valued for many reasons. Archaeological sites provide information about past cultures. Many sites also have religious, historic, or associational values for American Indian communities. Finally, historic sites have important interpretive, recreational, and heritage values, which are lost when artifacts and information are removed or destroyed. These resources are fragile and irreplaceable, especially objects still in their original locations. These undisturbed objects provide the most information about the culture that created them, how long ago they were made, and what the landscape was like at the time. Cultural resources provide a meaningful record of past cultures, events, and ecological conditions in Oregon.

Resource Condition

The northwest Oregon state forests have not been fully surveyed for cultural resources. However, the work done so far has identified potential Native American sites and over 400 European-American sites. Examples of these cultural resources include homestead sites, abandoned cabins and mills, stonework, bridge foundations, railroad trestle pilings, steam donkey sleds, logging camps, and the unburned remnants of camp life.

Cultural resource information is located in the Northwest Oregon Area Office in Forest Grove. This system includes an index, inventories, contact lists, bibliographies, map and photo collections, assessments, and oral histories. In order to protect these fragile, irreplaceable resources, much of the information is generally not available to the public, but is used by staff in the Department of Forestry.

Key Terms

Archaeological and historical resources — Those districts, sites, buildings, structures, and artifacts which 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. (ORS 358.905)

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)

Historic artifacts — Three-dimensional objects including furnishings, art objects and items of personal property which have historic significance. "Historic artifacts" does not include paper, electronic media or other media that are classified as public records. (ORS 358.635)

Historic property — Real property currently listed in 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.

Indian tribe — Any tribe of Indians recognized by the Secretary of the Interior or listed in the Klamath Termination Act, 25 U.S.C. 3564 et seq., or listed in the Western Oregon Indian Termination Act, 25 U.S.C. 3691 et seq., if the traditional cultural area of the tribe includes Oregon lands (ORS 97.740).

Lithic scatter — A location where prehistoric stone tools were made, usually from obsidian. The tools and weapons were used locally or traded.

Recognized Indian tribe — A tribe of Indians with federally acknowledged treaty or statutory rights.

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 biotic or geological remains or deposits. (ORS 358.905)

State Historic Preservation Office (SHPO) — Oregon's SHPO 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.

Energy and Mineral Resources

The mineral, oil, and gas potential of northwest Oregon state forests is largely unknown. According to the Department of Geology and Mineral Industries (DOGAMI), few systematic surveys have been conducted for most commodities and no regional geochemical studies have been made to define or eliminate areas of possible metal mineralization. However, there may be potential for production of natural gas, industrial minerals, geothermal resources, and rock aggregate that would supply regional and local markets and state forest management needs (Geitgey 1995).

The table on the next page summarizes the information available on energy and mineral resources. Some additional comments are below.

Rock for road construction — The northwest Oregon state forests have provided high quality rock for local road surfacing and ballast rock. As urban growth in the Willamette Valley encroaches on existing rock sources and generates land use conflicts, more distant sources of suitable rock become economically competitive. Rail hauls of 50 miles are now economically feasible, and that radius could be increased if crushing and screening facilities were located at the quarry so that sized products could be shipped.

Industrial minerals — The industrial mineral potential of the area is good, based on the limited data available. Sands in the Astoria area meet production requirements for some types of glass, and the deposits lie close to highways, railroads, and navigable waterways. Former brick clay sources in three provinces should be evaluated. Dimension stone and decorative stone have been produced from all provinces in the past. Both new building and restoration projects have generated interest in resuming production.

Metals — Gold, silver, and base metals (copper, lead, zinc) have been produced from the Quartzville and North Santiam mining districts near state forest lands in the Western Cascades. Additional reserves have been defined and neither area is sufficiently explored to rule out the possibility of further discoveries. The Tillamook Highlands province and its adjacent margins have precious metal and base metal mineralization reported from scattered areas. The known geologic setting has potential for several different types of deposits and a regional geochemical survey is necessary to define or eliminate the possibility of economic mineralization.

Table 2-1. Summary of Mineral Resource Occurrences, Production, and Potential

Energy or Mineral Resource	Astoria Basin	Tillamook Highlands	Northern Coast Range	Western Cascades
Aggregates	Stone and sand & gravel production; potential areas for regional rock quarries	Stone and sand & gravel production; potential areas for regional rock quarries	Stone and sand & gravel production; potential areas for regional rock quarries	Stone and sand & gravel production; potential areas for regional rock quarries
Geothermal resources	Very low potential	Very low potential	Very low potential	State forest lands within 10 miles of both Bagby and Breitenbush Hot Springs; moderate potential for power generation
Industrial Minerals	Past production of brick clay, peat, and iron oxide pigments; occurrences of glass-quality silica sand on state forest lands	Past production of expandable shale	Past production of brick clay, expandable shale, and dimension (building) stone	Past production of brick clay and dimension (building) stone; current production of emery
Metals	Iron-rich aluminum ore (bauxite) in southeast quarter, associated gold; production potential unknown	Assays with anomalous gold, lead, and zinc; geology has possibility of both precious and base metal deposits; unexplored; potential unknown	Occurrences of gold, silver, and base metals in northern quarter; unexplored; potential unknown	State forest lands near both Quartzville and North Santiam mining districts; occurrences, proven reserves, and past production of gold, silver, copper, and zinc
Mineral Fuels	Limited past production of coal; future production unlikely	None reported; geology unfavorable for coal	Limited past production of coal; future production unlikely; uranium occurrence	Limited past production of coal; future production unlikely; uranium occurrence
Oil and Gas	Production from Mist gas field; good potential for further exploration and production	Unexplored; some potential for exploration and production around margins	Unexplored; some potential for exploration and production for entire area	Geology generally unfavorable for occurrence of natural gas; possibility of resources at depth beneath volcanic rocks

Fish and Wildlife

Forests are more than trees. The northwest Oregon state forests provide habitats for hundreds of species of fish and wildlife. Appendix E has lists of native fish and wildlife species currently known or likely to exist in the planning area.

Wildlife

Northwest Oregon state forests currently have habitat suitable for most native species found in forests in both the Oregon Coast Range and northern Cascade Mountains (Brown 1985, Csuti et al. 1997). Appendix E provides lists of vertebrate species known or suspected to be found on, adjacent to, or in some cases, downstream of, state forest lands in both aquatic and terrestrial environments. In total, these lists include approximately 270 species, of which 63 are mammals, 147 birds, 32 amphibians and reptiles, and 28 fishes. These lists generally do not include the many species of marine fishes, birds, and mammals that may be found in the Tillamook and Columbia River estuaries adjacent to state forest lands, unless they use state forest lands for some portion of their life history requirements.

Because little inventory work or research has been conducted on state lands for other than state game species over the years, some species may be present but have not yet been detected or documented (e.g., pine marten). Other species on the lists are not currently known to be present but could become re-established as a result of habitat improvements, regional population recovery or potential re-introductions (e.g., peregrine falcon, Oregon spotted frog).

Threatened or Endangered Species

Of the many wildlife species potentially found on the northwest Oregon state forests, three species are listed as threatened or endangered under either (or both) federal and state Endangered Species Acts. (Fish are discussed separately, later in this section.) Some species are classified in various special designations such as candidate or sensitive categories. These terms are defined in the “Key Terms” box on the next page.

(Continued on page after “Key Terms” box)

Key Terms

Threatened and endangered species (T&E) — Federal and state agencies make formal classifications of wildlife species, according to standards set by federal and state Endangered Species Acts. The various classifications are defined below. Federal designations are made by the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (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 — "... 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.

Proposed threatened or endangered species — Species proposed by the USFWS or NMFS for listing as threatened or endangered; not a final designation.

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)

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 Oregon Department of Fish and Wildlife, of wildlife species that are likely to become threatened or endangered throughout all or a significant portion of their range in Oregon. Subdivided into two categories: critical and vulnerable status. This list is advisory only and is intended to be used as a proactive management and conservation tool to prevent further species listing.

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.

(“Threatened and Endangered Species” continued)

Bald eagle — The bald eagle was removed from the federal threatened and endangered species list in 2007 but is still listed as threatened by the state of Oregon. Currently, there are 13 known nesting territories in the planning area and 27 additional nesting territories located within one mile of these state forests, on other ownerships. Since a pair of eagles often uses alternate nest sites, each nesting territory can include multiple nesting sites. Bald eagles are found on and adjacent to state forest lands year-round, using available habitats for nesting, foraging, and roosting.

Marbled murrelet — The marbled murrelet is a seabird that uses mature or old growth coniferous forests within 50 miles of the ocean for nesting. Marbled murrelets do currently use some areas of northwest Oregon state forests in the Coast Range for nesting. During surveys, 75 to 95 percent of murrelet detections are bird calls rather than sightings of birds. Because it is so difficult to actually see the murrelets or find the nests, surveys cannot accurately count the number of murrelets nesting on northwest Oregon state forests. When surveys detect occupied behavior from murrelets, then a MMMA (marbled murrelet management area) is established in that area. Currently, 8,613 acres are in designated MMMAs in northwest Oregon state forests, within 50 miles of the ocean.

Spotted owl — Early surveys found extremely low densities of northern spotted owls in the northern Coast Range, an area with extensive forests of young Douglas-fir stands (less than 65 years old) and few remnant stands of old growth or mature forests (Forsman et al. 1977, Forsman 1986, Cunningham 1989). More systematic surveys began on state land after the USFWS listed the owl as a threatened species in June 1990. Since 1992, the Oregon Cooperative Wildlife Research Unit of the Oregon State University and ODF have conducted owl surveys on state forest lands. Nearly all potential nesting habitat, with special emphasis on habitat in or adjacent to planned or previously sold timber sales, has been surveyed during this time period.

The table on the next page summarizes the most recent data on spotted owls on northwest Oregon state forest lands. The number of spotted owl sites known to be present on or adjacent to ODF lands was 97 in 2001. In 2008 there were 119 resident owl sites on or adjacent to northwest State Forests. Trends in number of resident owl sites are difficult to interpret. Increases in spotted owl numbers may be partially related to increased survey effort as spotted owl populations have generally declined state-wide since the early 1990’s when the spotted owl was added to the federal endangered species list.

Table 2-2. Spotted Owl Sites on Northwest Oregon State Forests, in 2008

	Pair Sites On ODF Land	Pair Sites Adjacent to ODF Land	Resident Single Sites On ODF Land	Resident Single Sites Adjacent to ODF Land	Total
Astoria	3	0	0	0	3
Tillamook	2	3	1	3	9
Forest Grove	1	0	1	1	3
West Oregon	2	7	1	4	14
Western Lane	5	51	1	10	67
North Cascade	7	10	2	4	23
Total	20	55	4	14	119

Neotropical Migratory Birds

Neotropical migratory birds are species that breed mainly in temperate North America and winter primarily south of the United States-Mexico border. Of 463 species of birds known to exist in Oregon, 122 species (26 percent) are considered neotropical migratory birds. Twenty of the neotropical birds that inhabit northwest Oregon state forests show significant declines based on U.S. Fish and Wildlife Service breeding bird surveys conducted throughout Oregon since 1968.

There are no official state or federal requirements for management of these species other than maintaining viable populations on federal lands. However, since 1990 an international program called Partners in Flight has been developing a migratory bird conservation program emphasizing habitat management and protection, professional training, and public education. In the Pacific Northwest, a Washington-Oregon Partners in Flight chapter has developed a volunteer conservation plan for western coniferous forests that was completed in 1999.

Habitats for neotropical migratory birds are expected to improve in both quantity and quality with implementation of structure-based management and strategies for spotted owls, marbled murrelets, aquatic and riparian habitats.

Summary of Fish and Wildlife Status

The table on the next page lists all fish and wildlife species with listing status at either the state or federal level, in all categories, for the northwest Oregon state forests. These species are known or suspected to be found on, adjacent to, or in some cases, downstream of, state forest lands, on both land and water. Fish are discussed in the next subsection of this chapter.

Table 2-3. Fish and Wildlife Species with listing status on or near State Forest Lands [1,2]

Category	Species
Federal endangered species	**Oregon chub**
Federal threatened species	**Marbled murrelet, northern spotted owl, coho salmon (**Oregon coast and lower Columbia, Southern Oregon/Northern California ESUs**), chinook salmon (**lower Columbia and upper Willamette River ESUs**), chum salmon (**Columbia River ESU**), steelhead (**lower Columbia River and upper Willamette ESUs**), Bull trout**
State endangered species	**Coho salmon (lower Columbia River ESU)**
State threatened species	**Bald eagle, marbled murrelet, northern spotted owl**
Federal candidate for listing	**Oregon spotted frog, fisher, streaked horned lark**
State sensitive species	**Bull trout, chinook salmon** (upper Willamette, Coastal, and Lower Columbia ESUs and Rogue), **chum salmon** (Columbia River and Pacific coast), **coastal cutthroat trout (lower Columbia River ESU), steelhead** (lower Columbia, Oregon Coast, Upper Willamette ESUs and Rougue), **coho salmon** (Oregon Coast and Southern Oregon/Northern California ESU and Rogue), **Oregon chub,** Umpqua chub, Pacific lamprey (Columbia, Rogue, and Coast), Western Brook Lamprey (Columbia, Coast, Rogue), Cascade torrent salamander, **Cascades frog**, clouded salamander, **coastal tailed frog** Columbia torrent salamander, Cope's giant salamander, **foothill yellow-legged frog**, **Oregon slender salamander**, **Oregon spotted frog**, **southern torrent salamander**, western toad, **western pond turtle**, American peregrine falcon, **little willow flycatcher**, **northern goshawk**, **olive-sided flycatcher, purple martin,** slender-billed nuthatch, **streaked horned lark,** western bluebird, **American marten**, **California myotis**, **fisher**, **fringed myotis, hoary bat, long-legged myotis**, pallid bat, red tree vole, ringtail, **silver-haired bat**, **Townsend's big-eared bat**,
Federal species of concern	**western pond turtle**, **coastal tailed frog**, **Oregon slender salamander**, northern red-legged frog**, foothill yellow-legged frog**, **Cascades frog**, **southern torrent salamander**, **northern goshawk**, **olive-sided flycatcher, willow flycatcher**, harlequin duck**,** mountain quail, **band-tailed pigeon, purple martin, pallid bat**, white-footed vole**, red tree vole, Townsend's big-eared bat, silver-haired bat**, long-eared myotis, **fringed myotis**, **long-legged myotis**, **Yuma myotis, steelhead** (Oregon coast ESU).

1. Species in bold are listed under more than one classification.
2. ESU — evolutionarily significant unit (see page 2-34).

Fish

The streams, rivers, lakes, and other water bodies in the northwest Oregon state forests provide habitats for a variety of fish species. At least 28 species of fish use habitats in the plan area for part or all of their life history, or use habitats downstream from state forests that may be influenced by state forest management.

Native salmonid species in the northwest Oregon state forests include fall and spring races of chinook salmon, coho salmon, chum salmon, winter and summer steelhead trout, resident populations of rainbow trout, and both anadromous and resident races of cutthroat trout. Native non-salmonid fishes include various species of lamprey, sculpin, dace, chub, sucker, and others. Appendix E has a complete list of native freshwater fish species currently known or likely to exist in the planning area. The Oregon Department of Fish and Wildlife collects information on fish populations.

Salmonid species (salmon and trout) — Anadromous salmonid populations are generally depressed throughout western Oregon for a variety of reasons, including reduced survival in the ocean, reduced productivity of freshwater habitats, fishing levels, and other reasons. The regional trends have been observed in salmonid populations in the planning area. Listed fish species are discussed further on the next page.

For resident salmonid populations, resident cutthroat trout are widely distributed and appear stable, although special consideration is warranted for populations isolated above impassable barriers. Resident rainbow trout populations are generally isolated and rare in the planning area, and therefore may be a concern.

Non-salmonid species — There is much less information about the status of non-salmonid species. The Western Brook and Pacific lamprey are of concern, and Oregon chub is federally listed. Limited distribution, reduced abundance, and/or special habitat needs raise concern for these species. These species are discussed under the "Threatened and Endangered Fish Species" heading.

Key Terms

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

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

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.

Threatened and Endangered Fish Species

The federal government has listed some populations of coho salmon, chinook salmon, chum salmon, steelhead trout, and Oregon chub as threatened or endangered species (table 2-3). The federal government has identified "evolutionarily significant units," or ESUs, within these species. Only some ESUs, or certain groups of populations, are listed or proposed for listing.

Coho Salmon — Coho are listed as federally threatened in the Oregon Coast, Lower Columbia, and Southern Oregon/Northern California ESUs. These ESUs overlap with Coast Range and Southwest State Forest Districts. Over the last fifteen years, coho spawner abundance in the ESU has fluctuated over two cycles in ocean productivity. Abundance increased from 1997 till 2002, declined from 2003 until 2007, and appears to have resumed an increasing pattern beginning in 2007. Conservation measures may have contributed to a recent 10-year period of higher spawner abundance that is higher than for any other 10-year period on record. These improvements have eased near-term risks, but it is not clear whether all underlying factors for the recent decline have been addressed or if this is just a temporary response to improved ocean conditions.

Chinook Salmon — Chinook Salmon are federally listed as threatened in the Upper Willamette and Lower Columbia rivers. These ESUs overlap with the Coast Range and Cascade State Forests districts. At least one population is extinct (outside the planning area) and several others have extremely low returns or a high degree of hatchery influence. Numerous hatcheries in both Oregon and Washington release fall Chinook which spawn in tributary streams.

Chum Salmon — Chum are federally listed as threatened in the Columbia river ESU and are found in Coastal rivers of State Forests. Overall, populations outside of the Lower Columbia are much reduced from historic levels. The relatively healthy populations in the Necanicum, Nehalem, and Tillamook Rivers support important fisheries and are very important to the overall viability of Coastal Chum. Populations within the Lower Columbia ESU are considered functionally extinct. Reintroduction efforts are under consideration as habitat improvements undertaken for other species may support some chum production.

Steelhead Trout — Steelhead are federally listed as threatened in the lower Columbia and the Upper Willamette ESUs. These ESUs overlap with Coastal and Cascade State Forest ownership. Monitoring information for these populations is primarilly limited to dam counts. Fish counts at the Willamette Falls hydroelectric facility document low abundance of winter steelhead over the last five years. Improved information is needed regarding the status of these populations.

Chub — Oregon Chub is federally listed and is found in the Willamette basin. Umpqua Chub is not listed and occurrs in Umpqua Basins. State forest owersnhip are within the Cascades (Willamette) and Southwest districts (Umpqua). The Oregon Chub status has improved in recent years resulting from the discovery of several new populations and successful reintroductions within the historic range. However, these improvements have not eliminated the risk posed by non-native fishes, nor the substantial loss of historic habitats.

Lamprey — Oregon Western brook and Pacific lamprey occur in the Coastal and Lower Columbia/Willamette ESUs. While they are not listed, and they are widely distributed throughout Oregon, both distribution and abundance have likely decreased in recent years. Habitat loss and pollution have contributed to the decline. Little is known about life history characteristics of Western brook lamprey in Oregon, and many critical uncertainties regarding status, biology, and requirements remain.

Key Terms

Populations, Stocks, and Evolutionarily Significant Units

Species — "…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 Endangered Species Act].

Population — "A group of fish spawning in a particular area at a particular time which 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." [Oregon Administrative Rule, Division 7, 635-07-501(38)]. For example, "Nehalem River fall chinook salmon" are a population.

Stock — "For the purposes of fisheries management, a stock is an aggregation of fish populations which typically share common characteristics such as life histories, migration patterns, or habitats." [Oregon Administrative Rule, 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.

Evolutionary Significant Unit (ESU) — 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. (NMFS 1991). This term is used by the National Marine Fisheries Service as guidance for determining what constitutes a "distinct population segment" for the purposes of listing Pacific salmon species under the Endangered Species Act. 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.

Habitat Status

The Oregon Department of Fish and Wildlife completed habitat surveys on approximately 250 miles of streams within the planning area between 1994 and 1996. Most of the surveys were done in the Nehalem, Wilson, and Trask River basins, and in tributaries to the lower Columbia River. Surveys were also completed in portions of the Santiam, Yaquina, and Tualatin river basins.

The stream habitat surveys provide information on the current condition of key physical factors that can affect the productivity of fish habitat. In the summary below, the survey results are compared to habitat benchmark values developed by the Oregon Department of Fish and Wildlife. The following summary discusses general results for the planning area (Oregon Department of Fish and Wildlife 1997).

Aquatic shade — Aquatic shade is in good condition throughout the plan area. Most of the surveyed reaches meet the benchmark of greater than 70 percent aquatic shade. Red alder provides most of the shade (Stein 1997).

Fine sediments — The presence of fine sediments within riffles is of some concern for streams in the plan area. A majority of the surveyed basins only rate as "fair" for this habitat parameter. The poorest conditions were observed in the lower Columbia and Yaquina River areas, where many reaches had fine sediments in more than 20 percent of the riffle areas. The benchmark is less than 20 percent of the riffle areas containing fine sediments. This result is a coarse summary for the region and does not consider the potential effect of underlying geology on these conditions. Also, the survey sample size in the Yaquina basin was too small to derive any definitive conclusions for that area. In general, though, significant improvement in this parameter may be needed in all of the surveyed areas except the Wilson River basin.

Pool abundance — The proportion of pool habitat to total stream area was generally fair over much of the planning area, with pools generally occupying between 10 and 35 percent of total stream area. However, improvements to this parameter would be beneficial. The best abundance of pool habitats was found in the Nehalem basin. The abundance of pools is commonly related to the abundance of instream large woody debris, a habitat parameter that also needs improvement.

Instream abundance of large wood — The abundance of large wood was generally fair, and needs improvement over the entire planning area. The poorest area for instream large wood appears to be the Yaquina drainage, but this conclusion may again be affected by the small survey sample size.

Key pieces of large wood — The presence of key pieces of instream large wood is generally poor throughout the area. “Key pieces” include those materials greater than 24 inches in diameter and more than 30 feet in length. The key pieces are a critical factor in the formation of complex, productive fish habitats. Projects may need to focus specifically on supplying these largest pieces of wood.

Large riparian conifers — The abundance of large conifer trees (greater than 20 inches dbh) in the riparian area is consistently poor throughout the planning area. This condition indicates that there will be little natural improvement of instream large woody debris conditions in the near future, since riparian trees are the main natural source of instream large wood. The lack of large riparian trees also highlights the need to maintain any existing large trees in the riparian zone, and to manage riparian zones in a way that improves the supply of large diameter conifers over time.

General conclusions — The following general conclusions should be interpreted with some caution. The comparison of existing conditions to benchmarks does not recognize the influence of local geology, geomorphic constraints, stream size and location, or other factors on the surveyed streams. For these reasons, site-specific assessments are needed to determine more accurately the current and desired future conditions. The use of habitat benchmarks will be important in this process, but only to the extent that site-specific constraints on habitat potential will be considered.

In general, the planning area’s instream habitat conditions indicate that current freshwater productivity may be at a low point. This result was not unexpected, given the area’s history of large fires and other disturbances, and the young age of the forest. Habitat attributes such as large wood abundance and large wood key pieces can be addressed on a short-term basis through stream habitat enhancement actions. More specific assessments are needed to determine the potential success of actions to reduce fine sediments.

Long-term, management should restore the landscape’s ability to produce desirable habitat conditions on its own. For example, when large conifers are more abundant in riparian zones, the trees will eventually fall into streams and provide key pieces, and in turn abundant large wood should help create and maintain abundant pools. Therefore, the long-term management goal might be to grow large conifers in riparian zones. Watershed assessments will eventually provide more detailed, site-specific assessment of current conditions, and will be necessary to develop appropriate management actions to achieve the desired instream conditions.

Forest Health

Fire, windstorms, people, insects, and diseases constantly disrupt forests, injuring and killing trees and other living things. These disturbances are natural and necessary processes of the forest ecosystem, and are discussed in more detail earlier in this chapter, under “Biodiversity and Disturbance History.” However, when disturbance causes effects that are more severe and widespread than people consider normal or acceptable, the forest is often described as unhealthy (Campbell and Liegel 1996).

The most comprehensive definitions of a healthy forest are based on the premise that management objectives can be achieved only within the limits of an ecologically viable and sustainable system. The following concepts are common to most current definitions of forest health: 1) a healthy forest can vigorously renew itself across the landscape and recover from a wide range of disturbances; 2) a healthy forest provides for the human needs of values, uses, products, and services, and; 3) a healthy forest provides a diversity of stand structures that provide habitat for many native species and all essential ecosystem processes (Campbell and Liegel 1996; Kolb et al. 1994; Stolte 1997).

Forest health can be evaluated by measuring key ecosystem processes. It is essential to recognize that ecological conditions are always changing due to normal system variability, such as responses to natural events and human use. Evaluations must determine what level of change indicates a significant forest health trend, within the context of normal and historical variability.

Although comprehensive assessment of ecosystem health is beyond the scope of the *Northwest Oregon State Forests Management Plan*, several key indicators of ecosystem health and vitality can be evaluated. Key indicators of forest health include damage from insects, disease, and animals; and damage from abiotic stressors such as fire, weather extremes, and air pollutants. These disturbance agents kill trees or parts of trees, or reduce growth. The effects of these various disturbance agents are usually described in terms of number of acres affected, number of trees killed, degree of damage, or reduction in tree growth rates, all of which can be measured through various survey techniques.

The forest’s current condition can often be better evaluated by comparing present-day conditions to long-term averages or historical conditions. Some factors that influenced forest health historically are discussed earlier in this chapter, under “Biodiversity and Disturbance History,” starting on page 2-16.

Because they have a unique history, many of the northwest Oregon state forests are now at a critical point in terms of forest health. Much of the Tillamook Burn was planted or seeded with Douglas-fir from non-local seed sources, with unknown long-term consequences. The recent dramatic upswing of Swiss needle cast damage is a warning that the Tillamook and Clatsop forests may not be as healthy as once thought.

Current Condition

Overview

For the northwest Oregon state forests, the current condition can be ascertained by long-term trends in damage from major disturbance agents. Although northwest Oregon does not have the widespread deterioration of forests that has occurred in eastern Oregon, several diseases have reached noticeable levels of damage in recent decades. Swiss needle cast, the highly visible foliage disease of Douglas-fir in the Coast Range, is causing serious growth decline over a large area on the west side of the Coast Range, especially in the Tillamook District. Growth reduction is severe enough on some sites that the future of many stands is uncertain. Douglas-fir has been grown and harvested repeatedly on sites infested with the fungus *Phellinus weirii*, often increasing the amount and severity of laminated root rot on many sites. However, current management practices should stabilize or reduce unwanted effects of this disease. Black stain root disease was largely unheard of before 1969. Since then it has reached epidemic proportions in southwest Oregon, and now can be found at low levels throughout Douglas-fir plantations in northwest Oregon state forests. The strong correlation between the occurrence of black stain and tractor logging, site disturbance, precommercial thinning, and high stand densities, suggests that certain intensive management practices have contributed to an increase in this disease.

Very few insect problems occur in the early to mid-successional Douglas-fir and western hemlock stands that are common on northwest Oregon state forests. The most significant pest is the Douglas-fir beetle, whose outbreaks follow major windthrow events. The Sitka spruce weevil continues to limit Sitka spruce management. The present lack of significant insect pests in western Oregon forests contrasts with the situation in eastern Oregon where both bark beetles and defoliators are major pests of Douglas-fir. In eastern Oregon, the climate, overstocked stands, and periodic droughts are believed to be important factors in predisposing trees to insect damage.

Bear damage is an important problem in some young Douglas-fir stands on state forests. Tree mortality in any year is usually low, but the cumulative mortality over many years at the same site is significant. This is especially true when damage occurs in precommercially thinned stands. Since the current management regime for young stands produces favorable bear habitat, the problem of bear damage seems likely to persist.

There is no question that management has altered forest ecosystems on state lands in northwest Oregon. However, foresters do not yet fully understand the effects of management on forest health and trees' susceptibility to pests and abiotic stresses.

Continued monitoring should provide early warning of new problems, and gradually improve our ability to maintain a healthy forest.

Swiss Needle Cast

Swiss needle cast (*Phaeocryptopus gaeumanni*) is a native fungal disease of Douglas-fir that occurs throughout the Coast Range and western Cascades. Until recently the disease was of little consequence, causing premature shedding of three- and four-year-old needles. However, since the mid-1980s several hundred thousand acres of Douglas-fir in the northern Coast Range have shown increasingly severe damage from this disease.

A 1997 assessment of Swiss needle cast's impact on 10- to 30-year-old Douglas-fir plantations in coastal northwest Oregon showed that the disease caused an average of about 22 percent reduction in volume growth (Maguire et al. 1997). Growth loss over the entire Coast Range is much greater, and in some stands exceeds 50 percent of normal growth. The growth reduction, especially if sustained, will not only reduce yields but also will affect our ability to manage stands into desired structures and compositions.

Several hypotheses have been suggested to explain why this normally benign pathogen is causing severe damage to Douglas-fir. The most likely explanation is that our management practices, in combination with a climate conducive to the disease, have shifted the ecological balance in favor of the pathogen. Much of the Sitka spruce and western hemlock zones have been planted to dense stands of Douglas-fir. Often these plantations were established from seed collected farther inland and at higher elevations than native coastal stands. The combination of a favorable climate, an increase in the amount and density of Douglas-fir in coastal areas, and slightly off-site seed sources, may have set the stage for rapid and efficient spread of the fungus. As a result, the pathogen population may have increased to levels that can overwhelm naturally occurring mechanisms of disease tolerance. Apparently a delicate balance exists between the tree, the pathogen, and the environment. In order to predict the disease's long-term effects on the forests and develop practical mitigation measures, it is critical to understand the effects of various factors on this balance.

Current management efforts in relation to Swiss needle cast are guided by a strategic plan developed by Department of Forestry staff. Infection levels are monitored annually through aerial survey efforts and on the ground evaluations. A range of silvicultural treatments is being applied, ranging from young stand management practices that favor tolerant species, to conversion of severely infected stands and replanting with tolerant species. Cooperative research efforts are underway to evaluate the effectiveness of a variety of silvicultural approaches in reducing impacts from the disease.

Laminated Root Rot

Laminated root rot (*Phellinus weirii*), a native fungal disease that affects many conifer species, is the most widespread and destructive disease of Douglas-fir in the Coast Range and western Cascades. On average, it affects about five percent of the Douglas-fir forest land, but the disease is distributed unevenly. Results from several surveys show that in the northwest Oregon state forests, at least ten percent of the Douglas-fir type is affected by this disease (Kanaskie et al. 1994, Kastner et al. 1994). The area affected in individual stands ranges from zero to over seventy-five percent.

Laminated root rot causes tree mortality and growth loss, and predisposes trees to windthrow. Because the disease spreads from root to root and affects groups of trees, it commonly creates canopy openings of various shapes and sizes. These openings allow light to reach the understory, stimulating growth of herbs, shrubs, and tree species resistant to the disease (Holah et al. 1993). Trees killed by the disease provide snags and down logs which benefit certain wildlife species. The increased diversity and benefits to wildlife partially offset the huge volumes of timber lost to this disease annually. Because the disease destroys major structural roots, laminated root rot can contribute to extremely hazardous situations in developed recreation sites.

Laminated root rot intensifies on a site when Douglas-fir or other highly susceptible species are planted in an infested area and the fungus (which survives for decades in buried roots) grows from infected roots onto the roots of the newly established tree. The most susceptible host species are Douglas-fir, grand fir, and mountain hemlock. Western hemlock and noble fir have intermediate susceptibility; pines and cedars are resistant; and hardwoods are immune (Thies and Sturrock 1995).

Current management emphasizes planting or retaining resistant or immune species, and carefully designing silvicultural systems to prevent blowdown after thinning. In northwest Oregon state forests, most sale areas receive a root disease survey prior to harvest. Survey results are on file at the Insect and Disease Section in Salem and at district offices.

Black Stain Root Disease

Black stain root disease, caused by the fungus *Leptographium wageneri*, was largely unrecognized in the Pacific Northwest before 1969. Since then the disease has been detected in many areas. It occasionally causes severe damage to Douglas-fir. In northwest Oregon the disease occurs infrequently, often in association with other root diseases, and rarely causes significant damage. However, in the southern part of western Oregon as much as 25 to 50 percent of 10- to 30-year-old Douglas-fir plantations contain diseased trees, with mortality as high as 50 percent in some stands (Hansen et al. 1988).

Black stain is transmitted over long distances by spore-carrying bark beetles and weevils. The disease typically appears in small patches. These disease patches are encountered most frequently in areas with severe soil disturbance, in dense stands that have been precommercially thinned, along roads, and in stands with a history of tractor logging (Hansen 1978, Goheen and Hansen 1978). The high frequency of black stain root disease centers in disturbed areas probably reflects insect preference for stressed or injured host trees. Thinning in midsummer, avoiding site and tree damage, and favoring species other than Douglas-fir, can reduce impacts of this disease.

Armillaria Root Disease

Armillaria root disease is far less abundant and damaging than laminated root rot but occasionally causes significant damage in young Douglas-fir plantations. Root disease surveys have shown that in the northwest Oregon state forests, armillaria is widely scattered and occurs in very small patches, usually affecting only a few trees. Scattered dead trees from armillaria probably have a positive value for wildlife habitat.

In northwest Oregon, damage appears most severe in even-aged plantations and on severely disturbed sites. Tree stress, which can result from poor planting, inappropriate seed source, soil compaction, or nutrient imbalance, generally predisposes trees to damage by armillaria (Shaw and Kile 1991, Hadfield et al. 1986), but vigorous, rapidly growing trees also can be attacked and killed (Rosso and Hansen 1998).

Hemlock Dwarf Mistletoe

Hemlock dwarf mistletoe is the only dwarf mistletoe that occurs on state forest lands in the Coast Range or western Cascades. The principal hosts are western and mountain hemlock (each has its own subspecies of dwarf mistletoe), but several true firs also can be damaged. Dwarf mistletoes are flowering seed plants that parasitize conifer trees by growing root-like structures directly into tree branches. They extract nutrients and water from host trees and cause mortality, growth loss, deformation of tree form and crown structure, and reduced seed production. Although birds and mammals can carry the sticky mistletoe seeds a long distance, most spread occurs when seeds are cast from infected overstory trees onto susceptible understory trees (Hawksworth and Wiens, 1996).

In heavily infested stands, hemlock dwarf mistletoe can reduce wood volume to as little as sixty percent of normal. Infected trees are predisposed to damage from other stressors such as drought and bark beetles (Weir 1977). Hemlock dwarf mistletoe also provides food and habitat for certain wildlife species. For example, marbled murrelets have been observed nesting on hemlock branches deformed by dwarf mistletoe.

Because dwarf mistletoes are parasitic plants which require a living host to survive, clearcutting has been an effective control measure. Clearcutting, large fires, and short rotations have reduced occurrence of hemlock dwarf mistletoe on much of state forest lands. Long rotations and partial cutting may increase the abundance of hemlock dwarf mistletoe (Parmeter 1978).

Other Diseases and Insect Pests

The following diseases and insect pests are also present in northwest Oregon forests.

- **Annosum root disease —** In the northwest Oregon state forests, western hemlock, mountain hemlock, grand fir, and noble fir are the principal hosts. The most significant damage occurs on western hemlock. Most annosum decay is associated with tree wounds. Commercial thinning or partial cutting increases the potential for annosum. The disease may increase as thinning intensifies and stand ages increase.
- **White pine blister rust —** Western white pine is most abundant at mid to upper elevations in the western Cascades, and is rare in the Coast Range. White pine blister rust is caused by the fungus *Cronartium ribicola*, which was introduced from Europe into British Columbia in 1910. Western white pine has been decimated throughout its range (Kimmey and Wagener 1961). Special measures such as hazard rating, pruning, and planting resistant seedlings are necessary to ensure its continued presence.
- **Stem decay —** In old growth stands, decay organisms cause tree death or breakage, creating gaps in the canopy and providing rotten wood and hollow logs for wildlife. In areas with extensive young stands, the main concern may be the lack of decay and defect, and its probable effect on wildlife and ecosystem processes.
- **Douglas-fir bark beetle —** In western Oregon, the Douglas-fir bark beetle usually infests windthrown or diseased Douglas-fir trees. When a major windstorm occurs, the large supply of high quality Douglas-fir breeding logs allows beetle populations to increase tremendously. Unless the large (more than twelve inches in diameter) windthrown Douglas-firs are salvaged rapidly, a bark beetle outbreak can occur when the emerging brood attacks nearby standing green trees.
- **Spruce weevil —** The Sitka spruce weevil is an important pest of Sitka spruce regeneration in coastal Oregon. It can damage young, open-grown Sitka spruce badly. Research now suggests that a combination of stocking control, genetic resistance, and site selection may reduce the impact of weevil infestations.
- **Hemlock sawfly —** Outbreaks of the hemlock sawfly have occurred periodically in Clatsop County. The insect kills some tree tops and reduces growth in hemlocks. As hemlock stands mature, they will become more prone to sawfly infestations.
- **Hemlock looper —** In the past, the hemlock looper has been a significant pest of old growth hemlock in Clatsop and Tillamook Counties.
- **Spruce aphid —** Spruce aphid infestations cause premature loss of older needles in Sitka spruce, and eventually kill branches or the entire tree. Much of the spruce decline visible along the Oregon coast is attributable to the spruce aphid. Recently, damage has been reported on state land near Neahkahnie Mountain.
- **Exotic pests —** In addition to white pine blister rust, several other exotic pests can potentially affect the northwest Oregon state forests. Dogwood anthracnose occurs throughout Oregon, but damage has not been severe. The balsam woolly adelgid, gypsy moth, and hemlock adelgid can damage or kill trees, and have been found in northwest Oregon.

- **Noxious weeds —** Noxious weeds are an emerging problem on forest lands. Invading non-native plants compete with native vegetation, and can significantly alter ecosystems. Spotted knapweed and gorse are present in some western Oregon forests (Campbell et al. 1997).
- **Black bears —** Black bears peel and eat the bark of young conifers, especially Douglas-fir, in spring when bark is succulent and sugar content is high. They damage some trees, and kill others. Bear damage typically occurs in Douglas-fir stands from 16 to 25 years old, often soon after stands have been thinned (Kanaskie et al. 1990). Bear damage occurs in Tillamook, Clatsop, and Columbia Counties (Overhulser 1996, Campbell et al. 1997). Several districts have programs to manage bear damage.
- **Animal damage —** In addition to bears, other animals that can damage forest trees include mountain beavers, deer, elk, porcupines, gophers, and river beavers. With many of these animals, damage can be locally severe.

Drought, Freezes, Windthrow, and Other Non-Biological Factors

Severe windstorms, droughts, and freezes can kill many trees. At least several of these events should be expected over the life of a stand. Isolated fragments of conifer stands, which may be set aside for threatened and endangered species, will be particularly susceptible to windthrow. Windfall is minimized when sound trees, free of root disease, are left along cutting lines.

Periodic cold snaps have caused extensive browning of many conifers in the Coast Range, but the long-term effects have been generally minor. Low temperatures can also cause top-kill of conifers. Damage from abiotic stresses tend to be greatest when tree genotypes or species are poorly suited to their local environment.

Current Forest Health Management Programs

There are a number of federal and state programs related to forest health management, monitoring, and research on the northwest Oregon state forests.

Geology and Soils

Forests begin with dirt. Soil defines the type of forest that can grow and the vigor of the forest. In turn, soil is formed by the combined influences of bedrock geology, time, climate, topography, and biologic activity. Forest management has several important concerns related to soils: maintaining long-term soil productivity, preventing soil erosion, and minimizing landslide risks. To understand the soil, we have to start with the region's geology — the underlying rocks, and how they were formed.

Geology of the Northwest Oregon State Forests

Northwest Oregon can be subdivided into five provinces based on geology and topography: the Astoria Basin, the Tillamook Highlands, the Northern Coast Range, the Western Cascades, and the Willamette Valley. The northwest Oregon state forests are located in the first four of these provinces. The fifth province, the Willamette Valley, does not have any state forest land.

The topography and slope failure risks are characterized below. See the "Key Terms" box on the next page for definitions of terms used in this section.

Astoria Basin — The topography is moderately steep to gentle with frequent evidence of medium to large scale ancient slide features. There are earthflows, slumps, and rock block slides scattered through the landscape. There is also a wide distribution of low strength decomposed rock material that serves to produce potential landslide slip-surfaces. In general, slope stability risks in the Astoria Basin are slightly lower than average for Coast Range forests. There is a slightly higher than average risk of larger scale slope movements such as earthflows and slump-earthflows.

Tillamook Volcanic Highlands — The topography is steep with moderate dissection of slopes by drainage system development. The rock material and residual or colluvial soils are fairly high strength, leading to better than average slope stability conditions, compared to areas of similar slope and storm intensity. The risk of debris slides in headwalls and elsewhere appears to be slightly lower than in the sedimentary rocks of the Coast Range. Ancient, moderately-sized slumps and rock block slides are scattered over

Key Terms

Colluvial — Describes soil, debris, and other materials that have been moved downslope by gravity and biological activity.

Debris slide — Rapid landslide occurring on a slope. The material moved may include soil, wood, and vegetation. The slide may or may not reach a stream channel. See also "landslide" below.

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" below.

Geotechnical — The study of soil stability in relation to engineering.

Headwall — The steep slope or rocky cliffs at the head of a valley.

Landslide — The dislodging and fall of a mass of earth and rock. This assessment refers to various 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. The differences are not described in detail here.

Rock block slide — Type of landslide in which the weakness and initial breaking is in the underlying rock, not the soil. See also "landslide" above.

Slope stability — The degree to which a slope resists the downward pull of gravity. The more resistant, the more stable.

Slump — Type of landslide; involves a failure in the soil, tends to be spoon-shaped, and the base often oozes out. See also "landslide" above.

Slump blocks, slump earthflows — Types of landslides. See "landslide", "slump", and "earthflow" above.

the landscape. These ancient features pose site-specific increases in slope stability risk. This region has many old railroad grades, roads, skid trails, and road fills. These legacy conditions present an added risk of slope movement, above the natural risk.

Northern Coast Range — The topography is steep and dissected by drainage development. The predominant slope stability risk is the debris slide. The potential is moderately high for damaging debris slides originating from headwalls and other points. The risk of debris slides can be exacerbated by forest operations. In the past ten years, the risk has increased of rock block slides triggered by loading from landings or waste areas.

Western Cascades — The topography is steep (very long and somewhat less dissected slopes than the Coast Range mountains). The risk of debris slides is less than the Coast Range. There are significant numbers of medium to large rock block slides, slump blocks, slump earthflows, and some very large earthflows scattered over the landscape. Loading and undercutting, including waste area storage, landings, and roads, can trigger renewed movement in these features. The risk of slope stability associated with timber harvest and road building is somewhat less than that of the Coast Range mountains.

Soils

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

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

Mycorrhizal fungi function to extend the root system of plants, and native tree species and other native plants in the plan area depend on these fungi for survival. Other soil microbes fix nitrogen (take nitrogen from the air and convert it into a usable solid in the soil). Soil organisms also bind particles into water-stable aggregates that build soil volume and maintain pores, which allow water and air to move through the soil.

Soils of the Northwest Oregon State Forests

Soils of the northwest Oregon state forests are in two broad categories — the Coast Range and the Western Cascades.

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

Key Terms

Alluvial — Describes soil and other materials that have been deposited by currents of water.

Andesites — A type of volcanic rock; its composition is intermediate between basalt and rhyolite. The most common rock in the Cascades.

Best Management Practices — Oregon Forest Practices Act rules adopted by the Board of Forestry to minimize the impact of forest operations on water quality. These rules ensure that, to the maximum extent practicable, forest operations meet the water quality standards established by the Environmental Quality Commission. The rules recognize that some disturbance is associated with forest management.

Breccias — Aggregates composed of angular fragments of the same rock, or of different rocks united by a matrix.

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

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

Western Cascade soils — Soils of the Santiam State Forest are mostly derived from ancient andesites and their alluvial deposits. Other volcanic deposits may cap some soils. The soils are mostly gravelly with clay, clay loam, and sandy loam textures. They vary from shallow and skeletal on some slopes to deep and moderately well developed on gentle terrain. Rock volumes of 40 to 60 percent are common.

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

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

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). In this document, an age of 50 years is used. The 5 site classes are defined below.

Site Class I	135 feet and up
Site Class II	115-134 feet
Site Class III	95-114 feet
Site Class IV	75-94 feet
Site Class V	Below 75 feet

Current Management

The Department of Forestry manages state forest lands in accordance with the Oregon Forest Practices Act rules (Division 24) for soil protection. These rules define Best Management Practices for protecting soil and forest productivity when conducting timber harvest, prescribed burning, or road construction activities. The department uses the professional expertise of foresters, geotechnical specialists, soil scientists, and forest engineers to evaluate proposed activities.

Timber sales — Timber sale contracts have restrictions on logging systems, types of equipment, and the amount of soil disturbance allowed. In recent years, new management standards recognize the importance of large woody debris, and require leaving substantial amounts of large down wood in logged units.

During timber harvest and site preparation, many techniques are used to protect soils from compaction and puddling. Common techniques include limiting ground equipment activity to gentle slopes and to time periods when soil moisture is low, and limiting the amount of area on which ground equipment may operate. Cable and ground equipment operations must minimize gouging and soil displacement.

In selective harvest operations, soil characteristics can influence the vulnerability of remaining trees to windthrow. Managers consider soil type along with other factors when selecting the leave trees.

Silvicultural treatments such as thinning require repeated entries into forest stands. The more frequent entries increase the potential for erosion, compaction, soil removal, and decreased organic inputs to soils. Managers must plan stand management activities to minimize negative impacts to soil.

Prescribed burning — The organic or duff layer of soil and the amount of large wood influence soil productivity. Prescribed burning practices have been changed in recent years in order to protect these organic materials. Fewer acres are burned, and most burns are done in the spring, when large fuels and soil litter are moister and less likely to burn. In these “cool” springtime slash burns, the fire consumes very little litter, duff, and large pieces of wood. Most of these materials are retained on the site, contributing to long-term soil productivity.

Long-term productivity — The typical forest in northwest Oregon produces and stores large amounts of organic matter, including wood, leaves, needles, fungi, lichens, and animals. The nutrients in this organic matter must be constantly recycled in order to be used for new growth. The dead wood must decay, leaf litter must be broken down, animal droppings must decompose, and so forth. Soil and the thousands of organisms that live in it are critical to the constant nutrient recycling process. Thus soil productivity is key to forest productivity.

Best Management Practices are designed to maintain long-term soil productivity by protecting the mineral and biological components of soil, maintaining biological processes, and minimizing compaction and erosion.

Slope stability — Landslides are the dominant erosional process in the mountainous terrain of the northwest Oregon state forests. Debris slides are the most common type of slide. They can originate in headwalls or elsewhere on mountain slopes. Some slides are natural in origin, some are due to past logging practices, and others are related to current management activities. The Department of Forestry uses geotechnical expertise in planning and carrying out management activities, in order to minimize the increased risk of slope movements that can result from forest management operations.

A substantial portion of northwest Oregon state forest land has an inherent, relatively high risk of slope movement when forest operations are conducted. Despite the high risk, the slope stability condition of these lands is very good. Resource protection appears to be successful when current Best Management Practices are applied. Based on Department of Forestry slide reports and observations of the department's geotechnical specialist, the most significant occurrence of slides appears to be triggered by road maintenance problems and legacy conditions. Legacy conditions result from historical logging practices, especially old (sometimes abandoned) hauling and skid roads that were built before current Best Management Practices were in effect. Old roads have increased the probability of slope failure in some locations. The Tillamook State Forest has legacy conditions throughout the forest. In some areas, the legacy conditions pose serious threats to water quality, fish, and aquatic habitats.

Landslide monitoring occurs through the Forest Practices Landslide Reporting process, and identifies the areas and types of forest operations that have management-related slope movement and impacts. This information can be used to determine which management activities are most commonly associated with slope movements and to locate landslides in order to investigate a particular slide's cause. However, the current monitoring program cannot be used to judge the overall effects of forest management on the frequency or size of landslides, because the program does not examine background levels of slope movement that occur in the absence of management activities. Right now, geotechnical professionals can only make qualitative statements about how much forest operations increase the risk of slope movement. There is no quantitative data or proven method for measuring background levels, due to the complexity of spatial and temporal variations inherent in the natural processes.

Land Base and Access

In this section, the northwest Oregon state forests are described in terms of land ownership, administrative organization, and access.

Land Ownership

State forests include Board of Forestry Lands and Common School Forest Lands. The State of Oregon acquired the two types of land in different ways, and the two types are owned by different entities within state government. The Board of Forestry Lands are owned by the Board of Forestry, and the Common School Forest Lands are owned by the State Land Board. Each land ownership has its own set of legal and policy mandates. These mandates are discussed in Appendix D, “Legal and Policy Mandates.”

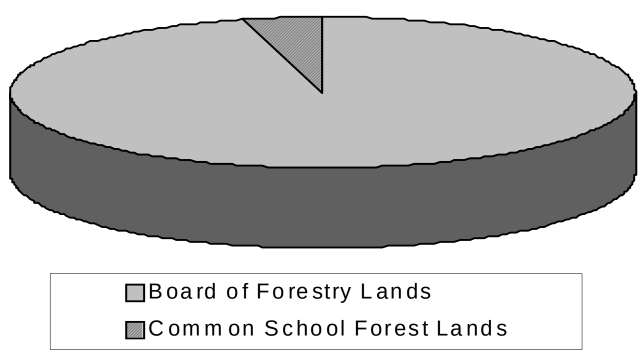


Figure 2-3. Land Ownership in the Northwest Oregon State Forests

The planning area includes about 615,680 acres of state forest land. Of this total, 597,340 acres, or 97 percent, are owned by the Board of Forestry; and 18,340 acres, or 3 percent, are Common School Forest Lands that are owned by the State Land Board.

Administration

The Department of Forestry divides Oregon into districts, for administrative purposes. District foresters and their staffs carry out all field activities of the department in their sections of the state. The *Northwest Oregon State Forests Management Plan* covers all state forest lands in the six districts listed in the table below. The figure below shows the proportional distribution of the state forest lands across the districts. The acreage figures were provided by the Department of Forestry's GIS (Geographic Information System).

The large blocks of state forest land are designated as state forests. The Santiam State Forest is entirely within the North Cascade District, while the Tillamook and Clatsop State Forests are both on more than one district. The table also lists the state forests in the planning area, and shows what district or districts they are located in. In addition to the state forests, there are smaller, isolated tracts of state forest land scattered throughout the planning area. These smaller tracts do not have individual names, and are known simply as "scattered state forest lands."

Table 2-4. Oregon Department of Forestry Administrative Districts in Northwest Oregon

District	Acres	State Forests Located on District
Astoria	136,103	Clatsop State Forest
Tillamook	250,759	Tillamook State Forest
Forest Grove	117,598	Tillamook/Clatsop State Forests
North Cascade	47,638	Santiam State Forest
West Oregon	37,594	None; scattered lands only
Western Lane	26,030	None; scattered lands only

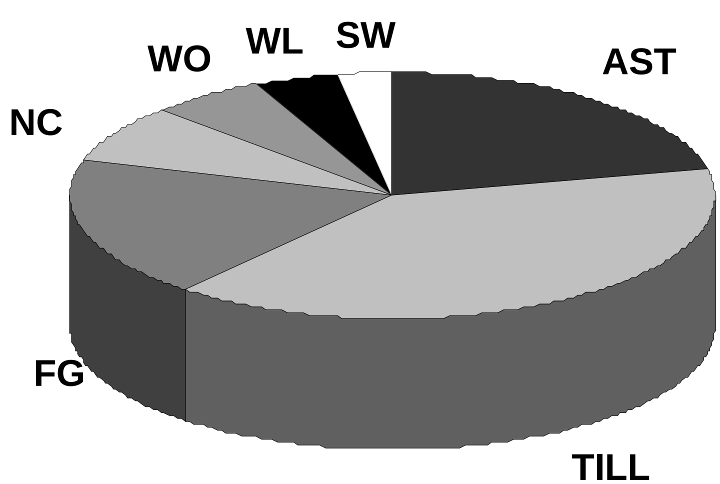


Figure 2-4. Distribution of State Forest Lands Across Districts

The Oregon Department of Forestry districts are organized into regional areas. As shown in the figure below, the Northwest Oregon Area (NWOA) staff provides management oversight, long-range planning coordination, and professional resource specialist support to five of the six districts in the planning area. Western Lane District gets similar support from the Southern Oregon Area staff. Professional resource specialist support includes geotechnical engineering services, public use coordination, forest education and interpretation program coordination, forest planning coordination, and wildlife biology consultation. Other technical support services provided by area personnel include heavy equipment maintenance and repair, radio system maintenance and repair, and computer network and systems maintenance and repair.

The South Fork Inmate Camp provides services and support to the five NWOA districts. Inmate crews accomplish a variety of forest management activities, ranging from tree planting to recreation site maintenance and repair.

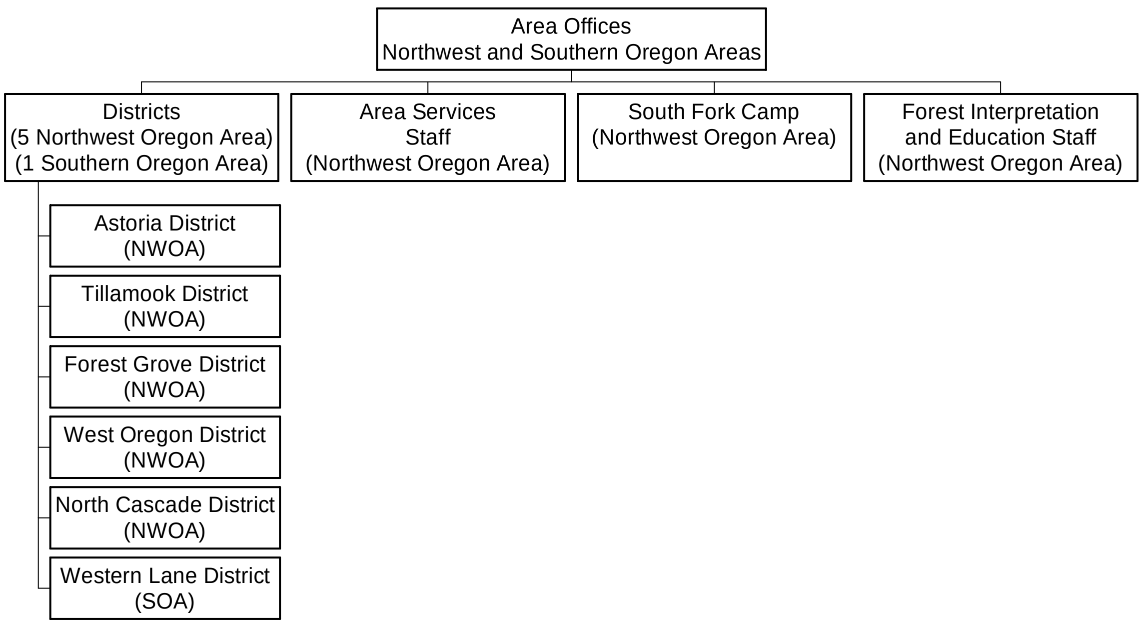


Figure 2-5. Management Organization

Management

In addition to the management provided by the districts and area staff, state forest management is supported by the State Forests Program staff in Salem. Under the leadership of the State Forests Program Director, the program staff provides overall program policy direction; liaison with other agencies and organizations; department-wide planning and program support; specialized expertise in biological, technical, and legal areas; business management; and fiscal accounting. The program staff carries out the forest management and business management functions that provide benefits through economies of scale and a consistent approach across all state forests.

The state forests program is operated almost entirely on program-generated revenue, with minor amounts coming from cost-share grants, mostly in the recreation management program. The primary source of revenue is the sale of forest products, mainly timber. Because the program is almost wholly self-supporting, careful financial management is imperative. On Board of Forestry Lands, 63.75 percent of the gross revenues is returned to the specific county in which the revenue was generated. The remainder goes to an account that is legally dedicated for the management of the forest lands.

On Common School Forest Lands, the net revenue (gross revenue minus management costs) is dedicated to the Common School Fund. Historically, costs have averaged approximately one-third of the gross revenue. Thus, all of the management activities for both BOFL and CSFL are accomplished on approximately one-third of the gross revenue produced.

Financial management of the program is accomplished in two primary ways:

- Revenue and expenditure planning, accomplished through revenue forecasting, and biennial and fiscal budgeting.
- Revenue accounting and expenditure monitoring, accomplished on both a fiscal and biennial basis.

The forest management plan and district implementation plans are the primary mechanism for financial management planning, since they identify the appropriate types and levels of management activities that accomplish the legal mandates for managing the lands. Through the biennial budgeting process, these specific activities are translated into resources required to implement the plan. Detailed annual operations are then reflected in the fiscal budgets. Biennial and fiscal budgets are prepared for the program staff in Salem, the Northwest Oregon Area staff, and for the six districts and the South Fork Camp.

Revenue forecasting is done at the district and program staff levels on a periodic basis, to ensure that revenue flow is adequate to support planned activities. Expenditure and accomplishment monitoring is done at the district, area, and program levels on a monthly and quarterly basis to ensure that actual expenditure levels are consistent with projected levels from fiscal and biennial budgets.

As part of the current planning process, all resources have been assessed for their revenue potential. For the foreseeable future, timber will remain the largest source of direct revenue generation, although revenue from recreational fees is expected to increase as more facilities are upgraded or added. Alternative revenue sources will continue to be examined and analyzed. The state forests' high quality water resources, fish and wildlife habitats, and diverse recreational opportunities will continue to produce important community and regionally based revenues and income.

Land Base Designation

By administrative rule (OAR 629-035-0040), all state forest land is designated either as silviculturally capable of growing forest tree species or not capable of such growth. A set of nine computer-generated maps depicts the capability of the lands to grow trees. These maps are merely descriptive, and do not propose a land use strategy.

Land Management Classification

A 1998 administrative rule (OAR 629-035-055) requires the State Forester to classify all forest lands according to the types of management that will be applied, the appropriate range of management activities, and the forest resources addressed. Land management classification describes the management emphasis for parcels of state forest lands, as determined by forest management plans. The system identifies when a particular forest resource may need a more focused approach, or possibly an exclusive priority, in management. State forest lands will be classified into one of three classifications: General Stewardship, Focused Stewardship, or Special Stewardship.

General Stewardship — These are lands where forest resources are managed using integrated management practices, and for which resource management goals are compatible over time and across the landscape. All resources addressed in forest management plans will be managed. All resources may not be treated equally on every acre, but across the landscape, management will meet the goals identified in the plans.

Focused Stewardship — These lands are also managed using integrated management practices, but for a specific resource or resources; a forest management plan or legal requirement identifies the need for supplemental planning, modified management practices, or compliance with specific requirements. On these lands, management of specific forest resources may have minor impacts on the management of other resources, but will not preclude integrated management. Focused Stewardship lands will be further classified into one or more of the following subclasses: Agriculture, Grazing, or Wildlife Forage; Aquatic and Riparian Habitat; Cultural Resources; Deeds; Domestic Water Use; Easements; Energy and Minerals; Plants; Recreation; Research/Monitoring; Transmission; Visual; and Wildlife Habitat. An example of Focused Stewardship might be an area with scenic values, where visual activities are protected during and after forest management activities. This consideration could affect harvesting systems, the size and location of harvest units, or road locations.

Special Stewardship — These are lands where one or more forest resources require a level of protection that precludes integrated management of all resources; where a legal or contractual constraint dominates the management of the lands; or where lands are committed to a specific use and management activities are limited to those that are compatible with that use. Special Stewardship lands are classified into one or more of the following subclasses: Administrative Sites; Agriculture, Grazing, or Wildlife Forage; Aquatic and Riparian Habitat; County or Local Comprehensive Plans; Cultural Resources; Deeds; Domestic Water Use; Easements; Energy and Minerals; Operationally Limited; Plants; Recreation; Research/Monitoring; Transmission; Visual; and Wildlife

Habitat. An example of Special Stewardship might be the area surrounding a nest tree of a threatened or endangered species.

Land management classifications will be displayed on maps. For the purpose of protecting threatened and endangered species, and some cultural resource sites, some specific locations will not be displayed on classification maps. Instead, broader geographic areas within which the sites exist will be displayed. Exact locations of boundary lines will be determined on site and will depend upon the conditions on site.

More than one classification or subclass may be assigned to a parcel of land. Where this occurs, the resource requiring the highest level of protection will determine the management approach.

The goals and strategies in forest management plans determine the management of key resources. The identification and mapping of land management classifications will be based on criteria in the plans. Information will be updated through watershed assessments and site-specific monitoring and field visits.

Public involvement is an important component of the land management classification process, and the process is described under the "Public Involvement" section of Chapter 5, in the subsection, "Public Involvement in District Implementation Plans and Annual Operations Plans." As of the date of this plan, initial land management classifications are still being completed for state forests.

Current Programs for Land Acquisitions and Exchanges

Oregon law gives the Board of Forestry authority and means through the Department of Forestry to acquire forest land by "purchase, donation, devise or exchange." Any acquisition of forest land must be approved by the board of county commissioners in the county where the lands are located. The Board of Forestry recently reaffirmed their policy that the Department of Forestry will actively pursue acquisitions and exchanges as a means to consolidate state forest lands for management efficiencies, economic values, or enhanced stewardship practices.

The purpose of acquiring and exchanging land is to increase the amount of state forest land and/or to block up state forest ownership (consolidate state forest lands in contiguous blocks, instead of in scattered parcels). The consolidation of state forest lands will increase management efficiencies and long-term economic values, and enhance stewardship practices and other forest resource values. The Department of Forestry has worked to block up state forest lands for many years. Each district has its own land exchange plan, with parcels identified for acquisition and divestment. The acreages involved vary between districts. The degree to which each district has accomplished its plan varies, depending on the level of need, opportunity, and workload.

Access

The access system for state forest lands is comprised of state highways, county roads, railroads, private and state forest roads, recreational trails, and navigable waterways. The state forest land access system is necessary to achieve forest protection and management goals, as well as to provide public access. State forest roads and trails are a resource and represent large, long-term capital investments. They must be maintained in usable condition, with minimum impacts on other resources such as water quality, soil, and wildlife.

State Highways and County Roads

The public road system of state highways and county roads provides the initial access to state forest lands. When state highways cross significant stretches of state forest lands, the scenic qualities of views from the highways are protected in accordance with the Forest Practices Act, appropriate land management classifications, and integrated resource management. County roads that cross large blocks of state forest land are considered an integral part of the forest road system in that area.

Roads on State Forest Lands

Roads on state forest lands are used to access timber sales, special forest products, and forest management activity sites. They also provide access for fire suppression and recreation. For most northwest Oregon state forest lands, the main road system is essentially complete. However, additional collector spurs and secondary spurs will still be needed to access future timber sale units. In addition, there are many miles of inherited old roads and old railroad grades now used as roads that need to be improved, reconstructed, or decommissioned to meet road maintenance standards and prevent damage to water and soil resources.

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, in order 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.

The following table summarizes the estimated miles of roads and designated trails on northwest Oregon state forests, listed by district. Designated trails include both hiking trails and OHV (off-highway vehicle) trails.

Table 2-5. Access System: Miles of Roads and Designated Trails

District	Miles of Roads	Miles of Trails
Astoria	670	2
Tillamook	1,437	58
Forest Grove	450	77
North Cascade	330	2
West Oregon	200	—
Western Lane	70	—

Note: Values have not been updated since 2001.

Trails on State Forest Lands

Trails on state forest lands provide recreational opportunities for hiking, horse riding, mountain bike riding, and OHV use. Most of the recreational trails are on the Tillamook State Forest because of its size, history, and proximity to the Portland area.

Most of the existing non-motorized trails on the Tillamook were planned and established in the early 1970s. Existing OHV trails on the Tillamook, as well as on other state forest lands, were not planned, but were established by users riding wherever they desired. As called for in the *Tillamook State Forest Comprehensive Recreation Plan*, existing non-motorized and OHV trails on the Tillamook are being inventoried, assessed, and incorporated into a designated trails system (Oregon Department of Forestry and Oregon Department of Parks and Recreation 1993). The designated trails will be mapped, signed, and maintained to reduce impacts to soil, water, and wildlife resources. With the approval of the Recreation Management Plans for the Clatsop and Santiam State Forests, trail development will begin in these forests.

Easements for Legal Access

A significant portion of state forest land is accessed by roads that go through privately owned forest land. Legal easements are necessary in order to use these roads to haul logs from timber sales or for other forest management activities. The Department of Forestry has acquired easements for many roads, and in some cases still needs to acquire easements. Depending on the Department of Forestry's needs and the private owner's desires, easements can be temporary or permanent, and either allow public use or allow only the agency's employees and contractors.

Current Access Management Programs

The Department of Forestry's 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. 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 department's *Draft Forest Engineering 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 2000b).

State forest roads and private roads with easements are maintained either by Department of Forestry road maintenance personnel and equipment, or by contractors as a requirement of a timber sale or other contract for forestry work. District personnel monitor road use, determine maintenance needs, and develop annual 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.

Plants

The northwest Oregon state forests have hundreds of species of plants. Understory plants without woody stems fill many roles in the forest ecosystem. They provide habitat, add organic matter to forest soils, influence micro-climate, and are used as cover and forage by many animals. In addition to their ecological functions, some plant species, such as beargrass and sword fern, are harvested commercially. Commercial uses of understory plants are discussed later in this chapter under the heading “Special Forest Products,” starting on page 2-77.

This resource description focuses on threatened, endangered, candidate, or rare plants (T&E plants), as listed under the state of Oregon’s Endangered Species Act.

There has never been a comprehensive assessment or basic systematic survey for threatened and endangered plants on northwest Oregon state forests. In the late 1980s, some surveys were done specifically for the Nelson’s checkermallow (*Sidalcea nelsoniana)* on the Tillamook State Forest (Forest Grove District), in cooperation with propagation studies sponsored by the city of McMinnville. Recently the Oregon Department of Forestry developed a base list of state-listed T&E plants with the assistance of the Oregon Department of Agriculture (ODA) and the Oregon Natural Heritage Program (ONHP).

Of the fifteen species of concern on the plant list, only four are state-listed. These four species comprise the base list for the northwest Oregon state forests. Nine species are candidates for T&E status, but are not currently proposed in the rule-making process. The final two species are considered rare, but are not currently state-listed as endangered, threatened, or candidate. All fifteen species are listed in the table on the next page, along with their status and/or category.

Most of these species occur in non-forested areas, such as open, high elevation rocky areas; open meadows; bluffs along the Columbia Gorge; or coastal areas (Gisler 1995). Six species are known to be present on the state forests: Coast Range fawn lily, Nelson’s checkermallow, Saddle Mountain bittercress, cold-water corydalis, Chambers’ paintbrush, and frigid shootingstar. The other plants have not been confirmed on northwest Oregon state forests.

The Department of Forestry is not aware of any other federally listed threatened or endangered plant species that are likely to occur on the northwest Oregon state forests.

Table 2-6. List of Plant Species of Concern

Scientific Name	Common Name	Status
Base List: State-Listed		
Cordylanthus maritimus subsp. Palustris	Point Reyes bird's beak	Endangered
Erythronium elegans	Coast Range fawn-lily	Threatened
Lupinus sulphureus subsp. kincaidii[1]	Kincaid's lupine	Threatened
Sidalcea nelsoniana [1]	Nelson's checkermallow	Threatened
Candidates for T&E Status, But Not Currently Proposed		
Eucephalus gormanii	Gorman's aster	
Cardamine pattersonii	Saddle Mt. bittercress	
Corydalis aquae-gelidae	cold-water corydalis	
Erigeron howellii	Howell's daisy	
Erigeron oreganus	Oregon daisy	
Saxifraga hitchcockiana	Saddle Mt. saxifrage	
Sidalcea hirtipes	bristly-stemmed sidalcea	
Sisyrinchium sarmentosum	pale blue-eyed grass	
Sullivantia oregana	Oregon sullivantia	
Rare But Not Currently State-Listed		
Castilleja chambersii	Chambers' paintbrush	
Dodecatheon austrofrigidum	frigid shootingstar	

1. Nelson's checkermallow and Kincaid's lupine are listed as threatened species under the federal Endangered Species Act. No other plants in the table are listed under the federal ESA.

Current Management

The Department of Forestry protects listed plant species in accordance with the state and federal Endangered Species Acts (ESAs). See Appendix D, "Legal and Policy Mandates," for more information about the ESAs and their provisions that apply to plants. The Department has identified listed species that occur or are suspected to occur on state forests, and continues to update these lists in consultation with the Oregon

Department of Agriculture. Known sites or habitats are being mapped. During plan implementation, Districts determine if listed species occur or are likely to occur on lands where management activity is planned. If so, the District will determine if the proposed action is consistent with the conservation program for the listed species established by the Oregon Department of Agriculture.

Recreation

Statewide demand for outdoor recreation is growing faster than the population, as indicated by SCORP data (Statewide Comprehensive Outdoor Recreation Plan) (Oregon Department of Parks and Recreation 1988). Demand is growing fastest near population centers such as the Portland metropolitan area. On many state and federal lands in Oregon, demand already exceeds supply, or is expected to soon.

SCORP found that the North Coast region and the region surrounding the Portland metropolitan area have the greatest need in the state for additional recreation facilities. These two regions need trails of all kinds (hiking, jogging, riding, biking, and off-road vehicle), and campgrounds as well.

In the Coast Range, the Siuslaw National Forest expects demand to exceed supply for semi-primitive settings in the next ten years (see the Background Information box below). The Mt. Hood National Forest, located in the Cascades east of Portland, is already reaching full capacity for recreation on its lands, with overuse occurring in some wilderness areas. Across the border in the Washington Cascades, the Gifford Pinchot National Forest estimates a 40 percent increase per decade in recreational use.

On BLM lands south of the Tillamook State Forest, demand already exceeds supply for picnic and campground facilities along the Nestucca River during the summer. Demand also exceeds supply at the state parks along the coast, where as many as 100 campers per night are turned away during the summer.

State forest lands comprise a significant percentage of public forest lands in parts of northwest Oregon. In several counties, they are the largest ownership open to the public for recreational use. Most of these lands lie within a two-hour drive of a major city such as Portland or Salem, and recreational use is growing rapidly. The northwest Oregon state forests play an important role in providing a wide variety of recreational opportunities, both to local residents and to visitors from nearby cities. Recreational activities on state forest lands produce significant revenues for local and regional businesses, and make an important contribution to the regional economy.

In addition, the northwest Oregon state forests offer an opportunity to link the public to natural resource management through educational and interpretive programs. There is a widening gap between the contact people have with natural resources and their everyday use of commodity products derived from forests. Education and interpretation will help to close the gap and improve people's understanding of resource issues, by cultivating an awareness of how forestry works to balance a variety of resource demands.

Background Information

The U.S. Forest Service developed the Recreation Opportunity Spectrum (ROS) to use in recreation planning. It is now widely used by other land management agencies also. ROS provides a framework for understanding and defining various settings of recreation environments, activities, and experiences. The settings are defined in terms of the opportunities to have different sorts of experiences, and range from primitive to urban. They are defined by setting indicators such as access, naturalness, facilities, and social encounters. Three ROS settings that are common on northwestern Oregon state forests are semi-primitive non-motorized, semi-primitive motorized, and roaded natural. SCORP found that state-wide, there is a growing gap between the demand for semi-primitive non-motorized settings and the availability of these settings.

Current Condition

Tillamook State Forest

The Tillamook State Forest is close to the Portland area and the Willamette Valley. Highways 6 and 26 cross the forest and connect the Willamette Valley to the coast. The highway access from the Portland area has resulted in a high level of recreational use on the forest. Continued population growth is expected to lead to increased recreational use on the Tillamook.

Recreation management program — In 1991, the Oregon Legislature passed House Bill 2501, which called on the Oregon Department of Parks and Recreation and the Oregon Department of Forestry to prepare a comprehensive recreation plan for the Tillamook State Forest, to interpret the forest's history, and to provide for diverse outdoor recreation on the forest. The *Tillamook State Forest Comprehensive Recreation Management Plan* was published in January 1993, approved by the Board of Forestry and the Parks Commission, and submitted to the 1993 Legislature for their review (Oregon Department of Forestry and Oregon Department of Parks and Recreation 1993). A broad-based recreation advisory committee continues to help plan and manage recreation on the forest. The action plan was updated in 2000.

District-level coordinators manage the ongoing recreation programs on Tillamook and Forest Grove districts. Motorized and non-motorized activity zones have been established on the forest to provide a range of settings for different user groups. The nine-member Tillamook State Forest Recreation Advisory Committee (TRAC) provides a framework for direct public involvement in recreation management. A formal volunteer program encourages clubs and individuals to be involved in recreation projects, including campground hosts, trail maintenance, and trail planning.

Motorized (OHV) use — The Tillamook State Forest fills an important regional recreation niche by offering large areas open to OHV (off-highway vehicle) use. Many people enjoy this activity, and there are few areas open for OHV use in the North Coast region. Motorized recreation is the most popular activity on the Tillamook, has the largest group of users, and is growing rapidly. OHV use is prevalent throughout the Wilson River basin, especially south of Highway 6. Low levels of use occur on the west side and northern third of the forest. Most use occurs in cooler weather, especially spring and fall. Summer use is less popular because of the dusty conditions and closures due to fire danger. Zoning has introduced designated OHV use areas based on historical use patterns and resource considerations.

OHV use is suitable on large areas of the general forest. However, some trails have developed with no planning or departmental involvement, and a few trails are causing resource damage, such as erosion in riparian areas and on steep slopes and siltation into streams. Several OHV clubs have worked with the Department of Forestry in educating users, and building and maintaining trails.

Non-motorized uses — Hiking, horse riding, and mountain biking are non-motorized trail activities that occur in lower numbers than OHV recreation, but are also growing on the Tillamook. River and ridge systems have fairly continuous and undisturbed natural settings, and offer good recreational opportunities for hikers, mountain bikers, anglers, and wildlife and native plant enthusiasts. Horse riders can also use some areas of general forest. There are currently about 70 miles of hiking trails on the forest, and staging areas have been created for horseback riding and mountain biking. Some resource impacts are occurring from poorly located non-motorized trails.

Fishing and boating activities — The Tillamook is a destination attraction for people fishing for salmon and steelhead. Most driftboat fishing takes place outside the forest boundaries on the lower portions of the Nehalem, Kilchis, Wilson, and Trask rivers. Bait fishing from the bank is common on the forest, with an increasing number of anglers voluntarily practicing catch-and-release techniques. The most popular fishing seasons are the fall chinook season, winter steelhead season, and spring cutthroat trout season. The most remote fishing spots on the Tillamook are along the Little North Fork of the Wilson River and the Salmonberry River. These river stretches have wild fish populations. The railroad management company has recently relaxed access restrictions to the railroad right-of-way traditionally used for hike-in fishing access along the Salmonberry River.

Whitewater river recreation is a small but growing use on the forest. Kayakers use the upper Trask, North Fork Kilchis, Nehalem, Lower Salmonberry, and Wilson rivers, with the most popular season during high water in winter and spring. During summer, people canoe on the Salmonberry and raft on the Wilson and Nehalem rivers.

Camping — There are ten designated campgrounds on the forest. Five campgrounds were recently rebuilt, and now charge fees. State parks on the coast are not able to meet the demand for campsites during the summer, so overflow campers are often directed to campgrounds in and around the state forest. Dispersed camping takes place throughout the forest, with several dispersed campsites receiving concentrated use. A summer survey done on the Tillamook in 1992 found that 75 percent of forest visitors stayed overnight one or more nights on the forest.

Many of the campgrounds and dispersed sites attract homeless people, presenting both social and resource impacts. Efforts to connect these people with local services have been made, but restricting access has become a costly and unpopular last resort.

Day-use activities — The forest is becoming increasingly popular for day-use activities. On Highway 26, the Sunset Highway Rest Area is a designated day-use picnic area with a short interpretive trail. Day-use has become the predominant use at several forest campgrounds. There are separate day-use facilities at three campgrounds and two trailheads. Many pullouts along the Wilson River Highway (Highway 6) receive regular day-use. There is no developed rest area along the Wilson River Highway, and some pullouts are used as rest stops, contributing to unsanitary conditions. During the summer, popular swimming areas along the Wilson and Nehalem rivers become very crowded and there are some incidents of antisocial behavior, often involving alcohol and minors. The department has instituted contracts with law enforcement personnel to improve safety.

Hunting and target shooting — Hunting use is concentrated in the fall deer and elk seasons, beginning with the opening of bow season in late August. Hunting occurs across the forest, but is concentrated near timber harvest areas and big game forage areas. Unregulated recreational shooting occurs forest-wide, concentrated in abandoned rock quarries, borrow pits, log landings, road cuts, and campgrounds. In some cases, signs, toilets, and other public facilities are the targets of destructive shooting.

Interpretive and educational programs — The Tillamook State Forest has an active interpretive program. It includes summer programs, lesson plans for schoolchildren, an interpretive wayside, brochures, and a new video on the history of the Tillamook Burn rehabilitation. Two school districts (Beaverton and Forest Grove) are currently using the forest to provide project sites for alternative high school completion programs. Pacific University is cooperating with Forest Grove School District in this program.

Future projects include a Tillamook Forest Interpretive Center, which will be located in the heart of the forest at Jones Creek on the Wilson River Highway. The center's opening is scheduled for 2003, and the department anticipates about 100,000 visitors per year. The center will be funded from private donations and timber revenues. No taxpayer dollars will be used. The new center will serve as a focal point for a network of interpretive waysides, trails and sites around the forest. Many of these are already in place, offering information and experiences related to the cultural, natural and management history of the Tillamook. A video on the history of the forest's rehabilitation is also available.

Clatsop State Forest

The Clatsop State Forest is within two hours of Portland, via Highway 30. Highways 26, 30, and 202 border or cross the forest. Highways 26 and 30 are designated as scenic highways by the Oregon Department of Transportation. They have established bicycle lanes and are part of the Oregon Bicycle Route System.

The Clatsop State Forest is developing its recreation management program, including more staff time, planning, and law enforcement. A new recreation plan was completed in fall 2000 (Oregon Department of Forestry 2000a, 2000f), and a permanent recreation coordinator has been added to the district's staff to begin implementation of the plan.

Recreation management program — Currently no formal program for recreation management exists on the Clatsop State Forest. The district assigns a recreation contact person (forester) and hires a recreation summer intern for short-term projects. The district and other forest landowners have a cooperative agreement with the Clatsop County Seriff to provide patrols and law enforcement.

In 1998 the district began developing a recreation management plan (Oregon Department of Forestry 2000a). A technical planning team and a citizen advisory committee have assisted in this planning. A management action plan will be completed in October 2000.

General recreational trends — People use the Clatsop State Forest mostly for dispersed recreation along roads, rivers, and streams. Recreational activities are hunting, target shooting, fishing, dispersed or campground camping, and off-highway vehicle use. Other uses are hiking, horse riding, mountain biking, scenic viewing (at viewpoints) and some interpretation. Most people who visit the forest are Clatsop County citizens, many of whom value the freedom of an unregulated setting.

Motorized (OHV) use — There are no formal designated off-highway vehicle trails in the Clatsop State Forest. Trails have developed with no department planning or management. Certain areas of the forest offer potential opportunities for this activity.

Non-motorized uses — The forest offers a few designated trails for hiking and mountain biking which are maintained during summers, none longer than 6 miles. Most non-motorized activities take place on less traveled unpaved roads.

Hunting and target shooting — Most hunting on the Clatsop is for deer and elk. Other animals that are hunted or trapped are bear, cougar, bobcat, river otter, brush rabbit, beaver, mink, ruffed grouse, and mountain quail. Indiscriminate target shooting has damaged signs, equipment, facilities, and trees. An archery range has been established on state land in the Astoria Basin, managed by the Saddle Mountain Archers.

Fishing — Portions of the Nehalem, North Fork of the Nehalem, and North Fork of the Klaskanine rivers, and Gnat Creek are within the forest. Anglers like to fish these rivers for winter steelhead, salmon, and trout. Across the forest, stream tributaries and headwaters are common fishing areas for small trout. There are four fish hatcheries in Clatsop County, all near state forest land. Many people fish on state forest land near these hatcheries. Big Creek, Klaskanine, and Nehalem fish hatcheries receive their heaviest viewing and fishing use between September and January. Gnat Creek Fish Hatchery receives its heaviest viewing and nearby fishing use between December and March. The number of trout anglers using the north coast streams has declined since legal trout are no longer stocked in the streams. ODFW has shifted its trout stocking to lakes, which has increased the use of those areas.

Camping and day use — The Clatsop State Forest currently has only one designated recreation area, Spruce Run Park (campground and day use), managed by the county. Spruce Run Park is next to the Nehalem River, south of the town of Elsie. The campground is popular, and often full on summer weekends. It also receives use during fall when many hunters use it as a base. Dispersed camping occurs throughout the forest and is allowed anywhere unless otherwise posted. Dispersed campsites are concentrated near roads, resulting in sanitary and litter problems.

Wildlife viewing — Currently no designated wildlife viewing areas exist within the forest. However, there are adjacent viewing areas, and these have direct implications for recreation on the state forest. Cooperative management among agencies has the potential to provide excellent viewing opportunities.

Interpretation and education — There are a few areas on or near the forest where there are interpretive signs and markers. A brochure takes people through a self-guided tour of a demonstration forest and arboretum at the district office, and Gnat Creek Park offers a short nature walk.

Santiam State Forest

The 48,000 acre Santiam State Forest is located in two main blocks located near Highway 22 east of Salem. Recreation is concentrated in several small areas of the forest, with the rest of the forest lightly used. Two areas in the Santiam State Forest are designated for recreation: Shellberg Falls and Butte Creek Falls.

Recreation management program — Little formal recreation management has existed on the Santiam State Forest. In 1998 the district began developing a recreation management plan (Oregon Department of Forestry 2000c). A technical planning team and a citizen advisory committee assisted in this planning. The management action plan was completed in October 2000.

General recreation trends — Areas near the Santiam State Forest have had increasing recreation use in recent years, but for the most common recreation activities on the state forest, demand is expected to be moderate. However, concentrated use has produced severe resource impacts in riparian areas. Most forest visitors are local residents who like the state forest because it is undeveloped and relatively unregulated, with little competition for favorite sites.

Motorized (OHV) use — At this time there are no formal designated off-highway vehicle routes, staging areas, or trails in the state forest. Location of existing trails has occurred with no department planning or management, but the areas have infrequent and sporadic use. Shellburg Falls received regular use until its closure to vehicle access in 1994. Forest roads receive minimal motorized use, especially for pre-season scouting, and hunting.

Non-motorized use — Santiam State Forest has few designated hiking trails. Some horse riding, picnicking, and mountain biking occur across the forest, but the level of use is low to moderate. Shellberg Falls rivals waterfalls in nearby Silver Falls State Park for scenic beauty and accessibility. Previously established trails and dispersed campsites are used by horse riders and hikers, because the trails connect across private timberlands and BLM land to the Silver Falls State Park horse trail system.

Other sites that attract hikers include Rocky Top peak, Abiqua Falls area, Natural Rock Arch in Sardine Creek drainage, and Butte Creek Falls. Trails have been developed to many of these sites but private land and terrain can make access difficult. Homestead Falls and Stout Creek Falls are spectacular but access to both falls is difficult. At over 150 feet high, Homestead Falls is the largest waterfall on the forest.

Fishing and boating — The Butte Lakes and Rhody Lake receive the highest use for fishing, but the lakes are not stocked and can't support heavy use. Access is difficult to Beaver Lake and Copper Lake. Some fish Abiqua Creek, but access is limited to a few who know about the falls.

Camping and day-use activities — Dispersed camping is the most frequent activity in the forest. Dispersed camping is allowed anywhere unless otherwise posted. Shellburg Falls is managed for day use during the summer seasons. Day-use infrastructures do not now exist in the forest.

West Oregon District

The state forests in the West Oregon District are popular for fishing and hunting, with most recreational use occurring during hunting season. The second most common activity is fishing on the Big Elk River. Some people ride OHVs and horses along Updyke Road, but use is light. Dispersed camping is generally limited to hunting season, with most camps along the Big Elk River. Recreational activities are focused on Highway 34, along the Alsea River. The other access point to state forest land is off Highway 20, where there is a rest area. Many areas in the West Oregon District are under-used, and no areas are over-used yet. Most users are local residents. Some campsite trash and trail damage occurs.

Western Lane District

The state forest lands in Western Lane District are very lightly used for recreation. The heaviest recreational use occurs during the deer and elk hunting seasons, with hunters camping at dispersed sites. These state forest lands are fragmented, and many parcels can be accessed only by roads crossing private land. Locked gates on these roads block public access to most Western Lane state forests. The state forests in the Western Lane district have no developed campgrounds.

Scenic Resources

In 1988, a SCORP survey (Statewide Comprehensive Outdoor Recreation Plan) found that sightseeing and driving for pleasure was the most popular outdoor activity in Oregon, with 69.3 percent of the households surveyed indicating that they participated in that activity (Oregon Department of Parks and Recreation 1988). The SCORP survey also found that sightseeing was the fastest growing recreational activity, increasing at the rate of 12.2 percent each year.

Northwest Oregon state forests are located near the state's major cities, and are crossed by several major highways through the north Coast Range and the Cascades. Thousands of people travel these highways on their way to the Oregon coast, or to the Cascades and central Oregon. In particular, state forest lands are a major part of the view along some stretches of Highways 6 and 26 in the Coast Range. Many people see the river corridors and areas around campgrounds. Sightseeing is popular on state forests, consistent with the statewide trend. Scenic values also play a major part in the quality of experience in other outdoor activities such as camping and fishing.

In many places, state forest lands blend with the general forest landscape and are not generally recognized as state lands by sightseers. The Clatsop and Tillamook State Forests are the state lands most likely to dominate viewsheds, and to be recognized as state forests by the public as they drive through the area.

Current Condition

Along major highways, the immediate visual foreground is protected either by Department of Transportation-owned scenic buffers or by scenic statutes and Oregon Forest Practices Act rules. For areas farther back from highways but still visible from the road, which are considered mid-ground and background scenic areas, many acres are designated as scenic, allowing management activities for these areas to be adjusted for visual considerations.

The following highways in northwest Oregon are designated as scenic for the purpose of visual corridor management, and are adjacent to state forest lands in the districts indicated. 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.

Highway 6	—	Forest Grove and Tillamook Districts
Highway 20	—	West Oregon District
Highway 22	—	North Cascade District
Highway 26	—	Forest Grove and Astoria Districts
Highway 30	—	Astoria District
Highway 34	—	West Oregon District
Highway 36	—	Western Lane District
Highway 101	—	Tillamook District
Highway 126	—	Western Lane District

Currently, there are two forest land management classifications used to designate areas for visual sensitivity: Focused Stewardship – Visual, and Special Stewardship – Visual. Lands designated in one of these categories have been identified as being highly sensitive to visual impacts from management activities. Generally, these are lands adjacent to or seen from major highway corridors designated as visually sensitive by the Forest Practices Act; lands with established, high public use vistas, viewpoints, and/or significant natural features; lands immediately adjacent to campgrounds; and lands highly visible from urban centers.

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.

Where legal requirements or the management of visual resources dominates over the management of other resources, the lands are classified as Special Stewardship – Visual.

State Scenic Waterways Program

The only state scenic waterway located on state forest lands in the planning area is the Nestucca River Scenic Waterway in Forest Grove and Tillamook Districts. Administrative rules for the Nestucca Scenic Waterway were published in July 1994 (OAR 736-40). State forest lands are within the scenic waterway segment that extends from the river's confluence with Ginger Creek (approximately river mile 45.5) downstream to the lower end of Alder Glen Campground. Rules for this segment state that timber harvest will be permitted by the Department of Parks and Recreation only when it is substantially screened from view from the river by topography or existing vegetation. Projects may be permitted if vegetation is established that will substantially screen the project in a reasonable time, such as four to five years. Developments necessary for public outdoor recreation and resource protection or enhancement may be visible from the river, but must blend into the natural scene.

Social and Economic Resources

Northwest Oregon state forests comprise only about two percent of Oregon's forest land. However, these forests are important to local communities economically dependent on the forests' resources and important to residents who recreate in these forests. Perhaps more important to Oregon's economy is the contribution the forests make to one of Oregon's major economic advantages, the perception of unsurpassed livability. The following discussion is based on the report, *Northwest Oregon State Forest Management Plan: Connection to State and Local Economies* (Lettman et al. 1996).

Oregon's Economy

In the last decade, the Oregon economy has changed, matured, and expanded. The economy has evolved from being very dependent on the use of natural resources, to a more balanced economy. The richness and diversity of northwest Oregon state forests are becoming more important as the state's economy changes. Oregon's forests are as important as ever to the economic health of the state's residents but, in addition to timber, they are expected to also provide recreation, clean water, and healthy populations of fish and wildlife for residents of burgeoning metropolitan areas and tourists alike.

The booming Oregon economy has attracted people from out-of-state. Between 1980 and 1995, Oregon's total population increased by 19 percent. Population is expected to continue growing considerably faster than the national average, reaching 3,457,000 by the year 2001.

Growth rates for Clatsop and Tillamook Counties have been positive since 1990, but slower than Oregon's growth rate. Populations in Clatsop and Tillamook Counties will continue to grow, although at slower rates than the state of Oregon.

Lumber and Wood Products Industry

Before the 1980s, the health of Oregon's economy depended on the forest products industry. The industry is still a major provider of jobs, and continues to have a large impact on state and local economies. However, as employment decreases in the manufacture of primary wood products and as other industries prosper, the state's dependence on lumber and wood products declines. In fact, the share of the state's workers in the wood products industry has declined steadily over the decades, from almost 20 percent in the late 1940s to a projected 3 percent in the year 2001. At the beginning of 1996, wood products industry employment was at 52,000, down from 69,000 jobs in 1988.

Timber harvest has declined to one-half of historical levels. Statewide timber harvests declined from 8.6 billion board feet in 1988 to approximately 4.1 billion board feet in 1995 (Oregon Department of Forestry 1996a). Although weak markets for wood products held down timber harvest in the early 1990s, the decline in federal timber sale levels was the most important reason for plummeting timber harvests in Oregon. A minor amount of the decline has been offset by increased harvests from nonindustrial owners.

Tourism in Oregon

Since the tourism industry is not well-defined, the economic impacts of tourism are difficult to measure. The industries most directly affected by tourist spending are hotels and lodging places, amusement and recreation services, eating and drinking places, retail stores, and automobile service stations. Tourist-related expenditures generated an estimated total of $23 million of personal income in Tillamook County in 1994. For Clatsop County, tourist-related expenditures generated a total of $62 million of personal income in 1994.

Visitors to the Oregon coast play an important role in the economies of both Tillamook and Clatsop Counties, but most visitors are not participating in activities on state forests. Many activities are beach or resort-related and may only indirectly affect recreation supply and demand relationships on the Tillamook and Clatsop State Forests.

Connections Between Northwest Oregon State Forests and Local Economies

Seventy-three percent of northwest Oregon state forests are found in Clatsop and Tillamook Counties. These two counties have had relatively weak economic growth compared with most counties in the Willamette Valley, and this trend could continue. The economies of both Clatsop and Tillamook Counties have become less dependent on manufacturing industries, such as the lumber and wood products industry, and more dependent on service industries and non-earned income, such as transfer payments and investments. Transfer payments include all payments from retirement and social welfare programs, such as Social Security, pensions, disability payments, unemployment insurance, and public assistance.

Timber sales to lumber and other wood products mills have historically been the primary commodity output sold from state forests in northwest Oregon. In 1994, 16 percent of timber harvested in Clatsop County originated on state lands, six times the percentage for the state as a whole. In Tillamook County, 21 percent of the timber harvested in 1994 originated on state lands, nine times the percentage for all of Oregon. Lumber and wood products employment remains significant in both counties, generating 11 percent of the personal income in both counties. The high percentage of state harvests in Clatsop and Tillamook Counties gives the northwest Oregon region 4.2 percent of its total harvest from state forests, almost double the state percentage.

Logging and other timber management activities create direct economic impacts, such as logging and treeplanting jobs, and also indirect and induced impacts, as timber industries buy supplies and workers spend their paychecks. Timber management activities on northwest Oregon state forests ripple through the economy. Their economic impacts include effects on employment, personal income, taxes, and revenues returned to schools, counties, and local governments.

The Lettman report estimates that each one million board feet of timber harvest in northwest Oregon state forests generates 24 jobs (Lettman et al. 1996). The most jobs are generated in the lumber and wood products industries, and in schools and other local and state government (which receive revenues from state forest harvests). The “ripple effect” leads to additional jobs created in construction, retail and wholesale trade, health and other services, and industries providing services to mills and the lumber industry.

In terms of income, the Lettman report estimates that each one million board feet of timber harvest in northwest Oregon state forests generates $1.2 million in Oregon personal income (Lettman et al. 1996). Personal income includes annual wages and salary disbursements from employers, proprietor’s income, dividends, interest, rent, and transfer payments.

State forest timber harvests also affect tax receipts and government expenditures. Almost all of the revenue generated from northwest Oregon state forests comes from timber harvest. Most timber harvesting revenues come from Board of Forestry Lands rather than from Common School Lands, but the proportions vary. From 1993 through the first half of 1996, 92 percent of stumpage revenues generated in northwest Oregon state forests came from Board of Forestry Lands. Revenues from Board of Forestry Lands are distributed according to a multi-step distribution formula in which 36.25 percent of the revenues are distributed to the Department of Forestry for management and fire protection expenses, and the remainder to the counties. The counties pass along most of their share to school districts within the counties. Revenues from the Common School Lands are distributed to the Common School Fund, with the Department of Forestry being reimbursed for management expenses.

In 1995 and early 1996, stumpage prices from timber harvest on northwest Oregon state forests were $601.42 per thousand board feet for clearcutting, and $443.16 per thousand board feet for partial cutting. The table on the next page shows how these funds would be distributed for a timber sale from Board of Forestry Lands in the northwest Oregon state forests, using one thousand board feet (1 MBF) as an example.

Table 2-7. Projected Distribution of Revenue from Clearcutting or Partial Cutting One Thousand Board Feet of Timber from Board of Forestry Lands

	Clearcutting	Partial Cutting
Schools	$282.13	$207.89
County General Fund	$ 81.81	$ 60.28
Other Taxing Districts	$ 19.47	$ 14.34
Department of Forestry	$127.80	$ 94.17
Protection Fund	$ 90.21	$ 66.47
Totals	**$601.42**	**$443.16**

Notes: Totals and other table entries may be off because of rounding.
Shows distributions from nonrehabilitated lands; distributions from rehabilitated lands would be lower until rehabilitation bonds are repaid. Values have not been updated since January 2001.

Revenues from state forests provide money to schools and other local governments. These revenues are particularly important to counties with relatively large acreages of state forest land and relatively low receipts of income from federal lands, such as Clatsop and Tillamook Counties. Total income from northwest Oregon state forests averaged $50 million per year in the 1994-1995 two-year period; in that same time period, Clatsop and Tillamook Counties received an average $30 million per year income (total for the two counties) from state forests. The table below shows the percent of county, school, and other taxing districts budgets in Clatsop and Tillamook Counties coming from state forest revenues.

Table 2-8. Percent of County, School, and Other Local Taxing Districts Budgets Derived from State Forest Revenues, in Clatsop and Tillamook Counties, Fiscal Year 1995-1996

	School Budgets	County Budgets	Other Taxing District Budgets
Clatsop County			
Taxing District's General Funds	11.9%	20.3%	19.5%
Taxing District's Total Budgets	9.2%	6.9%	12.8%
Tillamook County			
Taxing District's General Funds	13.4%	16.7%	4.9%
Taxing District's Total Budgets	11.6%	3.7%	2.0%

Notes: Clatsop County distributions are from April 1995 through March 1996.
Information in this table is preliminary.

Special Forest Products

Special forest products are those products other than timber that are collected for personal and commercial uses. The special forest products industry is growing nationally and internationally, and the industry makes an important contribution to Oregon's economy. It is difficult to develop statistics on the industry as a whole, since it includes a wide variety of products. However, in the Pacific Northwest, the floral greens and Christmas ornamental industry alone generated an estimated $128.5 million in sales at the wholesale level in 1989, and employed over 10,000 people in full-time and part-time jobs. The industry was expected to have 3 percent annual growth from 1989 to 1992 (Schlosser et al. 1991). Statistics on actual growth during that time are not available.

Historically each district in the planning area developed its own programs for special forest products. These programs were based on public demand for different products, and personnel time available to administer the program. Rough terrain, poor access, and distance to markets have limited public demand on some districts.

Each district developed a unique system for processing requests, permit duration, pricing, size of permit area, minimum permit volume and price, and intensity of permit administration. Districts issue three basic types of permits: free use permits for personal use only of some products, personal use firewood permits, and commercial fee permits for some products. Some districts have exclusive use permits, while others have non-exclusive permits. Longer term contracts have been issued for bough collection and Christmas tree harvest. One district restricts the number of permits issued per person annually. Some districts restrict harvesting during fire season. Districts with adjacent land have generally coordinated prices for permits, to prevent confusion among harvesters.

In the northwest Oregon state forests, permits have been issued for beargrass, boughs, cascara bark, cedar products, cones, ferns, firewood, moss, mushrooms, vine maple for transplants, poles, Oregon grape root, salal, and yew bark. The quantity and quality of products varies among districts. For most products, the number of requests is low. Generally, the sale of special forest products does not produce a large amount of revenue for the Department of Forestry. However, the department has developed programs for special forest products in response to public inquiries and demands for the products.

The types and quantities of special forest products available vary among districts. No inventory has been done to determine the amount of special forest products on the northwest Oregon state forests. For the six districts combined, overall revenues for special forest products, excluding cedar, averaged $12,051 annually over the five-year period from 1990 to 1994. Approximately 95 percent of the revenue came from three districts: Astoria, Forest Grove, and Tillamook.

Cedar revenues averaged $33,167 annually for the same five-year period, with 92 percent of the cedar revenue coming from Tillamook District. Cedar was sold primarily as shake and shingle bolts.

Many harvesters work part-time, using special forest products income as supplemental income. The changing seasonal quality of products and winter snow prevent year-round harvest of many products.

Public demand is increasing for a wider variety of special forest products, and districts are getting an increasing number of requests for permits. The floral and medicinal industries are growing, and new products are continually being developed into marketable commodities. For example, the six districts in the planning area never issued any beargrass permits until 1987, because there was no demand. Now, beargrass permits are sold regularly in the Tillamook District, reflecting the demand for this product in the floral greenery business.

The general laws and policies that govern the state forests provide legal direction for special forest products on the northwest Oregon state forests. These laws and policies are described in Appendix D, "Legal and Policy Mandates."

As the demand for special forest products has increased, the amount of harvest without a permit has also increased. Law enforcement has been minimal until recently. New efforts are being made to check permits on a regular basis.

Since each district developed its own program, the management of special forest products is not uniform throughout the northwest Oregon state forests. Additional management strategies are needed in order to efficiently inventory and sell special forest products on a sustainable basis. There may be some potential to develop silvicultural prescriptions that promote the growth of special forest products, as well as timber. For example, most floral greens thrive in stands with semi-closed canopies, so prescriptions that maintain stands in this condition might lead to the production of larger amounts of floral greens.

Several groups have formed across the state that are relevant to special forest product management on northwest Oregon state forests, although they do not have any authority over state forests. However, Department of Forestry staff are involved in groups that are interested in the development and management of the special forest products industry.

Timber

When we look at a forest, the first thing we see is the trees. The trees define the character of the forest, and they have many ecological functions. Live trees produce energy through photosynthesis, are the structural foundation of the forest, and provide habitat for wildlife, among other functions. Standing dead trees, known as snags, are used by cavity-nesting birds and animals and are food sources for many kinds of insects, which in turn are food for woodpeckers and other birds. On the forest floor, fallen trees take centuries to decay completely, and over that time are a source of organic material and nutrients for young trees and plants, and provide habitat for insects, salamanders, and small rodents, which in turn are prey for larger wildlife.

Timber is one human use of trees. This section discusses the timber resource on the northwest Oregon state forests. Other information relevant to trees and timber can be found under the headings “Biodiversity and Disturbance History” and “Forest Health”, earlier in this chapter.

Timber Management

The timber program is based on general policies for managing state forests, which in turn are based on the Oregon Constitution and statutory direction. These legal and policy mandates are discussed in some detail in Appendix D. The policies are summarized below for Common School Forest Lands and Board of Forestry Lands.

> **Common School Forest Lands** are managed “with the object of obtaining the greatest benefit for the people of this state, consistent with the conservation of this resource under sound techniques of land management.” (Oregon Constitution Article VIII, Section 5(2))
>
> **Board of Forestry Lands** are managed to provide “greatest permanent value” (ORS 530.050), which the Board of Forestry has defined to include “sustainable and predictable production of forest products that generate revenues for the benefit of the state, counties, and local taxing districts; properly functioning aquatic habitats for salmonids, and other native fish and aquatic life; habitats for native wildlife; productive soil, and clean air and water; protection against floods and erosion; and recreation.” (OAR 629-035-0020)

Key Terms

Board foot — The amount of wood equivalent to a piece of wood one foot wide by one foot high, by one inch thick.

MBF — Thousand board feet.

MMBF — Million board feet.

OSCUR — This acronym refers to the Department of Forestry's current computerized state forest inventory system. The acronym's letters stand for Ownership, Site, Cover, Use, and Recommendations. It includes 1:12,000 scale maps and overlays, data files by type and various sorts, and data summaries. OSCUR was developed by the Department of Forestry.

Stocking — A measure of the adequacy of tree cover on an area. Unless otherwise specified, stocking includes trees of all ages.

The timber on the northwest Oregon state forests is an asset to the counties, local taxing districts, and the Common School Fund. Administrative rules require that these lands be managed in an environmentally sound manner to provide sustainable timber harvest and revenues to these government entities. Prudent and careful management of the timber resource is an important theme in all planning for and management of these forests.

The principle of sustained yield guides the timber program, and ensures that the Common School Fund, counties, and local taxing districts will benefit from a perpetual source of revenue from a managed forest.

In past forest management plans, the predominant land use was timber production, with 86 percent of the Northwest Region's (Tillamook, Astoria and Forest Grove districts) and 87 percent of the Willamette Region's (North Cascade , West Oregon and Western Lane districts) 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 60 to 75 years in the Northwest Region, and 60 to 92 years in the Willamette Region.

During the first five years of the decade from 1986 to 1996, the average annual timber harvest for the northwest Oregon state forests was 150 MMBF (million board feet). When the spotted owl was listed as a threatened species in 1990, the Department of Forestry increased habitat protection for spotted owls on state forest lands. Spotted owl habitat was protected within a 1.5 mile radius of owl activity centers, leading to a decline in state forest timber harvests during the early 1990s. On the northwest Oregon state forests, average annual harvests declined to roughly 85 MMBF. As the staff learned more about spotted owls and habitat needs, they were able to increase harvest levels. For example, innovative silvicultural techniques, including partial cuts, can be used to enhance habitat while producing timber. From 1991 to 2000, average annual timber harvests in the plan area were approximately 116 MMBF (million board feet), ranging from 72 MMBF in

1991 to 214 MMBF in 2000. Volumes of timber are expected to increase in the future as the trees continue to grow.

Management of the timber asset includes investment of time, dollars, and resources to realize the forest's ability to generate sustainable timber harvest and revenue over the long term. Investments include direct expenses in young stand management activities such as precommercial thinning and fertilization; and in forest infrastructure, such as roads and bridges. There are also indirect expenses for long-term management, such as forest inventory and GIS systems, research projects, and monitoring projects.

Current Condition

Conifer forest covers most of the land in the northwest Oregon state forests (over 555,000 acres, out of a total of 615,124 acres). Before these lands became state forests, large fires and logging killed or removed most older conifer forests. In the northwest Oregon state forests today, most conifer forests are less than 85 years old, as shown in the table and graph on page 2-82.

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 OSCUR inventory as of April, 1997 (see the "Key Terms" box).

Forests are typically 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 OSCUR inventory. The inventory recognizes three main types of stands.

- **Conifer stands —** These stands occupy most of the northwest Oregon state forest land. The Department of Forestry classifies as conifer stands those in which conifer species comprise 30 percent or more of the stand. 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.
- **Non-conifer stands —** These stands are found on a minority of northwest Oregon state forest land. The Department of Forestry classifies as hardwood stands those in which hardwood species comprise more than 70 percent of the stand.
- **Unclassified stands —** These stands are currently under contract for harvesting, or have been harvested already and will be planted soon.

Figure 2-6. Summary of Conifer Age Classes, by District
In the northwest Oregon state forests, most conifer forests are less than 85 years old.

Table 2-9. Summary of Conifer Age Classes, by District

	Age Class (Years)						
District	**0-25**	**26-55**	**56-85**	**86-115**	**116-145**	**146+**	**Total**
Astoria	35,181	42,698	42,449	3,079	106	44	123,557
Tillamook	24,505	164,394	15,698	5,879	1,090	501	212,067
Forest Grove	14,713	74,027	24,772	665	35	0	114,212
North Cascade	8,282	15,004	19,354	1,593	532	516	45,281
West Oregon	15,378	8,323	6,653	1,721	2,615	1,003	35,693
Western Lane	3,555	7,286	10,809	989	1,134	933	24,706
Total Acres	**101,614**	**311,732**	**119,735**	**13,926**	**5,512**	**2,997**	**555,516**

Water Resources

Water affects virtually every other resource — trees, plants, fish, wildlife, soils, and recreation. On the northwest Oregon state forests, water resources include surface water (streams, lakes, and wetlands), groundwater and aquifers, riparian areas, water supply (for instream and out-of-stream uses), and water quality.

Other resource descriptions also have information related to water resources. In particular, see “Geology and Soils” for a discussion of slope stability, and “Fish and Wildlife” for a discussion of streams as fish habitat and a summary of stream survey information. The sections on “Recreation” and “Scenic Resources” mention water resources in relation to those topics.

History

Extensive logging and forest fires occurred on the northwest Oregon state forests when these lands were still privately owned. The well-known Tillamook Burn was the largest fire, but not the only fire that occurred on forest lands. These fires often left riparian areas and uplands with little vegetation to hold soil in place and shade streams. In the past, logging and road-building practices did not protect streams and riparian areas. Riparian forests were usually harvested along with upland forests, and large logs were frequently removed from streams. As a result of historical logging and fires, today many streams have limited amounts of mature conifer forest in their riparian areas and have few large logs in the streams. Instead, streams often have riparian forests of alders and other hardwoods, or young conifers.

In the northwest Oregon state forests, historically there were only a few water withdrawals for out-of-stream uses. Most agricultural and industrial uses were farther downstream where the valleys were wider. Homes near forest lands used to get their water supply directly from small streams, but in recent decades these homes have generally shifted to wells for their water supply. New water quality standards and water use regulations have limited the requests for domestic water use permits.

In 1909, the Oregon Legislature declared that all water in the state belonged to the public. In the years since then, many state agencies have been given the job of helping manage Oregon’s public waters. Currently, the Water Resources Commission (WRC) has the primary responsibility for the development of an integrated, coordinated state program for managing Oregon’s public waters. Other state agencies and public corporations are directed to conform to statements of water resources policy.

Water resources received greater attention in the 1970s, when new laws set water quality standards to be met in all bodies of water, including forest streams and rivers. The state of Oregon passed the Forest Practices Act in 1971 to regulate forest operations. The federal government passed the Clean Water Act in 1972. This federal law set national water quality standards, and gave states the responsibility for carrying out the law.

The Department of Forestry addressed the effects of forestry activities on water quality through additional Forest Practices Act rules, enacted at various times over the last 25 years. The new rules were designed to meet the water quality needs of fish and wildlife, and also to meet the requirements of the federal Clean Water Act. Water quality rules focus on retaining riparian vegetation and reducing the amount of sediment coming into streams from forestry operations such as road-building and logging. Wetlands are also protected by Forest Practices Act rules and various state and federal laws.

Hydrology of the Northwest Oregon State Forests

Hydrology is largely determined by geology, topography, and climate. The northwest Oregon state forests are in two distinct hydrologic areas: the Coast Range and the Cascades. The basic hydrologic features of the two areas are described below.

Coast Range — The Coast Range has a maritime climate, with wet winters and relatively dry summers. Precipitation occurs mainly as rainfall, averaging between 50 and 90 inches annually along the coast and east of the Coast Range crest, but totaling as much as 200 inches at higher elevations in the mountains. (Beschta et al. 1995)

Coast Range streams and rivers generally have steep gradients in their headwater sections, and very flat gradients in their lower reaches. Stream densities are high in this region, ranging from two to three miles of stream per square mile of land. Streams originating on the west slopes generally flow into the Pacific Ocean, and streams that drain the east slopes are tributaries to the Willamette River. On the North Coast, a number of streams drain north directly into the Columbia River.

Cascades — The western slopes of the Cascades receive most of their precipitation as snow, from November through March. At higher elevations up to 300 inches of precipitation may fall annually, and the lower slopes get at least 80 inches annually (Beschta et al. 1995). Temperatures are still influenced by the ocean, but are more varied than the Coast Range.

The Cascade Range's streams and rivers usually have high gradients. Stream densities range from 1.5 to 2 miles of stream per square mile of land. (Beschta et al. 1995). All Cascades streams west of the crest flow westward and eventually join one of the major rivers draining the area (Santiam, Sandy, Willamette, and Clackamas Rivers).

Most state forest lands are located in the lower elevations between 1,200 and 3,600 feet, an area known as the transient snow zone. In this zone, winter precipitation falls sometimes as rain and other times as snow. A rain-on-snow event occurs when rain falls on the ephemeral snowpack in the transient snow zone. The rain-on-snow event melts the snow rapidly, and the combined runoff of rain and melting snow can cause very high peak flows in rivers. The last major rain-on-snow event was in February 1996.

Key Terms

Management basin — An area used for forest planning. Management basins range from 5,000 to 8,000 acres. Their boundaries are based primarily on drainage and topographic patterns within the major drainage basins and watersheds, with some adjustments to follow roads or obvious topographic features.

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. There are different levels of watersheds, from the watershed of a small stream to the watershed of the Willamette River.

Surface Water: Streams, Lakes, and Wetlands

Roughly 400 rivers and streams flow across or near the northwest Oregon state forests. The major rivers are the Nehalem, Kilchis, Wilson, Trask, Salmonberry, Klaskanine, Big Elk, and Alsea rivers. Streams from state forest lands flow into the Miami, Tualatin, Yaquina, Siuslaw, and North Santiam rivers. The state forests have a few small lakes, such as Rhody Lake and the Butte Lakes on the Santiam State Forest.

Several of these waterways are sources for municipal water systems, and many more support smaller diversions for domestic and agricultural use. Several streams supply water for fish hatcheries. In addition, these streams and rivers support key populations of fish species and support a diverse array of recreational opportunities.

All the districts have divided their state forest lands into management basins, and the information has been entered into GIS. Management basins are based primarily on watershed boundaries, but have been adjusted to follow roads or topographic features in some places, for easier identification on the ground. The management basin boundaries in each district were reviewed with local Oregon Department of Fish and Wildlife biologists and the regional non-game biologist, and adjusted based on their input.

Water moves continuously through a watershed, crossing property lines and other manmade boundaries. Each landowner in a watershed affects water as it flows across or underneath that piece of land. Water resources downstream are influenced by the actions of upstream owners. In most northwest Oregon watersheds, the state forest lands comprise only a small percentage of the total watershed, and the Department of Forestry will need to work cooperatively with federal land managers and private landowners to achieve the desired future condition for water resources. The Tillamook and Clatsop State Forests have the greatest contiguous land area, and offer the greatest opportunity to influence water resources in their watersheds.

The basic character of streams is shaped by hydrology, the steepness of the slope, channel morphology, and geology. An important factor is the nature of the stream's substrate, which can be silt, sand, gravel, or bedrock. Riparian areas and streams influence and shape each other in many ways. In particular, riparian forests are the source of fallen trees, which are important structural components of streams. Large, fallen trees in streams create pools, modify the stream gradient, and retain organic material and sediments.

Healthy streams are naturally dynamic ecosystems. Occasional major disturbances, such as floods and landslides, are normal processes that can add logs, boulders, and gravel, which are important building blocks of stream structure and aquatic habitats. In healthy streams, undisturbed floodplains, wetlands, off-channel habitats, complex stream structures, beaver dams, and deep pools provide the resilience that enable streams to absorb these disturbances.

Stream Classification

Streams are grouped in categories based on their beneficial use, as described in the Department of Forestry's Forest Practice Technical Note FP1 — Water Classification, published in April 1994 (Oregon Department of Forestry, 1994b).

- Type F — Fish-bearing streams.
- Type N — Not a fish-bearing stream.
  — perennial streams
  — intermittent streams
- Type D — Domestic use.

Wetlands

Wetlands are often near streams or have trees, but they are ecologically distinct from streams and forests. The Forest Practices Act identifies three major types of wetlands: significant wetlands, stream-associated wetlands, and other wetlands. Significant wetlands are defined as bogs, estuaries, and both forested and non-forested wetlands larger than eight acres.

In the northwest Oregon state forests, most wetlands are located along stream channels and are forested with red alders. Other wetlands are identified as seeps, and wet areas under the forest canopy. These wetlands are usually associated with red alders, devil's club, and skunk cabbage. Many wetlands have conifers also. Sitka spruce wetlands exist in the coastal spruce zone. A few Cascades wetlands have sedges and tag alder stands.

Key Terms

Aquatic — In or on the water; aquatic habitats are in streams or other bodies of water, as contrasted to riparian habitats, which are near water.

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 protected area with site-specific boundaries established by the Department of Forestry; 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 the riparian area. Aquatic resources include water quality, water temperature, fish, stream structure, and other resources.

Stream — To qualify as a stream, a water course must have a distinct channel that normally carries flowing surface water.

Perennial stream — Year-round surface flow. In the Forest Practices Act, defined as a stream that normally has summer surface flow after July 15.

Intermittent stream — 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.

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."

Groundwater, Riparian Areas, and Uplands

Groundwater is subsurface water that accumulates in tiny open spaces in soil or loose rock, or the crevices in hard rock formations. Groundwater and surface water are interconnected. Surface water percolates down through the tiny open spaces in soil and eventually reaches the groundwater. Groundwater moves from zones of high pressure to zones with lower pressure, and discharges into springs and streams. Streams often exchange water with the groundwater repeatedly along their course, with groundwater upwelling into the stream at various points, and surface water from the stream downwelling into the groundwater at other places.

Uplands are part of the hydrologic cycle. Rain or snow can evaporate, infiltrate into the soil, or flow overland until it reaches a stream or area where it can soak into the ground. The condition of the uplands can influence the retention of water, the rate of water runoff from rain or snow, and the frequency of landslides. These processes are influenced by the geology and soils, type of vegetative cover (whether forest or grass, for example), and the age of forest stands. The hydrologic processes on uplands affect the amount of stream flows and the timing of peak flows after rainstorms.

Riparian Habitat

The condition of the trees, other vegetation, and soils in the riparian area affects the morphology of streams, and the condition of fish habitat. Ecological functions of riparian areas include shade, bank stability, nutrients (as leaves and wood drop into the water), large wood, and complex margins to the stream. These functions are important for healthy fish habitat, and also for the many wildlife species that rely partially or completely on riparian habitats, from rare amphibians to birds of prey. Floods may occur on only one or two days a year, but a healthy riparian area is especially important at these times and may influence whether the flood renews or degrades conditions within the stream.

Key Terms

Aquifer — A sand, gravel, or rock formation that is capable of storing or transporting water below the surface of the ground.

Groundwater — The subsurface water supply in the saturated zone below the water table.

Hydrological maturity — The degree to which hydrologic processes (e.g., interception, evapotranspiration, snow accumulation, snowmelt, infiltration, runoff) and outputs (e.g., water yield and peak discharge) in a particular forest stand approach those expected in an older forest stand under the same climatic and site conditions. In this document, for rain-on-snow runoff, a well-stocked conifer stand is defined as hydrologically mature when it is at least 25 years old.

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.

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.

Water Supply and Water Quality

Water that flows through state forest lands sustains ecosystems and also provides for out-of-stream uses such as irrigation, domestic use, and municipal use. The Department of Forestry's districts keep records of all registered water users that use water from state forest lands. The Oregon Water Resources Department monitors stream flows, issues permits for water withdrawals from streams, and regulates water rights.

There are two main issues for state-wide water supply policy. First, the demands on Oregon's water resources are increasing while the supply of freshwater stays the same. Future water needs may be met through alternatives such as conservation, storage, and water right transfers. Second, instream flows provide substantial public benefits, including support of fish and other aquatic life, recreational opportunities, and the maintenance of water quality. The Oregon Water Resources Department is working to restore and enhance stream flow and lake levels by the establishment of instream water rights through new allocations, the transfer of existing out-of-stream rights to instream uses, and support for environmentally sound multi-purpose storage. These activities are designed to be consistent with the preservation of existing water rights.

Forest management activities influence water supply by determining the ages, species, and density of tree cover and other vegetation; the location and condition of roads; and the condition of the soil.

Water Quality

Water quality is measured by chemical, physical, and biological properties of water. Aquatic species such as salmon need high quality water as well as suitable habitat. In forests, the water quality parameters of most concern are usually sediment and temperature. A biological parameter, bacterial contamination, can be of concern near recreational areas. Chemicals are not usually a water quality concern in forests, but could be if any chemical contamination occurred, such as a fuel or herbicide spill.

Both natural events and forest management activities can put sediment in streams. Sediment, soil, and debris are often delivered to streams in pulses, during major storms or floods. Road systems and poor timber harvest methods can generate and deliver considerable amounts of sediment to streams during storms. The episodic nature of these events can make it difficult to evaluate their impacts on water quality. Water quality monitoring is further complicated by the natural variability within stream systems. Forest management activities can also influence water temperature. This effect can occur through the loss of streamside shade, or when stream channels become wider and shallower.

Many of the older roads in the Tillamook and Clatsop State Forests and other state forests were built on old railroad grades or built during the logging of the 1940s and 1950s. An inventory is being done of surface erosion features such as roads, road waste disposal sites, landings, and other features that present a substantial risk of failure and delivery of sediments into stream systems.

Temperatures in some northwest Oregon streams are high enough for part of the year to be harmful to salmonids and other cold water-dependent aquatic life. The Department of Environmental Quality (DEQ) has identified 194 sample sites with one or more water temperature values above 68 degrees Fahrenheit. Many sample sites are in low elevation reaches of the streams, and the temperatures may be affected by the activities of other landowners. The Oregon Department of Fish and Wildlife is currently collecting water temperature data in streams on northwest Oregon state forests. In preliminary data, this study is finding stream temperatures on state forests to be cool.

DEQ has established total maximum daily loads (TMDLs) for pollutants in several water bodies with tributaries in or near the northwest Oregon state forests. Load allocations for pollutants from forest operations have been prescribed for the Tualatin River. Within the planning area, other waters where TMDLs are established include the Yamhill River, Rickreal Creek, Pudding River, Coast Fork of the Willamette River, Willamette River, Columbia Slough, and Columbia River.

Current Management Programs for Water Resources

Many laws and programs apply to water resources. Just a few of these are the federal Clean Water Act, Oregon water law, water rights, the Oregon Plan for Salmon and Healthy Watersheds, and the Forest Practices Act. These laws and programs, and others, are described in Appendix D.

Key Terms

Best Management Practices (BMPs) — Forest practice rules adopted by the Board of Forestry that ensure, as much as possible, that nonpoint source discharges of pollutants resulting from forest operations regulated by the Board meet the water quality standards established by the Environmental Quality Commission.

Loading — The quantity of a substance entering a body of water.

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.

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.

Pollutant — Any substance of such character and in such quantities that when it reaches a body of water (or the air or the soil), it degrades the resource by impairing its usefulness (including its ability to support living organisms).

TMDLs — Total maximum daily loads; one measure of water quality.

Chapter 3

Guiding Principles, Vision, and Goals

The previous chapter described the forest resources. The next step in forest management, according to Aldo Leopold, is to "… convert our collective knowledge of biotic materials into a collective wisdom of biotic navigation. … This, in the last analysis, is conservation."

Chapter 3 presents the guiding principles, forest vision, and resource management goals. These set the direction for the management plan — the compass that guides our navigation. This chapter also presents the working hypotheses that lead us to believe that we can indeed achieve the future vision and resource goals.

Chapter 4 explains the concepts and strategies that will be the navigation tools in forest resource management. Finally, Chapter 5 provides implementation guidelines and monitoring that will keep us on course as we implement the management plan.

The main headings in this chapter are:

The Guiding Principles

Guiding principles are the overall rules, goals, and responsibilities that guide the planning process for Oregon state forests. They arise from state and federal laws and administrative rules; policies of the Board of Forestry, State Land Board, and State Forester; and input from advisory committees, scientists, interest groups, and the public. The guiding principles for this plan were originally drafted and reviewed with the planning forum and the public at the beginning of the northwest Oregon planning process. The guiding principles have been amended since 1995, subsequent to adoption of a new administrative rule for state forest management; new scientific knowledge, especially about salmon and watersheds; and changes in social values.

1. **The plan will recognize that the goal for management of Board of Forestry Lands is to secure the greatest permanent value to the citizens of Oregon by providing 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. The goal for management of Common School Forest Land is the maximization of income to the Common School Fund over the long term.**

   Most of the northwest Oregon state forests (97 percent) are Board of Forestry-owned land. The remaining lands (3 percent) are Common School Forest Lands, owned by the State Land Board. The Oregon Department of Forestry manages all state forest lands in northwest Oregon for both landowners. Oregon Administrative Rules (OAR 629-035-0000 through 629-035-0100) describe the Board of Forestry's guidance to the State Forester for managing Board of Forestry Lands:

   > 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:
   >
   > a) Results in a high probability of maintaining and restoring properly functioning aquatic habitats for salmonids, and other native fish and aquatic life;
   >
   > b) Protects, maintains, and enhances native wildlife habitats;
   >
   > c) Protects soil, air, and water; and
   >
   > d) Provides outdoor recreation opportunities.

The Oregon Constitution (Article VIII, Section 5) authorizes the State Land Board to manage Common School Forest Lands "with the object of obtaining the greatest benefit for the people of this state, consistent with the conservation of this resource under sound techniques of land management." According to a 1992 opinion of Oregon's Attorney General, 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. The resources of the lands are not limited to those such as timber that are currently recognized as revenue generators for the Common School Fund. The Land Board should consider other resources, such as minerals, water, and plant materials, that may offer revenue for the fund. In addition, the Land Board may take management actions that reduce present income if these actions are intended to maximize income over the long term.

2. The plan will recognize that ecosystem restoration and watershed health are among the key goals that this plan must achieve, in a manner that is aligned with the policy direction for Board of Forestry and Common School Forest Lands.

When the state acquired the northwest Oregon state forest lands, some lands had a legacy of repeated, large-scale wildfires, and other lands had already been extensively logged. Over the last several decades, a massive restoration project has been accomplished across these state forest lands. The plan will emphasize a continuing commitment to restoration activities, especially in the context of the decline of salmonids and the vital contribution that these forests can make to the success of large-scale regional efforts like the *Oregon Plan for Salmon and Healthy Watersheds*.

3. The plan will be a comprehensive, integrated forest management plan taking into account a wide range of forest values.

When we say that the plan will be comprehensive, we mean that it will include consideration of the following commodity and amenity resources and issues.

- Agriculture and grazing
- Air quality
- Cultural resources
- Energy and minerals
- Fish and wildlife
- Forest condition (health and biodiversity)
- Land base and access
- Plants
- Recreation and scenic resources
- Social and economic issues
- Soils
- Special forest products
- Timber
- Water quality
- Water supply
- Wetlands

For each of these resources and issues, the plan will include:

- A description of the current condition of the resource or issue.
- A summary of the information known about the resource or issue.
- The management goals for development and/or protection of each resource.
- The strategies that will be used to accomplish the management goals.

An integrated plan provides for development and protection of forest resources across the landscape. Single use focus is avoided. Compatible uses are emphasized.

4. The plan will be developed within the context of Northwest Oregon State Forests as managed forests.

The majority of northwest Oregon state forest lands are owned by the Board of Forestry. The statutes governing management of Board of Forestry lands are contained in Oregon Revised Statutes, Chapter 530. Oregon Administrative Rules direct that these lands will be actively managed. Active management means applying practices, over time and across the landscape, to achieve site-specific forest resource goals using an integrated and science-based approach that promotes the compatibility of most forest uses and resources over time and across the landscape.

The Oregon Constitution and the Admission Act of 1859 direct the State Land Board to manage the Common School Forest Land with the object of obtaining the greatest benefit for the people of Oregon. The primary goal is the generation of the greatest amount of income for the Common School Fund, an educational trust for the benefit of all Oregon school children. This goal is discussed in more detail under guiding principle 1. Timber harvest from all Common School Forest Lands managed by the Department of Forestry has produced over $230 million for the Common School Fund over the past twenty years.

The Oregon Department of Forestry manages these lands under an agreement with the State Land Board to prepare and carry out programs for the management, control, and protection of the Common School Forest Lands.

5. The plan will acknowledge the protected and recognizable interest of the counties from which most of the Board of Forestry Lands were originally derived.

Significant portions of the state forests were originally private lands that reverted to counties as tax-delinquent properties. Eventually these properties were deeded to the state with assurances that the lands would be managed to produce revenue and the counties would share in the revenue that was produced. The counties' input and advice into the management of Board of Forestry lands is organized through the Forest Trust Lands Advisory Committee, authorized by statute as an advisory committee to the Board of Forestry.

6. **The plan will recognize that the forest is intended to be an important contributor to timber supply for present and future generations.**

   State forest lands in northwest Oregon represent approximately 8 percent of the forested area in northwest Oregon, and are an important contributor to the timber supply for the next century. In Clatsop and Tillamook Counties, state forest lands represent a much larger percentage of the timbershed and will play a much more significant role in contributing to timber supply in these counties.

   The majority of northwest Oregon state forests are second growth, created from early reforestation efforts following harvesting and the Tillamook fires. The age class structure for northwest Oregon state forests is dominated by the 35-65 year age class (roughly 57 percent of the forest). The 65 plus age class accounts for about 25 percent of the forests.

7. **Lands will be identified and managed to provide for a sustained contribution, biological capability, and economic and social values. The plan will recognize that there will be trade-offs between revenue-producing activities and non-revenue-producing activities.**

   An important part of managing the northwest Oregon state forests is the concept of promoting healthy, sustainable forest ecosystems that:

   a) Produce timber and revenues for the state, counties**,** and local taxing districts;
   b) Result in a high probability of maintaining and restoring properly functioning aquatic habitats for salmonids**,** and other native fish and aquatic life;
   c) Protect, maintain, and enhance native wildlife habitats**;**
   d) Protect soil, air, and water; and,
   e) Provide outdoor recreational opportunities.

   As part of the planning process, existing inventories will be utilized and data collected on a number of resources. The planning process will also evaluate the economic and social impacts of management decisions and the overall role of state forests in local economies. As dictated by the statutory obligations for these forests, the forests will be managed “so as to secure the greatest permanent value of such lands to the state,” consistent with the guidance provided in the administrative rules. This management will be consistent with sustainable ecosystem and social values, which include impacts to local communities and amenity values on the forest.

8. **The plan will examine opportunities to achieve goals through cooperative efforts with other agencies, user groups, or organizations.**

   Management objectives can often be achieved more effectively and efficiently through collaboration with others. An example of cooperative efforts already taking place is the relationship between the Oregon Department of Fish and Wildlife and the Department of Forestry. The two agencies work together to provide increased forage for big game through forage seeding and pasture land management, to reduce harassment of big game by closing roads, and to incorporate fish and wildlife considerations in timber sale plans by working with local biologists.

Additional opportunities will be explored in the forest planning process to pursue cooperative efforts with adjacent landowners, user groups (both commodity and amenity oriented groups), and other individuals and groups who are interested in the management of northwest Oregon state forests.

9. Diverse input from a variety of interested parties, including user groups, business interests, adjacent landowners, and the general public will be a high priority throughout the planning process.

Public involvement in the northwest Oregon state forests planning process is based on the concept that inclusion and consideration of diverse viewpoints is critical to gaining public understanding, acceptance, and support.

The goals for public involvement are:

- To seek insight, opinions, and data on planned management actions on northwest Oregon state forest lands.
- To build understanding, acceptance, and support for the forest resource management planning process and decisions.
- To offer information to the public about forest systems and forest stewardship.
- To provide the public with meaningful opportunities to comment and affect planning decisions at a time when public involvement can contribute positively to the planning decisions under consideration.

10. The plan will be goal-driven.

A goal-driven plan begins by defining overall management goals for the forest. Examples of overall goals for the forest are found in these guiding principles. Once these have been established, then specific goals can be developed for each resource. These specific goals spell out exactly what the vision is for the development or protection of the resource.

In contrast, an issue-driven plan begins by identifying concerns about existing management practices. It then works to analyze and address those concerns. This is usually done by developing a series of alternatives that deal with the issues in a piecemeal fashion. The problem with an issue-driven process is that it is easy to lose sight of the goals for managing the land. For this reason, the *Northwest Oregon State Forests Management Plan* will be goal-driven.

11. **The plan will view northwest Oregon state forest lands in both a local and regional context.**

    Consistent with Oregon Administrative Rules and principles of good stewardship, planning will consider different geographic scales. These will include the immediate physical area, the watershed level, and the overall landscape, which may include other public and private ownerships.

    In the area of northwest Oregon, approximately 54 percent of forest land is in public ownership. State forests represent about 15 percent of that total. The forest must be viewed in context with these other forest lands in the region. This view looks at both timber production and other resource issues.

    For example, evaluation of the recreation resource will include an assessment of the types and quantities of various recreation opportunities available on forest lands throughout northwest Oregon. Based on this information, the appropriate role of state forest lands in providing specific recreation opportunities will be determined and described in the goals and strategies developed.

12. **The plan will consider the overall biological diversity of state forest lands, including the variety of life and accompanying ecological process.**

    Oregon Administrative Rule 629-035-0000 defines biological diversity as "the genetic variation and the abundance and variety of microbial, plant, and animal life, the range of ecological functions, and the physical processes at any local or landscape scale." This definition has been used throughout the planning process. It emphasizes process and the interactions that lead to landscape, ecosystem, species, and genetic diversity.

    Managing for biological diversity requires managing at various levels of biological organization: species, genetic variation within species, communities of organisms, and functional diversity. The final item, functional diversity, includes the many processes in which organisms transfer energy with each other and the physical environment.

    Strategies for biological diversity must deal with resources at two spatial levels: the forest stand and the broader landscape.

    Managing for biological diversity also requires recognizing that certain concepts and many details of managing ecosystems require further testing and refinement. Because we lack complete understanding, an adaptive management approach is required that integrates management, research, and monitoring to accomplish goals and objectives.

13. **Northwest Oregon state forest lands will be managed to meet state and federal Endangered Species Acts while fulfilling the Board of Forestry's other statutory responsibilities. Management plans for threatened or endangered species will seek to complement or supplement habitat provided by other landowners to the extent that such provision of habitat is compatible with administrative rules defining greatest permanent value.**

    The forest management plan must comply with all federal and state laws. Although many laws apply to the management of state forest lands, legal requirements for protection of threatened or endangered species are expected to have the most significant impacts.

    The intent of the plan is to adopt management strategies that contribute to providing for the survival and recovery of currently listed threatened and endangered species, and assist in preventing future listings of other species. The fact is recognized, however, that northwest Oregon state forests are one part of a larger landscape, and cannot by themselves provide sufficient habitat to guarantee the survival or recovery of a species. When managing habitat conditions on northwest Oregon state forests, planners should consider conditions on other public and private lands, in order to ensure that state forest lands contribute to species recovery goals.

14. **The plan will commit the Oregon Department of Forestry to using monitoring and research to generate and utilize new information as it becomes available, and employ an adaptive management approach to ensure that the best available knowledge is acquired and used efficiently and effectively in forest resource management programs.**

    This plan will gather, for the first time, a wide range of available natural resources data for northwest Oregon state forests. However, new information will continue to become available after the plan's completion. Some information will be the result of specific research activities, such as the retrospective study for the northern spotted owl, which will provide demographic and habitat information. Other information will be collected through ongoing work conducted by state agency resource specialists.

    New information will also become available through monitoring. The Department of Forestry is committed to an ongoing monitoring program.

    As new information becomes available, the Department of Forestry will review and analyze its applicability to the management of the forest. Management of the forest will be adapted in light of the best available scientific knowledge.

The Forest Vision

The forest vision is a picture of the northwest Oregon state forests in the future. Like a mural painted on the side of a building, the forest vision has many images, which together form one larger picture. The forest described by the vision is that which the Oregon Department of Forestry feels will represent attainment of “greatest permanent value” to the citizens of the state, as defined in statute and rule. Achieving “greatest permanent value” means providing a full range of social, economic and ecological benefits, and achieving a balance between short-term and long-term economic returns.

The forest vision represents an idealized view of the future, without the constraints of the current forest condition. The strategies and implementation plans that follow will describe how each district can move from the current forest condition toward this future forest, and do so in a manner that meets the short-term needs for timber and revenue generation. The forest vision is written in the present tense, as if we are already in the future and actually looking at this idealized forest.

The forest described produces sustainable and predictable forest products that generate jobs and revenues for the benefit of the state, counties, and local taxing districts. The management approaches described reduce economic risks by producing a diverse mix of stand structures and associated timber products, and will lead to increases in the asset value of the lands over time.

The diversity of forest structures is enhanced over time, providing for a broad range of social values important to Oregon citizens, including recreation. The diverse forest structures produced contribute to the range of fish and wildlife habitats necessary for all native species, and contribute to broad biodiversity. This forest will provide the range of forest conditions that will need to exist to achieve the goals for all resources.

The Forest

The landscape has a broad range of forest structures and native tree species. The forest stands are predominantly conifer, although hardwoods are intermixed in most stands. Some stands and drainages are dominated by hardwoods. Typical stand structures are listed below.

- Regeneration stands, i.e., young stands with newly established trees, grasses, herbs, and shrubs.
- Stands in which the tree crowns have closed together, creating a closed canopy where very little light reaches the forest floor.
- Stands with some openings in the canopies and some canopy layering; these stands have newly established shrubs, herbs, and shade-tolerant trees in the understory.
- Open stands that have significant understory development. Vigorous herbaceous and shrub communities combine with tree crowns to create multiple canopy layers. Tree crowns and shrubs create a complex vertical structure from the forest floor to the tops of the tallest trees.
- Stands with large trees; multiple, deep canopy layers; substantial amounts of coarse woody debris; large snags; and other structures typically associated with older forests.

Well-stocked, healthy, and vigorous forest stands are the rule. Insect and disease agents are present at low levels, and are considered a normal part of a healthy forest. Insects, disease, minor windthrow, other natural events and active management create gaps throughout the forest. Gaps are relatively small openings within a stand, or small patches of a different vegetation type within a more general stand type. Stands vary in size from a few acres to hundreds or even thousands of acres, and generally have irregular shapes.

Hard and soft snags and down woody debris provide for soil productivity and habitat needs. Snags and down logs are located in all stand types, but occur in significantly different amounts in individual stands.

Although the forest maintains the same general balance of structures over the landscape through time, individual stands are changing continuously. This shifting mosaic of forest structures maintains vigorous timber-producing stands, contributes to the diversity of plant communities and wildlife habitats, and enhances overall biodiversity throughout the forest. The diverse mix of habitats includes habitat for species associated with older forest structures.

The forest contributes to the range of habitats needed by native fish and wildlife species in northwestern Oregon. Although the locations of specific types of habitat may change over time, the shifting forest mosaic provides an overall stability in the amount and distribution of various habitats. Because the state forests contribute to this mosaic of habitats, the risk is significantly reduced that species will become threatened or endangered due to forest habitat conditions.

Many recreational uses are available in the managed forest. Recreation occurs across the whole landscape — in areas intensively managed for timber, as well as areas where little timber management occurs. Specific sites or areas with low timber production capacity are managed primarily for public use values, with timber as an incidental use.

Thinnings, partial cuts, and regeneration harvests produce a predictable and sustainable supply of timber and revenue. Smaller diameter wood is produced from thinnings in the early stages of stand development. High quality timber is produced through silvicultural techniques and harvested through partial cuts and regeneration harvests. Timber harvest and silvicultural activities contribute to employment in local communities, and to increased volumes of timber and more diverse wood products flowing into local economies.

Riparian areas are dominated by stands of large conifers, with hardwoods flourishing on wetter sites. Healthy herb and shrub communities are part of the riparian environment. Many snags and down logs are found in and around streams. The riparian areas support a diversity of tree, plant, and animal species. Diverse riparian conditions contribute to healthy aquatic habitat elements. Although the specific locations of channels, deep pools, and other habitats shift over time, the mosaic of stream habitats has an overall stability. High quality fish habitat exists in most areas.

Management Perspective

The forest is actively managed to produce the various stand types in much shorter time frames than would occur in unmanaged stands. Management activities are scheduled to provide a sustainable flow of timber and revenue while maintaining the desired array of forest structural conditions over time. When natural events such as windstorms or fires affect forest structures, management activities are adjusted as needed to maintain the desired ratio of forest conditions.

Stewardship — Oregon Department of Forestry employees carry out good stewardship of the forest and its many resources efficiently and professionally. They coordinate with other state and federal agencies, nongovernment organizations, neighboring landowners, and other interested individuals to achieve the management goals for northwest Oregon state forests. The comprehensive management program is adequately staffed.

Monitoring — The monitoring program is an integral part of forest management. Monitoring provides feedback for adaptive management, ensuring that resource goals are being met, and that new information is incorporated into planning at all levels.

> ***"I have read many definitions of what is a conservationist, and written not a few myself, but I suspect the best one is written not with a pen, but with an axe ... A conservationist is one who is humbly aware that with each stroke he is writing his signature on the face of his land. Signatures of course differ, whether written with axe or pen, and this is as it should be." (Aldo Leopold 1949)***

Resource Management Goals

This section describes the management goals for each resource on the northwest Oregon state forests that will be actively managed. Goals are general, non-quantifiable statements of direction. The management strategies in Chapter 4 describe how the Department of Forestry will achieve the goals. Resources are listed in alphabetical order in this chapter.

The management goals were developed in the context of legal and policy mandates for the management of state forests. Oregon Revised Statutes direct that Board of Forestry Lands shall be managed by the State Forester to “secure the greatest permanent value of such lands to the state.” The Oregon Constitution directs that Common School Forest Lands shall be managed “with the object of obtaining the greatest benefit for the people of this state, consistent with the conservation of this resource under sound techniques of land management.”

Oregon Administrative Rules state that the goal for management of Board of Forestry Lands is to provide “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.”

The goals were developed and must be viewed in the context of this overall goal for management of state forest lands. Individual goals can only be met to the extent that they are compatible with this overall goal and with other applicable laws.

Agriculture and Grazing

1. Permit agriculture and grazing, to the extent that they are compatible with other resource goals.

Air Quality

1. Contribute to meeting National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration standards (PSDs) established under the federal Clean Air Act (42 USC 7401 et seq.).
2. Manage prescribed fire to comply with the Oregon Smoke Management Plan.
3. Maintain compatibility with Oregon's Statewide Planning Goal 6 (Air, Water, and Land Resources Quality) direction to maintain and improve the air resource of the state.

Cultural Resources

1. Preserve and protect archaeological sites or archaeological objects in accordance with state law (ORS 97.740 to 97.760; 358.905 to 358.955; and 390.235).
2. Conserve historic artifacts and real property of historic significance in accordance with state law, in consultation with the Secretary of State and the State Historic Preservation Office (ORS 358.640 and 358.653).
3. Protect additional cultural resource sites that are determined by the Department of Forestry to have special educational or interpretive value.
4. Maintain compatibility with Oregon's Statewide Planning Goal 5 (Open Spaces, Scenic and Historic Areas, and Natural Resources).

Energy and Minerals

1. Manage gas, oil, and mineral resources on Board of Forestry Lands to provide revenues to counties and local taxing districts.
2. Manage gas, oil, and mineral resources on Common School Forest Lands to maximize long-term revenues to the Common School Fund.
3. Provide products useful to society, while minimizing impacts to surface resources (i.e., forests, fish, wildlife, etc.).
4. Maintain compatibility with Oregon's Statewide Planning Goal 5 (Open Spaces, Scenic and Historic Areas, and Natural Resources).

Fish and Wildlife

1. In a regional context, provide habitats that contribute to maintaining or enhancing native wildlife populations at self-sustaining levels, and contribute to properly functioning aquatic habitats for salmonids, and other native fish and aquatic life.
2. Meet the requirements of federal and state endangered species acts.
3. Contribute to maintaining fish and wildlife populations at levels that allow recreational and commercial opportunities, including fishing, hunting, and wildlife viewing.
4. Maintain compatibility with Oregon's Statewide Planning Goal 5 (Open Spaces, Scenic and Historic Areas, and Natural Resources).

Forest Condition (Health and Biodiversity)

1. Maintain or restore healthy forest conditions, thereby promoting sustainable, productive, and resilient ecosystems.
2. Maintain biological diversity across the landscape.
3. Provide for structural complexity and age diversity within and among stands.
4. Maintain long-term forest soil productivity.
5. Protect forest resources from unwanted fire and damaging pests.

Land Base and Access

Land Base

1. Conserve the state forest land base to maintain resource values.
2. Maintain compatibility with all Oregon Statewide Planning Goals and the Oregon Coastal Management Program.
3. Achieve a land ownership pattern that can be efficiently managed.

Access System

1. Develop and maintain an access system adequate for fire protection and management activities.
2. Minimize potential adverse environmental and biological impacts of roads and other components of the access system.
3. Allow public access where it is compatible with resource protection, management activities, and where impacts to adjacent landowners can be minimized.

Plants

1. In a regional context, provide habitats that contribute to maintaining or enhancing native plant populations at self-sustaining levels.
2. Meet the requirements of federal and state Endangered Species Acts.

Recreation and Scenic Resources

Recreation

1. Provide diverse forest recreation opportunities that supplement, rather than duplicate, opportunities available in the region.
2. Provide opportunities for interpretation and outdoor education on state forest lands.
3. Manage recreational use of the forests to minimize adverse impacts to other resources and adjacent ownerships.
4. Minimize conflict among user groups.
5. Maintain compatibility with Oregon's Statewide Planning Goal 8 (Recreational Needs).

Scenic Resources

1. Meet the scenic protection requirements of the Oregon Forest Practices Act for visually sensitive corridors associated with designated scenic highways (ORS 527.755).
2. Manage the forest to minimize visual effects in areas designated by the Department of Forestry as visually sensitive.
3. Maintain compatibility with Oregon's Statewide Planning Goal 5 (Open Spaces, Scenic and Historic Areas, and Natural Resources).

Social and Economic Resources

1. On Board of Forestry lands, provide sustainable timber harvest and revenues to the state, counties, and local taxing districts.
2. On Common School lands, maximize the long-term revenues to the Common School Fund.
3. Select sound forest management practices that promote sustainable state and local economies.
4. Provide for a mix of resource outputs and amenity values that promote the long-term social health and economic viability of state and local communities.
5. Enhance public understanding of forest resources and forest resource management.
6. Maintain compatibility with Oregon's Statewide Planning Goal 9 (Economic Development).

Soils

1. Maintain long-term forest soil productivity.

Special Forest Products

1. Manage the special forest products resource to provide 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.

2. Manage special forest products for sustainability over time.

Timber

1. Manage the timber resource to provide sustainable timber harvest and revenues to the state, counties, and local taxing districts; maximize long-term revenues to the Common School Fund; and contribute to Oregon's timber supply.

2. Produce a sustained yield of timber harvest from state forest lands.

3. Promote the maintenance, growth, and development of forest trees and stands through the use of appropriate silvicultural techniques.

Water Quality

1. Maintain a level of water quality sufficient to support beneficial uses of the waters of the state, including propagation of fish and aquatic life, wildlife, domestic, agricultural, industrial, municipal, recreational and other legitimate uses (ORS 468B.015(2)).

2. Maintain water quality that meets standards established by Oregon under the mandates of the federal Clean Water Act (33 USC et. seq.).

3. Maintain compatibility with Oregon's Statewide Planning Goal 6 (Air, Water, and Land Resources Quality).

Water Supply

1. Maintain healthy watershed conditions to support the beneficial uses of the waters of the state.

2. Maintain natural watershed storage capacity processes.

3. Protect water-related functions of riparian lands.

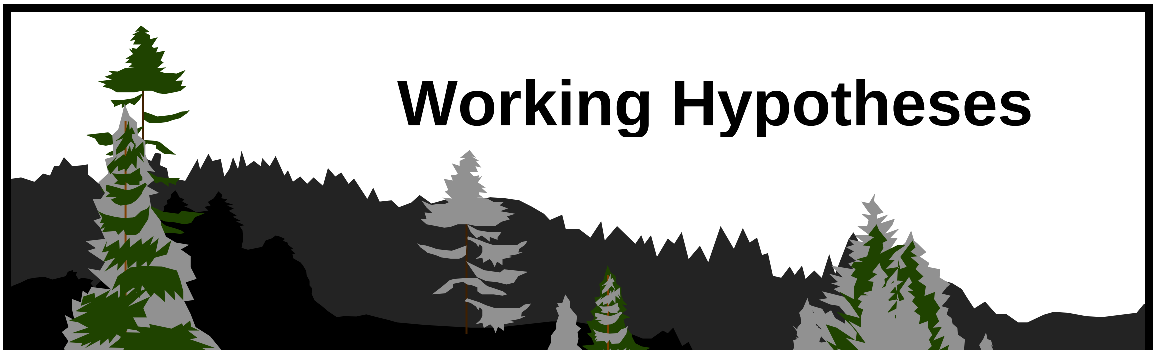
Wetlands

1. Maintain the natural functions and attributes of wetlands over time.

2. Ensure that no net loss of wetlands occurs as a result of our management activities.

3. Maintain compatibility with Oregon's Statewide Planning Goal 5 (Open Spaces, Scenic and Historic Areas, and Natural Resources).

Working Hypotheses



The forest vision described earlier in this chapter provides an idealized view of the future. It describes a type of forest and an approach to forest management that the Department of Forestry believes will achieve the resource management goals and thus provide for “greatest permanent value.” However, it is reasonable to ask why we believe such a future can come to pass, and what assumptions we have based this belief upon.

Forest management is ecologically, socially, and economically complex. Our understanding about forest systems is substantial, but incomplete. We continue to learn more through monitoring and research, and a strong adaptive management framework is essential to successful implementation of this plan. At the very heart of this plan, and fundamental to the adaptive management program outlined in a later chapter, is a set of working hypotheses. These working hypotheses relate to broader assumptions or beliefs that, if validated over time, lead us to believe that we can indeed achieve the future vision and thus the benefits that accrue from that future forest.

These key working hypotheses are:

- The citizens of Oregon will continue to support integrated and active management of state forests in northwest Oregon to provide for multiple outputs and benefits.

- An active and integrated forest management approach will provide for high levels of sustainable and predictable timber and revenue while concurrently providing habitat for native fish and wildlife species.

- Identification and protection of key habitat areas for specific species will maintain existing populations as a source to colonize new habitat.

- Species will colonize new habitat as it develops over the longer term.

- A diverse array of stand types will, at various times, provide for achievement of all the resource goals outlined in the previous section of this plan.

- Providing for biodiversity at the landscape level requires providing for an array of forest conditions through time and space that emulates conditions created by historic disturbance regimes.

- Providing for a diverse array of forest conditions through time can be accomplished in a managed context through the application of silvicultural principles.

- A diverse array of forest conditions will enhance overall forest health and reduce the risks of catastrophic loss from insects and disease.

- Active management through a combination of landscape-level strategies and site-specific standards will result in maintaining and restoring properly functioning aquatic and riparian habitats.

- Timber markets will exist over time for the range of timber types and qualities that will be produced from state forests. The diverse “portfolio” of products available from a diverse array of stand structures will strengthen the ability of state forests to capitalize on changing markets.

- A diverse array of forest conditions will provide diverse recreational opportunities on these state forest lands.

- Long-term management of natural resources can only succeed within a framework that provides for change.

Collectively, these working hypotheses form the basis for the set of integrated forest management strategies described in the next chapter. They also provide the foundation for the key questions that must be explored through time, as this plan is implemented, to assure that change occurs in an appropriate and timely manner.

Chapter 4

Resource Management Concepts and Strategies

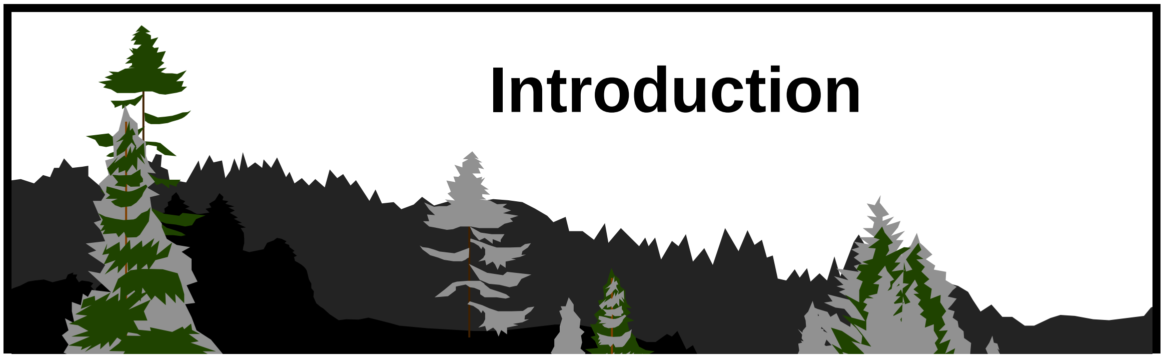
Chapter 4 presents the resource management concepts and strategies for a broad, integrated management approach to be implemented on northwest Oregon state forests. This integrated management approach is designed to generate a full range of economic, environmental, and social values from these state forests. This chapter presents an active management approach, and stresses the compatibility of uses across the landscape and over time.

This chapter briefly explains the resource management concepts that were used to develop the strategies of the FMP. The concepts were derived from scientific research in the fields of silviculture, forest ecology, fisheries and wildlife biology, and stream ecology. The full references for scientific publications cited are given in Appendix B, and the concepts are explained in greater detail in Appendix C. Following the explanation of the conceptual foundation, the strategies of the FMP are presented. The strategies are the heart of the FMP and provide the direction for achieving the goals and vision that were outlined in Chapter 3.

The chapter's main headings are listed on the next page.

The main headings in this chapter are listed below.

Introduction



Forest planning begins with overall policy (legal framework), guiding principles, vision, resource management goals, landscape management strategies, and then proceeds through several steps to site-specific projects. On the next page, Figure 4-1 shows the hierarchy of three planning levels, from strategic to operational.

The *Northwest Oregon State Forests Management Plan* (FMP) builds an encompassing strategic framework. The strategies in this chapter are the heart of the FMP. Using the strategic framework in the FMP, district implementation plans are developed to achieve the FMP's management goals for a ten-year period, and move toward the forest vision. Finally, annual operations plans describe site-specific projects and how those projects are designed to contribute to the goals of the FMP for a one-year period.

The three planning levels, shown on the following page and described in Chapter 1, provide a framework for adaptive management. Agency staff, through identified review and approval processes, can make changes as needed at the various levels, ranging from strategic, landscape-wide changes to the FMP, to specific, tactical changes at the district and project level.

STRATEGIC → **OPERATIONAL**

FOREST MANAGEMENT PLANS (*Planning Area)*

Greatest Permanent Value (full range of benefits)

Resource Goals

Integrated Forest Management Strategies

Resource Management Strategies

Key Working Hypotheses

Land Base Designation

Land Management Classification System

Monitoring/Research Goals

10 YEAR IMPLEMENTATION PLANS (*District)*

Current Condition

Desired Future Condition

Watershed/Basin Descriptions

Management Opportunities

Harvest Objectives

Young Stand Management Objectives

Land Management Classification Maps

Recreation Plans

Road Plans

Monitoring/Research Plan

ANNUAL OPERATIONS PLANS (*District)*

Timber Sale Plan

Habitat Improvement Projects

Young Stand Management Projects

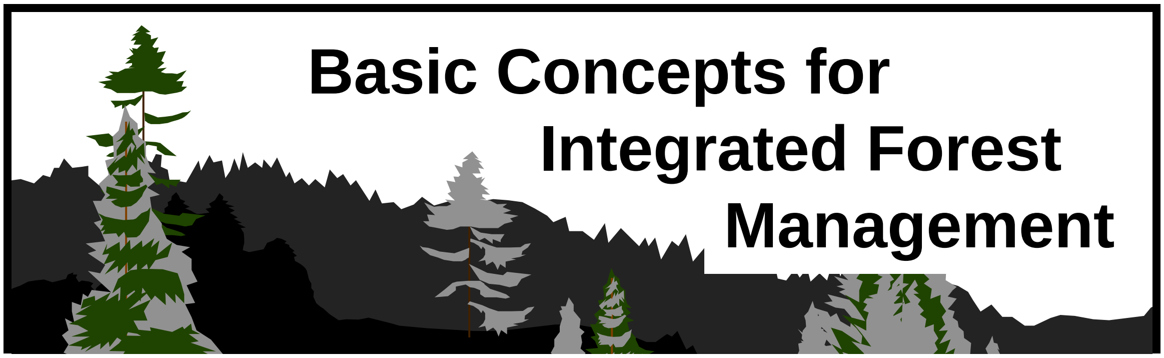
Recreation Projects

Road Management Projects

Monitoring/Research Projects

Figure 4-1. State Forest Plans And Policies: Planning Hierarchy And Key Products

Basic Concepts for Integrated Forest Management



Integrated management, as the term is used in this plan, is 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.

The basic concepts for integrated forest management in this plan focus on:

- Landscape management (structure-based management).
- Aquatic and riparian conservation.
- Forest health.

Landscape management (structure-based management) — The landscape management concepts and strategies presented in this chapter are based on an approach called structure-based management (SBM). SBM is the application of silvicultural tools in a manner that is designed to attain a desired landscape condition, which in turn will meet the land management objectives of the FMP. Specifically, it is designed to produce and maintain an array of forest stand structures across the landscape in a functional arrangement that provides for the social, economic, and environmental benefits called for in the management direction for these lands. These benefits include a high level of sustainable timber and revenue, diverse habitats for indigenous species, a landscape level contribution to properly functioning aquatic systems, and a forest that provides for diverse recreational opportunities.

The following four key concepts are the foundation for structure-based landscape management:

1. Active management for a diverse array of forest stand types.
2. Landscape design to provide for a functional arrangement of the stand types in terms of habitat values.
3. Active management to provide for key structural components within stands and on the landscape (snags, down wood, legacy trees, etc.).
4. Active management for social and economic benefits.

These landscape management concepts are discussed in the following pages, with more detailed discussion in Appendix C.

Aquatic and riparian conservation — Three aquatic and riparian concepts key to integrated management are discussed beginning on page 4-32:

1. Management for proper functioning of aquatic systems.
2. The blended approach — landscape-level approach combined with site-specific strategies.
3. Use of watershed assessment and analysis to refine strategies and plan management activities during plan implementation.

Forest health — Finally, two forest health concepts are the basis for the forest health strategies described in the strategy section of this chapter:

1. Active management for a diverse and healthy forest ecosystem that is resilient to biotic and abiotic influences.
2. Adherence to the principles of integrated pest management.

This plan also describes two important processes for assuring that these concepts and the related strategies are applied in a manner that results in the intended outcomes. These two processes are:

1. Implementation planning that relies on the knowledge and expertise of local natural resource professionals to determine specific stand pathways and prescriptions.
2. A monitoring and adaptive management system that operates at the temporal and spatial scales necessary to assure that course corrections occur in a timely manner.

Implementation planning is included as a key strategy later in this chapter and is discussed in more detail in Chapter 5. The concepts, framework, and processes for monitoring and adaptive management are described in Chapter 5.

Basic Concepts for Landscape Management

Structure-based management is designed to emulate many aspects of natural stand development patterns and to produce structural components found in naturally developing stands, but in fewer years. By anticipating future patterns of forest development, foresters predict the potential for individual stands to produce specific characteristics such as a multi-layered canopy. Foresters can then develop appropriate silvicultural prescriptions to accelerate the rates of stand development and the types of structures, products, and habitats that forest stands will produce over the long term. The result will be a forest landscape that more closely emulates historic variability and diversity in a much shorter time frame than if these existing stands were left to develop through natural influences.

Individual stand management will vary greatly under SBM. Some stands will be managed along pathways that focus on timber production, with habitat structures such as snags and down wood incorporated. Others will be managed to produce stands that emulate habitat conditions normally associated with older forests. These stands are also expected to produce high volumes of timber. In the long term, many stands will move through all of the stand types, and return to a regeneration type through a final harvest. Thus, when the desired future condition is achieved, much of the landscape will be a dynamic mosaic of slowly shifting stand types, but with relatively stable quantities of each. Embedded within the mosaic will be a network of areas which develop into older forest conditions and then persist in a relatively unmanaged state. Many of these stands will eventually become true old-growth stands as that condition is commonly defined.

Stand density will be actively managed to accelerate stand development; this will be done through periodic thinning and partial cutting. These techniques can be used to produce a variety of results. Some prescriptions will result in fast-growing, well-stocked stands with minimal understories. Other prescriptions will develop more complex stand structures, with rapid tree diameter growth, enough sunlight on the forest floor to maintain understory plants, and a complex forest canopy. Thinning and partial cutting can also be used to create or maintain other important structural components, such as snags, down wood, gaps in the canopy, and multiple canopy layers.

A diversity of stand structures will provide for a broad range of ecosystems and wildlife habitats, which will contribute to maintenance and restoration of biodiversity. 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.

The high level of biodiversity should result in a more resilient forest that will be less prone to large-scale damage from environmental or human stresses.

Oliver (1992) states:

> "Biodiversity (biological diversity) describes the variations in life forms, genetic makeup, biological processes and ecological niches that occur in any specific area. Regional and global biodiversity has been declining: attempting to reverse the trend is of both moral and practical concern. Maintaining stable populations of all species by managing for each species individually is an impossible task. However, biodiversity can be promoted by maintaining the habitats — forest structures — in which the species are found."
>
> "Much recent environmental attention has been misdirected at stand level forestry operations, as if an ideal stand structure would solve all environmental concerns. The solution actually lies at the landscape level — where the appropriate dynamic balance of stands in diverse structures and patterns can maintain habitats for a diversity of plants and animals."

Many other researchers agree that there is no single, ideal stand structure that serves as a panacea to the wildlife and biodiversity issues we face today. A diversity of stand structures across the landscape in varying amounts and arrangements is probably the most reasonable way to provide habitats for the broad spectrum of birds, small mammals, or wildlife in general. (For entire paragraph: Hunter 1990, Hansen et al. 1991, Carey et al. 1996, Carey and Johnson 1995.)

Landscape Management Concept 1: Active Management for a Diverse Array of Stand Types

The first concept of structure-based landscape management is "active management to produce a more diverse array of forest stand types."

Pacific Northwest forests follow a typical progression of stand structures over time following a major stand-replacement disturbance. Historically, these large scale disturbances resulted from major windstorm events, large scale insect and disease outbreaks, and from both natural and Native American caused wildfires. One model of this progression following disturbance has been clearly defined by Oliver and Larson (1996). Their descriptions for stand initiation, stem exclusion, and understory reinitiation processes have been used in this plan. The stand types identified later in this section are all characterized by these three phases of stand development.

The final stage of stand progression identified by Oliver and Larson is old growth structure. This definition is based upon natural stand progressions that could take 200 to 1,000 years or more in the western hemlock/Douglas-fir associations typical on northwest Oregon state forests. Oliver and Larson (1996) state:

> "Different aspects of old growth structure can for the most part be created in a relatively short time frame; but for stands to complete the process of growing without intervening disturbances takes more time and often requires careful planning of protected locations for the stands, intensive protection from fire, and luck to keep the stands from blowing over or being destroyed by insects or other disturbances.
>
> For non-timber management objectives such as recreation and wildlife habitats, most concern is for an old growth structure, not the old growth process of stand development."

For the *Northwest Oregon State Forests Management Plan*, we have defined "older forest structure" and "old growth." Older forest structure stands are the most complex structural stage for managed stands. The definition for older forest structure includes tree sizes, vertical structure, snags, and other characteristics. This definition is based on research that describes stand characteristics commonly associated with older forests. It is also consistent with observations from the Oregon Department of Forestry's ongoing wildlife demographic studies (Anthony et al. 2000). These observations show that structural characteristics of the trees and other vegetation are important factors that influence whether or not a stand is used by a given community of wildlife species, not the length of time or the process by which the stand developed those characteristics. Older forest structure stands do not necessarily function exactly like old growth stands, although they have some characteristics of old growth and are anticipated to provide many of the same benefits for wildlife and biodiversity.

Partial disturbances, caused by natural agents such as low intensity fires and windstorms, can result in patchy openings in stands and may not affect all sizes of trees in the stand. Such disturbances can result in stands with numerous variations in structure, often with remnant patches or individual trees larger or smaller than the rest of the stand. In some instances the residual trees grow fast enough to prevent the establishment of another age class. In other instances new trees, shrubs, and herbs regenerate in the larger openings. The patches of new regeneration will generally follow the same sequence of development that occurs in stands that regenerate following a major disturbance. Partial disturbances may thus result in stands with a variety of age classes and vegetation development (McComb et al. 1993).

There is no stand type identified in the forest management plan that specifically corresponds to stands developed from partial disturbances, although some of the components of understory and layered stands could be created by this mechanism. Some similarity to these stands will be achieved through the retention of residual trees, snags, and down wood, as discussed in the concepts for managing for structural components.

Forest stands develop along continuums. The stand type definitions on the next page represent snapshots of stand conditions taken along the various continuums. On the next several pages, figures show what these stand types look like, and describe the stand types in more detail.

Stand types are broadly defined categories of the structural characteristics of stands on the landscape. The stand type definitions will be used by field managers to categorize existing stands and to describe the desired future condition for the development of stands through time. Because the definitions describe points along continuums, it will not always be apparent how a particular stand should be classified. See "Stand Type Definitions" in Appendix C for more detailed guidelines on classifying stands. If a stand does not appear to fit any given type, then it should be placed into the type with the closest fit. Future inventories will be designed to better assist the field manager in determining the stand types.

The sidebars on the next few pages describe both the stand condition, and the stand development process that occurs in that stand type. The terms for both stand types and development processes are used throughout this document. When the discussion refers to stand condition, the stand type names are used. The process names are used when the discussion refers to stand development processes. The table on page 4-12 shows the relationship of stand types to stand development processes.

Structural components such as snags, residual trees, and down wood will be carried over or recruited from the regeneration harvests or other stand management activities conducted under this plan. Snag and residual tree standards are more stringent for older forest structure stands. See Landscape Management Strategy 3 for these standards.

Stand Type Definitions

The forest stand types are briefly defined here and are explained in more detail in the next several pages.

Regeneration (REG) — This stand type occurs 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.

Closed single canopy (CSC) — This stand type occurs when new trees, shrubs, and herbs no longer appear in the stand, and some existing ones begin to die from shading and competition, in a process called stem exclusion.

Understory (UDS) — This stand type occurs after the stem exclusion process has created small openings in the canopy, when enough light and nutrients become available to allow herbs, shrubs, and new trees to grow again in the understory.

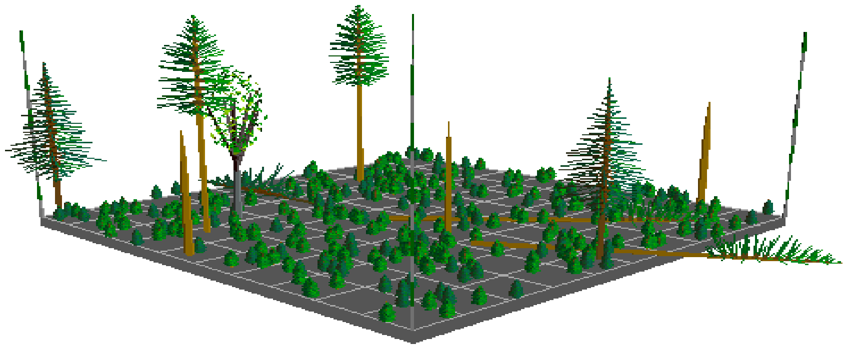
Layered (LYR) — This stand type occurs as the process of understory reinitiation progresses where openings in the canopy persist. Shrub and herb communities are more diverse and vigorous, and two or more distinct layers of tree canopy appear.

Older forest structure (OFS) — This stand type occurs when forest stands attain structural characteristics such as numerous large trees, multi-layered canopy, substantial number of large, down logs, and large snags. It is not the same as old growth, although some of its structures are similar to old growth.

Old growth — Typical characteristics of old growth include: a moderate to high canopy closure; a patchy, multilayered, multispecies canopy with trees of several age classes, but dominated by large overstory trees with a high incidence of large living trees, some with broken tops and other indications of old and decaying wood; numerous large, standing dead trees (snags); heavy accumulations of down woody debris; and the presence of species and functional processes that are representative of the potential natural community. In western Oregon, old-growth characteristics begin to appear in unmanaged forests at 175 to 250 years of age.

Table 4-1. Relationships between Stand Type Definitions and Stand Development Processes

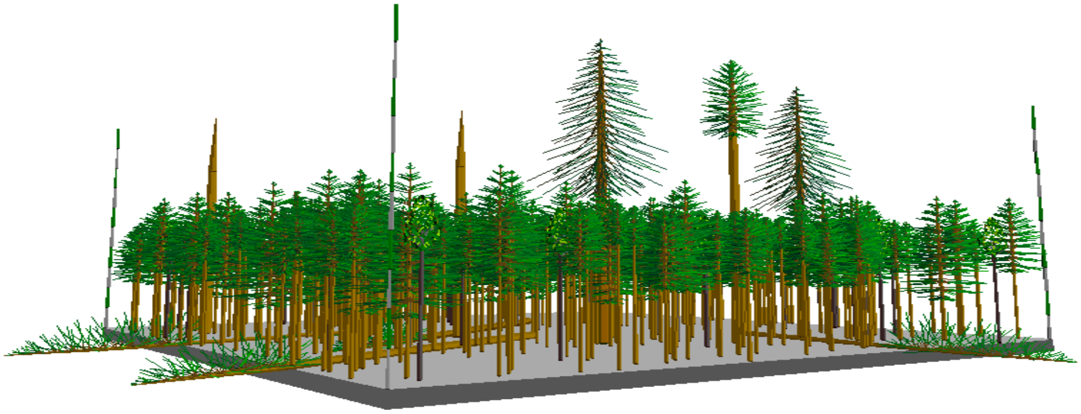
Stand Type	Stand Development Process
Regeneration (REG)	Stand Initiation (SI)
Closed Single Canopy (CSC)	Stem Exclusion (SE)
Understory (UDS) Layered (LYR) Older Forest Structure (OFS)	Understory Reinitiation (UR)



Stand Type 1 — Regeneration (REG)
Stand Development Process — Stand Initiation (SI)

The site is occupied primarily by tree seedlings or saplings, and herbs or shrubs. The trees can be conifers or hardwoods. Herbs, shrubs, and/or grasses are widespread and vigorous, covering 20 to 80 percent of the ground. This type includes first-year regenerated stands, and continues to the stage when the trees approach crown closure.

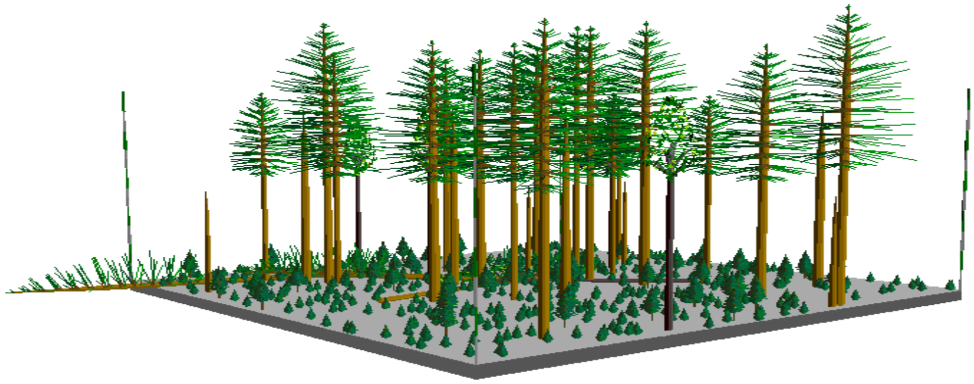
A REG stand develops through the stand initiation process, which begins when a disturbance such as timber harvest, fire, or wind has killed or removed most or all of the larger trees, or when undesirable vegetation is cleared for planting. Herbs, shrubs, and some live trees will remain from the previous stand, as well as snags and down wood. New plants (trees, shrubs, and herbs) begin growing from seed, sprouts, artificial regeneration, or other means in the early years of this stage. 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.



Stand Type 2 — Closed Single Canopy (CSC)
Stand Development Process — Stem Exclusion (SE)

Trees fully occupy the site and form a single, main canopy layer. There is little or no understory development. Where understory vegetation exists, there is low shrub and herb diversity. The shrub and herb layers may be completely absent or may be short and dominated by one or two shade-tolerant species, such as sword fern, Oregon grape, oxalis, or salal. CSC stands may include sapling stands, unthinned stands, or thinned stands where the overstory still occupies most of the stand.

A CSC stand develops when the trees in a REG stand grow larger and begin to compete for moisture, light, and nutrients. The stem exclusion process begins when new trees, shrubs, and herbs no longer appear and existing ones begin to die, due to competition. Later in the stage, shrubs and herbs may essentially die out of the stand altogether. The trees begin to show decreasing limb sizes, diameter growth rate, and crown length. Later, less competitive trees die. Root diseases may kill additional trees. As some trees die, snags and down wood begin to appear in the stand. The surviving trees grow bigger and have more variation in height and diameter. Near the end of the stage, enough trees have died and the living trees have enough variation that small gaps form and understory trees, shrubs, and herbs begin to reappear.

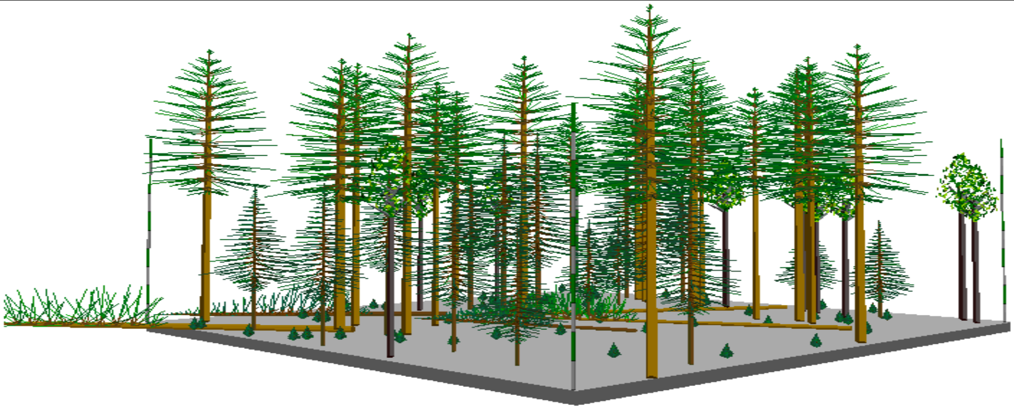


Stand Type 3 — Understory (UDS)
Stand Development Process — Understory Reinitiation (UR)

These stands have developed more diverse herb or shrub layers than CSC stands and have trees larger than sapling size. Tree canopies may range from a single-species, single-layered, main canopy with associated dominant, codominant, and suppressed trees, to multiple species canopies. However, significant layering of tree crowns has not yet developed.

The least developed stands in this category consist of a single-species, single-layered, main tree canopy with a diversified understory of shrubs and herbs. 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. This category also includes stands where the herbs, shrubs, and understory trees are vigorous and beginning to diversify. Vertical layering may be developing but is not yet extensive.

The understory reinitiation process occurs after stem exclusion, 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. In all UDS stands, the shrub and herb layers are likely to continue to diversify and maintain or improve their vigor. These stands offer good potential to develop into highly diversified vegetative communities. Depending on the intensity and timing of density management activities, stands could shift back and forth between the CSC and UDS stand types over time.



Stand Type 4 — Layered (LYR)

Stand Development Process — Understory Reinitiation (UR)

LYR stands have extensive layering of herbs, shrubs, and tree crowns; vertical structure is more complex than in UDS stands. Shrubs or herbs are present and tree canopies have two or more levels. Trees of 18 inches or larger dbh and 100 feet or more in height are predominant in the overstory.

More complex LYR stands have a mixture of shade tolerant (e.g., western redcedar, western hemlock) and intolerant tree species (e.g., Douglas-fir, noble fir); and shrub and herb species (vine maple, huckleberry, rhododendron, Indian plum, prince’s pine). The younger cohort of trees should be at least 30 feet tall. 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. The plant community provides a wide range of habitat niches from the forest floor through the canopy.

Older Forest Structure (OFS), as defined on the next page, is merely a LYR stand that has attained substantial amounts of down wood and snags. Highly diverse LYR stands may have all the required attributes of OFS, but lack the minimum tree diameters needed to provide habitat for wildlife species such as northern spotted owls, pileated woodpeckers, and flying squirrels. These LYR stands may provide habitat for some other species commonly associated with older forests.

The understory reinitiation process occurs after the stem exclusion process, when enough light and nutrients become available to allow herbs, shrubs, and tree regeneration to appear again in the understory. The new understory may grow very slowly at higher stand densities. Understory brush and herbaceous species increase to a substantial component of the stand by the end of the stage.

Stand Type 5 — Older Forest Structure (OFS)

Stand Development Process — Understory Reinitiation

This stand type occurs when a LYR stand develops the structural characteristics below, which are typically linked with older forests or old growth. OFS stands will not necessarily emulate all the processes and functions of very old forests. In addition to the variety of trees typically found in a layered stand, OFS stands have all of the following four characteristics.

- At least 8 or more live trees per acre that are at least 32 inches in diameter at breast height. For site classes 3, 4, or 5 on the Santiam State Forest at elevations greater than 3,000 feet, the diameter standard is lowered to at least 8 or more live trees per acre that are at least 24 inches in diameter at breast height.
- Two or more tree canopy layers. Often one layer is a shade-tolerant species.
- Snags — at least 6 per acre, 2 of which are at least 24 inches dbh; the remaining 4 must be at least 12 inches dbh.
- 600 to 900 cubic feet per acre of sound down logs (decay class 1 or 2), or 3,000 to 4,500 cubic feet of down logs in any or all decay classes 1-5.

In addition, the following characteristics are normally associated with older forest conditions, but they may be present to varying degrees and widely differing distributions. These conditions are not required to meet the OFS definition.

- At least 1 large remnant tree per 5 acres. Large remnant trees have the following characteristics — large diameter (over 32”), deeply fissured bark, large limbs or “platforms”, broken tops, evidence of fungal decay, dwarf mistletoe, or other evidence of decadence.
- Multiple tree species — at least 2 species; 1 is a shade-tolerant species.
- Some trees within the stand contain defect or indicators of decadence.
- Diverse understory vegetation including herbs and tall shrubs.

The understory reinitiation process described under UDS and LYR stand types is also the developmental process occurring in OFS stands. OFS stands are essentially LYR stands that have achieved the structural characteristics defined above.

Old Growth

Numerous definitions exist for old growth. The following definition is taken from the glossary of the FEMAT Report (Forest Ecosystem Management Assessment Team) (USDA Forest Service et al. 1993).

> "Old-growth conifer stand — Older forests occurring on western hemlock, mixed conifer, or mixed evergreen sites that differ significantly from younger forests in structure, ecological function, and species composition. Old growth characteristics begin to appear in unmanaged forests at 175-250 years of age. These characteristics include (1) a patchy multi-layered canopy with trees of several age classes, (2) the presence of large living trees, (3) the presence of larger standing dead trees (snags) and down wood, and (4) the presence of species and functional processes that are representative of the potential natural community. Definitions are from the Forest Service's Pacific Northwest Experiment Station Research Note 447 and General Technical Report 285, and the 1986 interim definitions of the Old-Growth Definitions Task Force."

On the northwest Oregon state forests, large disturbances or timber harvest eliminated almost all old growth stands before the state acquired the lands. Currently only scattered old growth trees and a few remnant patches of old growth are known to exist in the planning area. In the future, old growth will likely occur on state forest lands in areas managed for special purposes, such as riparian areas, nesting habitat for bald eagles or northern spotted owls, or other special areas. Some residual old growth trees remain from the Tillamook Burn.

Older Forest Structure is the managed stand type that is intended to emulate some, and possibly many, of the structures and functions of old growth. As the *Northwest Oregon State Forests Management Plan* is implemented, scientific research and monitoring will be necessary to determine if OFS can provide the functions of old growth, or if the characteristics of OFS should be modified to better emulate specific old growth functions.

Hardwoods

Hardwood stands are classified along with conifer stands in one of the five stand structure types. However, for the purpose of discussion, hardwood stands are defined as those stands where hardwood tree species comprise more than 70 percent of the tree canopy. Seventy percent is a subjectively set measure that identifies when hardwoods dominate the stand's tree canopy and thus will likely be the focus of stand management practices. Seventy percent is also being used to identify hardwood stands by current research such as the "Coastal Landscape Analysis and Modeling Study" (CLAMS) (Tom Spies 1996). Common hardwood species include red alder, bigleaf maple, and Oregon white oak.

Field managers may choose to manage hardwood stands for a variety of reasons, such as to obtain economic benefits from hardwood products, to manage tree diseases in the stand, or to introduce or maintain additional vegetative diversity within conifer-dominated landscapes.

At this time it is assumed that a small percentage (probably 10 percent or less) of the landscape will be managed as hardwood stands. Maintaining a component of hardwoods within conifer stands is encouraged, and it is anticipated that most stands will have some hardwoods.

Determining the Appropriate Quantity of Stand Types

The stand structures are not an end in themselves. In order to determine an appropriate array of stand types, forest managers examined the diversity of stand types historically associated with conifer forests in the Coast Range and Cascades. Studies have been done on the historical distributions of older stand types (old growth) in the Oregon Coast Range (Teensma et al. 1991). At the province scale, research suggests that the percentage of older stand types ranged from 30 to 70 percent of the landscape at any point in time. At smaller scales the variability was even greater, ranging from 15 to 85 percent of the landscape at any point in time (Wimberly et al. 2000).

The desired stand structure array presented later in this chapter is designed to emulate the diversity of stand types historically associated with conifer forests in the Coast Range and Cascades, recognizing that the actual quantity and distribution of these stand types was highly variable through time. Within this context, the stand type array described in this plan must be viewed as adaptive, subject to periodic review and possible revision throughout the life of this plan. Once a desired future condition of stand types is achieved, individual stands on the landscape will continue to change. For example, with continued density management through thinning, an understory stand will develop into a layered stand and eventually into an older forest structure stand. Some OFS stands will continue to persist and others will be returned to a regeneration condition as they are replaced by developing stands. However, the relative abundance of the different types is expected to remain reasonably stable. At some point decades in the future, a dynamic balance will be achieved of the stand types in a desired array, and individual stands will move in and out of the various types at a relatively even rate.

Determining the landscape percentages — Both objective and subjective processes were used to determine the desired future condition (DFC) percentages for stand structure types given later in this chapter, under Landscape Management Strategy 1. Foresters and biologists from the planning team considered the following factors and information.

- The available information on historical distributions of older stand types in the planning area (as referenced above). Although the goal was not to re-create these same conditions, it was an important consideration in trying to evaluate what array might emulate habitat functions for native species.

- The array of habitat necessary for state forests to contribute to conservation of all native wildlife species, with particular concern for providing older forest stands in sufficient quantity to provide for key species of concern (e.g., northern spotted owl, marbled murrelet). This determination involved the professional judgment of wildlife biologists and existing information from the relevant recovery plans for the northern spotted owl and the marbled murrelet.
- The array of stand types and conditions that could concurrently provide for the needed habitats, enhance and maintain biodiversity, and provide for sustainable timber and revenue levels consistent with the forest management plan's goals. This was based on information from a preliminary economic analysis of alternative rotation ages that would result in different amounts of older forest structure. This analysis was conducted by department technical staff.
- The current arrangement of, and management intentions for, other forest lands in the planning area. History suggests that while it may be relatively easy to forecast short-term conditions that will result from the application of landowner goals and objectives on these other ownerships, it is difficult to predict exactly how these adjacent lands will be managed over the long term. If historical trends persist, private land ownership is likely to change several times prior to this plan achieving a particular desired future condition. It is also possible that federal forest management plans will be subject to change in the future under changing political or legal circumstances. Thus, it was not considered advisable to adjust the desired future condition (DFC) at the landscape level based on the habitats that adjacent ownerships are expected to provide if they continue to be managed under current landowner goals and objectives. Stand conditions and management on adjacent ownerships will be considered during development of district implementation plans, and through comprehensive watershed assessments and analyses.
- The current array of stand types on lands in the planning area, and the knowledge that it will take many decades to achieve the DFC in relation to the older stand types. Sound science includes the process of developing a strong working hypothesis based on existing scientific knowledge, and applying it within a monitoring and adaptive management framework that ensures necessary changes are made through time. Given the anticipated time frame required to achieve the initial array proposed, there will be many opportunities through periodic reviews to change the DFC array as better information comes available.

The stand structure types correlate with at least four types of habitats. Open habitats occur during the regeneration stage; closed canopy habitats are associated with the closed single canopy stage. In the understory and layered stages, habitats have more horizontal and vertical diversity and a variety of habitat niches. Older forest structure and some layered stands provide habitats commonly associated with older forests or old growth.

Precise desired future condition vs. ranges of stand types — The planning team decided to use ranges for the desired future condition array instead of setting an exact percentage for each type. First, the stand types as defined do not always appear on the landscape as clearly defined, discrete types. Regeneration stands blend into closed single canopy stands with the onset of crown closure. The exact point at which a closed single canopy stand should be classified as understory, or an understory stand as layered, is open to individual interpretation.

Second, there is no single right answer for the appropriate balance of the stand structures. Historically, the stand structures present in the northwest Oregon state forests have varied greatly. Large wildfires that resulted from native American burning and subsequent European settlement (Tillamook Burn and others) significantly reduced the diversity of stand structure types within specific watersheds or regions. Wildlife populations always fluctuated in accordance with the amount of available habitat, as well as from other natural factors.

There is currently no research that supports one specific, idealized array of stand structures optimal for all species. However, since native species co-evolved with historical disturbance regimes and the forest conditions that resulted, it is reasonable to conclude that providing meaningful contributions to the habitat needs of all native species will require producing all habitat types or surrogates.

For all these reasons, a precise DFC array is unnecessary for the stand structure percentages, and the loss of flexibility could lead to poor long-term forest management. The planning team identified ranges that would provide a reasonable chance of successfully providing the full array of habitats for native species, without boom and bust cycles.

Regional differences — The planning team also considered "regionalizing" the DFC array to reflect the local conditions in each of the planning area's management districts. Oregon Department of Forestry district personnel, Oregon Department of Fish and Wildlife (ODFW) field biologists, and members of the planning team discussed the regional context for each district. The discussions focused on physiographic conditions that might require a different desired future condition, based on the different biological needs of wildlife in different parts of the Coast Range, or between the Coast Range and the Cascades. Different ownership patterns between districts were also discussed as a basis for setting different DFCs.

However, ODFW biologists from the North Coast Range, Central Coast Range, and Cascades all concurred that although some species differences may exist between the Coast Range and Cascades, there was no basis for setting different desired future conditions for these two geographic areas. There was no biological reason to set different DFCs within the northern and central Coast Range.

For the reasons described earlier, the team concluded that the appropriate level at which to consider stand conditions and management on adjacent ownerships was during development of shorter-range district implementation plans and through comprehensive watershed assessments and analyses.

Landscape Management Concept 2: Landscape Design to Provide for a Functional Arrangement of Stand Types

The second basic concept of structure-based management is “landscape design to provide for a functional arrangement of the stand types in terms of habitat values” (page 4-5).

Structure-based management involves more than achieving a specific array of stand types. Landscape planning is necessary to provide for a functional arrangement of the stands, and the stand types must also have key structural components. In order to meet these needs, stands will vary in size and exist in a variety of arrangements. Generally speaking, individual watersheds will contain a mix of all stand types. However, some watersheds may have only one or two of the stand types at any point in time. Interior forest habitats will be part of the mix. Decisions on the mix in any given basin will be made at the district level in implementation plans. As comprehensive watershed assessments and analyses are completed, these desired future conditions will be reevaluated and revised based on recommendations from that process.

The concepts discussed under this heading are:

- Managing biodiversity.
- Landscape design principles.
- Interior habitat area principles.

This chapter presents an overview of these ideas. See Appendix C for detailed discussion of these concepts, and Appendix B for full information on the citations.

Managing Biodiversity

Managing for biodiversity requires managing at various levels of biological organization: species, genetic variation within species, communities of organisms, functional diversity, ecosystem diversity and associated diversity of processes. Managing for diversity also requires recognition that certain concepts and many details of managing ecosystems require further testing and refinement. Thus, an adaptive management approach is required that integrates management, research, and monitoring.

For the northwest Oregon state forests, an operational approach for biodiversity management is the “coarse filter — fine filter” concept proposed by Hunter (1990). 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. Individual species or habitats that require special consideration, such as species with unique or limited distributions (not addressed using the coarse filter), are managed specifically under a fine-filter approach. Fine-filter management superimposes specific management actions in addition to those required under the coarse-filter management. Collectively, coarse- and fine-filter management maintains and restores ecosystem diversity.

Forest management for biodiversity is characteristically implemented at two scales: the forest stand and the broader landscape. The stand is a relatively homogeneous area forming an operational unit to which a silvicultural treatment is applied. Stand management defines the composition and structure through time. The landscape represents the distribution of many stand-level management units across a large area.

Landscape-Level Management for Biodiversity

Landscape management for biodiversity is based on the following principles.

1. Manage for a variety of seral stages, stand structures, and stand sizes across the landscape, emulating natural patterns.
2. Maintain habitats of individual species or groups of species at particular risk of extinction.
3. Maintain unique ecosystems. Examples include riparian areas, springs, wetlands, rock outcrops, and talus slopes.
4. Manage fragmentation to provide for adequate interior forest habitats.

Stand-Level Management for Biodiversity

The landscape-level principles address the broad distribution of forest stands over the landscape and through time. Stand structure and function differ with seral stage, ecosystem, and disturbance history. Stand-level management deals with the structure and function of the individual stand. Within individual stands, the most important structural features for maintaining diversity are:

- Dead and dying wood (snags, wildlife trees, and down wood).
- Large and old trees.
- Vertical and horizontal structure.
- Herb and shrub communities.

Relationship between Coarse and Fine-filter Planning

Coarse-filter planning provides the foundation for protecting biodiversity. When special habitat requirements dictate, fine-filter habitat requirements should be superimposed on the coarse filter to ensure that overall biodiversity goals are reached. Fine filter/coarse filter planning for the northwest Oregon state forests will be accomplished at the landscape level through district implementation planning. Planning at the district level can effectively integrate the two approaches. The main goal will be to maximize compatibility between coarse- and fine-filter planning efforts.

Landscape Design Principles

The following discussion is based on the paper, “Landscape Management to Meet Wildlife Diversity Objectives” (McAllister 1997).

A **landscape** is defined as an area of land containing a mosaic of habitat patches, often within which a particular "target" habitat patch is embedded (Dunning et al. 1992). There is no one size of landscape for all classes of wildlife, since each organism scales the landscape differently. Planning for wildlife diversity at the landscape level requires consideration at a range of spatial scales.

Habitat **patches** may be thought of as environmental units differing in quality for one or several species (Wiens 1976). A forest stand may be a convenient unit for silvicultural planning, but it may not be synonymous with a habitat patch for a particular wildlife species. The lower size limit of a patch for a particular organism is that scale at which the organism no longer perceives it as suitable habitat. The upper size limit is defined by an individual's home range (Kotliar and Wiens 1990). Patch size for populations or a spatially structured group of populations (metapopulations) will be larger.

The term **matrix** refers to the landscape patch in which other habitat patches are embedded. The matrix is the dominant and most connected landscape element, and therefore exerts the greatest habitat contribution. The relationship of the matrix to embedded patches is known as **fragmentation** (Franklin and Forman 1987).

Landscapes exist in a larger scale **context**. Generally, landscapes are evaluated at the watershed level or across several watersheds. An even larger context must be considered for some species, such as migrating birds. Forest managers must understand the relationship of a particular species to its landscape and the surrounding landscapes.

Landscape structure is composed of two key landscape elements: **composition** and **pattern**. Both affect ecological processes and wildlife. Landscape composition refers to the presence and amounts of each patch type, independent of placement.

Landscape pattern is also important for many species. Landscape pattern refers to patch size, shape, and placement; the distance between suitable patches; the spatial arrangement of patches; and connectivity.

Certain landscapes affect wildlife populations through **source/sink relationships**. In these landscapes, productive source patches supply emigrants to less productive patches termed sinks. Both landscape composition and pattern of source and sink patches can have an influence on overall population size (Thomas et al. 1990). Three factors have been found to define the functional patch size: 1) actual size, 2) distance from a similar patch, and 3) degree of habitat difference of the intervening matrix (Harris 1984). The presence and abundance of a species in a particular patch can be strongly affected by the composition of adjacent patches.

These **neighborhood effects** or **edge contrasts** can be both positive and negative. In the case of habitat generalists such as deer and elk, the edge between different patches is generally considered beneficial. For other species, notably interior habitat specialists, high contrast edge can have negative effects, including predation, competition, nest parasitism from other species, and micro-climatic effects from surrounding open areas (Rosenberg and Raphael 1984, Chen et al. 1992, Harris 1984).

The degree of isolation or connectivity between suitable habitat patches affects many wildlife species. **Corridors** have the opposite function of boundaries. Corridors can facilitate movement of individuals between habitat patches, serving to connect separate but similar habitat within the landscape mosaic.

In western Oregon, the most important wildlife habitat to consider is that commonly associated with older forests. This habitat is important because it is in limited supply, and because it provides important habitat for over 118 wildlife species (Harris 1984). Emphasizing management for mature forest habitat also ensures maintaining other habitats during the course of expected forest development.

All mature forest patches do not function as effective habitat. **Interior habitat area (IHA)** is defined as that portion of the mature forest patch that remains functional after negative effects of high contrast edge are removed. Three factors influence the amount of IHA in relation to total patch size: 1) degree of edge contrast with surrounding patches; 2) patch configuration, which changes the amount of edge, and hence the amount of IHA; and 3) size of the older forest patch. Harris (1984) found that in landscapes where older forest patches are adjacent to high contrast edge (REG or early CSC) patches, habitat conditions within the older forest can be negatively affected for up to several tree heights from the boundary (see also Chen et al. 1992).

Interior Habitat Area Principles

This plan places an initial focus on the development of mature forest patches and interior habitat areas (IHAs) in planning for a desired future condition. This does not mean that other patch types are less important. All patch types are essential if habitats are to be provided for all species. The rationale for this initial focus is as follows:

- IHAs are associated only with mature forest patches.
- The wildlife associated with IHAs is usually the component needed to reach wildlife diversity goals in forested landscapes.
- The planning area has a limited acreage of mature forest conditions that produce IHAs.
- Forest development will progress through other patch types on its way to becoming interior habitat.

Types of Landscape Considerations to Be Addressed at Each Scale

Different wildlife conservation issues and different landscape functions are addressed at each scale in landscape planning. See “Guidelines for IHAs and Other Patch Types across the Landscape” in Appendix C for detailed guidelines on planning the distribution and size of IHAs across the landscape.

Landscape Management Concept 3: Active Management for Key Structural Components

The third concept of structure-based landscape management is "management to provide for key structural components within stands and on the landscape" (page 4-5). These key components are listed below, followed by the reasons why it is important to provide them in the managed forest. See Appendix C for a more detailed discussion of these concepts. Increasing the complexity of the forest environment will increase the overall diversity of habitat niches and will benefit the maintenance or restoration of biodiversity.

The key structural components within managed forests are:

- Remnant old growth trees
- Residual live trees
- Snags
- Down wood
- Multi-layered forest canopies
- Multiple native tree species (conifers and hardwoods)
- Herbs and shrubs
- Gaps

Structure-based landscape management requires managing the structural components of stands, as well as arranging stand structure types on the landscape. This challenge requires managers to weigh all factors important to the long-term sustainability of the forest ecosystem, and also to consider the short and long-term productivity of the forest for human needs. Effective control of wildfires may be adversely affected by multi-layered canopies, down wood, and tall snags. Through careful planning of the spatial arrangement and temporal occurrence of stands and structural components on the landscape, managers can find reasonable approaches to develop the desired forest structural characteristics for wildlife and biodiversity, while still protecting the forest from unwanted wildfire. It is likely that trade-offs will have to be made in specific locations within districts. However, on a district-wide basis, both fire control and the desired future condition can be achieved.

The structural components will be retained during any management activities 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. Examples of unacceptable operational difficulties include situations where the location of a tree might require relocating a road to a less stable place, or require that a substantially longer road be built to avoid the tree. Examples of situations where a decision may be made to remove a residual tree, snag, or patch of trees include situations where if the tree(s) came down through windthrow or other natural causes, they would likely damage improvements such as bridges or buildings, or cause road washouts or other road damage. It is expected that the vast majority of structural components will be retained, and there will be few situations where these components must be removed.

Remnant old growth trees — Old growth is described earlier in this chapter (page 4-18). Existing old growth in the planning area occurs as widely scattered individual trees, and occasionally as small isolated patches. Because the occurrence is limited, the Department of Forestry will retain all existing old growth to provide this element of diversity in present and future stands. The discussion below about residual live trees applies to remnant old growth trees also.

Residual live trees — Residual live trees help to meet the short-term habitat needs of species, to serve as a source of future snags and down 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 they will remain.

A key structural component of older forest structure stands is the presence of large trees. One way to sustain this structural component within a managed forest is to retain enough residual green trees in regeneration harvest units to provide the required level of large trees when the stand develops the other characteristics associated with older forest structure.

Snags — Snags help to meet the habitat needs of cavity-using species and to serve as a source of future down wood. Snags can be provided in all stand types, through a combination of existing snag retention, natural mortality in maturing stands, and artificial creation.

Standing dead trees are important to many species of wildlife, including woodpeckers, other cavity-nesting birds, raptors, bats, marten, bear, and many other birds and mammals. Snags provide nesting, roosting, foraging, perching, and denning habitat for various species of wildlife in the forests of northwest Oregon.

Down wood — Down wood on the forest floor provides many important functions in forested ecosystems. Some of the identified functions are mineral cycling, nutrient mobilization, maintenance of site productivity, natural forest regeneration (nurse logs), substrates for mycorrhizal formation, and provision of diverse habitats for wildlife species. Down wood is an integral component of the structure of old forest stands and provides a biological legacy from old stands to young stands after catastrophic events. This legacy can also be provided in managed stands if appropriate requirements are incorporated into timber harvest plans.

Multi-layered forest canopies — Complex layering of forest canopies generally creates diverse habitat niches and benefits biodiversity. The more heterogeneous and complex the physical environment becomes, the more complex the plant and animal communities that can be supported, and the higher the species diversity (Krebs 1972). This is because structurally diverse habitats provide more available niches than do more homogeneous habitats.

Multiple native tree species (conifers and hardwoods) — Increased tree species diversity within and among stands generally creates more diverse habitat niches and benefits biodiversity. Hagar (1992) found that the presence of hardwoods within Douglas-fir stands was an important factor influencing the presence and abundance of several species.

The presence of multiple tree species within a stand may lead to several wildlife habitat benefits.

- Different growth rates, tree forms, and shade tolerance result in increased vertical and horizontal within-stand diversity.
- Different tree species support different insect communities, which may lead to a greater diversity of foliage- and bark-gleaning wildlife species.
- Presence of short-lived species, such as red alder, may lead to an important source of within-stand decadence within younger stands as individuals begin to decline and die around age 40-65.

Herbs and shrubs — Diverse herb and shrub vegetation layers provide important forage for wildlife, provide diverse habitat niches, and benefit biodiversity. Herbs and shrubs in recently harvested units provide an important source of forage for big game species. Native plants such as bitter cherry and elderberry provide important forage for a large variety of non-game species. Large bigleaf maple trees are an important source of natural cavities and habitat structure in the forest. Unfortunately, these same plants compete with the planted and seeded trees that will grow to form the new forest stand. Plantation vegetation management is designed to control vegetation that is competing with commercial tree species. Overly aggressive vegetation management assures a successful plantation, yet greatly reduces the habitat value of the young plantation for wildlife. Aggressive vegetation management also truncates the herb-shrub (regeneration) stage and accelerates the onset of the closed single canopy stage, which has a much lower wildlife habitat value.

Gaps — Gaps increase the horizontal diversity within stands, provide important forage for wildlife, provide diverse habitat niches, and benefit biodiversity. A within-stand "gap" is an interruption in the continuity of the vegetative community in a stand. These gaps are generally small openings (½ to 2 acres) where herbs, shrubs, and new trees are being established, within larger stands with a dominant overstory tree canopy. One example of a gap is an opening created by windthrow in a densely stocked stand of trees.

On large parts of the northwest Oregon state forests, structurally complex natural forest stands have been replaced with more simplified even-aged stands. Unless actions are taken to introduce structural complexity (both vertical and horizontal) into these second- and third-growth stands, they are likely to support lower wildlife diversity than their naturally regenerated predecessors.

Landscape Management Concept 4: Active Management for Social and Economic Benefits

Managing for Diverse, Sustainable Forest Products and Revenues

The major emphasis in managing stand structures will be to maintain vigorously growing stands and to move stands through the early and middle forest stages as quickly as possible. This emphasis will require extensive thinning and partial cutting. These activities will produce significant volumes of lower quality timber from young stands. Final harvests of these stands will result in the harvest of high volumes of high quality wood.

The periodic thinnings required to move stands towards the more diverse structures described in this plan can be expected to extend the age at which volume production culminates (culmination of mean annual increment, or CMAI) (Curtis 1995). The associated rotation ages (80-130 years) necessary to maintain the diverse array of stand structures are within the range of the age of CMAI (Carey et al. 1996). Recent harvest scheduling and economic analysis work conducted by OSU supports the conclusion that integrated management can concurrently provide for development of more diverse stand conditions and high levels of timber volume and revenue from active management practices.

Maintaining a variety of stand structures across a landscape over time provides consistent employment in silvicultural operations and in the processing of forest products. It sustains a constant labor force, and consistent supply of forest products, rather than the historical boom and bust when large regions were harvested in a short time. SBM produces complex forests which can be managed for varied products. Diversified treatments can produce a range of qualities, sizes and species of logs to match market conditions, as well as special forest products such as mushrooms, berries, or greenery. (Oliver 1992, 1994)

Managing for Fish, Wildlife, and Forest Recreation

With the development of a variety of stand structures across the landscape, the local and regional economies will benefit from opportunities for recreational hunting as well as wildlife viewing. Recreational and commercial fisheries will also be enhanced by aquatic and riparian strategies that maintain and restore properly functioning habitats for salmonids and other native fish and aquatic life.

Existing forest recreation opportunities on these state forest lands are diverse (Oregon Department of Forestry and Oregon Department of Parks and Recreation 1993). Many existing uses such as angling, hunting, horseback riding and off-road vehicle use are highly compatible with active forest management and have co-existed with these activities for decades. Other popular uses, such as remote hiking and camping generally occur in less actively managed areas of the forest. The diverse array of stand types and landscape design envisioned under SBM will over time and space provide a diversity of recreational opportunities. These opportunities will range from developed camping and trail use in close proximity to main highways, to remote hiking and viewing opportunities in “special stewardship” areas. Activities such as hunting and off-road vehicle use will continue to be provided for at high levels, and additional opportunities will be realized for uses that are becoming increasingly popular (hiking, mountain biking, interpretive and educational programs).

Basic Concepts for Aquatic and Riparian Conservation

For northwest Oregon state forests, riparian and aquatic habitats will be managed to maintain or restore key functions and processes of aquatic and riparian systems. Since streams are tightly linked to the landscapes they flow through, riparian and aquatic conditions depend upon the interrelated components of the entire landscape. For this reason, this plan uses a blended approach that applies the concepts of landscape ecology to manage riparian and aquatic habitats at both the landscape level and through site-specific prescription. This type of two-tiered approach was cited by the Independent Multidisciplinary Science Team (IMST) as necessary to achieve a high likelihood of restoring and maintaining properly functioning aquatic systems (Independent Multidisciplinary Science Team 1999).

The structural components in a landscape include the physical habitat occupied by salmonids and other organisms, along with the structures and processes that maintain the integrity of that habitat. Functional interactions include the flows of energy and materials within the ecosystem. Landscapes are dynamic: both structure and function change across time and space. Even with change, stability is ensured as long as ecosystem structure and function are maintained within certain bounds and all required components remain within the landscape (Independent Multidisciplinary Science Team 1999).

The key concepts for aquatic and riparian conservation are:

- Management for proper functioning of aquatic systems.
- The blended approach — a combination of landscape level and site specific strategies.
- Use of watershed assessment and analysis to refine strategies and plan management activities during plan implementation.

Aquatic-Riparian Concept 1: Management for Proper Functioning of Aquatic Systems

The functioning of natural riparian and aquatic areas depends on the interaction of three components: vegetation, landform and soils, and hydrology. Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high waterflows, reducing erosion and improving water quality; filter sediment, capture bedload and aid floodplain development; improve flood-water retention and ground-water recharge; stabilize streambanks; develop ponds and channels of sufficient depth and duration to provide fish habitat; and support biodiversity. (USDI Bureau of Land Management 1993, revised 1995) In determining what constitutes "properly functioning aquatic systems," the overall approach in this plan is based on the following key concepts:

- 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 greatly 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 biological and ecological objective of the strategies in this plan is to maintain or restore 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.

Riparian Area Management

Riparian area management to contribute to properly functioning aquatic habitats must occur through two major approaches: 1) management towards a desired future condition in specific riparian areas; and 2) management to support targeted functions and processes in specific riparian areas.

Certain RMAs should be managed for conditions associated with mature forests. This is based on the assumption that the vegetative conditions associated with these conditions support a majority of the functions and processes of properly functioning aquatic habitats. Other RMAs should be managed in a manner that supports the maintenance or restoration of identified aquatic functions and processes. A more detailed explanation of these approaches is presented later in this chapter, under the heading, "Aquatic and Riparian Strategies."

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 is 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 (CMZ) — 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.

Inner gorge — An area next to a stream or river where the adjacent slope is significantly steeper than the gradient of the surrounding hillsides. In the absence of an on-site inspection and determination by a Department of Forestry geotechnical specialist or other qualified person, these areas are defined as having a slope gradient adjacent to the stream of 70 percent (35 degrees) or greater, and where the height of the slope break is at least 15 feet (measured vertically) above the elevation of the channel.

Stream — A 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 since this type of flow does not have a defined channel.

Management strategies within riparian areas should be consistent with achieving or maintaining the desired conditions specified for the water body. For areas that do not meet the desired condition, management strategies should be designed to move the stand towards these conditions in a timely manner. Riparian areas that meet the desired conditions should be maintained in that state with limited or no management activity.

Key Terms

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 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.

Wetland — An area that is inundated or saturated by surface or ground water 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 to determine the presence of wetlands will be consistent with the method described in the 1989 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (USDI Fish and Wildlife Service et al. 1989).

Desired Conditions

Fish-bearing streams (Type F) and large/medium non-fish-bearing streams (Type N) — 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 become similar to those associated with mature forest stands. For sites conducive to conifer production, these are generally the conditions associated with conifer stands of approximately 80 to 200 years of age or older. For sites where hardwoods are expected to be the natural plant community, mature hardwood stands are the desired condition. This plant community is often more common on riparian sites because of the presence of saturated soils (high water table), or due to the effects of periodic floods. Mature forest conditions should support a relatively high proportion of the functions and processes associated with properly functioning aquatic habitats.

Small non-fish-bearing streams (Type N) — Along small non-fish-bearing streams, the overall goal of riparian vegetation management is to grow and retain vegetation sufficient to support the functions and processes identified as important 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. Management strategies should be designed and implemented in a manner that maintains water quality, supplements wildlife habitat, and contributes to the overall supply of instream large wood within a watershed.

This plan 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, the strategies for these Type N streams should vary according to which functions and processes are dominant within an individual stream. Riparian vegetation retention should be designed to maintain or restores these dominant functions. The following section summarizes the key functions and processes that are considered important for different small Type N streams.

- **Perennial streams —** These streams are characterized in terms of function by their potential ability to influence water temperature in downstream reaches. Steeper gradient streams may also periodically transport large woody debris and coarse sediments to downstream reaches. Fine sediment and leaf litter (nutrient) storage processes are somewhat limited in the steeper streams due to their natural hydrologic ability to transport smaller materials. The presence of large wood may enhance nutrient storage processes, and substantially affects the morphology of steep channels primarily through the storage of coarse sediments. These streams are also often recognized as providing important habitats for certain sensitive amphibian species.

  Lower gradient perennial streams generally lack the hydrologic force necessary to transport large woody debris or coarse sediments, but they possess the ability to transport fine sediments during normal storm events. These streams are often the sites where large wood and coarse sediments "settle out" and are stored during flood events. Fine sediment and leaf litter (nutrient) storage processes are dominant in these streams during most times of the year. The presence of large wood enhances these processes, and can directly influence channel morphology in non-confined reaches.

  Riparian vegetation on these streams plays a key role in protecting stream bank stability, providing leaf litter input, and to maintaining water temperature to provide cool water sources to downstream reaches. Water temperature protection should be focused in the downstream portions of these streams where the greatest influence on fish-bearing stream temperatures is most likely to occur. Vegetation retention should also be prioritized on reaches (emphasis areas) that may support amphibians. Management should be designed to provide a source of large durable wood for recruitment to these channels. In steeper streams, the wood will function as localized sites to sort and store coarse sediments, and as a potential supply of large wood for downstream reaches during periodic transport events. In all channel types, large wood enhances fine sediment and leaf litter (nutrient) storage and routing processes. Instream material to support these processes is provided by adjacent riparian stands, and may be delivered from steeper, upstream reaches.

- **Seasonal high energy streams—** The presence of a relatively wide active channel on these seasonally flowing streams indicates that periodic high flows can be a prevalent channel-forming feature. The relatively steep gradient, in combination with the potential for high flows, indicates a capacity for these streams to potentially transport coarse sediment and large wood. Where the influence of large wood is lacking, segments of these channels are often observed to have scoured to a bedrock-dominated form. With large wood, these channels commonly exhibit a stepped profile as a result of coarse sediment storage. The presence of large wood can substantially affect the morphology of these channels. Fine sediment and leaf litter (nutrient) storage processes are somewhat limited due to the natural hydrologic ability of these streams to transport smaller materials. Large wood transport events are assumed to be limited to infrequent high flow events and debris flows. The lack of perennial flow minimizes the influence of these streams on water temperature in downstream fish-bearing reaches.

  Management along these streams should be designed to focus on providing a source of large, durable woody debris to maintain a stepped profile channel form, and to create habitat beneficial to aquatic species. The wood will function as sites to sort and store coarse sediments within the stream, and to provide a large wood supply for downstream reaches during periodic transport events. Large wood in these streams will also function to trap smaller materials, which will enhance the storage and processing of leaf litter (nutrients). Riparian vegetation should also be managed to protect stream bank stability, and provide leaf litter input. Since these streams do not flow perennially, management has little potential to affect water temperature in downstream reaches, or moderate near-channel riparian micro-climate.

- **Seasonal potential debris flow track reaches—** The physical setting and characteristics of these streams indicates a high probability of large wood delivery to downstream fish-bearing waters should slope failure events occur. The morphology of these channels is conducive to transporting large wood during debris flows. The presence of high risk sites near these channels indicates a potential that debris flow events could occur. During these events, it is assumed that vegetation retained along the debris flow track will either reduce the energy of the event and cause the materials to become temporarily stored within the channel, or become entrained within the debris wedge for delivery to downstream reaches. Management should focus on maintaining vegetation that has a high probability of interacting with debris flows along this track. The emphasis should be on maintaining large trees that can provide the functional habitat-forming elements of these natural disturbance events.

  The presence of vegetation along these channels supports stream functions and processes during the period when debris flow events do not occur. Riparian vegetation provides nutrient (leaf litter) input. Large wood recruited to these channels sorts and stores coarse sediments, and influences channel morphology. This material also enhances nutrient storage and processing functions. The lack of perennial flow minimizes potential influences on summer water temperature in downstream fish-bearing reaches.

- **Other seasonal streams—** Individually, these streams are assumed to have limited overall influence on watershed-level aquatic conditions due to their small size, flow pattern, and morphological characteristics. Their small size and seasonal flow pattern limits their individual potential to influence downstream water temperatures. The size, morphology, and physical setting of these streams also indicate a lower probability that large wood transport to downstream reaches is a significant function. The major functions of these waters are assumed to be the recruitment, routing, and processing of leaf litter, and transport, sorting, and storage of fine sediments.

  It is assumed that individually, these streams have a less significant contribution to watershed-level functions and processes that support properly functioning aquatic habitats. Management along these streams should primarily be designed to maintain some of the functions associated with leaf litter and sediment storage and routing processes. Tree retention and understory vegetation growth near these waters provides leaf litter to the stream, and large wood input. In-channel large wood from retained trees and snags enhances the processes of leaf litter and fine sediment storage, routing, and processing. Although the site-specific vegetation retention standards may be less than on other streams, the majority of these streams should be maintained in a forested condition for significant time periods. It is assumed that developing forest stands will contribute components that will support the functions and processes of these streams. The assumptions concerning these streams will need to be tested over time through watershed assessments, monitoring, and research.

Aquatic-Riparian Concept 2: The Blended Approach — a Landscape-Level Approach Combined with Site-Specific Strategies

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 upon forest management practices that recognize, maintain, and enhance the functions and processes that compose these terrestrial-aquatic interactions at a variety of scales.

Historical Conditions, Disturbance Regimes, and Riparian and Aquatic Habitats

Conditions over the landscape are dynamic, not static. Aquatic and riparian habitats in northwest Oregon have always represented a continually shifting mosaic of disturbed and undisturbed habitats. Every stream would undergo periods when habitat conditions were of better quality for specific species and times when habitat conditions were of lower quality for those species. At any particular point in time, some streams offered better habitat conditions for specific species than others. (Independent Multidisciplinary Science Team 1999)

Historically, forest stands in northwest Oregon ranged from dense mature or old growth conifer forests, to sparsely forested open conditions created by fire, floods, wind, or other disturbance factors. It is estimated that from 1850 to 1920, approximately 50 to 70 percent of forest stands in the Oregon Coast Range were in the mature or old-growth stages, defined as greater than 100 years of age (Teensma et al. 1991). More recent modeling efforts have estimated that historic levels of old growth ranged from 30 to 70 percent at the province scale. At smaller scales the variability was even greater, ranging from 15 to 85 percent of the landscape at any point in time (Wimberly et al. 2000). Streamside forests probably had similar proportions of old and young forests, although the proportion of hardwood stands and young stands may have been higher near large streams due to more frequent disturbances, including floods, debris flows, beaver activity, and related competition with shrub species. The riparian areas of smaller streams were more likely to be dominated by conifer stands. During those same years, 1850 to 1920, instream habitat conditions probably also varied in response to periodic catastrophic disturbances and variations in forest conditions across a watershed. Overall, however, mature forest conditions probably dominated the landscape.

It is becoming increasingly evident that riparian and aquatic ecosystems are maintained over the long term by periodic upland and hydrologic disturbances. As just one example, wildfires left burned forests with many structural elements such as snags and fallen trees, many of which were ultimately delivered to stream channels through landslides or other mechanisms. Natural disturbances such as wildfires, windstorms, and floods have affected and created Oregon's forests for millennia. Native flora and fauna evolved with these disturbance events. There is considerable debate about the frequency and magnitude of these events, and it appears that forest disturbance frequencies vary considerably throughout Oregon's forests, based on location, climate, and ecosystem. The typical disturbance pattern in an area is known as the disturbance regime.

In the past, forest managers often did not recognize the structural needs of the streams and forests and the processes that created these structures. In the rehabilitation of the Tillamook Burn, salvage logging was done before new trees were planted. Many snags were removed that, if left, would have provided large woody debris to the streams over time. Similarly, historic timber harvest did not attempt to maintain large conifers and fallen trees in riparian and aquatic habitats. Finally, due to concerns about fish passage and floods, woody debris was deliberately removed from stream channels. Thus, past management activities have contributed to the very low levels of large woody debris currently in most stream channels on western Oregon state forests.

More specific assessment efforts are necessary to accurately describe the current conditions of riparian and aquatic habitats, including the levels of structural components such as large woody debris and large streamside conifers. This information will be the basis for site-specific prescriptions that use both active and passive management strategies to produce the desired conditions. While active management can potentially produce the desired results several decades sooner than passive management, it also has some short-term risk. Prescriptions must balance the benefits and risks based on site-specific conditions.

Thus, in developing a set of strategies to restore and maintain properly functioning aquatic systems, it is necessary to apply principles of landscape ecology to manage habitat at both the site-specific and landscape level. This type of a blended approach seeks to emulate disturbance patterns in both upslope and riparian areas (Independent Multidisciplinary Science Team 1999)

Aquatic-Riparian Concept 3: Watershed Assessment and Analysis

Watershed assessment and analysis must be a critical process in refining and planning management activities related to implementation of this forest management plan. With a greater understanding of the interrelated processes occurring in watersheds, plans and activities can be better structured, potential consequences better anticipated, and communication and resource understanding improved.

There is a need on state forest lands to employ a goal-driven process to characterize the watershed features of its management basins. These features include the riparian, aquatic, terrestrial, and cultural conditions, processes, and interactions that affect the overall watershed character and response to management activities. In order to assess these components so that they provide insight into management effects and resource potential, a relatively high-level assessment must be applied to key watersheds.

Important goals for developing and implementing a watershed assessment and analysis process on these state forest lands are to:

1. Collect data on and evaluate baseline condition assumptions by:
   - Identifying and assessing the condition of limiting factors.
   - Determining if the riparian and aquatic strategies are addressing the appropriate process and function concerns within the watershed.
2. Provide information for the refinement of district implementation plans.
3. Contribute watershed-level information to a comprehensive review of forest management plan goals and strategies.

Successful implementation of watershed assessment and analysis can provide qualitative and quantitative information useful to managers as they develop plans and set objectives for their management basins. Watershed analysis is a tool to guide management and policy decisions to the best possible sustainable use of a watershed's resources, and to assure that the broader goals of restoring and/or maintaining watershed health and providing for properly functioning aquatic systems are achieved.

Coordination with other watershed users is a critical step in a successful watershed assessment and analysis. Not only is the extent of land use activities identified, but also important information is gathered about reference condition, current use, issue prioritization, and future expectations. Watershed assessments and analyses should be coordinated with adjoining private and federal landowners wherever possible, as well as with the broader public.

To be successful, a watershed assessment and analysis must provide relevant, understandable, and logical information to managers and policy makers. Managers and policy makers must be able to use this information to improve actions and plans. Prioritization of analysis issues and data collection should be directed to this goal. To be most effective, information from watershed assessments and recommendations from watershed analysis should be processed through the adaptive management framework and processes developed for implementation of this plan, so that proposed changes are implemented in a timely way, and review and approval take place at the appropriate levels.

Basic Concepts for Forest Health

Forest Health Concept 1: Active Management for a Diverse and Healthy Forest Ecosystem Resilient to Biotic and Abiotic Influences

The desired forest condition is one in which biotic and abiotic influences do not threaten resource management objectives now or in the future. Biotic influences, such as insects, diseases, and vertebrates, are integral parts of the forest ecosystem. These disturbance agents, which can damage or kill trees, are for the most part native species that have been functional parts of northwest Oregon forest ecosystems for thousands of years. (A few agents, such as white pine blister rust, have been introduced and have become naturalized). Abiotic factors, such as weather extremes, drought, fire, climate change, and pollution, are often unpredictable or uncontrollable, but history shows that they too can cause severe damage.

When disturbance agents damage or kill trees, they affect the structure and composition of forests. These effects can be either positive or negative, depending on management objectives. Birds and other animals use dead and/or decayed trees for nesting, hiding, and foraging. Selective killing of certain tree species or individuals contributes to biodiversity by creating canopy gaps that provide space, light, and nutrients for a variety of plant and animal species. When forests are “out of balance,” often the result of human activities, large-scale insect outbreaks or disease epidemics can occur, which can result in catastrophic and unwanted changes to the forest.

A general principle of forest management is that high biodiversity provides stability and resiliency to the forest, especially with regard to pests. A diversity of tree species provides some assurance that pest outbreaks will not kill all of the trees, largely because most native pests have some degree of host specificity. Structurally and compositionally diverse forests also will contain habitats and conditions suitable for the many natural factors that help keep pest populations and levels of damage within acceptable levels.

Strategies to reduce the undesirable impacts of insects, diseases, and other agents must be based in the ecology of these ecosystems and also must be tailored to individual stands, situations, management objectives, and the landscape or regional context. Management objectives for northwest Oregon state forests vary over the landscape and often differ from one stand to the next. These various objectives help determine the desired future condition of the forest, which in turn drives stand management activities. Management actions must consider the effects of disturbance agents, which are a permanent part of the forest ecosystem. By integrating forest health strategies and forest management, we ensure the most options for the future as we continually adjust and adapt our management.

The best way to maintain a desirable forest condition is to prevent an undesirable condition from occurring. This is accomplished primarily through active management of stands. Prevention strategies generally involve establishing tree species and genotypes that are well-suited to the site, ensuring a diversity of species to avoid catastrophic losses, manipulating stand density to avoid stress that may predispose trees to pest injury, and manipulating stand structure and composition to create unfavorable conditions for pests.

Forest Health Concept 2: Integrated Pest Management

Our aim is not elimination or eradication of pests on state forests (except perhaps in the event of an introduced exotic pest), but rather to manage the forest in such a way that pest effects are within acceptable ranges, which vary over time and space with changing objectives and constraints. The undesirable effects of these various influences can be mitigated through several prevention and suppression strategies. Many of these strategies involve applying existing silvicultural treatments and technologies. However, new approaches to management should be explored, and existing methods monitored closely to ensure that the best strategies are used. The forest health strategies apply to upland and riparian areas.

In some cases pest populations and associated damage can exceed the desired levels. In this case suppression might be appropriate. Any suppression activities on state forest lands must adhere to the principles of integrated pest management (IPM). IPM is a coordinated decision-making process that uses the most appropriate of all reasonably available means, tactics, or strategies, blended together to minimize the impact of forest pests in an environmentally sound manner to meet site-specific management objectives. IPM 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 Forest Management Strategies

The integrated management strategies in the following section are based on the conceptual foundation and principles described in the first part of this chapter.

The technical approach and strategies in this forest management plan are a substantial departure from previous approaches to planning for state forests. Previous plans in northwest Oregon have focused almost exclusively on strategies for the timber resource. Other resource values were given strong consideration, and commonly acted as constraints on potential timber values. Specific management strategies for other resources were not included in previous forest management plans. In some cases, specific strategies for other resources were developed in separate planning processes, such as the *Tillamook State Forest Comprehensive Recreation Plan* (Oregon Department of Forestry and Oregon Department of Parks and Recreation 1993). More recently, when plans were developed for the Elliott State Forest and Eastern Oregon Region (including Sun Pass State Forest), strategies were developed separately for timber, wildlife habitat, forest health, biodiversity, and other resources in an interdisciplinary approach.

This plan presents a set of integrated strategies that are the basis for managing the forest landscape as a whole. They are designed to be applied through a system of active management that realizes a high level of the forest product producing potential from these lands, and thus a high level of revenue to beneficiaries. These begin with four landscape management strategies, which are the core of structure-based management. The landscape management strategies are supplemented by riparian and aquatic strategies, which include upslope components such as roads and slope stability, and forest health strategies. Together, this set of integrated strategies will apply across the landscape. These integrated strategies will contribute to a range of habitats likely to accommodate most wildlife species, and contribute to maintenance and restoration of biodiversity. Over the long term, they will provide for most species most of the time. Thus, this set of integrated strategies represents the “coarse filter” approach discussed earlier.

It will take many decades to produce the desired forest, riparian, and instream conditions. Over the short term, the integrated strategies may not provide for the habitat needs of all species. When necessary to provide short-term habitat considerations for wildlife and fish species of concern, additional conservation tools may be used, including anchor habitats or site protection. These conservation tools are addressed in the "Species of Concern Strategies" section. Management around specific sites or for specific species are further detailed in district implementation plans, annual operations plans and operational policy.

The integrated strategies will largely be implemented through active forest management practices that focus on the production of the identified desired future condition in relation to forest and stand structures. These structures are expected to produce valuable wood products and contribute to a broad range of habitats and maintenance and restoration of biodiversity. Previous state forest management plans set timber volume targets as the objective for forest management. This plan stresses both the achievement of forest structure conditions in the long term, and also regular, sustainable, timber harvest through silvicultural operations. This approach does not minimize the importance of timber management. Instead, it takes the proactive view that appropriate forest management activities, properly applied, can be used to produce a diversified forest landscape and a sustainable timber harvest.

It is essential that the integrated strategies be viewed in an adaptive management context. It will take many decades to fully implement the strategies and produce the desired landscape. Over time, monitoring will tell us if the strategies are accomplishing their intended purpose. As monitoring provides feedback, the plan will be fine-tuned and improved through adaptive management.

The integrated strategies provide general guidance for management of northwest Oregon state forests. Because forests are complex, the specific application of strategies may vary from site to site. Structure-based management will be implemented across the landscape through implementation planning (Landscape Management Strategy 4), as well as through annual operations plans. The district implementation plans will describe the activities and harvest objectives associated with structure-based management that will move each forest towards the vision and the specific desired future condition, for specified time periods (generally ten years or less). These district plans provide a perspective on how quickly the transition to the DFC will occur and an estimate of the timeline to achieve the vision.

Landscape Management Strategies

Under structure-based management (SBM), landscape strategies will gradually move the forest to a more desirable range of stand structures and landscape conditions, as described in this chapter and Appendix C. Once attained, this range of stand types and their relative abundance across the landscape will remain reasonably stable, although individual stands will continue to change. Because the structures will be in a dynamic balance across the landscape, the forest will provide a steady flow of timber volume and revenue, jobs, habitats, and recreational opportunities.

The approach is based on active management, with the main emphasis on the use of sound silvicultural approaches for producing timber and revenue. These silvicultural practices are designed to contribute to the range of habitat types or forest structures used by indigenous species and to enhance biodiversity. SBM will move forest management away from approaches that stress conflict and trade-offs between uses, and towards an approach that stresses integration and compatibility of uses over time and space. Instead of managing the forest to produce habitat for individual species, we will manage the forest to produce the range of habitats needed by indigenous species. This approach will reduce the likelihood of having to manage in a crisis situation for individual species or for individual sites.

Landscape Management Strategy 1

Actively manage the state forest landscape and individual forest stands to produce the desired future array of stand structure types across the landscape in each Department of Forestry district and produce high levels of sustainable timber and revenue.

The percentages in the table below are intended to describe the direction to move the forest. They describe a long-range desired future condition, described with upper and lower limits as well as a mid-range percentage that is used for technical analysis. There is no specific time frame for achieving the array described.

Table 4-2. Stand Structure Types: Percent of the Landscape in Each District

Regeneration	15-25 percent
Closed Single Canopy	5-15 percent
Understory	30-40 percent
Layered	15-25 percent
Older Forest Structure	15-25 percent

The percentages in the preceding table are based on the hypothesis that such an array of stand types, properly arranged on the landscape, will contribute to the habitat needs of all native species. Because of the inherent uncertainty in this hypothesis, and the ongoing accumulation of knowledge through research, it is the Department of Forestry's intent to conduct an ongoing review through adaptive management of this strategy and the specific array described. This review will evaluate the extent to which the array of stand conditions at that point in time meets the habitat needs of native species, and whether additional layered and older forest structure stands are needed to meet that goal.

The following techniques, among others, will be used to accomplish this strategy.

- Partial cuts to enhance tree growth and biodiversity in vegetative communities.
- Regeneration harvests in stands that have poor potential for growth or development of layered or older forest structure types.
- Regeneration harvests in all stand types as excess acres in those types are identified through implementation planning and it is determined that they are not necessary to produce other stand structure types or are not consistent with landscape design (Landscape Management Strategy 2). There will be regeneration harvests of stands in CSC, UDS, LYR, and OFS. These harvests create the open habitats provided in regeneration types.
- All stands will not necessarily be managed to produce OFS. Generally speaking, only those stands that have the structural potential to be managed for OFS and that are

located in those areas of the landscape identified for OFS will be managed to become this type. Some stands will be managed to stay within the closed single canopy stage while others will be managed to pass through all the stand stages.

- Specific decisions on the location and arrangement of stand types for the desired future condition will be made through the district implementation planning process described in Landscape Management Strategy 4, and in Chapter 5 of this plan.
- The Department of Forestry will continue to manage the forests using good business practices and will consider an array of economic information in making forest management decisions.

Implementation of Landscape Management Strategy 1

The path toward accomplishing Landscape Management Strategy 1 will not necessarily be the most direct path. If the plan were carefully followed and no major natural disturbances occurred, it would take decades or centuries before forest stands would be smoothly flowing into and out of the various structure types. Natural disturbances will occur and current stand conditions, cyclical economic trends, and the necessity to meet volume and revenue goals will all affect how quickly forest management practices can produce the desired results. Draft district implementation plans will be included when the draft forest management plan is considered for adoption. These district plans will describe how each district will transition from the existing management approaches to the new strategies. Implementation plans will include projected management activities, expected timber harvest, and expected achievements for wildlife habitat and other resources.

Natural disturbances — As with any plan, a significant natural disturbance such as an extensive stand replacement fire would result in the need to reevaluate existing plans.

Genetic tree stock — Thousands of acres in the planning area were planted and seeded with genetic seed sources that we now consider unacceptable. Much of this was due to the vast acreage of planting and seeding done to reforest the Tillamook Burn and the limited availability of local seed or seedlings. To date, limited sampling does not indicate significant adaptation problems. However, research has shown that it may take several decades for genetic seed source problems to become evident. If significant problems were to develop, managers might need to significantly alter the way the plan is implemented in specific basins or districts. More information is included in the forest health strategies.

Current stand type distributions in each district — In the planning area as a whole, due to management and fire history, most of the state forest lands are in the closed single canopy, understory, and layered stages. A lower but substantial number of acres are in the regeneration stage. Very few acres are in the older forest structure stage.

Current stand type distributions vary significantly among districts. Each district's current stand type distribution will affect how quickly the desired stand structure conditions can be attained. Existing inventories are evaluated in conjunction with timber volume and revenue constraints to determine how quickly each district can move toward the desired future condition.

Cyclical economic trends: timber and revenue — Most stand structure work is accomplished through timber harvest revenues or through work accomplished in timber sale contracts. Generally, for the past decade, economic conditions have been good for marketing timber from commercial thinnings. Historically, this has not always been the case. Economic conditions could get even better or they could worsen to the point that commercial thinning is no longer feasible. Over the short term, as economic conditions fluctuate, the pace of stand structure management will also fluctuate. Over the long term, it is likely that markets will support the stand management activities required for SBM.

Landscape Management Strategy 2

Develop a landscape design that arranges the forest stand types to create a variety of patch types, patch sizes, and patch placement on the state forest landscape over time.

Each district, through the district implementation plan, will develop a landscape design that is consistent with the landscape design guidelines that follow. The application of these principles and guidelines will be discussed and reflected in the landscape design section and desired future condition display contained within each district implementation plan. The design will describe or display how stand types will be arranged on the district landscape, in a regional context, to achieve the variety of patch types, sizes, and arrangements necessary to provide functional habitat for native species.

Landscape Design Guidelines

- Range of patch sizes.
- Connectivity between basins and across the landscape.
- Corridors for key species.
- Maintenance of “anchor” habitat areas as identified for specific species.

Landscape Management Strategy 3

Actively manage the state forest landscape to incorporate structural habitat components into the forest at a landscape level.

This strategy presents approaches for managing the habitat components listed below. These standards are meant to be general guidelines for forest managers. It is understood that individual stands may exceed or may fall below these standards, but it is expected that on a landscape-wide basis, stands will average the habitat conditions outlined by these standards.

- Remnant old growth trees
- Residual live trees
- Snags
- Down wood
- Multi-layered forest canopies
- Multiple native tree species (conifers and hardwoods)
- Herbs and shrubs
- Gaps

There are no numerical standards given for multi-layered canopies, multiple native tree species, herbs and shrubs, or gaps. Managers are expected to retain or develop these characteristics in stands when they find opportunities that are consistent with the overall stand management objectives.

The structural components identified will be retained during any management activities 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. It is expected that the vast majority of structural components will be retained, and there will be few situations where these components must be removed. The following guidelines will govern exceptions to retention of the structural components:

Guidelines for Determining Exceptions

- **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.
- **Pest management concerns —** Where retention would constitute a significant threat to surrounding stands due to the presence of insect or disease agents, individual trees or snags may be removed. The Department of Forestry's forest entomologist or forest pathologist will be consulted in making the determination of significant threat.
- **Severe operational concerns —** Where retention would result in impacts on the Department of Forestry's ability to protect other key resources identified in this plan, individual trees or snags may be removed.

Landscape Management Strategy 3a. Remnant old growth trees — Retain remnant old growth trees or patches of old growth.

Existing old growth in the planning area occurs as widely scattered individual trees, and occasionally as small isolated patches. Because the old growth is limited, the Department of Forestry will retain all existing old growth patches and individual old growth trees to provide this element of diversity in present and future stands. Until the desired future condition of stand types in a district is achieved, existing older forest structure stands will not be removed in areas that are designated as OFS in desired future condition in district implementation plans.

Landscape Management Strategy 3b. Residual live trees — Retain an average of 5 green trees per acre during regeneration harvest.

Residual live trees will be retained to meet the short-term habitat needs of species, to serve as a source of future snags and down 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. In the long term, legacy structures will be present in all stand types across the landscape. Sufficient trees will be retained to compensate for windthrow or other mortality that may occur during stand development.

Guidelines for Residual Live Tree Retention

- Retained trees will include a component of defective trees where available.
- Retained trees will include a component of sound, healthy trees with good crowns.
- Retained trees will include a component of hardwood trees, especially bigleaf maple and/or Oregon white oak when available.
- Trees will 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 higher levels in some units, and lower levels in others, with the intent to achieve the average of 5 trees per acre for all regeneration harvest units in a given annual operations plan.
- Additional trees (above the 5 per acre desired condition) will be retained where necessary to supplement snag or down wood recruitment goals.

Landscape Management Strategy 3c. Snags — During harvest activities, retain all existing snags. Manage to provide at least 2 hard snags per acre, at least 15 inches in diameter, on average across the landscape on each district. Manage to provide at least 6 snags per acre in older forest structure stands, at least 2 of which must be 24 inches or larger in diameter.

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

Guidelines for Snag Management

- Snags will 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.
- Where fewer than 2 hard snags per acre exist in a planned harvest unit, consider using snag creation prescriptions or additional live tree retention to supplement snag levels.
- Select larger diameter trees for snag creation; larger snags can be used by more species than smaller snags.
- Snag creation prescriptions may be applied in any partial cut harvests, but will be emphasized in larger diameter stands.

Landscape Management Strategy 3d. Down wood — During harvest activities, retain existing down logs. During regeneration harvest, retain an average of 600 to 900 cubic feet of hard conifer logs (decay class 1 and 2) per acre, including an average of 2 logs per acre greater than 24 inches in diameter (at the largest end), where available. Manage to achieve OFS stands that contain 600 to 900 cubic feet per acre of sound down logs (decay class 1 or 2), or 3,000 to 4,500 cubic feet of down logs in any or all decay classes (1-5).

Guidelines for Down Wood Management

Down 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 to achieve older forest structure in the future. Achievement of the down wood component of older forest structure 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 down wood within all stand types through time, through a combination of existing wood retention, natural mortality in maturing stands, and artificial creation.

- Retain and, where necessary, supplement the supply of down wood at the time of partial cut or regeneration harvests.
- When salvaging windthrow and other dead timber, retain a portion of the down wood in the amounts specified above for regeneration harvest.
- Retain and, where necessary, supplement the supply of down wood during other management activities.
- Down wood will be retained in a variety of arrangements within individual harvest units and 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. The desired conditions will not be present on every acre or on every individual unit, but will be present as an average across the district.
- Rely on the contributions of retained snags and residual trees that fall to the forest floor through the course of forest development to contribute down wood through the life of each stand.
- Emphasis will be placed on retaining large diameter logs (greater than 24 inches) in later partial cuts and in regeneration harvests.

- Retain scattered windthrow in stands following partial cuts.

Large diameter logs (greater than 24 inches). are an important component of older forest stand structure, and since larger logs decompose more slowly, large logs placed during regeneration harvests will contribute to down wood needs into the future.

Landscape Management Strategy 3e. Multi-layered forest canopies — Manage vegetative communities to create complex multi-canopied forests or at least to increase the amount of layering in most stands.

In order to meet the stand structure criteria for the complex and older forest structure stands, it is necessary to develop multiple canopies in many stands. Stands managed in the closed single canopy type will not have multi-layered canopies.

Landscape Management Strategy 3f. Multiple native tree species (conifers and hardwoods) — Manage to include a variety of native species.

Individual stands may be predominantly single species (conifers or hardwoods), and the forest overall may be predominantly conifer. However, maintaining or establishing components of other species (conifers and hardwoods) is desirable.

Landscape Management Strategy 3g. Herbs and shrubs — Manage vegetative communities to encourage diverse herb and shrub layers.

Development of multiple layers of vegetation will increase the amount of vertical diversity in the stand, and provide additional habitat niches that can support increasing numbers of wildlife species.

Landscape Management Strategy 3h. Gaps — Manage stands for gaps to provide horizontal diversity. Natural openings due to windthrow, insects, and disease, etc. will suffice in many cases. However, where a deficiency exists, consider creating gaps through management activities.

A within-stand gap is an interruption in the continuity of the vegetative community in a stand. In most cases we consider such gaps to be small openings (½ to 2 acres) where herbs, shrubs, and new trees are being established, within larger stands where the dominant feature is an overstory tree canopy.

Landscape Management Strategy 4

Develop implementation plans for each district that provide more specific information on the application of Landscape Management Strategies 1 through 3, for a ten-year period.

Implementation plans will be developed for each district that contain more detailed information describing how each district is moving towards achievement of the desired future condition, implementing the landscape design guidelines, and providing for the structural habitat components at the landscape level. The implementation plans will include information that describes:

- Current stand type amounts and distribution on the district, and the location of any specific habitats for species that may occur, or that may be identified for species of concern.
- Desired future stand condition array for each management basin in the district, in a regional context, and how this array is arranged across the district landscape to meet the landscape design strategy.
- Proposed management activities for the time period that will be necessary to move towards the identified stand type array and landscape design, and to move towards the goals for structural habitat components.
- Land management classifications that have been applied to lands in the district to reflect the management approaches and strategies adopted in the FMP, and described in the implementation plan. This will include areas designated as riparian management areas, monitoring controls, or specific habitat areas identified for species of concern.
- Specific management activities, outputs, and achievements anticipated for the next ten-year period. This will include:
  - — Annual activity ranges for specific silvicultural operations during the ten-year period (e.g., acres of regeneration harvest per year, acres of partial cut per year, etc).
  - — Estimates of the acres of each stand type that will be moved towards another stand type through the identified management activities.
  - — Estimates of the amounts of each structural habitat component that the Department of Forestry expects to be created through the identified management activities.

Implementation planning is an ongoing process in which Oregon Department of Forestry personnel will organize resource information, identify and coordinate management activities, and assess progress toward meeting the goals identified in the forest management plan. District personnel apply the goals and strategies provided by the *Northwest Oregon State Forests Management Plan* to real stand and forest conditions within specific watersheds or groups of watersheds that comprise identified management basins. Stand management activities are then identified for the foreseeable future (variable time, but roughly ten years) based on the specific opportunities and constraints inherent to each management basin.

Information from each management basin is then used to develop district implementation plans. The implementation plans integrate district operations and are used in the development of annual operations plans, and budgets. Following completion of comprehensive watershed assessments and analyses, district implementation plans will be re-evaluated and updated to reflect the key recommendation from that process.

The draft forest management plan will be accompanied with a set of implementation plans for each district. Implementation plans will provide reviewers with necessary information to evaluate the draft plan. The information in this initial set of implementation plans will be improved and refined in the following years. Future updates on the status of the forest management plan will be accompanied with more fully developed implementation plans.

See Chapter 5 for a description of the approval process for implementation plans and the opportunities for public input into the process.

Adaptive Management Measures for Landscape Management Strategies

Key Working Hypotheses:

- An active and integrated forest management approach will provide for high levels of sustainable and predictable timber and revenue while concurrently providing habitat for native fish and wildlife species.
- Providing for biodiversity at the landscape level requires providing for an array of forest conditions through time and space that emulates conditions created by historic disturbance regimes.
- Providing for a diverse array of forest conditions through time can be accomplished in a managed context through the application of silvicultural principles.
- Timber markets will exist over time for the range of timber types and qualities that will be produced from state forests. The diverse “portfolio” of products available from a diverse array of stand structures will strengthen the ability of state forests to capitalize on changing markets.
- A diverse array of forest conditions will provide diverse recreational opportunities on these state forest lands.

Key Assumptions/Questions to be Addressed through Monitoring:

- There is a predictable relationship between forest stand structure and habitat requirements of native species.
- Active silvicultural management can accelerate the development of more complex stand structures.
- Active silvicultural management towards more complex stand structures can produce high levels of sustainable timber and revenues from forest operations.
- Older forest structure stands will provide habitat for native species that is similar in function to that provided by old growth forests.
- Multi-layered stand canopies are a measure of structural diversity that supports more complex plant and animal communities than stands that are not layered.
- A diversity of stand structures will provide for a broad range of biodiversity and a range of habitats for native species.
- The identified array of forest stand types (the desired future condition) provides the necessary quantity and arrangement of habitats to provide for native species.
- A diversity of stand structures will provide for diverse recreational opportunities and activities over time throughout the forest.
- Over the long term, the stand types can achieve the goals through a dynamic mosaic that shifts slowly across the landscape.

Aquatic and Riparian Strategies

This section presents the integrated strategies for aquatic and riparian areas. Additional conservation tools may be considered for fish species of concern as described later under the "Species of Concern" section. The landscape level component of the blended approach consists of the landscape management strategies described earlier in this chapter. Over time, the application of these strategies is intended to create forest conditions on the landscape that will more closely emulate historic conditions and processes relative to aquatic systems.

The second component of this blended approach is a set of more site-specific or prescriptive strategies designed to protect key resource elements or provide for specific functional elements not necessarily addressed by the landscape strategies.

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

In addition to the landscape management strategies, the strategies for aquatic and riparian resources include:

1. Implement watershed assessment and analysis.
2. Apply management standards for aquatic and riparian management areas.
3. Restore aquatic habitats.
4. Apply alternative vegetation treatment to achieve habitat objectives in riparian areas.
5. Apply specific strategies to other aquatic habitats: wetlands, lakes, ponds, estuaries, bogs, seeps, and springs.
6. Slope stability management.
7. Forest road management.

Aquatic and Riparian Strategy 1

Implement watershed assessment and analysis.

Watershed assessment and analysis will be used during plan implementation to collect needed information at both watershed and site-specific levels, and to synthesize that information into recommendations for appropriate changes to goals and strategies. Information from watershed assessments and other inventory and assessment projects will be used in an adaptive management framework to accomplish plan objectives.

Aquatic and Riparian Strategy 1a. Develop a comprehensive watershed assessment and analysis process for state forest lands that is consistent with, but more rigorous than, the existing Oregon Watershed Enhancement Board (OWEB) process.

The Department of Forestry will develop watershed assessment protocols suited to its management needs, using the existing OWEB manual and protocols as a foundation. It is anticipated that this will involve development of more rigorous information collection protocols for specific "modules" based on information needs related to specific management strategies in the plan. The Department of Forestry's assessment process will facilitate coordinated activities with other landowners in watersheds that have a significant percentage in state forest lands.

Aquatic and Riparian Strategy 1b. Conduct watershed assessments and analyses on priority watersheds on state forest lands within the planning area, within the initial ten-year implementation period following plan adoption.

The Department of Forestry will be assessing watersheds at the fifth field level. This is the scale in the USGS (U.S. Geological Survey) spatial hierarchy smaller than a sub-basin and larger than a sub-watershed. On state forest lands, a fifth field watershed ranges in size from 5,000 acres to 50,000 acres depending on the region and river system. The scale of fifth field watersheds was chosen because it:

- is used by other state and federal agencies in Oregon
- currently has the finest scale, yet most comprehensive, set of GIS data available
- appears to facilitate data collection that is neither too general nor too specific for management objectives

In most cases, the fifth field watersheds overlap with the district management basins. In other instances, these scales do not overlap. In these cases, watershed assessment and analysis will be completed at the smaller sub-watershed or drainage level and then aggregated to provide complementary information with other district watershed analyses.

Watersheds will be prioritized for assessment and analysis based on the following criteria (not in order of importance):

- percent of state lands ownership
- watershed size
- potential resource impact
- presence of highly sensitive resources or key anchor habitat areas
- public involvement and interest
- presence of interested cooperators

It is anticipated that following completion of protocol development under Aquatic and Riparian Strategy 1a, watershed assessments could be completed at a rate of two fifth-field watersheds per fiscal year, given available funding. Under this scenario, key North Coast watersheds could be completed within the first five years following plan adoption, with a broader goal of completing all assessments within the initial ten-year implementation period.

Aquatic and Riparian Strategy 1c. Cooperate with local watershed councils and adjacent landowners, to assure that watershed assessments on Department of Forestry lands consider conditions and limiting factors on other lands to the greatest extent possible.

Coordination with other watershed users is a critical step in a successful watershed assessment and analysis. Not only is the extent of land use activities identified, but also important information is gathered about reference condition, current use, issue prioritization, and future expectations. Watershed assessments and analyses will be coordinated with adjoining private and federal landowners as well as the broader public. To the greatest extent possible, local watershed councils will be engaged to assist with conducting assessments.

Many watersheds containing state forest lands have already been the subject of assessment efforts by watershed councils and other entities. In addition, information relevant to specific assessment modules has been collected by the Department of Forestry in recent years. Examples are aquatic habitat and fish presence survey efforts, and road hazard assessment efforts. These previous information collection outputs will be incorporated into refined protocols and supplemented where necessary to meet management needs.

Aquatic and Riparian Strategy 1d. Analyze information collected through watershed assessments and other inventory and assessment projects, and effectively apply the results at the appropriate planning level through the adaptive management process.

Integration of watershed assessment results, both with assessments of nearby watersheds and with other relevant ecosystem information, is critical. The Department of Forestry will develop an interdisciplinary approach to integrating assessment information as part of the protocols established under Strategy 1a. Data collected will be compatible, on similar scales, and collected with appropriate indicators to complement other module information.

Using the adaptive management framework described in Chapter 5, implementation of this plan will be adjusted and improved based on the results of these integrated assessments. Depending on their significance and scope, necessary adjustments will be made through changes to specific standards and practices, revisions to annual operations plans, formal updates to district implementation plans, or amendments to the broader strategies of this forest management plan.

Aquatic and Riparian Strategy 2

Apply management standards for aquatic and riparian areas. Establish and maintain riparian management areas adjacent to all streams, in accordance with Appendix J of this plan and species of concern strategies where they apply.

More 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 standards will be applied until the adaptive management process results in identification of alternative strategies or standards that better meet the objectives for aquatic and riparian habitats. 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.

The management standards include specific provisions for establishing riparian management areas and describe how management is to occur within these areas.

Riparian management areas will be established immediately adjacent to waterways for the purpose of protecting aquatic and riparian resources, and maintaining the functions and ecological processes of the waterways. Within these areas, special management considerations and operational restrictions will be applied, and the protection of aquatic resources will be a high priority.

The width of riparian management areas will vary by the 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 width of a riparian management area (RMA) 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 inner gorge areas, or other special sites noted in the management prescriptions.

Riparian management area 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 will 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.

See “Basic Concepts for Aquatic and Riparian Areas” earlier in this chapter for related discussion and definitions of terms used in this strategy. See Appendix J for the specific management standards that will be applied in these areas.

Guidelines: The Four Zones of a Stream Riparian Management Area

Riparian management areas established along streams will contain four zones. The purposes and differences between these four zones are defined 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 riparian management area are established upslope from the outer edge of these features.

Stream bank zone — The stream bank zone is the land closest to the stream, including the stream banks. Most riparian functions are supported to some extent by vegetation in this zone, including providing aquatic shade, the delivery of down wood and organic inputs (leaves and tree litter) to the stream and riparian area, stabilizing the stream bank, contributing to floodplain functions, and influencing 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 is the next area away from the stream, adjacent to the stream bank zone. 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.

- The inner RMA zone extends from 25 feet (the outer edge of the stream bank zone) to 100 feet from the stream. This zone exists on both sides of a stream.

Outer RMA zone — The outer RMA zone is the portion of the riparian management area farthest away from the stream. Vegetation within this zone may still contribute to certain riparian functions and processes, but to a lesser extent than the two zones closest to 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.

- The outer RMA zone extends from the edge of the inner zone at 100 feet out to 170 feet from the stream. This zone exists on both sides of a stream.

Guidelines: 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 Oregon Forest Practices Act, as described in the Department of Forestry's Forest Practice Technical Note FP1 — Water Classification (Oregon Department of Forestry 1994b).

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 Endangered Species Acts.

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

Flow Pattern Classifications

Small non-fish-bearing (Type N) streams are also classified according to the flow pattern exhibited in normal water years. For the purposes of this plan, 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 woody materials during high flow events. For the purposes of this plan, and in the absence of specific geomorphologic identification, stream reaches with an average gradient exceeding 15 percent, and an active channel width of five (5) feet or more will be defined as seasonal high energy streams.
- **Potential debris flow track reaches —** Potential debris flow track reaches are reaches on seasonal Type N streams that have been determined to have a high probability of delivering woody debris to a Type F stream.

Oregon Department of Forestry field staff will make the determination of the probability that a reach will deliver woody debris to a Type F stream, using the following criteria:

1. The seasonal stream reach must terminate at or below a high risk site. High risk sites include:
   a. Active landslides (slopes with tension cracks, unvegetated soil scarps, or jackstrawed trees caused by slope movement).
   b. Slopes steeper than 80 percent, excluding competent rock outcrops.
   c. Headwalls or draws steeper than 70 percent.
   d. Abrupt slope breaks, where the lower slope is the steeper and exceeds 70 percent, except where the steeper slope is a competent rock outcrop.
   e. Incised channels (hill slopes adjacent to the channel and steeper than the upland slope) with slopes steeper than 60 percent.
   f. Any other site determined to be of marginal stability by a Department of Forestry geotechnical specialist.

2. The path of a potential debris flow and the likelihood that a debris flow will reach a Type F stream. If any one of the following three conditions is present along the path from the high risk site to the Type F stream, then a debris flow is likely to stop and the stream reach would be determined to have a low probability of woody debris delivery:
   a. 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.
   b. The presence of a stream reach which is less than 6 percent gradient for at least 300 feet.
   c. An average slope from the high risk site along the potential landslide path to the stream that is less than 20 percent.

Aquatic and Riparian Strategy 3

Restore aquatic habitats.

The aquatic habitat restoration strategies are intended to eliminate human-induced conditions on the forest that may contribute to aquatic habitat deficiencies, or that may limit the timely recovery of desired aquatic habitat conditions. The restoration strategies will promote aquatic habitat conditions that will support the short-term survival needs of depressed salmonids, in order to reduce the potential for further declines in these populations. 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 will support the ecological processes necessary to naturally create and maintain complex aquatic habitats on a self-sustaining basis.

This approach addresses aquatic habitat restoration on a more comprehensive basis than is currently done, and uses both short-term and long-term management actions. These strategies will improve levels of aquatic function in the short term (to meet the immediate habitat needs of depressed species and place aquatic habitats on a trajectory toward desired conditions), while at the same time actions are carried out to restore the ecological processes and functions that create and maintain self-sustaining habitats over the long term. The following strategies and actions will be implemented as part of the aquatic habitat restoration strategy.

Aquatic and Riparian Strategy 3a. Complete assessments to identify potential factors that could be contributing to undesirable aquatic habitat conditions, or that could be limiting the recovery of aquatic habitats.

This strategy will be implemented primarily through the watershed assessment and analysis strategies described earlier. Road inventories and risk assessments, aquatic habitat inventories, and riparian vegetation surveys will be key sources of information.

Aquatic and Riparian Strategy 3b. Identify, design, and implement projects to remedy identified problems in a timely manner.

- Aquatic habitat restoration 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, and with direct consultation with the Oregon Department of Fish and Wildlife.
- 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 woody debris) 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 woody debris 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 woody material, 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.
- "Constructed" habitat projects will only be used where these efforts are deemed necessary to support the continued survival or recovery of depressed salmonid species. These projects (when deemed necessary) will only be placed in areas where the created habitat type would be expected to occur naturally.

Aquatic and Riparian Strategy 4

Apply alternative vegetation treatment to achieve habitat objectives.

The term "alternative vegetation treatment" refers to the application of silvicultural tools and management techniques in riparian management areas, using standards that differ from general riparian management standards, for the purpose of changing the vegetative community to better achieve the plan's aquatic and riparian habitat objectives.

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 not specifically described in the management standards for riparian areas.

The alternative vegetation treatment strategies will apply alternative silvicultural approaches in riparian areas where basin-level 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, including depressed salmonid populations.

Aquatic and Riparian Strategy 4a. Complete basin-level assessments to evaluate whether alternative vegetation treatments are needed to achieve properly functioning aquatic habitat conditions in a timely manner. Where appropriate, use the information from the assessments to plan alternative vegetation treatments.

This strategy will be implemented primarily through the watershed assessment and analysis strategies described earlier.

Aquatic and Riparian Strategy 4b. Alternative vegetation treatment projects will be planned using a multi-disciplinary approach involving a variety of resource specialists.

These projects will be designed with the involvement of resource specialists from the Oregon Department of Forestry and the Oregon Department of Fish and Wildlife. The specialists involved in a given project will vary according to the resources and physical conditions present at the site.

Aquatic and Riparian Strategy 4c. Alternative vegetation treatment projects will be monitored and evaluated over time to assure that the objectives are being achieved, and undesirable effects are being minimized. The results of these evaluations will be incorporated into these management activities in an adaptive management context.

The plan recognizes that these treatments are experimental actions, and that over time managers will gain additional knowledge and experience through monitoring and research. This knowledge will be applied in an adaptive management context, in order to more successfully meet the multiple resource objectives for riparian and aquatic habitats.

Aquatic and Riparian Strategy 5

Apply specific strategies to other aquatic habitats.

The northwest Oregon state forests contain other aquatic habitats besides 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. The following strategies apply to these other aquatic habitats.

Establish and maintain riparian management areas adjacent to other aquatic habitat areas in accordance with the standards described Appendix J of this plan and species of concern strategies where they apply.

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 evolved with specific adaptations to, or dependence 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.

Aquatic and Riparian Strategy 6: Slope Stability

Landslides and other geologic processes can have dramatic effects on watersheds, including aquatic and riparian areas. The integrated strategies include the following strategies to address concerns about landslides and slope stability.

The objective in relation to landslides and slope stability management is to ensure a high probability of restoring and maintaining riparian and aquatic habitats through restoration of properly functioning landslide processes. 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. Monitoring and hazard assessment, combined with adaptive management, will provide assurance that this objective is realized.

Management Strategies and Standards

The Department of Forestry will use a three-level approach to manage slope stability concerns in forest planning and operations on state forest lands in the planning area (Michael 1997, Prellwitz 1985).

Aquatic and Riparian Strategy 6a. Through the watershed assessment process developed under Aquatic and Riparian Strategy 1, complete a broad level assessment of landslide hazards on state forest lands in the planning area (Level 1).

The methods and procedures will be consistent with, but more intensive than the protocols described in the *Oregon Watershed Assessment Manual* (July 1999). Department of Forestry geotechnical specialists will take a lead role in developing assessment methods and procedures. The assessments will be used to assign risk levels to state forest lands within each watershed as follows:

- **High Hazard Area —** Areas that are likely to contain sites with relatively high probability of failure.
- **Moderate Hazard Area —** Areas that may contain sites with relatively high probability of failure.
- **Low Hazard Area —** Areas with a low chance of containing sites with relatively high probability of failure

Aquatic and Riparian Strategy 6b. During district implementation planning and annual operations planning, utilize geotechnical specialist expertise in evaluating alternatives that can minimize, mitigate for, or avoid risk in high and moderate hazard areas (Level 2).

Aquatic and Riparian Strategy 6c. During project planning and design, utilize geotechnical specialist expertise in designing operations that will minimize, mitigate for, or avoid identified risks (Level 3).

Geotechnical specialist input will be used in all aspects, when alternatives are being considered for proposed operations. Districts will coordinate geotechnical specialist review and input at these levels and will be responsible for subsequent evaluation of alternatives and selection of the course of action.

Site-specific geotechnical evaluation will be used as follows:

Road alternatives will receive Level II, site-specific geotechnical evaluation, when the forest engineer needs this input to compare risk of alternative roads (i.e., mid-slope road to ridge-top road with longer span logging).

Annual Operations Plans (AOP) — 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.), in order to achieve the best decision for the resource. Districts are responsible for requesting this review, and the geotechnical specialist is responsible for input. For timber harvesting and road construction operations the following process will be used:

- Operations in high hazard level areas (ones that are likely to contain sites with relatively high probability of failure) will be evaluated by the geotechnical specialist during the annual operations plan review for specific sites that will require on the ground assessment for risk (likelihood of delivery to aquatic system).
- Operations in moderate hazard level areas (ones that may contain sites with moderately high probability of failure) will be investigated during operations planning field work by district personnel, to locate high risk sites. If high risk sites are identified during fieldwork, the geotechnical specialist will be consulted and the site treated the same as high hazard sites.
- Operations in low hazard level areas (ones with a low chance of containing sites with high probability of failure) will not be expected to have any further geotechnical input. If high risk sites are identified during fieldwork, the geotechnical specialist will be consulted and the site treated the same as high hazard sites.

The effect of the forest operation on the landslide potential (probability of failure or landslide rate) will be judged based on slope, landform, underlying rock material, and type of operation (road building, clearcut, partial cut, thinning, etc).

Risk Findings:

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

If the risk is moderate (potential to deliver but likelihood is low) then there will be further assessment of the condition and significance of the aquatic resource. If the aquatic resource is already significantly degraded or identified as part of a salmonid emphasis area, then the geotechnical specialist will develop recommendations for modifying the harvest operation. Otherwise, no modifications to the operation will be made.

If the risk is high (likely to deliver to the aquatic system) then 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 riparian management area strategies.

If the risk is high and the logistics of the harvest layout (topography and geometry) will allow simple boundary changes, then the potential initiation site (hazard) will be excluded from the operation area.

Aquatic and Riparian Strategy 7: Forest Roads Management

The *Forest Roads Manual* (Oregon Department of Forestry 2000b) 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 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 for adequate fish passage where roads cross fish-bearing streams; and minimize exacerbation of natural mass-wasting processes.

The construction and use of forest roads is an integral part of actively managing state forest lands. Roads provide the 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 on forests. Proper road system planning, design, construction, and maintenance will prevent or minimize water quality problems and associated impacts on aquatic resources, and 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 and improvement program designed to meet the objectives stated above.

For the Department of Forestry transportation system, the vision is a road network that will provide efficient, effective access for all the 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 a minimum needed to achieve forest management objectives. Barriers to fish passage created by road crossings will be eliminated. 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 abandoned 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 learn more appropriate methods for meeting the objectives of this plan.

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

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

Aquatic and Riparian Strategy 7a. Through the watershed assessment process developed under Aquatic and Riparian Strategy 1, complete a comprehensive inventory of existing roads on state forest lands in the planning area.

All districts in the planning area have already conducted comprehensive road hazard inventories to a common standard specified through Oregon Plan protocols. The information from this inventory is being used to identify priority restoration and improvement projects related to the forest roads system.

It is anticipated that through the process of developing comprehensive watershed assessment protocols for state forest land, as described in Aquatic and Riparian strategy 1a, additional information needs may be identified. Any additional information needed would be collected through the application of the identified protocol and incorporated into the subsequent analysis and revision to district level plans.

Aquatic and Riparian Strategy 7b. Through development and updating of district implementation plans, apply the processes and standards for transportation planning described in the *Forest Roads Manual*.

Initial district implementation plans will not contain all of the transportation planning elements described in the *Forest Roads Manual*. Following completion of watershed assessments, and as district implementation plans are subsequently revised and updated, the complete transportation planning process will be applied.

Aquatic and Riparian Strategy 7c. Forest road design, construction, improvement, and maintenance will be carried out in accordance with the processes and standards described in the *Forest Roads Manual*.

Aquatic and Riparian Strategy 7d. Identify and prioritize roads for closure and/or abandonment using information gained from the comprehensive forest roads inventory, and in accordance with the standards described in *Forest Roads Manual*.

Adaptive Management Measures for Aquatic and Riparian Strategies

Key Working Hypothesis:

- Active management through a combination of landscape level strategies and site specific standards will result in maintaining and restoring properly functioning aquatic and riparian habitats.

Key Assumptions/Questions to be Addressed through Monitoring:

- Aquatic and riparian systems in the planning area were historically subjected to random disturbance events at a variety of scales that resulted in a wide range of riparian stand conditions adjacent to aquatic areas at any given point in time.
- The combination of the landscape management strategies and the aquatic and riparian strategies will provide an array and frequency of riparian stand conditions across the landscape through time that provides for properly functioning conditions.
- In riparian areas where mature forest condition is the desired future condition, and young stands currently predominate, active management is more likely to restore properly functioning conditions in a timely manner than more passive approaches.
- Active management of stands in riparian areas will supplement natural elements, particularly large woody debris, that are lacking due to previous disturbance events, and/or management activities.
- Compliance with management standards for forest road design, construction, improvement and maintenance will minimize road-related landslides and sediment loading to streams.
- Application of the three level hazard and risk evaluation process described, will minimize the occurrence of management related landslides, and restore properly functioning conditions in relation to natural landslide events.

Forest Health Strategies

Forest Health Strategy 1

Actively manage the forest to maintain or improve forest health.

The most effective way to maintain or improve forest health is through active management of stands. Generally, management activities are intended to promote tree vigor, keep pest populations and damage within desired levels, encourage high biodiversity, and provide long-term productivity. Active management for forest health may include:

a. Maintain appropriate stocking levels through thinning.
b. Favor appropriate tree species.
c. Maintain or create desired stand structures.
d. Take advantage of natural influences of pathogens and insects on trees and stands to create desired conditions.
e. Maintain a diversity of tree species.
f. Take advantage of genetic variation within tree species.
g. Plant disease-resistant seedlings.
h. Plant seedlings that are well-suited to the site and avoid unnecessary planting stress.
i. Prevent buildups of pest populations through sanitation and salvage.
j. Maintain healthy riparian management areas.
k. Minimize injury to trees during stand management activities.
l. Avoid damage to soils.

Forest Health Strategy 2

Detect and monitor pest populations, damage levels, and trends.

A critical step in forest health management is to describe the extent, distribution, and severity of damage caused by major forest pests. Monitoring activities over time allow description of changes in forest condition and help evaluate the effectiveness of management. See the discussion of monitoring under “Adaptive Forest Resource Management” in Chapter 5. Several techniques applied in monitoring and detection of forest pests are listed below.

a. Aerial surveys

b. Ground surveys
c. Stand exams/resource inventories
d. Trapping for insect pests, including exotic pest introductions
e. Geographic Information System (GIS) for long-term tracking
f. Participation and coordination with the national Forest Health Monitoring Program

Forest Health Strategy 3

Use the integrated pest management (IPM) process to implement suppression or prevention actions when pest populations or damage exceed acceptable levels.

The Insect and Disease Control Law (ORS 527.310 to 527.370) states that the State Forester shall implement the Integrated Pest management process (described in ORS 634.122) on state forests. IPM is not a strategy per se, but a coordinated decision-making process that uses the most appropriate of all reasonably available means to minimize the impact of forest pests in an environmentally sound manner to meet site-specific management objectives. The steps in the IPM process are listed below.

- Define the management unit.
- Define the site-specific management objectives.
- Establish detection and monitoring systems for pests or damage.
- Evaluate pest conditions in the management unit.
- Establish pest population or damage thresholds, and take action only when exceeded.
- Develop potential strategies and evaluate them with the following criteria: Effectiveness, operational feasibility, cost-effectiveness, ecological soundness, environmental impact, management objectives for the site
- Implement the selected strategy.
- Monitor and evaluate results of the activity.
- Maintain current and accurate records.
- Structure the program so it can be adjusted to accommodate changes or varying situations.

Forest Health Strategy 4

Assess and manage forest genetic resources.

Many planted forest stands in northwest Oregon pre-date our current scientific understanding about the importance of seed source. Data from long-term genetic field trials demonstrate that poorly adapted Douglas-fir seed sources can yield poor survival, slow growth, and susceptibility to many pathogens (Silen 1996). An assessment will be done of older planted or seeded forest stands in state forests, and will include an evaluation of forest health indicators to determine if stands are growing to expectations. Stands that are at high risk can be considered for earlier harvest.

Reforestation projects on state forest lands will take advantage of the highest quality seed to assure that forest trees and forest stands are well-adapted to planting locations and are capable of growing vigorously with resilience to forest health threats. The Department of Forestry is also involved in genetic improvement efforts to improve levels of pest resistance.

Forest Health Strategy 5

Implement the State Forest Program's Swiss Needle Cast Strategic Plan.

Revise the Swiss Needle Cast Strategic Plan (Oregon Department of Forestry 2000d) as needed to incorporate new information.

Forest Health Strategy 6

Participate in research and cooperative programs that align with our management objectives, to improve our knowledge and actively enhance forest health and biodiversity.

Often forest health problems are best investigated through a structured and credible research effort. By cooperating in research projects, we can assure that results will be applicable to state forest lands. Some current examples include the Swiss Needle Cast Cooperative and the Regional Forest Gene Conservation Program.

Forest Health Strategy 7

Cooperate with other agencies and associations to prevent the introduction of non-native pests.

With the recent increase in international trade of wood and other products, there is increased potential for the introduction of exotic forest pests in northwest Oregon. The department supports regulatory and monitoring efforts coordinated by APHIS (USDA program, Animal and Plant Health Inspection Service) and the Oregon Department of Agriculture. If a new pest is introduced, we will participate in interagency eradication efforts if necessary.

Adaptive Management Measures for Forest Health Strategies

Key Working Hypothesis:

- A diverse array of forest conditions will enhance overall forest health and reduce the risks of catastrophic loss from insects and disease.

Key Assumptions/Questions to be Addressed through Monitoring:

- Implementation of the forest health strategies will keep the effects of pests and pathogens to acceptable levels, while recognizing that these levels will vary over time and space as objectives and constraints change.
- High biodiversity provides stability and resiliency to the forest, especially with regard to pests. Active management can promote tree vigor, encourage high biodiversity, and provide long-term productivity.
- Dense stands of single tree species provide conditions that favor rapid spread of root and foliage diseases and other pest-caused damage. Thinning of stands can promote vigorous growth, allows selection of tolerant or resistant species or genotypes, and may limit spread of certain pests and pathogens.
- Thinning, selective harvesting, interplanting, and underplanting can increase the proportion of pest-tolerant or -resistant species in a stand.
- Different stand structures will influence occurrence and distribution of pests and pathogens. Active management will allow forest managers to take advantage of these natural processes.
- Planting seedlings that are well-adapted to the specific site are less susceptible to damage by pests and pathogens than are seedlings from an inappropriate seed source.
- Timely harvest of dead, dying, or diseased trees will reduce the spread of some pests and pathogens.
- Limiting mechanical injury to trees will minimize the occurrence of stem decay and other diseases.
- Limiting disturbance of soils during harvest will minimize stress of trees which, in turn, will minimize their susceptibility to pests and pathogens.
- Long-term monitoring of the extent, distribution, and severity of disease and pest damage will allow forest managers to evaluate the effectiveness of management and to determine necessary adjustments in management practices.

Strategies for Specific Species of Concern

The integrated management strategies described in this chapter are intended over time to result in habitat conditions on the landscape, and in aquatic and riparian areas that will provide functional habitat conditions for all native species. As described, these more diverse and potentially functional habitats will take many decades to create. While moving the landscape toward a more diverse habitat condition there are expected to be individual species, referred to as “species of concern,” or habitats that require special consideration.

Species of concern are fish and wildlife species that have been identified as being at risk due to declining populations or other factors (e.g., having a limited range). Species of concern identified as part of this management plan are currently present or have the potential to be present on state forest lands. In some areas, there is little suitable habitat for these species available elsewhere on adjacent lands (i.e., private lands in the North Coast area), and in other cases there is substantial habitat on neighboring lands (i.e., federal lands in the Cascades).

As stated, this plan relies on integrated management strategies intended to maintain and enhance habitat for species of concern, as detailed in this chapter. These integrated strategies include:

Landscape Management Strategies

- **Structure-based Management**: Application of silvicultural tools to attain an array of forest stand structures across the landscape, in a functional arrangement, and produce structural components (e.g., canopy layering, understory development).
- **Snags, Green Trees, and Downed Wood**: Actively manage state forests retaining and developing structural components such as snags, green trees, and down wood as part of the landscape forest structure. This plan includes specific targets.
- **Landscape Design Principles**: Provide a functional arrangement of stand types considering characteristics such as patch size and distribution, fragmentation, corridors, and interior habitat.

Aquatic and Riparian Strategies

The plan relies on a functional approach to managing near aquatic and riparian resources. Goals for aquatic and riparian functions are dependent on stream classifications for fish streams and non-fish streams. Strategies include management of forest roads, steep slopes, and specific riparian management standards.

- **Stream Restoration**: Contributes to the timely recovery of desired aquatic conditions. Dependent on available resources, projects will be designed to create conditions and introduce materials sufficient to enhance or re-establish natural physical and biological processes.

Additional conservation tools will be implemented where determined necessary for species of concern, including the use of anchor habitats and site protection as described below. Management strategies will be implemented to address identified species of concern on a regional or district basis. This process will support district implementation planning.

Anchor Habitats

The designation of "anchor habitat" is a core concept for managing habitat for some terrestrial and aquatic species of concern in some districts. The role, quantity, and distribution of anchor habitat for any given district will be dependent in part on ownership patterns, species distributions, and habitat conditions.

The strategy is to develop or maintain habitat areas across the landscape for species of concern that can be readily colonized as species abundance increases or distribution expands. Anchor habitat areas are intended to provide locales where populations will receive a higher level of protection in the short-term until additional suitable habitat is created across the landscape. Anchor habitat areas are not intended to be permanent reserves; however, they will be maintained until it can be demonstrated through adaptive management that the species concerned is colonizing new areas of habitat and persisting in those areas.

Anchor habitats are designated based on existing information, such as availability of suitable habitat for specific species, and species abundance and distribution. Anchor habitats will be well-distributed, and consider landscape design principles identified under the landscape management strategy. Anchor habitat areas also will be considered when designating additional areas for the development of habitat through the landscape design process. The location of these additional areas will vary depending on the mobility of a species and fidelity to specific sites.

- **Terrestrial Anchors**
  Terrestrial anchors are intended to benefit terrestrial wildlife species of concern, especially those associated with older forest conditions or interior habitat conditions, sensitive to forest fragmentation, or those that do not readily disperse across younger forest conditions. Terrestrial Anchors will be located based on information such as

known use by species of concern and habitat conditions. Terrestrial anchors should be well-distributed, and will be located in the same areas as aquatic anchors when appropriate for achieving the conservation objective.

Management within Terrestrial Anchors will promote the development of complex structure, and once at complex structure management will be designed to emulate natural, small-scale disturbance patterns. Management conducted within Terrestrial Anchors will be conducted in a manner that will maintain the integrity of interior habitat conditions and retain and promote vegetative and structural diversity.

- **Aquatic Anchors**
  Aquatic Anchors are intended to benefit fish and amphibian species of concern. The quantity, size, and distribution of Aquatic Anchors will vary by district, in part dependent on state forests ownership patterns and species distributions. Information from research and monitoring will be used to identify sub-watersheds that provide high quality habitat for salmonid species of concern. Specific criteria include but are not limited to: population abundance and distribution, habitat condition, and professional opinion of ODFW fish biologists. The Aquatic Anchors will be subject to additional management standards (e.g., in addition to Appendix J) intended to maintain and enhance habitat for salmonids and headwater amphibians.

Site Protection

In addition to anchor habitats, some species of concern will be protected through site-specific management approaches. Species receiving site-specific protection will be those with habitat needs that otherwise might not be met with the provisions of this management plan, or with the anchor habitat approach. Examples of species receiving site-level protection are species known to use a unique resource (e.g., caves and mines, mineral springs), those with a legal mandate for site-level protection under the federal Endangered Species Act (spotted owl and marbled murrelet) and the Forest Practices Act (e.g., bald eagle, osprey), and species especially rare in the region (e.g., northern goshawk). Site-specific management approaches will address both habitat protection and protection from disturbance, if applicable.

Adaptive Management Measures for Species of Concern Strategies

Key Working Hypotheses:

- Identification and protection of key habitat areas for specific species will maintain existing populations as a source to colonize new habitat.
- Species will colonize new habitat as it develops over the longer term.

Key Assumptions/Questions to be Addressed through Monitoring:

- Landscape strategies provide additional habitat on the landscape for species of concern.
  - — Active silvicultural management can accelerate development of habitat suitability compared to passive management.
  - — There is a predictable relationship between stand structure and habitat requirements for species of concern.
- Landscape management and design strategies allow species that colonize new habitats to become firmly established and to occupy the new territories for long periods.
- Species of concern in newly developing habitats will successfully reproduce.
- Connectivity of habitats across the landscape is provided by the landscape strategies.
  - — Large, extensive areas of the landscape are not maintained in forest conditions that could be obstacles to species dispersal.
  - — Higher quality habitats are well-distributed across the landscape, including representation in areas otherwise dominated by lower-quality conditions.
- Management actions will not result in extirpation of species of concern in any portion of the planning area.

Strategies for Specific Resources

So far this chapter has presented the integrated forest management strategies, which are the basis for managing the forest landscape as a whole, and additional fine-filter strategies for species of concern such as spotted owls and marbled murrelets.

The rest of this chapter presents the management strategies for additional individual resources in the northwest Oregon state forests, as described in the Guiding Principles and Resource Management Goals presented in Chapter 3. These strategies are designed to meet specific goals that the integrated strategies alone may not achieve. These specific actions will occur within the overall framework of the integrated strategies and fine-filter strategies.

Taken together, all the strategies presented in this chapter are the heart of the *Northwest Oregon State Forests Management Plan*. They are the specific actions that will be taken to achieve the plan's management goals and move toward the forest vision (Chapter 3).

Agricultural and Grazing Resources

Agriculture

1. **Agricultural uses will be considered on a case by case basis. Permits will be issued when these activities are compatible with other forest resources and activities.**

   Agricultural activities on state forests in northwest Oregon have been insignificant in the past and are not expected to change in the future. If the demand for agricultural use should increase, the Department of Forestry will consider these activities to the extent that they are compatible with the other resource goals.

   Agricultural uses are permitted under ORS 530.050(4) and ORS 530.490(2). Board of Forestry policies allow for non-exclusive permits to be granted for special uses. Agriculture is considered a special use. Agricultural activities are only allowed within the scope of a special use permit. These permits allow the department to control the activity and protect other resources by the provisions used in the permit.

Grazing

1. **Grazing leases on Board of Forestry lands will be considered on a case by case basis and issued when they are compatible with managing for greatest permanent value of the lands and do not conflict with other resources.**

   Grazing activity has been insignificant in the northwest Oregon state forests and is expected to remain so. Anyone requesting a grazing lease will be responsible for preparing a grazing management plan. This plan will address the following items.

   - Suitability and carrying capacity of the land for grazing.
   - How livestock will be kept out of areas where land use designations preclude grazing.
   - How grazing will be managed to protect or be compatible with timber production, cultural resources, fish and wildlife, soils, special forest products, and water resources.
   - How livestock will be prevented from trespassing onto adjacent lands.

Before the plan is approved, the Department of Forestry must determine that the plan adequately addresses all concerns and that the department's share of revenues generated under the plan will cover all costs of administering the plan.

2. **Grazing leases on Common School Forest Lands will be considered on a case by case basis and those leases will be issued by the Division of State Lands (DSL) when they are compatible with other resources.**

   The Department of Forestry and DSL have overlapping land management responsibilities on Common School Forest Lands with regards to grazing. The respective responsibilities of the two agencies are described in detail in a contract that was approved by the State Land Board (Oregon Division of State Lands and Oregon Department of Forestry 1993). Although DSL is assigned the authority and responsibility to manage grazing leases, the Department of Forestry is responsible for the overall management, control, and protection of Common School Forest Lands. The contract makes the Department of Forestry responsible for preparing long-range management plans that govern all forest resources, including grazing. The Department of Forestry will rely on DSL's expertise in grazing and will regard DSL's grazing management plans as extensions of the long-range plan. The Department of Forestry will actively review grazing plans but will rely on DSL to administer grazing leases on Common School Forest Lands. DSL's management of grazing must comply with the current administrative rules for rangeland management on Common School trust lands.

Air Quality

1. **To protect visibility in Class I wilderness and national park areas:**
   a. **Conduct prescribed burning outside the restricted July 1 to September 15 period.**
   b. **Comply with the provisions in the Visibility Protection Plan that allow exemptions to the summer burning prohibition in the case of (a) coastal conifer and hardwood conversion burning; (b) western Cascade research and hardwood conversion burning; (c) application of the emergency clause, which deals with undue, adverse economic impacts on the forestry industry caused by unusual weather conditions.**
   c. **Advise the Department of Environmental Quality (DEQ) of any significant changes in prescribed burning that would cause emissions to exceed allowable increments over baseline levels, in accordance with the Prevention of Significant Deterioration Rule.**
   d. **As a long-term (15-year) effort to further remedy existing impairment and prevent future impairment, develop and implement best available technology (BAT) in cooperation with DEQ, federal landowners, and private landowners.**

This strategy is based on DEQ's Visibility Protection Plan for Class I Areas. The Plan contains short-term and long-term strategies that affect forest prescribed burning as well as other sources of smoke emissions.

The short-term strategies for forest prescribed burning are designed to remedy visibility impairment during the July 1 through September 15 protection period, particularly in the Mt. Hood, Mt. Jefferson, Mt. Washington, and Three Sisters Wilderness Areas. Regional haze impairment will also be reduced. DEQ's goal is a 60-90 percent reduction in substantial visibility impairment as compared to the 1982-1984 baseline monitoring period. The short-term strategies include (a) a general prohibition on prescribed burning in all northwestern Oregon counties (including all of the northwest Oregon state forests) with the intent of shifting burning to the spring and fall months; (b) setting aside Class I lands as protected areas under the Smoke Management Plan; (c) regulation of the "exempted" burning activities through specific provisions in the Smoke Management Plan. The Smoke Management Plan will adequately protect designated population areas that might be impacted by the shift to spring and fall burning. Therefore the short-term goals should be attainable without a significant reduction in the amount of acreage burned, compared to historical levels.

The long-term strategies address the Prevention of Significant Deterioration Rule (PSD) and the development and implementation of best available technology (BAT). PSD generally applies to stationary sources such as industrial sites, but a major change in prescribed burning practices should also be considered. Emissions may increase to a specified level above the 1977-78 baseline without violating PSD standards. The Department of Forestry is approaching the development of BAT as a department-wide project, and new techniques have been implemented in the northwest Oregon state forests, as discussed in strategy 3 below. DEQ estimates that the long-term strategy can result in a 22 percent reduction in western Oregon prescribed forest burning emissions from the 1982-1984 baseline period.

2. Comply with the Oregon Smoke Management Plan.

The resource description for air quality outlines the objectives of the Smoke Management Plan and lists procedures for conducting prescribed burning in northwestern Oregon. Because it is an element of DEQ's state implementation plan, the Smoke Management Plan contributes to meeting National Ambient Air Quality Standards. As a whole, it reduces emissions from prescribed burning in western Oregon, minimizes smoke intrusions into designated population areas, and supplements the Visibility Protection Plan for Class I wilderness areas and national parks.

3. Continue to implement alternatives to prescribed burning, and use burning techniques that reduce smoke emissions.

Prescribed burning will remain a necessary tool in order to reduce fuel loads, prepare sites for reforestation, and provide certain types of wildlife habitat. During the past several years, smoke emissions from state forests have been reduced through the use of techniques described in the air quality resource description. New techniques may be developed as part of the "best available technology" initiative, discussed in strategy 1 above. Because circumstances vary in different locations, smoke-reduction techniques must be prescribed on a site-specific basis. Some techniques, such as small wood utilization, may be driven by market conditions.

Cultural Resources

The cultural resource strategies recognize that historic sites, relics, and structures are a public resource and provide important clues to the historic use of state forest lands. Forest management activities such as timber harvest, road construction, and recreation site development can irreversibly destroy the integrity of historic sites. A cultural resource management program for northwest Oregon state forests will be applied to meet both legal protection mandates and internal protection priorities.

1. Complete an inventory and assessment of cultural resource sites and conduct a prehistoric and historic cultural resource review.

In order to effectively manage cultural resources, an inventory of sites must be available to district staff. Cultural resource sites may range from sites with legally mandated protection to sites with little or no significance. Each site identified will be assessed and rated for its legal or nonlegal protection status. The Department of Forestry will rate sites for significance using the following categories:

- Mandated Protection (Class I)
- Internal Protection (Class II)
- No Protection (Class III)

Table 4-3 on pages 4-92 and 4-93 describes the categories of site significance, the criteria used to designate sites, and the relative management objectives for each site category. The tools and guidelines needed by managers will be developed for use at the district level, with coordination from area staff and specialists.

A prehistoric and historic cultural overview is a professional-level review, including extrapolation and interpretation of existing literature and information specific to northwest Oregon state forests. Such an overview provides the understanding and context for making cultural resource and other resource management decisions. The State Historic Preservation Office (SHPO) will provide guidance to the Department of Forestry in determining the elements to include in an overview. The overview would be accomplished through a professional services contract.

2. **Develop a cultural resource database for tracking and planning purposes, including a system of recording, filing, and retrieving cultural resource site data from GIS overlays and basin level inventories.**

   As the Department of Forestry moves toward a GIS-based information and inventory system, existing cultural resource databases will be incorporated and more easily available to staff planning long and short-term management actions. Making cultural resource data easily accessible will greatly aid in protecting cultural sites and meeting long-range plan goals. Some work has already been done to prepare a database for conversion to GIS compatible files, but this work is incomplete and will need to be reviewed and refined.

3. **Develop a procedure for integrating site protection into forest activity plans by providing practical guidelines for recognizing, assessing, recording, and protecting sites.**

   As the cultural resources management program is being developed, new or known sites will be encountered by Department of Forestry field staff in carrying out management plans and activities. A system will be developed to provide guidance in recognizing, recording, and protecting sites in the short term, as well as after strategy 1 is implemented. This system will identify procedures best carried out at the intermediate planning level (management basin) and at the annual planning level (activity area or site).

Much of the work necessary to accomplish the cultural resource strategies has already occurred through comprehensive recreation planning efforts or is underway in existing planning efforts. It is anticipated that the remaining work called for by these strategies will be completed during the initial 10-year implementation period.

Table 4-3. Cultural Resource Classes and Objectives

ODF Class	Site Protection Categories	Site Criteria and SHPO Site Examples	Management Objectives
I Mandated Protection	**A. Pre-Historic Archaeological Site:** Created/used before Euro-American inhabitancy.	• The site has a record of creation/use by an indigenous culture (OAR 736-51). • Sites may include lithic quarries, lithic scatters, camps, villages, burials and sites of objects such as symbols, tools and facilities.	• Management activity excluded to protect sites from any excavation, alteration, disturbance or removal of remains. • If disturbance is necessary and detrimental to structure/site integrity, then a SHPO Archaeological Permit is required if any excavation, alteration, disturbance or removal of remains in the immediate area. Permits to be reviewed by qualified archaeologist. • Extend Level 1 objectives and consideration to sites that are soon to qualify for higher levels of significance (sites within 5 years of age minimum).
	B. Historic Archaeological Site: Created/used by humans after Euro-American inhabitancy.	• The site has a record of creation/ use by recent post-European culture (proof of existence, not remains). • At least 75 years old, and consider 45 year old sites in planning horizon. • Sites may include shipwrecks, homesteads, camps, towns, monuments, tools, facilities, grave sites and cemeteries.	• Same as above.
	C. Historic Sites: Created/used by humans after Euro-American inhabitancy.	• Aboveground structural remains or work of a master. • At least 50 years old, and consider 45 year old sites in planning horizon. • Sites include bridges, tunnels, trestles, rockwork, roads and trails that usually have structural or marked remains.	• Same as above, except that: SHPO Archaeological Permit not required (may be exemption).

Table 4-3 continued. Cultural Resource Classes and Objectives

ODF Class	Site Protection Categories	Site Criteria and SHPO Site Examples	Management Objectives
II Internal Protection	**B. Historic Archaeological Sites:** --------------------- **C. Historic Sites:**	• Less than 75 years old • Valuable for public use and education --- • Less than 50 years old • Valuable for public use and education Examples: railroad grades, camp sites, lookout remains, sites related to ODF history (tree genetic trials, guard stations).	• Give highest protection to sites close in age to Level 1 significance. • Protect the site from disturbance where possible, survey, remove, and catalog site/relics if destruction unavoidable. • No legal requirements, except complete protection of grave sites and any work of a master.
III No Protection	**B. Historic Archaeological Sites:** **C. Historic Sites:**	• Less than 75 years old • Not valuable for public use value	No special management action required. Before disturbance gather information on the site, record in CR inventory, and map. Remove relics, label, and store for Interp/Ed programs or archival use.

Energy and Minerals

1. **Survey, evaluate, and identify aggregate rock sources important for the long-term management needs of northwest Oregon state forests.**

   This strategy is aimed at Department of Forestry districts that have rock source opportunities on state forest land. The amount and quality of rock sources on state forest land is limited and needs to be reserved for future forest management needs. For the long-term management of the aggregate rock resource, there needs to be a higher level of certainty about the amount and kind of rock potentially available. Good quality information has been developed for most of the larger important state forest rock quarries. However, we need to develop the same level of information for known high potential sites, other smaller sites, and for sites discovered through future surveys.

   Each district will evaluate their need to update existing rock source plans and, if necessary, identify additional aggregate rock sources on state forest land using existing information from the Department of Forestry or other sources. In addition, staff should examine the short and long-term availability of commercial sources, other private landowner sources, and other governmental agency sources. Development opportunities on non-state owned sites could be established through use of mutually beneficial cooperative agreements.

   The assessment for each state forest rock source should include information about the potential amount and extent of rock, the quality or type of rock, quarry development constraints (access, amount of surface disturbance, amount of overburden and placement, etc.), initial development plans, and maintenance or reclamation plans.

2. **Review and update Division of State Lands (DSL) and Oregon Department of Forestry (ODF) roles, responsibilities, and procedures dealing with mineral and energy resource assessment and prospecting and mining permit applications involving state forest land.**

   It will be necessary to review and update joint DSL/ODF roles, responsibilities, and procedures to ensure they are fully aligned with all the resource goals and strategies addressed in this plan. The review could cover a broad array of issues, but would include the items on the next page.

- Board of Forestry and Common School Fund management mandates and guidelines.
- Procedures and responsibilities for reviewing permit requests, setting royalty rates, resolving resource conflicts, and developing reclamation strategies.
- Administration of issued permits.
- Energy and mineral resource assessment and data sharing opportunities with the Division of State Land and Department of Gas and Mineral Industries.
- Update of the existing DSL/ODF Rock and Mineral Sales Interagency Agreement (“Interagency Agreement”).

Land Base and Access

Land Base

1. **Minimize the amount of forest land used for roads, road corridor clearings, landings, and mineral extractions by ensuring that construction and development specifications are designed to efficiently meet management activity objectives.**

   This strategy addresses land base goal 1 by minimizing the amount of forest land used for management infrastructures and other resource developments. Roads, landings, rock quarries, or other developments are necessary to manage forests effectively. However, planners must ensure that each proposed development is necessary, designed to appropriate specifications, and uses no more forest land than necessary. Planners should develop and analyze an array of alternatives, and choose specifications that accurately reflect management objectives and site-specific constraints.

2. **Follow the procedures in ORS 197.180 and OAR 660-30, 660-31, and the Department's State Agency Coordination Program, OAR 629-20, to assure that land use programs and activities are consistent with Statewide Land Use Planning Goals and are compatible with acknowledged county comprehensive plans and land use regulations.**

   All state agencies must comply with the Statewide Planning Goals, by assuring that land uses are compatible with acknowledged local government comprehensive plans and land use regulations. The Department of Forestry's State Agency Coordination Program and OAR 629-20 describe the procedures to be followed. Counties and cities with state forest land within their boundaries have reviewed and commented on the compatibility of the *Northwest Oregon State Forests Management Plan* with their comprehensive land use plans.

   The procedures in OAR 629-20 will also be followed in order to ensure that other levels of forest planning are compatible with acknowledged city and county plans and land use regulations. Other levels of forest planning include district implementation plans, annual operation plans, transportation plans, and land acquisitions through sale or exchange.

3. **Continue with an active land exchange and acquisition program in those districts that have favorable consolidation opportunities.**

   The Department of Forestry will actively pursue beneficial land acquisition and exchange opportunities as a means to increase management efficiency and economic values, and to enhance forest stewardship and other forest resource values. This will be carried out in accordance with Board of Forestry policy and administrative rules.

   Each district has existing land acquisition and exchange plans that identify potential consolidation and divestment opportunities. These plans are in varying degrees of development and implementation depending on each district's level of need, opportunity, benefit, and workload associated with particular exchanges or acquisitions. In carrying out this strategy, districts will review and update acquisition and exchange opportunities, establish priorities, and implement specific transactions by following procedures and reviews as outlined in Board of Forestry policy and rules.

4. **Develop and implement land survey plans for each district, in order to establish and/or reestablish state forest boundaries necessary to meet management activity needs.**

   Established property corners and posted property lines are an essential part of the forest infrastructure. They help to identify land ownership and confirm locations of management activities, which in turn helps to achieve efficient conservation of state forest land (land base goal 1). Many property corners and lines for state forest land have already been established as part of the required work for past timber sales and other stand management activities. However, a significant number of property corners and lines must still be established and posted to meet broader resource management and public access needs, as well as future timber harvest needs. The establishment of property corners and lines will also aid in the development of accurate GIS land ownership overlays.

   The amount of land survey work already accomplished varies among districts. To work toward completing land surveys, districts will determine their total survey workload remaining, set survey priorities in relation to planned forest management activities, and develop survey project proposals. The survey proposals may use a combination of Department of Forestry personnel, cooperative agreements with adjacent landowners, and service contracts.

Access

1. **Develop a database and GIS overlay of the road and trail network, to use for planning and tracking purposes.**

   Many management activity plans are dependent on or affected by roads, including timber and special forest product sales, road improvement and maintenance plans, fire suppression access, fish and wildlife habitat issues, public access, and recreation management. It is important to have accurate information about existing and planned road and trail networks, in order to meet access system and resource management needs. The conversion of this information into a GIS overlay will help planners to use it most efficiently.

2. **Construct, improve, and maintain road and trail systems using engineering design, construction techniques, and maintenance programs consistent with the type and level of use, level of difficulty and hazard, amount of resource risk, and the minimum standards set by the Forest Practices Act.**

   It is essential to provide forest access for fire protection, management activities, and public use. To minimize potential impacts from forest roads and trails, districts will use a variety of techniques to match their specific access needs.

   Road and trail system management will be accomplished in accordance with the processes and standards described in the *Forest Engineering Roads Manual* and in the *Recreation Design Standards and Management Guidelines Manual*.

3. **Consult and coordinate with adjacent landowners concerning possible road sharing opportunities to avoid unnecessary duplication of road systems.**

   Avoiding duplication of road systems will help to achieve access goal 2. Districts will continue to consider using adjacent landowner roads that logically provide better access for management activities. Districts would also reciprocate road use with other landowners on equal terms, where this exchange is appropriate and would reduce the overall road density on the landscape.

Plants

The integrated forest management strategies will provide the foundation for protecting biodiversity, and will meet the habitat needs of most plant species native to the northwest Oregon state forests. The following strategies apply to all northwest Oregon state forests.

1. **Maintain a variety of seral stages, stand structures, and stand sizes across the landscape by implementing the integrated forest management strategies. These include the landscape management, aquatic and riparian, and forest health strategies.**

   The goal of "providing habitats that contribute to maintaining or enhancing native plant populations at self-sustaining levels" is achieved through the general biodiversity approach that is implemented through the integrated forest management strategies. The overall result of this strategy will be a diversity of native plant communities across the landscape.

2. **Protect riparian vegetation during forest operations by applying aquatic and riparian strategies.**

   Plants that grow in riparian areas have important roles in wildlife habitat, hydrology, and nutrient cycling, and riparian features such as trees and understory vegetation are protected in order to maintain the biological and hydrologic functions of these areas.

3. **Protect endangered, threatened, candidate, and rare plants as identified by the Oregon Natural Heritage Program by following procedures for complying with state and federal Endangered Species Acts for plants.**

   Special procedures were developed to manage individual species and habitats whose needs are not adequately addressed through the general strategies for plants. These procedures specifically address plants that are classified as endangered, threatened, candidate, and rare (i.e., identified by the Oregon Natural Heritage Program as species of concern). The procedures for endangered, threatened, and candidate plants are found in the document, *ODF State Lands Program — Procedure for Complying with Federal and State ESAs for Plants* (Oregon Department of Forestry). The procedure for rare plants will be the same as for candidates. Detailed information about these plants is given in Chapter 2 under the heading "Plants."

4. **Contribute to statewide efforts to reduce the quantity and range of invasive, non-native plant species.**

   The Department will apply integrated pest management principle to address incidences of invasive, non-native plants on state forest land, and will cooperate with other agencies and landowners in cooperative efforts to address such problems. The Department will take steps to assure that management activities are not contributing to existing or new invasions of non-native plant species. This will include vegetation management efforts to control such species on state forest land, and the use of native plant species in re-seeding projects on state forest lands.

Recreation

The recreation strategies are divided into two sets, one for all state forest lands in the planning area, and a separate set for the Tillamook State Forest, where a comprehensive recreation management plan has been in place since 1993. The strategies for the entire planning area address the broader needs of all northwest Oregon state forests.

Strategies for the Entire Planning Area

1. Complete recreation management plans for the following forests: Clatsop State Forest, Santiam State Forest, West Oregon/Western Lane District State Forest Lands.

Strategies 1 through 4 address recreation goal 1: to provide opportunities that supplement, rather than duplicate, those opportunities already available in the region. To accomplish this goal, it is necessary to develop recreation plans at the district level and to have basic program elements in place. District recreation programs will enable staff to manage existing and future recreational uses. Recreation plans have now been completed for the Clatsop and Santiam state forests.

The recreation management plans will address the following topics, at a minimum.

a. Summary of the current situation regarding recreational use of the forest.
b. Assessment of recreation demand and needs for the forest.
c. Description of the resources as they relate to recreation.
d. Description of the forest's regional role as a recreation provider.
e. Identification of opportunities for different uses, particularly semi-primitive camping, non-motorized trails, motorized off-road trails, day use areas, and interpretive program sites.
f. Short-term action plan identifying key sites or program areas to be addressed, with relative priorities assigned.
g. Implementation plan, including timelines under alternative funding and staffing levels.
h. Identification of future recreation needs and opportunities for the forest.

Forest level recreation planning will be conducted by the responsible districts, with coordination and assistance from area staff. Public involvement will be incorporated to the extent needed to develop a credible plan locally. Much of the assessment work listed above (items a through e) has been completed during the recreational assessment stage of the forest planning process. The remaining items (f, g, and h) can be accomplished largely through the district implementation planning process.

2. **Develop a set of standards and guidelines to govern recreation management activities and facility development and maintenance.**

   The purpose of the standards and guidelines is to streamline the process of recreation project planning, costing, development, construction, and maintenance. The set of standards will provide a consistent look and continuity of signs and facilities between districts, provide for greater efficiency and economy, and make it easier to budget and track costs. The sign design and facilities manuals developed for the Tillamook State Forest will be the basis for a manual that applies to all northwest Oregon state forests.

3. **Complete development of a coordinated volunteer program for the northwest Oregon state forests to maximize the efficient use of volunteers in recreation management efforts.**

   The use of volunteers is desirable and necessary in order to effectively implement recreation plans in those districts having significant recreation resources needing management. Beyond the benefits of cost savings, an active volunteer program can build relationships between users and the Department of Forestry, encourage cooperation and learning among users, increase understanding of broader forest management issues, and better blend recreation interests with resource management needs. Most districts have an existing broad-level volunteer program in varying stages of development and use. District volunteer programs would be more fully developed to match the needs and opportunities for each district's recreation program.

4. **Pursue cooperative agreements with user groups, and other agencies and organizations, to diversify the funding for recreation management projects and programs.**

   Exploring partnership and cooperative agreement opportunities in implementing various aspects of district recreation programs is important in order to diversify funding sources and share costs with those using the resource or with those having similar resource management responsibilities. There are four main categories of partnership potential: interagency, user group organizations, business, and individuals. Interagency partnerships could involve Oregon Department of Fish and Wildlife, Oregon Department of Transportation, Oregon Department of Parks and Recreation, Bureau of Land Management, U.S. Forest Service, school districts, and county governments. Partnerships with user group organizations would primarily involve local fishing, hunting, hiking, bicycle, equestrian, off-highway vehicle, or environmental clubs. Business partnerships involve sponsorship and donation of material, services, and money to support volunteer projects. Individual partnerships and agreements are in many cases an extension and benefit of the volunteer program.

5. **Develop consistent themes and interpretive media for informing the public about the management of state forest land.**

   This strategy addresses recreation goal 2: to provide opportunities for interpretation and outdoor education on state forest lands. This strategy must be coordinated with the cultural resource site identification strategies. Many of the themes and media prescriptions can be implemented using the cultural resource sites. An interpretive program is already being developed on the Tillamook State Forest. The ongoing work on the Tillamook should provide valuable interpretive tools that can be modified for use on other state forests.

6. **Apply Oregon Administrative Rules (Chapter 629, Division 25) governing recreational use, combined with an effective law enforcement program designed to meet each district's needs.**

   This strategy addresses recreation goals 3 and 4. These goals are to minimize adverse impacts to other resources and land ownerships, and to minimize conflicts among users in the forest. The Oregon Administrative Rules that govern recreational use of state forest land and set use fees exist for this purpose, and they were recently updated. These rules need to be continually evaluated for effectiveness and amended as necessary through the rulemaking process.

   Consistent user education and enforcement is critical to the success of the rules, which includes posting rules and signs, making user contacts and issuing citations. Enforcement needs differ between districts, which have varying levels of public access and use. Districts will develop their own enforcement programs to the level needed, relying primarily on cooperative agreements with existing law enforcement agencies and possibly other landowners with similar needs. User fees will be applied as specified in the administrative rules and handled according to standards developed with Department of Forestry finance personnel.

Tillamook State Forest Strategies

The two strategies below recognize that the *Tillamook Comprehensive Recreation Management Plan* will continue to provide direction for the recreation program on the Tillamook State Forest (Tillamook and Forest Grove districts). It is not necessary to develop additional strategies for this plan.

1. **Continue to implement the action items identified in the *Tillamook Comprehensive Recreation Management Plan* adopted by the Board of Forestry in 1993 and updated in 2000.**

   The recreation plan for the Tillamook State Forest includes an updated action plan, which details objectives and specific actions for recreation management on the forest. It includes specific actions for a variety of recreational uses. These actions are very specific strategies for managing recreational use, and development of additional strategies is not necessary at this time. Implementation of this action plan has been underway since 1993.

2. **Continue with the implementation of the *Tillamook State Forest Interpretive Master Plan*. Identify and pursue opportunities to use Tillamook State Forest materials for interpretive opportunities on other state forests.**

   The interpretive master plan lays out the interpretive themes, media prescriptions, and the network of sites and facilities needed to implement an effective interpretation program on the forest. A short-term action plan and long-term implementation plan were developed in 1996. These plans detail more specific actions or strategies.

   Much of the work necessary to accomplish the recreation resource strategies has already occurred through comprehensive recreation planning efforts or is underway in existing planning efforts. It is anticipated that the remaining work called for by these strategies will be completed during the initial 10-year implementation period.

Scenic Resources

The scenic resource strategies recognize that landscape aesthetics are a public resource, and forest management activities such as timber harvest and road construction can greatly affect the visual quality of the landscape.

The visual management program for northwest Oregon state forests will be applied at both the landscape and stand level. The program will be compatible with other resource goals and values. The silvicultural practices used in implementing structure-based management will provide the necessary tools to effectively apply landscape design principles.

1. **Identify and classify areas for level of visual sensitivity in accordance with the Land Management Classification System described in Oregon administrative rule. Conduct management activities consistent with the requirements of the administrative rule.**

   Areas will be identified which are highly sensitive to visual impacts from management activities. These will be areas adjacent to or seen from major highway corridors designated as visually sensitive by the Oregon Forest Practices Act; those areas with established, high public use vistas, viewpoints and significant natural features; areas adjacent to campgrounds; and lands visible from urban centers.

   By applying visual landscape analysis and design principles, timber harvest can occur in most of these areas and meet administrative rule requirements. A full array of silvicultural treatments, harvest methods, and logging systems would be considered for use when planning operations. These methods include various degrees, combinations and shapes of clearcutting, patch cuts, commercial thinnings, and partial cuts.

   Some highly sensitive areas, in which timber harvest would significantly impact visual quality, will be classified so that the growing and harvesting of trees and other incompatible resource uses will be secondary to the visual values. Any timber harvest that may occur in theses areas would be for salvage, stand health, or scenic enhancements.

   Visual sensitivity level is an indicator of public and Department of Forestry concern for visual impacts on the landscape resulting from a forest management activity. An area’s degree of visual sensitivity will be determined by assessing the relative importance of a number of factors, including the factors listed below.

Viewer Factors:

- Number of viewers
- Viewer perception
- Viewing distance and duration
- Viewing angle and position

Physical Factors:

- Cultural modifications: logging patterns, powerlines, roads, structures
- Landform: diversity of form and line; outstanding features (exposed peaks and ridges)
- Vegetation: diversity of pattern and color; natural openings; continuity
- Water: land/water interface, waterfalls, lakes, significant streams
- Uniqueness: scarcity of form or feature

2. **Identify other areas of visual sensitivity according to criteria for moderate and low sensitivity levels. Conduct management activities consistent with visual management objectives identified for moderate and low sensitivity levels.**

   Table 4-4 on the next page shows the overall visual management program that will be applied on northwest Oregon state forest lands, including the high visual sensitivity areas that the Land Management Classification System addresses. Visual management objectives are set and applied based on the level of an area's visual sensitivity. The moderate and low sensitivity level areas will be determined through an inventory and assessment process using criteria listed above and in the table. Once visual sensitivity levels have been established, visual management objectives will be applied that give direction to visual landscape design and planning of forest operations.

3. **Develop a visual resource management handbook and training manual for use by managers to help them effectively incorporate landscape design concepts into district implementation plans and annual operations plans.**

   The visual resource management system described in these strategies is different from the system currently used by the Department of Forestry. In order to effectively implement such a visual management system, managers will need training and supporting tools, such as a visual management handbook and landscape design computer software. These tools could be acquired by contracting with a landscape design company to develop a comprehensive training package tailored to the Department of Forestry's needs. The package would include a training course, training manual, and management handbook. The Department of Forestry can use as a model training courses and manuals that have been developed for various forest management agencies and private company landowners.

   Much of the work necessary to accomplish the scenic resource strategies has already occurred through comprehensive recreation planning efforts and through land management classification. It is anticipated that the remaining work called for by these strategies will be completed during the initial ten-year implementation period.

Table 4-4. Scenic Classifications and Management Objectives

Visual Classification	Vantage Point	Land Management Classification System Criteria and Visual Objectives
Level 1 **High Sensitivity (as designated by the Land Management Classification System)**	• Highway corridors designated as visually sensitive by the Forest Practices Act • Established high use vistas, viewpoints, and natural features • Designated campgrounds • Urban views	**Landscape Perspective:** Management activity is not highly evident and closely fits character of the landscape. Partial cut, patch cut, and thinning harvest methods are preferred. Visual objectives have high priority in balancing resource considerations. **Stand Perspective:** Management activity is apparent. Clearcuts are screened by various types of visual buffers; exposed areas have clean, orderly, managed appearance. Example techniques: low cut stumps, small amount of residual slash, seeded road cuts & fills; precommercial thinning, pruning, and signs may be evident.
Level 2 **Moderate Sensitivity**	• Secondary highway corridors • High public use forest roads • Low use vistas, viewpoints, and natural features • Trails and trailheads • Designated camping areas • Rural communities	**Landscape Perspective:** Management activity may dominate but fits landscape line, form, and texture. Visual management techniques are fully considered but must be compatible with meeting harvest plans, operational needs, and other resource priorities. **Stand Perspective:** Management activity dominates but has orderly, managed appearance. Example techniques: low stumps, moderate amount slash residual, precommercial thinning may be evident.
Level 3 **Low Sensitivity**	• Low public use or low visibility areas	**Landscape Perspective:** Management activity dominates and landscape characteristics are considered only when compatible with operational and other resource needs and priorities. **Stand Perspective:** Activity dominates. Residual affects from harvest, road, or other management activities do not need to be addressed for visual management considerations.

Soils

The integrated management strategies provide an overall framework for maintaining long-term soil productivity as well as other resource values. The additional strategies below describe some specific ways that soils will be protected during forest management activities.

1. **Comply with all Oregon Forest Practices Act requirements for soil protection.**

   OAR 629-24-422 has general provisions for protecting forest soils during forest operations; for example, adapting the logging method and type of equipment to the given slope, landscape, and soil properties in order to minimize soil deterioration. The water protection rules (OAR 629, Division 635 through 660) protect long-term soil productivity and hydrologic functions within riparian management areas and wetlands.

   Specific actions that implement this strategy are detailed in presale plan reports and in written plans (as required) for riparian management areas. Timber sale operators must comply with the administrative rules and sale contract provisions that address the protection of soils during harvesting operations. The next strategy, geotechnical assistance, further ensures that soils will be protected in the planning, design, and layout of roads and harvest units.

2. **Minimize management-induced slope soil movements by obtaining timely geotechnical input.**

   Timber sale planners should use input from geotechnical specialists in designing roads and harvest units. This input is based on interpretive geology and the use of soil and rock mechanics in slope stability analysis. It provides a rationale for risk assessment and mitigation in forest land management decisions. Geotechnical models developed by engineering geologists are the best available tools for predicting the likelihood of inducing slope movements through land management activities. The use of geotechnical analysis in management decisions makes it possible to minimize the number or magnitude of management activity-induced soil movements, and to protect other resources.

   This strategy will be achieved through application of the processes and standards for hazard and risk assessment, and geotechnical specialist input as described in Aquatic and Riparian Strategy 6 — Slope Stability Management.

3. **Maintain quantities of organic material in the soil (duff and litter).**

    a. **Conduct prescribed burns under conditions that minimize the impact to soil organic materials. For example, take into consideration the amount and distribution of fuels, fuel moisture, weather conditions, and topography.**

    b. **During timber harvest, use logging systems that minimize disturbance to the existing duff, litter, and woody debris, except where disturbance is desirable to facilitate regeneration. To the greatest extent practicable, retain logging residue (limbs, tops, cull logs, etc.) while not creating an unacceptable fire hazard.**

    This strategy recognizes the importance of maintaining duff and litter as part of the soil. Organic materials increase soil fertility, retain moisture, slow water runoff, prevent erosion, and add to long-term soil productivity. Limbs, cull logs, and duff also contribute to biodiversity by providing habitat for many species of small animals.

Special Forest Products

The following strategies have been developed to fulfill the vision that special forest products will be managed as a viable, sustainable commodity program, compatible with other forest resources. These strategies will enable the special forest products program to provide benefits for local communities and the special forest products industry and to become more profitable over time. In recognition of the developmental nature of this program, the strategies will be implemented based on individual district need and in phases that will allow for adjustments to be made as experience is gained. A commitment of resources, especially additional human resources, may be needed in order to conduct the program in a businesslike manner. The special forest products program will build on business practices that are already in place, such as the procedures for competitive bidding and negotiated sales. Business elements that are missing or in need of modification will be developed and brought up to date.

The Department of Forestry believes that these strategies will enhance the overall efficiency of the State Lands Program. In addition, Oregon's Economic Development Department has an interest in helping this segment of the state's economy to grow. The Department of Forestry's link to this effort will be to provide a reliable source of raw materials for commercial and personal use.

1. **On districts where special forest products are an active resource, develop inventories for specific, high demand products.**

   On each district there are certain forest products that are in high demand. The Department of Forestry has little information about the special forest products resource base. For those districts with high demand products, a product-based inventory could be useful for characterizing the resource, identifying potential harvest sites, responding to requests for permits, tracking harvest, and analyzing product availability. Some possible information sources for developing an inventory are to: a) analyze existing data and track harvest activities with GIS; b) collect data through the ongoing timber inventory.

   An inventory system could take an extensive look at the forest by comparing timber type associations with ground cover, then doing some field checking for ground truthing. This type of inventory could be used for appraisals and determining the actual harvest potential of an area.

This strategy furthers the goals of providing useful products, managing for revenue production, and managing for sustainability.

2. **Develop and provide districts with the following resources to assist with special forest product management.**

   a. **Provide districts with a manual to guide special forest product sales.**

   The manual will contain all of the guidance needed to offer sales and personal use permits. Examples are: procedures for competitive bidding or negotiated sales, contractual considerations, pricing guidelines, and accountability guidelines. Along with the manual, a state-wide pricing list would be developed and updated annually for all known special forest products. In addition, information will be provided about each product, such as how it is harvested, processed, and marketed; what characteristics determine product quality; the harvesting season; how long between harvests; cultural requirements; proper harvesting methods; sustainability of the resource. The manual will assist districts in deciding how to offer sales, write contracts, and administer the sales. It will assist them in handling requests for products that are not routinely requested.

   b. **Develop a standardized accountability process (load tickets, etc.).**

   A load accountability system will be developed that ties purchasers with each load of material sold from state forest lands. Currently there is no way of identifying products that are removed from state forest lands. This system will identify each load of products removed from state forest lands and make it easier for law enforcement to identify legal removal. This system would standardize our business practices while providing for local administration.

   c. **Review and revise, as needed, the Department of Forestry's directives that pertain to special forest products.**

   The Department of Forestry sets forth its operational procedures and business practices in a series of directives. For the most part, special forest products can be handled under the existing directives. However, some of the directives were written with timber in mind, and do not sufficiently cover special forest products.

   d. **Coordinate and disseminate special forest product information between districts, and communicate about special forest product activities with adjacent landowners.**

   The Department of Forestry needs a focal point for information to be received and disseminated to the districts. Information sharing about new products, harvest techniques, ongoing research, and enforcement concerns is useful and needs to be reviewed and made available to the districts. Information can be gained and shared through association with the Western Oregon Special Forest Products Committee, U.S. Forest Service, Bureau of Land Management, and other agencies. Also, communications with adjacent landowners will minimize user conflicts. Special attention should be given to intermixed land ownerships or differences in operating procedures that could lead to conflicts.

3. **Where districts identify a need, districts will develop a special forest products sale planning program.**

   In each district there are certain products that are in higher demand than others. The district may see a need for a sale plan to help facilitate the sale of these products. These plans could be quite elaborate, or very simple, depending on district need. The following are suggested steps to address in the plan.

   a. **Identify the major products that will be emphasized on each district (for example, moss, salal, boughs, mushrooms, beargrass) as well as the other incidental products that may be requested.**

   b. **For the major and incidental products, delineate logical sale units and personal use areas that can be made available throughout the district over time.**

      These logical units could be based on an inventory as well as operational considerations. The objective will be to market products through identified sale units, and to minimize costs associated with walk-in requests for permits.

   c. **Develop a harvesting schedule based on the productivity of special forest products for both commercial harvesting and personal use.**

      Like agricultural products, some special forest products can be cultured to enhance both quality and quantity. Harvest scheduling will be based on the products' productivity using the best available information on growth, culturing, and harvest. The actual sale offerings may be affected by operational considerations, other public use, and district resources available for sale administration.

Some of the work necessary to accomplish the special forest products resource strategies has already occurred through earlier planning and assessment efforts. Additional information to support implementation of this strategy will become available during plan implementation through updated forest inventory and other date collection efforts. It is anticipated that the remaining work called for by these strategies will be completed during the initial 10-year implementation period.

Chapter 5

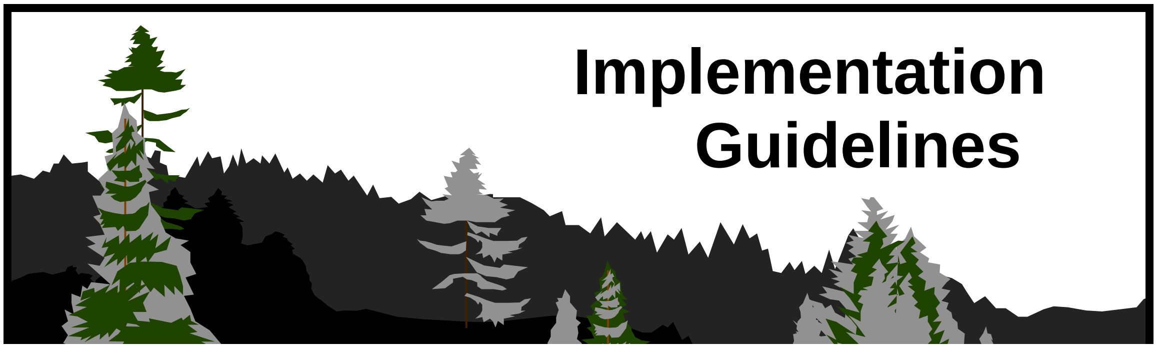
Implementation

Chapter 3 describes a vision and direction for the management of forest resources on northwest Oregon state forest lands. It described a forest that will provide a multitude of benefits to Oregonians; social, environmental and economic benefits. Chapter 4 describes the concepts and strategies for an approach to forest management that could achieve these benefits. This includes a set of integrated forest management strategies, combined with species-specific and resource-specific strategies. The ability of this forest management plan to achieve the outcomes that are possible and to realize the many benefits that have been described will largely depend on the manner in which these strategies are implemented on the ground.

Chapter 5 describes guidance and standards for processes and activities that will be undertaken to implement the strategies described in this forest management plan. This chapter includes guidelines for implementation planning, asset management guidelines, processes for monitoring and adaptive management, and opportunities for ongoing public involvement in plan implementation.

The main headings in Chapter 5 are:

Implementation Guidelines



This section describes who is responsible for implementing the plan, and how implementation will be carried out.

Responsibilities

District Foresters are responsible for implementing all aspects of the *Northwest Oregon State Forests Management Plan* on their districts. The key areas include the management strategies for all resources, district monitoring projects, and district public involvement.

The forest planning and operations coordinator is responsible for coordination among districts in the planning area. Key areas include coordinating the development of implementation plans, operations plans, monitoring priorities and projects, periodic operational reviews, and information exchange.

Also part of the Northwest Oregon Area staff, the geotechnical specialist, wildlife biologist, and public use coordinator are responsible for providing technical assistance to district and other state forests personnel in the development of implementation plans, operations plans, and monitoring plans. They are also responsible for providing technical assistance to district and other state forests personnel for field reviews, and for both landscape-wide and site-specific recommendations on specific management activities. They may also have specific responsibilities for monitoring and research projects.

The State Forests Program staff, including administrators and technical specialists, is responsible for providing guidance and direction on statewide program issues. They also may have specific responsibilities as identified in the forest management plan.

Plan Scope

For the Astoria, Forest Grove, and Tillamook Districts, this plan supersedes the *Long-Range Timber Management Plan / Northwest Oregon Area State Forests*, dated 1984.

For the North Cascade, Western Lane, and West Oregon Districts, this plan supersedes the *Long-Range Timber Management Plan / Willamette Region*, dated 1988.

Plan Duration

This plan will be in effect until it is replaced by a new plan. OAR 629-035-0030 requires that the Board of Forestry review the plan at least every ten years.

There are several reasons why it is anticipated that the plan will endure for a decade or even longer. First, the *Northwest Oregon State Forests Management Plan* is a goal-driven plan. The plan strategies will be most successful in achieving the goals if they are applied over the long term, in an adaptive management context. Second, the strategies give field managers substantial flexibility in using existing or new approaches to meet the goals. Monitoring and adaptive management information will be used to incorporate changes necessary to successfully implement the strategies. Third, the Board of Forestry and the public will have access to periodic updates through monitoring reports and implementation plans that will describe how the plan is being applied and provide insight into how well the goals are being achieved. These updates will be a primary mechanism for the Board to determine if there are portions of the plan that should be amended or if development of a new plan is necessary.

Implementation Priorities

Funding for plan implementation will vary based upon cyclical economic trends. All resource management in the plan is funded through revenues produced from the state forests. Over the long term, it is likely that revenues will support the management activities necessary to meet the forest management plan goals. However, there may be periods of time where revenues limit funding. For this reason, the following priorities are established for conducting activities:

1. Legally or contractually required activities.
2. Minimum activities necessary to achieve the social, economic, and environmental benefits identified in OAR 629-035-0020, including high priority monitoring activities, while emphasizing activities with higher economic return.
3. Fully implement all strategies and monitoring plans.

Implementation plans and operations plans will identify the activities that will be pursued within given time periods based on the anticipated funding levels.

District Implementation Plans

As described in Landscape Management Strategy 4 in Chapter 4, districts will develop implementation plans that describe the management approaches and activities each district in the planning area will pursue in order to carry out the *Northwest Oregon State Forests Management Plan* (FMP). Requirements for these plans are on the next page.

Each district implementation plan will include information that describes:

- The current condition of stand types and their distribution on the district.
- The desired future condition array for each management basin in the district.
- The projected timeline for reaching the desired future condition.
- How the landscape design guidelines were used to arrange the desired future condition array across the district landscape.
- The extent and location of anchor habitat areas for key species of concern.
- Proposed management activities for the ten-year period that will be necessary to move toward the desired future condition.
- The land management classifications that have been applied in accordance with OAR 629-035-0050 to 629-035-0060 to reflect management strategies of the FMP.
- Management activity levels, outputs, and achievements anticipated for the ten-year period.

Prior to adoption of the forest management plan, draft implementation plans will be developed by each district. These will provide reviewers of the forest management plan, including resource specialists and the public, with the necessary information to evaluate the draft forest management plan and guide management for the first decade of implementation. The information in the implementation plans will be improved and refined during the first few years of implementation. Watershed assessment and forest inventory projects will generate additional valuable information during this time period. As new information becomes available, districts will incorporate it into their implementation planning framework and develop a revised set of implementation plans.

Concurrent with the development of these implementation plans, districts will apply the land management classification system in a manner that is consistent with the goals of this forest management plan. (The land management classification system is described in Chapter 2, on pages 2-58 to 2-59.)

Initial district implementation plans and the associated land management classifications will be available for public review and comment for a 90-day period prior to consideration for approval by the State Forester. Implementation plans that undergo major revisions will be available for public review and comment for a 30-day period prior to consideration for approval by the State Forester. The following circumstances will be considered major revisions:

- Revisions that propose changes to the annual harvest level ranges of more than 25% (based on combined acreage of regeneration and partial harvests).

Additional details on the public involvement process can be found later in this chapter.

Monitoring Implementation Plan

The Department of Forestry will develop a *Monitoring Implementation Plan* (MIP) that describes the approaches and activities that the department will undertake over the course of the initial ten-year implementation period to assess compliance with and effectiveness of the resource management strategies described in the *Northwest Oregon State Forests Management Plan* (FMP). The MIP guides research and monitoring program in the western Oregon planning area during the initial implementation period.

The objectives of the monitoring program are:

- To determine that state forests are managed to achieve the greatest permanent value by providing the full range of social, economic, and environmental benefits to the people of Oregon.
- To determine whether FMP programs and strategies are implemented as stated.
- To determine whether FMP programs and strategies result in anticipated habitat or other conditions for the species of concern.
- To assist the adaptive management process by providing information on the species of concern, testing critical assumptions in the plan, and by providing a learning opportunity to refine management decisions to better meet plan objectives.

Monitoring will provide information to assess the implementation and effectiveness of the management strategies and to evaluate fundamental assumptions that form the planning basis for the FMP (see “Working Hypotheses,” on page 3-18 in Chapter 3). The evaluation of these fundamental assumptions will focus the development of specific monitoring projects to determine if the strategies are achieving their objectives.

The specific objectives of the *Monitoring Implementation Plan* are:

- To describe how implementation monitoring will evaluate achievement of the management strategies, to provide information for internal staff reports and for annual reports to the federal services and other entities.
- To provide a framework to aid prioritizing and developing specific monitoring projects to assess the effectiveness of the management strategies.
- To describe how these monitoring activities will help assess the validity of key assumptions that underlie the management approaches or strategies.
- To describe the funding mechanisms and level of commitment to monitoring during the initial ten-year implementation period.

Annual Operations Plans

Annual operations plans will describe the actual projects each district will pursue to implement the forest management plan for a fiscal year. Management activities may include harvest operations; road construction, improvement, vacating, or obliteration; reforestation and young growth management; aquatic habitat restoration; development or maintenance of recreational trails or facilities; etc. Annual operations plans are developed by each district and must be consistent with the longer-term district implementation plans. Resource specialists from both the Oregon Department of Forestry and the Oregon Department of Fish and Wildlife will have an opportunity to provide input to the plans.

The operations plans will be submitted to the District Forester for approval. The District Forester will consider any written comments from resource specialists and the public before approving or denying approval of an operations plan. Once the operations plan is approved, the Department of Forestry has the authority to implement the operations plan.

Team Concept in Implementation

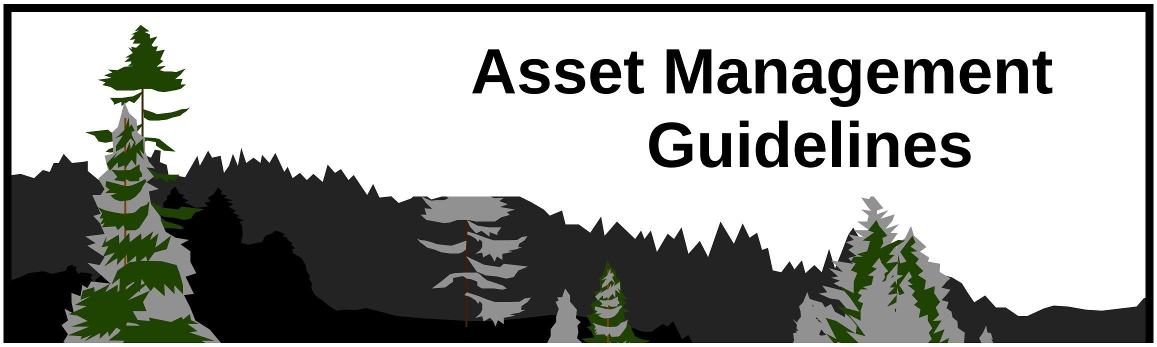
The forest is a diverse and complex weave of resources. This forest management plan has been developed by teams of resource specialists, field foresters, managers, scientists, researchers, and various interests that use or benefit from the forest. Participants have come from local, state, and federal government; universities; various interest groups; and the general public.

This forest management plan calls for the continued use of a number of teams. Listed below are examples of the people it will take to make the plan a success in the long term.

- Teams of field foresters and biologists developing landscape plans and site-specific prescriptions.
- Watershed assessment teams with various technical specialists.
- Monitoring teams of resource specialists, foresters, resource interests, and the general public.

Not all decisions require the use of a team. However, when evaluating approaches or complex resource relationships, a well-directed team is a powerhouse of talent and knowledge. Successful implementation will demand a strong commitment to the ideas in the plan, by the same broad cross-section of resource specialists, managers, researchers, and resource interests that helped build the plan.

Asset Management Guidelines



The northwest Oregon state forests are a tangible asset of the people of Oregon, and of the counties and local taxing districts where the forests are located. These forests and their rich resources provide both an ecological and economic foundation for local communities and the northwestern Oregon region. The forests must be managed to ensure that healthy, productive, and sustainable forest ecosystems continue to provide social, economic, and environmental benefits to the people of Oregon, into the future.

“Assets”, as they are discussed in this section, are confined to the tangible resources and infrastructure (forest roads and related improvements) on the state forest lands. This section provides a brief overview of what these assets are, details guidelines for efficient and effective management of the assets, and describes the anticipated outcomes in terms of the value of the assets if these guidelines are implemented through time.

Description of Key Forest Assets

Lands

The planning area contains 593,173 acres of Board of Forestry land and 18,828 acres of Common School land. As of January 2001, the estimated total bare land value of these lands is $235 million (Tables 5-1 and 5-2, on page 5-12). More importantly, these lands provide the potential to produce resource values from timber, fish and wildlife, recreation, and a variety of other forest uses. Maintenance of this land base as productive and sustainable forests is essential to maintaining and enhancing the overall asset value of these lands.

Forest Products

The timber stands on the northwest Oregon state forests are an asset to the state, counties, local taxing districts, and to the Common School Fund. The total value of standing timber on lands in the planning area is currently estimated at over $5 billion (Oregon Department of Forestry 2000e).

Management of the timber asset includes investment of time, dollars, and resources to realize the forest’s ability to generate sustainable timber harvest and revenue over the long term. Investments include direct expenses in young stand management activities such as precommercial thinning and fertilization; and in forest infrastructure, such as roads and bridges. There are also indirect expenses for overall planning and long-term management, such as forest inventory and GIS systems, research projects, and monitoring projects.

The timber resources are renewable and sustainable, and therefore the forest's revenue-generating potential is viewed in a long-term context.

Fish and Wildlife

The northwest Oregon state forests provide habitat for many species of native wildlife. In this role they have both direct and indirect social, cultural, and economic benefits for local communities and for the citizens of Oregon. Populations of several big game species (deer, elk, and bear) support a recreational hunting industry with significant local and regional economic benefits. To manage this asset, it is important to maintain forest conditions that provide habitats that support harvestable levels of game species.

Populations of trout, salmon, and steelhead are another key asset and support a large recreational fishing industry with significant economic and social benefits. To maintain this asset, it is critical to make investments that will maintain or restore properly functioning aquatic habitats. Investments in this area also contribute to improved availability of these same species to support commercial fishing interests offshore.

A variety of other wildlife species have value for non-consumptive uses such as wildlife viewing. As such, there is a tangible asset value in maintaining diverse habitats that contribute to sustainable population levels for these species.

Recreation

Many state forest lands are close to the state's major cities in the Willamette Valley. As "near urban" forests, they have significant tangible and intangible value as a source of recreational opportunities. In addition to the recreational value of the fish and wildlife resources, these forests support a host of other recreational activities that provide direct social and economic benefits both locally and regionally.

Off-highway vehicle (OHV) use in the Tillamook State Forest is a major recreational activity and one that produces significant revenue to local and regional businesses. Non-motorized trail use on state forest lands also supports local and regional economies, through purchase of services, supplies, and equipment related to these uses. Popular uses are horseback riding, mountain biking, and hiking.

Camping is a popular activity on the state forests, and the Tillamook State Forest has several improved campgrounds. A fee system generates revenue from these campgrounds, and supports the ongoing management.

Investments in infrastructure and opportunities for recreationists, such as the development and maintenance of interpretive centers, campgrounds, trails, trailheads, and other facilities, add to the net asset value of the forest.

Water Resources

The waters that flow from the state forest lands are another major asset to local communities. There are many major streams and rivers that originate on these lands. Several of these are water sources for municipal water systems, and many more support smaller diversions for domestic and agricultural use. Several streams supply water for fish hatchery operations. In addition, these waterways support key populations of fish species and support a diverse array of recreational opportunities, as discussed earlier.

In order to maintain the asset value of the water resources, it is key to protect and maintain high levels of water quality.

Forest Roads and Related Infrastructure

Integrated forest management to achieve the goals of this plan requires a high quality, well-maintained system of forest roads and associated infrastructure. Currently, there are approximately 3,290 miles of "active" forest roads on state forest lands in the planning area. These range from mainline access roads serving large areas for a variety of uses, to short spur roads that may only receive intermittent use for specific purposes. Related infrastructure includes 153 bridges and thousands of culverts. In aggregate, these forest roads and their related infrastructure have an estimated value of $209 million, as of January 2001. Thus, they represent a significant investment in these state forest lands that has occurred over time, and a significant asset value. Cost effective design, construction, and maintenance of forest roads is essential to protecting this investment and to achieving the array of resource values that constitute greatest permanent value.

Guidelines for Asset Management

Maintaining and/or enhancing the value of the assets described in this plan is fundamental to maintaining the ability of these forest lands to provide for sustainable timber and revenue, and to produce the other resource values described in administrative rule. The asset management guidelines below and on the next page derive from language in state law, Board of Forestry policy, and Department of Forestry policy.

Implementation of this forest management plan will be consistent with the guidelines below and on the next page, in order to assure that the asset value of these forests is maintained or enhanced through plan implementation.

- Conserve forest lands by maintaining the state forest land base.

- Maintain a land exchange and acquisition program that actively pursues acquisitions and exchanges as a means to consolidate state forest lands for management efficiencies, economic values, or enhanced stewardship practices.

- Actively manage in a sound environmental manner to provide sustainable timber harvest and revenues to the state, counties, and local taxing districts.

- Maintain a budgeting and financial management system that assures that revenues derived from these state forest lands are sufficient to cover the department's costs of implementing this plan.

- Prioritize and undertake investments in stand management activities such as precommercial thinning and fertilization that are designed to increase timber quality and/or quantity and enhance wildlife habitat values.

- Maintain key investments in development and protection of forest infrastructure, such as roads, bridges, and recreational trails and facilities.

- Maintain key investments in information systems such as forest inventory and GIS systems, in order to support overall plan implementation and to contribute to assessing the value of assets over time.

- Prioritize and undertake investments in research and monitoring projects, in order to ensure the success of adaptive forest resource management under this plan.

- Develop strategic plans for addressing identified critical forest health issues so as to minimize the effect of insect and disease on the timber asset.

- Implement marketing strategies designed to maximize the value received for products sold from state forest lands.

- Implement timber accountability strategies and systems designed to assure that the state and other beneficiaries receive anticipated revenue from the sale of timber and other products.

- Grow and harvest trees to produce timber, revenues, jobs, and habitat for native species.

Summary of Anticipated Outcomes from Implementing the Asset Management Guidelines

Tables 5-1 and 5-2, on page 5-12, show the total value of the land and timber on the northwest Oregon state forests, as of January 2001. These numbers were calculated using timber volumes from the forest inventory and estimated bare land values from recent land transactions.

In addition to generating the annual revenues, which are detailed in the implementation plans, the base asset value of the land and timber is expected to increase as a result of implementing this forest management plan.

This increase in asset value is expected to result from several factors:

- Increasing bare land values in the northwest Oregon region.
- Increasing standing timber volume and average stand value on these forests as average stand age and size increase through time. This will be accomplished through active density management (precommercial thinning and partial cutting) and investments in pruning and fertilization. Based on the decadal analysis conducted by Oregon State University, it is estimated that standing timber inventory will increase from approximately 17.4 billion board feet today, to 28.4 billion board feet when the desired future condition is achieved. This is a 63 percent increase in the timber asset value.
- Increasing value of facilities and infrastructure on these state forest lands. This includes roads, bridges, recreational facilities, trails, and other infrastructure investments.
- Increasing ability of these lands to provide direct and indirect economic benefits associated with diverse wildlife habitats, properly functioning aquatic systems, broad recreational opportunities, and high levels of water quality.
- Increasing carbon sequestration values of these forest lands over time, as the forests grow from younger to older age classes.

Implementation of the plan’s strategies is expected to result in significant revenue to the state, counties, and local taxing districts. The district implementation plans provide details on anticipated revenues by district, associated expenses, and the resulting net income expected.

Table 5-1. Value of Land and Standing Timber, by District (Board of Forestry Lands) January 2001

District	Acres	Bare Land Value	Timber Value	Infrastructure Value	Total Value
Astoria	133,960	$ 61,731,209.00	$ 1,371,860,420.00	$ 46,153,406	$1,479,745,035.00
Tillamook	243,767	$ 82,849,811.00	$ 1,584,284,053.00	$ 93,390,570	$1,760,524,434.00
Forest Grove	116,769	$ 45,387,829.00	$ 1,096,928,238.00	$ 30,916,176	$1,173,232,243.00
West Oregon	29,508	$ 13,127,207.00	$ 245,822,241.00	$ 10,588,139	$269,537,587.00
North Cascade	46,755	$ 14,677,574.00	$ 394,250,936.00	$ 18,801,990	$427,730,500.00
Western Lane	22,414	$ 9,312,991.00	$ 322,574,067.00	$ 3,318,604	$335,205,662.00
Total	**593,173**	**$ 227,086,621.00**	**$ 5,015,719,955.00**	**$203,168,885.00**	**$5,445,975,461.00**

Table 5-2. Value of Land and Standing Timber, by District (Common School Lands) January 2001

District	Acres	Bare Land Value	Timber Value	Infrastructure Value	Total Value
Astoria	2,040	$ 940,069.00	$ 10,504,448.00	$ 702,844	$12,147,361.00
Tillamook	5,035	$ 1,708,069.00	$ 42,190,319.00	$ 1,905,930	$45,804,318.00
Forest Grove	954	$ 196,011.00	$ 2,860,008.00	$ 249,324	$3,305,343.00
West Oregon	8,058	$ 3,584,705.00	$ 76,794,718.00	$ 2,899,936	$83,279,359.00
North Cascade	954	$ 299,542.00	$ 6,414,408.00	$ 383,714	$7,097,664.00
Western Lane	1,787	$ 742,063.00	$ 20,256,705.00	$ 265,202	$21,263,970.00
Total	**18,828**	**$ 7,470,459.00**	**$ 159,020,606.00**	**$6,406,950.00**	**$172,898,015.00**

Adaptive Forest Resource Management

> Adaptive policy design stresses the use of methods and concepts that are often not simple to explain, demand the explicit admission of ignorance, and place a premium on imagination rather than on precision of thinking. Anyone who is convinced that it is important to design and use adaptive policies should be prepared for an uphill battle: he implicitly places high importance on long-term objectives and will have to act as an active advocate of these objectives while trying to be dispassionate about the available scientific evidence.
>
> *C. J. Walters, 1986*

The issues surrounding forest management are ecologically, socially, and economically complex. This complexity, along with our limited understanding of forest ecosystems and the unpredictable character of many natural events, contributes to uncertainty about the outcomes of forest resource management decisions. Changing social values and goals further increase uncertainty and contribute to controversy. Adaptive resource management is presented as the conceptual and operational framework to address these issues in the context of the *Northwest Oregon State Forests Management Plan*.

Adaptive management is an approach to resource management that explicitly acknowledges uncertainty about the outcomes of implementing management policies, and deals with this uncertainty by treating management activities as opportunities for learning how to manage better. Management activities are not just modified as a result of new information. Rather, they are deliberately designed to increase understanding about the system being managed.

In other words, we don't know exactly how everything will turn out, and therefore we plan our actions so we can learn from them. We use what we learn to do better in the future.

This section describes the concepts, process, and strategies of adaptive management. This section also describes the importance of research and monitoring for obtaining information necessary for decision-making, the role of stakeholders in adaptive management, and the process for dealing with changes in policies and practices when needed.

Basic Concepts for Adaptive Management

The following key concepts provide the foundation for adaptive forest resource management as it is described in this plan:

- Adaptive management is a system of making decisions that recognizes that ecosystems and society are always changing.
- Adaptive management is not a replacement for decision-making at any level, but a system for making better decisions.
- Successful adaptive management requires a well-designed process including a strong monitoring program.
- Adaptive management requires a well-defined framework for dealing with change.

Concept 1. Adaptive management is a system of making, implementing, and evaluating decisions that recognizes that ecosystems and society are always changing. It is a systematic, rigorous approach for learning from our actions, improving management, and accommodating change (Holling 1978; Lee 1993; Nyberg 1998; Walters 1986).

In the administrative rules which govern state forest management (OAR 629-035-0000 to –0110), adaptive management is defined as a scientifically based, systematically structured approach that tests and monitors management plan assumptions, predictions, and actions, and then uses the resulting information to improve management plans or practices. It is the goal of the Department of Forestry, through the application of adaptive management techniques, to continually improve management policies and practices by learning from the outcomes of operational programs. Adaptive management requires managers and decision-makers who are willing to learn by doing, and who acknowledge that making mistakes is part of learning.

Adaptive management involves:

- Explicitly recognizing that there is uncertainty about the outcome of management activities.
- Deliberately designing management policies or plans to increase understanding about the system, and to reveal the best way of meeting objectives.
- Carefully implementing the policy or plan.
- Monitoring key response indicators.
- Analyzing the outcomes, considering the objectives and predictions.
- Incorporating results into future planning decisions.

Concept 2. Adaptive management is not a replacement for decision-making at any level, but a system for making better decisions.

Adaptive management is more than simply altering objectives and practices in response to new information. It is a formal, rigorous approach to management where activities are treated as opportunities for generating information about the system being managed. With traditional approaches to management, learning is haphazard, and improvements in management are slow and incremental, often because of inadequate or inappropriate monitoring and failure to incorporate results into future planning and decision-making.

Although adaptive management has many benefits, it is not a universal remedy. It can help resolve disagreements stemming from gaps in knowledge, but it cannot resolve conflicts over values. Similarly, it can help managers respond to changes in values, but it cannot predict them. Adaptive management is a way to learn how to manage consistently within an overall vision, but it is not a process for developing that vision.

Adaptive management cannot eliminate surprise events (Hilborn 1987). Managers can deal with surprises only by expecting the unexpected, by modifying management when surprises occur, and by implementing plans that do not foreclose management options. Adaptive management does not eliminate uncertainty. It helps managers deal with it.

Adaptive management is not a replacement for research. Among other roles, research can lead to better predictions and hypotheses about the effects of management activities. Such information is particularly valuable when social, budgetary, or ecological constraints dictate that management apply a single treatment everywhere.

Finally, adaptive management does not relieve decision-makers and managers of the obligation to proceed with caution when the risk and cost of negative outcomes are high, for example, when an activity has a high probability of causing irreversible ecological damage. Adaptive management is not an excuse for continuing with harmful activities.

In summary, adaptive management is not really much more than common sense. But common sense is not always in common use (Holling 1978). Pilot projects, test modeling, and market surveys are all ways that adaptive management is used in other professions. These techniques can be extended to natural resource management, with the inclusion of environmental considerations, and the integration of systematic and rigorous assessment and planning processes.

Concept 3. Successful adaptive management requires a well-designed process, including a strong monitoring program.

There are six main elements of adaptive management (after Nyberg 1998) that will be applied as this plan is implemented.

1. Problem assessment.
2. Design experiment and monitoring plans.
3. Implement plans.
4. Monitor.
5. Evaluate outcomes.
6. Adjust activities and policies.

The framework formed by these six elements (see the figure below) is intended to encourage a thoughtful, disciplined approach to management, without constraining the creativity that is vital to dealing effectively with uncertainty and change. In practice, some of the steps will overlap, some will have to be revisited, and some may be better done in more detail than others. All of the steps are essential to adaptive management. Omission of one or more will hinder the ability to learn from management actions. In addition, to build a knowledge base, it is crucial to document the key elements of each step and communicate the results, especially for long-term projects.

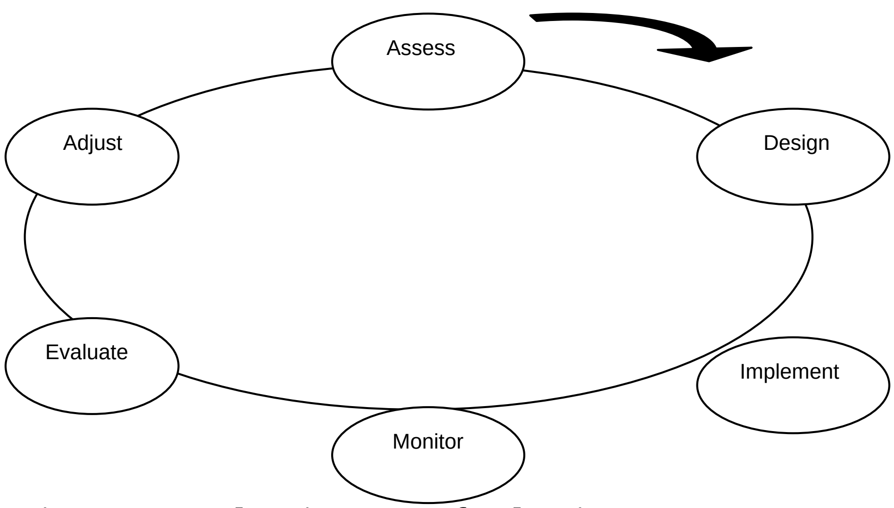


Figure 5-1. The Six Steps of Adaptive Management

These elements are discussed briefly in the following sections. Although these elements describe a framework that will be useful in a broad range of management activities, here the framework is meant to be applied to the development of management experiments to test the integrated forest management strategies in the forest management plan. Management experiments range from relatively small-scale, short-term operations on a unit, to long-term tests of silvicultural prescriptions at multi-watershed scales.

Step 1: Assessment — Define the scope of the management problem (e.g., a particular stand structure type), synthesize existing knowledge about the system, and identify potential outcomes of alternative management actions. Make predictions about outcomes, in order to assess which actions are most likely to meet management objectives.

This step sets boundaries on the spatial and temporal scales and the range of factors to be considered. Problems can be bounded effectively by defining the following parameters:

- The breadth of factors considered (e.g., timber production, biodiversity, etc.).
- The depth of detail.
- The spatial scale and resolution (e.g., stand, landscape, bioregion).
- The time scale and resolution (e.g., 20 years, one rotation, 500 years).

During this exploration and forecasting process, key gaps in understanding of the system are identified. These gaps may limit the ability to predict outcomes.

Management experiments should focus on those questions where the expected value of information is high. Once uncertainties and key questions have been identified, hypotheses can be developed to test assumptions about management actions (Underwood 1995). To make decisions, managers need to know more than simply whether a treatment results in a particular effect. Managers also need to know:

- The magnitude of a response to a management activity.
- The response over a range of conditions.
- The reason for a particular response.

Step 2: Design — Design experiments and related monitoring plans that are informative and provide reliable feedback.

The Department of Forestry intends to use a mix of active and passive approaches. In many instances a range of management actions will be compared. It may be worthwhile to evaluate several designs, one of which may be a passive design, in which only the "best" alternative is tested. In some situations, actions will be tested in a small-scale pilot project before testing them at a larger scale, in order to narrow the range of plausible actions and refine methodologies. In situations or areas where the risk of damage is high and irreversible, mangers may decide to postpone any management intervention until research and trials in less vulnerable areas provide more information.

In the design of the management experiments, it is important to select indicators that are relevant to the objectives and responsive to management actions. Indicators are measurable attributes of system behavior that allow evaluation of management options and, eventually, assessment of outcomes. Indicators should be selected so that some respond in the short term, some in the medium term, and others in the long term, and at different spatial scales (e.g., site, landscape, region) (Holling 1978; Noss 1999; Walters

1986). Careful selection of response indicators goes hand in hand with development of the monitoring protocol, which should specify the following items (see also Step 4).

- The type and amount of baseline (pre-treatment) data required.
- Frequency, timing, and duration of monitoring.
- Indicators to be monitored at each interval.
- Appropriate spatial scales for monitoring different indicators.
- Who is responsible for undertaking different aspects of monitoring.

It is important to plan how the data will be managed and analyzed (e.g., access, analysis, interpretation, storage). Managers will need to define the intensity and degree of response in an indicator that will trigger a change in management actions or objectives. Adjustments should reflect the trade-off between the costs of acting if preliminary results later prove to be incorrect, and the costs of not acting if they later prove to be correct. A system should be established to communicate results and information.

For the FMP, research will be conducted to obtain information needed to inform decisions, and will include several different approaches, as described below.

- **Replicated management experiments —** Rigorous experimental design is important for distinguishing between alternative hypotheses and characterizing cause-and-effect relationships between management activities and observed outcomes.
- **Non-replicated management experiments —** For many problems in forest management, particularly large-scale disturbances, replication is often impractical or impossible. Although managers may be able to replicate treatments at a small scale, extrapolating the results to the large scale at which many management actions occur can be uncertain.
- **Other sources of information —** Although well-designed management experiments may be the most powerful way to discriminate between alternative hypotheses, it is sometimes impossible or impractical to design experiments at an operational scale, in an operational setting. In such cases other sources of information will be used to help identify the most likely hypotheses and best policies, and interpret outcomes. Such information sources include:

  — Results from research on ecosystem processes.
  — Extrapolation of results from small-scale experiments.
  — Descriptive or observational studies.
  — Retrospective studies of past management activities.
  — Observation of natural variability, rather than deliberate manipulation.
  — Local knowledge.
  — Expert opinion.

Step 3: Implement — Implement experiments and monitoring as designed. Decide when and what type of deviations are acceptable. Ensure that these circumstances are clear and accepted by all involved. Monitor implementation, and document any deviations from the plan.

Step 4: Monitor — Measure environmental characteristics and conditions over an extended period of time, in order to determine status or trends in various aspects of environmental quality.

Monitoring is often neglected, but it is critical to adaptation and improvement. Monitoring allows assessment of how management activities actually affect indicators. This information allows managers to evaluate the effectiveness of alternative actions, adjust hypotheses, and take appropriate corrective action. Monitoring can also determine if actions were implemented as planned, and may detect surprising events.

The challenge is to clearly understand why monitoring is an important activity, to decide which characteristics to measure, to determine what information these characteristics indicate, and to use that information to make better informed management decisions.

For the FMP, monitoring is organized into three categories.

- **Implementation monitoring** is used to determine if the objectives, standards, guidelines, and management practices specified in the FMP are being accomplished. Sometimes used as a synonym, **compliance monitoring** is used to determine if specified actions or criteria are met. Implementation, or compliance, monitoring asks the question, "Are we doing what we said we would do?"
- **Effectiveness monitoring** is used to determine if the design and execution of the prescribed management practices are achieving the goals, objectives, and desired future conditions stated in the FMP. 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 conditions and the desired future conditions to describe the overall progress or success of the management activities. Effectiveness monitoring asks, "Are the management practices producing the desired results?"
- **Validation monitoring** is used to determine whether data, assumptions, and coefficients used to predict outcomes and effects in the development of the FMP are correct. Validation monitoring seeks to verify the assumed linkages between cause and effect. Validation monitoring asks, "Are the planning assumptions valid, or are there better ways to meet planning goals and objectives?"

These types of monitoring are not mutually exclusive, nor are they conducted in a linear progression. Validation and effectiveness monitoring are most powerful when used in combination.

A well-designed monitoring program is statistically credible, cost-effective, and practical.

When done in conjunction with good experimental design and appropriate data analysis, monitoring can allow managers to:

- Determine whether practices are meeting objectives.
- Improve understanding of the mechanisms that underlie ecosystem function and change (to test alternative hypotheses).
- Determine the effect of management actions on the ecosystem.
- Identify thresholds and anticipate shifts in the state of the ecosystem.

Step 5: Evaluate — Analyze data and compare actual results to the forecasts made in Step 1. The evaluation should explain why outcomes occurred and include recommendations for future action.

Predicted responses to alternative treatments and how those responses will affect future management activities should be documented when the management experiment is designed. These feedback loops will provide a framework to guide change. Outcomes can be the result of the management activity, or of some unanticipated factors, or both. Negative or unexpected outcomes can be just as informative as positive, predicted outcomes. All results must be documented and communicated.

Step 6: Adjust — Verify or update the hypotheses used to make the initial forecasts, and adjust management actions as necessary. Review the objectives, and adjust as necessary to ensure they remain consistent with overall goals and values.

It should be specified at the outset how information will be used to adjust management, in order to facilitate timely and appropriate application of new information, and also to ensure that the monitoring program answers questions relevant to management decisions.

Predetermined quantitative or qualitative changes in key indicators should trigger predetermined changes in management activities or guidelines. These trigger points should be defined for a variety of time frames, so that changes in management are not unnecessarily delayed by indicators with long response times. Preliminary data can serve as early warning signals that trigger adjustments in management to avoid irreversible detrimental changes. The size of these adjustments should reflect a balance between the reliability of the data and the potential cost of not adjusting activities.

Additional information on adjusting management activities or objectives is presented later in this chapter, under the heading “Effecting Change.” A number of methods can be used to document plans and communicate results, including written progress and final reports, presentations, seminars, field trips, informal discussions, and posters.

Finally, managers and team leaders have a critical leadership role in encouraging the conditions that facilitate adaptive management. Institutional environment and individual attitudes are as critical to effective adaptive management and learning as the actual steps followed (see Senge 1990). In an atmosphere that is conducive to long-term learning, mistakes are recognized as the price of innovation and are treated as opportunities to learn, incentives to improve are greater than the fear of failure, there is less demand for quick fixes, and people are explicitly rewarded for innovation and learning.

Concept 4. Adaptive management requires a well-defined framework for effecting change.

The *Northwest Oregon State Forests Management Plan* must be implemented using a scientifically based, systematically structured approach that tests and monitors management plan assumptions, predictions, and actions, and then uses the information to improve management plans or practices. Monitoring and research must be linked to the process through hypothesis development, information gathering, analysis, and reporting.

Technical specialists and field managers must evaluate results and make recommendations for change to the appropriate decision-makers. Proposed changes may involve minor adjustments in management practices, or they may require significant changes at policy and planning levels.

There are four planning levels at which change may be proposed, considered, and initiated: the Forest Management Plan level, the District Implementation Plan level, the Annual Operations Plan level and the Management Activity level. The Forest Management Plan level demands the broadest review and most rigid approaches before change is allowed, whereas the Management Activity level requires the least review and provides the simplest avenue to change.

The range of decisions that will be made, how they will be made, and who will make them are described in more detail in the strategies that follow.

Strategies for Implementing Adaptive Management

The following actions will be taken to ensure a strong adaptive approach for forest management in the context of the *Northwest Oregon State Forests Management Plan:*

Adaptive Management Strategy 1: Implement an adaptive management process and framework that provides for change at the appropriate planning level and in a timely manner.

The range of decisions that will be made, how they will be made, and who will make them are described in the following tables and discussed in more detail in the text that follows.

Table 5-3. Effecting Change

Forest Management Plan **(Long Term – 10 Years or More)**	**District Implementation Plans** **(Periodic – Maximum 10-Year Interval)**	**Annual Operations Plans** **(Annual)**	**Management Activities** **(As Appropriate)**
Examples of What Might Change			
FMP • Stand type percents • Arrangement	• 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 Public Involvement			
Formal • BOF meetings • OAR process • 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 • Public review & 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 & 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

(Table continued on next page)

Table 5-3 continued. Effecting Change

Forest Management Plan (Long Term – 10 Years or More)	Implementation Plans (Periodic – Maximum 10-Year Interval)	Annual Operations Plans (Annual)	Management Activities (As Appropriate)
Examples of Monitoring			
Framework Implementation • Are we doing what we said we would do? 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** 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 layered and older forest structures? • Are our silvicultural practices used to achieve forest structures sufficient to maintain a full array of forest products? • Is structure-based management helping to improve forest health on State Forests? Protocol development and implementation Data gathering and analysis Evaluation Communication		

When Department of Forestry managers and staff receive new information, they recommend changes to the appropriate official for each of the four planning levels, as shown below. This official makes the final decision. At all four levels, various sources of information can trigger change: public input, monitoring information, research information, and operational input.

Table 5-4. Decision-Makers for the Four Planning Levels

Planning Level		**Who Decides**
FMP	→	Board of Forestry/State Land Board
District Implementation Plans	→	State Forester
Annual Operations Plans	→	District Forester
Management Activities	→	Management Unit Forester

Effecting Change through Planning Processes

The plan's success will depend on timely changes in strategies, approaches, and prescriptions in accordance with new knowledge. As new information is available, it must be evaluated in the context of the guiding principles, goals, and strategies of the FMP.

As Tables 5-3 and 5-4 show, decisions on change will be made by different people or groups at different levels. For example, if research or monitoring information shows that the forest stand type percentages in Landscape Management Strategy 1 should change by a substantial amount, a fundamental change in FMP strategies, this decision would be made by the Board of Forestry and the State Forester, after a formal public involvement process.

Where the proposed change does not significantly alter the fundamental strategies, changes may be instituted by field personnel without a formal approval process. For example, field staff could make a decision to create snags by girdling trees instead of blasting out the tops.

The methods for change at each level are discussed below.

Forest Management Plan

At this level, planning is typically at broad spatial and long temporal scales, and identifies general goals and strategies. Changes made will likely apply to all the districts within the planning area.

Information, decisions, and management in the FMP encompass landscape scales, policy concepts, and social, cultural, and environmental influences that may extend beyond state forest lands. These plans make forecasts for at least 10 years, and generally for 30 to 100 years or more. These plans are reviewed periodically and, at a minimum, at least every 10 years. It will frequently take 10 years or more to develop relevant monitoring information for these long-term forecasts.

What types of changes might occur at the FMP level?
Changes could occur in the FMP's fundamental concepts and strategies. The FMP integrated forest management and landscape strategies that would require this level of evaluation address:

- Stand type percentages.
- Patch characteristics and arrangement.
- Structural habitat components.
- Aquatic and riparian conservation strategies.
- Upland management activities.

Who makes the decision to change the FMP?
The Board of Forestry/State Land Board and State Forester will weigh the scientific, operational, and public information in a formal public process to determine changes to the FMP.

What will be the basis for recommending changes?
Monitoring projects will focus on the overall implications of the management strategies and assumptions in the FMP. This work will generally be long-term and at broad landscape scales that include many specific monitoring and research projects. This information will help guide changes in the strategies, objectives, and potentially even the goals of the FMP. For example, to determine if the FMP strategy on stand type percentages is successful, it will be necessary to determine if the percentages provide for the range of native species, if the habitat components provide the habitat as expected, and if the stand types and percentages provide functional habitat for the intended species.

What are the opportunities for public involvement in FMP changes?
Many opportunities will be offered for public involvement. Formal processes will include Board of Forestry meetings, FMP administrative rule hearings, public meetings and workshops, and public input or special interest committees. Less formal opportunities will exist for volunteer involvement in actual monitoring projects and comments on periodic monitoring reports.

District Implementation Plans

Changes at this level will occur over the whole planning area, or for a district or basin, and over time frames longer than one year but no more than ten years. The district implementation plans determine how the FMP strategies will be implemented in each district. These plans include the management activities scheduled for the next ten years and estimates of the district's progress toward the FMP goals. These plans are reassessed periodically (at least every 10 years), or if some significant event occurs or information is received that would significantly change the planned activities or approaches.

What types of changes might occur at the implementation plan level?
Changes could be made to the long-term landscape design of stand types, anticipated sequence of stand treatments, the management opportunities that will be pursued over the next ten years, and other elements. Changes to the actual strategies themselves will not be made at this level.

Who makes the decision to change district implementation plans?
The State Forester will weigh the scientific, operational, and public information, when considering the approval and subsequent changes to district implementation plans.

What will be the basis for recommending changes?
Monitoring will focus on issues covered by implementation plans and issues relevant at district levels. Areas of interest will include silvicultural pathways, and approaches used to develop structural components such as snags, remnant old growth, and green trees.

The research and monitoring coordinator will organize the development of projects, interpretation of data, and proposals for change. Teams with appropriate technical and operational expertise will evaluate information and make proposals for change.

What are the opportunities for public involvement in implementation plan changes?
Many opportunities will be offered for public involvement. Formal processes may include public meetings and workshops, and technical specialist or citizen input committees. Less formal opportunities will exist for volunteer involvement in actual monitoring projects and comments on periodic monitoring reports.

Annual Operations Plans

Annual operations plans identify all major forest management activities that are proposed for the next year. This includes silvicultural prescriptions, recreation projects, road construction and maintenance, stream restoration projects, and any other major projects. Monitoring information will be gathered about the short-term effects, implementation, and contribution of these activities toward FMP goals. This information will be used to effect change from year to year, at scales ranging from site-specific to district-wide.

What types of changes might occur at the annual operations planning level?
Annual operations plans are specific action plans that describe specific projects. Silvicultural prescriptions, recreation projects, stream enhancement approaches, and other projects could be changed to improve outcomes. In the case of silvicultural prescriptions, examples might include thinning to lower densities or changing the mix of species being planted. For recreation, an example is a change in hiking or OHV trail standards.

Who makes the decision to change annual operations plans?
Each District Forester will weigh the scientific, operational, and public information through the annual operations planning process, and then make changes and approve annual operations plans. The operations planning process includes review by Department of Forestry staff and a variety of technical specialists.

What will be the basis for recommending changes?
Monitoring will focus on issues covered by annual operations plans. Areas of interest will include the assessment of silvicultural prescriptions, methods used in stream restoration projects, effectiveness of operational approaches, and techniques to develop or retain structural components such as snags, remnant old growth, and green trees.

Districts will work with the research and monitoring coordinator to develop necessary monitoring projects and interpret data from monitoring and research. The technical and operational evaluation team approach used at the FMP and implementation plan levels will be used for many issues; however, districts may choose to initiate change based upon local information that is soundly based.

What are the opportunities for public involvement in annual operations plan changes?
Annual operations plans are prepared by each district and will be made available for public comment prior to consideration for approval by District Foresters. Other opportunities may exist for volunteer involvement in actual monitoring projects and comments on periodic monitoring reports.

Management Activities

Agency personnel learn and make changes on a daily basis in the forest. In order to achieve the best possible results, it is critical to adapt practices to new information and changing conditions. Frequently, professionals on the ground can identify improved techniques that can be used immediately to achieve better results. In addition, some changes can be incorporated into an ongoing project based upon new information from monitoring and research, or from larger-scale information sources offering applicable and appropriate information.

What types of changes might occur at the management activity level?
At this level, change will generally involve adjusting specific techniques. Reasons might include learning a technique that will produce better results, or a more cost-effective way may be found to get a particular job done.

An example is the creation of snags from live trees. In this case, cutting or blasting tops out of trees may have been the preferred method, but based on research or operational concerns the decision may be made to girdle or inoculate trees instead. This decision does not affect the basic principle of developing snags, but merely changes how it is done.

Who decides to make changes at the management activity level?
Field supervisors will be responsible for weighing the scientific and operational advantages and disadvantages of changes and determining whether change is appropriate.

What will be the basis for recommending changes?
Change at the management activity level may occur without any formal process constraints.

What are the opportunities for public involvement at the management activity level?
These decisions are typical of the daily field work of natural resource professionals and are made in a tight time frame. Opportunities may exist for volunteer involvement in actual monitoring projects or in commenting on periodic monitoring reports.

Technical and Operational Adaptive Management Review Team

The research and monitoring coordinator is responsible for coordinating the development of monitoring projects, interpretation of data from monitoring and research, and development of proposals for change. Throughout the year information will be available from many sources, including Department of Forestry monitoring projects, research, operational feedback from the field, and the general public. The research and monitoring coordinator, together with Department of Forestry resource specialists and field administrators, will assess the information to determine key issues for the current year.

When the discussion topics are identified, the research and monitoring coordinator will assemble a team to evaluate the information from research, monitoring, operational input, and the public, and to make proposals for change. The expertise on the team will vary depending on the topic. Table 5-5 describes the pool from which team membership will be drawn.

Table 5-5. Adaptive Management Review Team Membership

Core Members	Pool Members
Research and Monitoring Coordinator	Field managers
Area Forest Planning Coordinator	Area resource specialists
Program Forest Planning Coordinator	Program resource specialists
	Other agency resource specialists
	Academics
	Consultants/contractors
	County representatives
	Citizen/interest group representatives

The team will provide reports to the state forests program director, interpreting the available information and making recommendations for change.

Evaluation of Technical Information

Information evaluation or data analysis may be done by the team or some other group, as deemed appropriate by the research and monitoring coordinator. For evaluation and analysis, the goal is to explain the data, its weaknesses, and strengths; identify triggers and thresholds for the data set and resource; reach conclusions; and make recommendations.

Triggers and thresholds are critical, in order to determine if change is needed. In a complex ecosystem, triggers or thresholds are rarely achieved with unequivocal certainty. The analyst will have to decide 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 these complex situations, risk assessment becomes a significant part of the adaptive process. Risk evaluation is a critical concept that links monitoring and research information to effective and efficient adaptive management decisions. In cases where the system or population is particularly sensitive or the risk is high, the thresholds for change will be lower and triggers more sensitive. Where risk to the resource is not as great, thresholds may be higher and the triggers more demanding. More data may be needed to justify a change. Assessments of risk and resource sensitivity that affect thresholds and triggers will be presented to decision-makers along with recommendations.

Even during technical analysis, situations may arise where people will not agree on the interpretation of the data. A process will be developed for issue resolution, in order to help the team clearly articulate their concerns and differences and arrive at as much of a consensus as possible before offering their conclusions and recommendations. If technical issues cannot be resolved, then the only option may be to include one set of technical information and recommendations, along with a report of the differing opinions expressed by the team.

Adaptive Management Strategy 2: Develop and implement a monitoring program designed to evaluate the working hypotheses over time. Review and update a monitoring implementation plan at least every ten years.

The Application of Monitoring

Monitoring is an important step in the adaptive management process and is, therefore, a key element in the *Northwest Oregon State Forests Management Plan*. The basic principles of monitoring as it relates to adaptive management are presented earlier in this chapter. This section describes how monitoring will be used in the adaptive management strategies of the FMP.

Oregon administrative rules for state forest management (OAR 629-035-0000 to 0110) require forest management plans to include general guidelines for “implementation, monitoring, research, and adaptive management” that describe “the approach for determining whether the strategies are meeting the goals of the Forest Management Plans; and, the process for determining the validity of the assumptions used in developing the strategies.” For this FMP, Guiding Principle 14 commits the Department of Forestry to using an adaptive management approach, with monitoring and research as part of that approach.

It will take many decades to fully implement the strategies described in Chapter 4 of this plan, and to produce the desired future condition of stand types on the landscape. Over time, monitoring and research will indicate the extent to which the assumptions underlying the strategies are correct and if the strategies are accomplishing their intended purpose. As monitoring provides feedback, the plan will be fine-tuned and improved through adaptive management (McAllister et al. 1998).

Monitoring Framework

Information from monitoring and research will be planned for and used to assess the following items:

- **Assumptions and hypotheses —** Are the basic assumptions and hypotheses that support the strategies scientifically valid? (See Chapter 4. Also compare the summary of working hypotheses in Chapter 3, page 3-18.)
- **Resource condition —** Can historic and current conditions serve as a basis for estimating desired future conditions and likely trajectories of changes in resources?
- **Ecological/cultural trends —** Are resources changing due to ecological, social, political, and economic influences outside the scope of the plan's management actions?
- **Management actions —** How are the plan's strategies being implemented?
- **Management effects —** How are the resources changing in response to management actions?

These questions serve as the basis for developing specific monitoring projects or research needs. As information becomes available from the monitoring program, as well as from researchers and others working on forest management issues, it will be evaluated to determine additional information needs and necessary changes to the management strategies.

Key Questions

The Department of Forestry will conduct implementation, effectiveness, and validation monitoring. Initially, the department will emphasize implementation and effectiveness monitoring. A more formal research effort may be necessary to evaluate the validity of the underlying assumptions of the management strategies. The Department of Forestry will help support the necessary research at selected research institutions.

Implementation and effectiveness monitoring will concentrate on a series of key questions:

- Does the FMP provide for healthy, productive, and sustainable forest ecosystems that over time and across landscapes provide a full range of social, economic, and environmental benefits to the people of Oregon?
- Does the FMP maintain and restore properly functioning aquatic and riparian habitats?

- Does the FMP protect, maintain, and enhance native wildlife habitats, recognizing that forests are dynamic and that the quantity and quality of habitats for species will change across landscapes and over time?
- Does the FMP provide sustainable timber harvest?
- Does the FMP provide for healthy forests by managing forest insects and diseases and by using appropriate genetic sources of forest tree seed and trees?
- Does the FMP maintain or enhance long-term forest soil productivity?

The monitoring program must assess not only ecological processes and management activities, but also the cultural and economic circumstances linked to them. Therefore, monitoring projects must be designed to provide information to evaluate the integration of natural and social systems.

The key questions must first be broken down into components that can be addressed by specific monitoring projects. Projects will be developed around precise, well-focused monitoring questions that focus on specific information needs. Monitoring projects will be initiated as determined by requirements of the management experiments. Identification and definition of monitoring needs will be part of the decision analysis process during the "assess" and "design" phases of adaptive management.

Reporting and Information Management

A successful monitoring program requires acting on collected information in a timely manner. However, in order to have relevant, high quality data to act on, an organized system must securely store, analyze, and report project results using the collected data.

Data storage and analysis — Because the FMP focuses on landscape issues and large-scale responses to management, primary responsibility for data storage and analysis will be at the program level. Data will be stored in a central database, in order to maintain data integrity and consistency. Data collected at the district or site-specific scale will be available in raw form for archiving and use at the district if desired. However, the general approach early in the monitoring program will be to provide analyzed information back to the districts. Data will be made easily accessible to the public, except for data that are exempt from disclosure under public records law (e.g., specific locations of threatened and endangered species).

Analysis will be done with appropriate analytical tools. Potential tools include spatial analysis, univariate and multivariate statistical analysis, trend analysis, and basic graphical analysis. Planning for analysis will occur during the project development phase rather than in reaction to the data gathered. Primary responsibility for coordinating and completing analyses will be with the adaptive management team, as already described under the heading, "Effecting Change through Planning Processes."

Reporting — Information, analysis, and recommendations for action will be presented in an annual report. Preparation of this report will be coordinated with other reporting requirements (e.g., reports to the Board of Forestry) so that a single report can satisfy more than one requirement. At a minimum the report will include the following information.

- Objectives for the monitoring program.
- Effects on the covered species and/or habitat.
- Location of sampling sites.
- Methods for data collection and variables measured.
- Frequency, timing, and duration of sampling.
- Description of the data analysis.
- Evaluation of progress toward achieving measurable biological goals and objectives.

This report will be the basis for determining the need to adapt management policies, biological or habitat goals, or monitoring activities. This report will be available to the Board of Forestry, the public, and other state and federal agencies. The state forests management monitoring program will also provide an annual oral report and update to the Board of Forestry. Special project reports that stand alone may also be available, and monitoring program updates and project descriptions will be available on the Department of Forestry's web site. As the monitoring program develops, reporting mechanisms will be refined and improved.

Coordination

In light of increased monitoring occurring within state, federal, and non-governmental organizations in the Pacific Northwest, coordinated efforts are critical to the success of the plan. Coordination with regional monitoring programs (such as the federal *Northwest Forest Plan* and the *Oregon Plan for Salmon and Watersheds*) will help ensure the most efficient application of financial and human resources. Cooperation and exchange of information among programs will allow for a more extensive exploration of the effects of the landscape management objectives, and also for the generation of recommendations for adapting management or monitoring activities. Other forms of coordination include participation in multi-agency monitoring committees; contact, planning, and coordination with watershed councils; review, application, or modification of existing protocols; joint development of protocols with landowners, stakeholders, and other agencies; and data sharing.

Current Monitoring

Although the state forests management program has not had a formal monitoring program, conditions on state forest lands have been monitored for many years. Resource specialists, such as the insect and disease program staff and the wildlife biologists, have conducted aggressive monitoring and research projects to stay abreast of issues such as Swiss needle cast incidence and severity, and habitat protection and use for northern spotted owls and marbled murrelets. The state forests management program cooperates with the Oregon Department of Forestry's forest practices monitoring program, Oregon

Department of Fish and Wildlife, Oregon State University, federal agencies, and private landowners. The state forests management program will use these contacts and data sources to help establish a formally structured monitoring program. In the future, monitoring projects, data analysis, and storage needs will be included in area and district implementation plans and in an annual program-wide monitoring report.

Adaptive Management Strategy 3: Conduct a comprehensive review of the goals and strategies of this FMP every ten years following adoption.

At the completion of the initial ten-year implementation period, and every ten years thereafter, the Oregon Department of Forestry will compile a ten-year Implementation and Monitoring Report, that summarizes the management activities that have occurred over the period, the results of monitoring and research efforts during that time, and any proposed changes to the FMP strategies to better meet the goals. In preparing this report, the department will collaborate with other agencies as necessary to obtain the best available information, and will support any major modifications proposed with information from independent scientific review. Examples of the types of issues that will be considered during the comprehensive review process:

- The overall effectiveness of the strategies in moving towards the desired future condition of stand types and a functional arrangement of those stands.
- What we have learned about species responses to specific activities and to the stand structures and the implications of this information to the FMP.
- The status of developing habitat and the extent to which species are colonizing and using that habitat.
- The ability of ODF to meet the range of resource goals described in the FMP.

Outcomes or recommended changes that evolve out of the ten-year comprehensive review will be implemented using the appropriate process, dependent on the significance of the change.

Adaptive Management Strategy 4: Conduct a comprehensive review of the landscape management strategies when 30% in aggregate of LYR and OFS stand types is achieved on lands in the planning area.

This review will be conducted as part of a ten-year comprehensive review (described above). This review will be constructed to reevaluate the desired future condition stand type array described in Landscape Management Strategy 1 and determine whether the best available scientific information supports continuing to pursue that DFC, or if it supports some other desired future condition.

Public Involvement in Implementation

The Oregon Department of Forestry is committed to public participation in land management decisions (OAR 629-035-0080 and Guiding Principle 9). The guidelines in the *Draft Public Involvement Guidance* (Oregon Department of Forestry 2000f) describe the department's public involvement policies and procedures. Public participation in the development of forest management plans and this FMP was discussed in Chapters 1 and 2. Public input is also important in developing recreation plans.

The result of an effective public involvement program will be decisions that are made with a full understanding of public concerns and that are, in turn, better understood and trusted by the people affected. Although public participation is not by itself sufficient to ensure public acceptance of decisions, it is a necessary component.

Early and Continuous Involvement

The benefits of public involvement cannot be achieved by means of a simple public notice and comment period once plans or projects are completed. The Department of Forestry prefers to involve the public early, so that concerns can be addressed as part of the planning process, rather than after the fact in a review or mediation. Early public participation is particularly important in the case of large-scale, complex projects or plans such as this FMP.

Appropriate Scale and Flexibility

The public involvement program should be appropriate for the scale and complexity of the project. A long-term, extensive public participation program is required for large-scale, complex projects that call for comprehensive evaluations.

Public involvement must be a flexible process, adapting to different sets of environmental issues and public concerns. The Department of Forestry will design and implement public involvement programs that match the needs of the project, and that reflect the needs and preferences of people involved. Since public involvement is a dynamic process, the department may need to revise public participation plans when necessary.

Accountability and Timeliness

Participants in a public involvement process must be accountable for their actions. The Department of Forestry will ensure that the participation process is directly linked to the decision-making process. Participants should report back to their constituents in a fair and accurate manner, and follow through on any negotiated commitments. The department must ensure that members of the public have adequate time in which to review information and provide meaningful input (Oregon Department of Forestry 2000f). Stakeholders and other people involved should recognize that the decision-makers remain accountable for making the decision. Decision-makers should explain their decision, clearly demonstrating how the public's input has been used, or explaining why the results have not been incorporated in the decision.

Shared Process and Mutual Respect

Public involvement programs will often bring together people representing a wide range of perspectives, opinions, and values. The process should be conducted in an atmosphere of mutual respect.

Public Involvement Techniques

Techniques should match needs. There is no single best public involvement technique. There are many techniques, and each may be effective in a particular set of circumstances or in response to the preferences of a particular public group. Specific techniques are presented in the *Draft Public Involvement Guidance* (Oregon Department of Forestry 2000f).

Public Involvement in District Implementation Plans and Annual Operations Plans

Public involvement can provide local forest managers with additional information and ideas as they develop implementation plans and annual operations plans to achieve the goals of this forest management plan. Ongoing public involvement during implementation of this plan is also critical to gaining public understanding, acceptance and support for local plans and operations.

Public involvement opportunities will be provided as district implementation plans, land management classifications, and annual operations plans are reviewed and approved. These opportunities will be designed to meet the goals provided in OAR 629-035-0080 and Guiding Principle 9 (Chapter 3):

- To seek insight, opinion and data on planned management actions.
- To build understanding, acceptance and support for the forest management planning process and decisions.
- To offer information to the public about forest systems and forest stewardship.

- To provide the public with meaningful opportunities to comment and affect planning decisions at a time when public involvement can contribute positively to the planning decisions under consideration.

District Foresters will be responsible for developing and implementing public involvement opportunities that will meet these objectives. At a minimum, the following opportunities will be provided:

District Implementation Plans — Prior to submitting initial implementation plans and the associated land management classification maps to the State Forester for approval, there will be a ninety-day public comment period in order to gather public input. All public comments submitted in writing will be forwarded to the State Forester, along with each District Forester's recommended implementation plan and land management classifications.

The State Forester shall approve, modify, or deny the recommended implementation plans. If the State Forester modifies a recommended plan, the modifications will be incorporated into the original plan and appropriate revisions made to land management classifications. If the State Forester denies the recommended plan, the District Forester shall prepare a revised or new implementation plan and/or revised or new land management classifications as appropriate.

Prior to submitting a revised or new implementation plan, and/or revised or new land management classifications, after a previous denial, there will be a thirty-day public comment period to gather public input. All public comments submitted in writing will be forwarded to the State Forester, along with the revised or new implementation plan. The State Forester shall approve, modify, or deny this plan. The process described in this paragraph will be followed until approval of an implementation plan is obtained.

Annual Operations Plans — The District Forester must consider any written comments from resource specialists and the public before approving or denying approval of an operations plan.

Appendix A
Glossary

The following references were used in developing the glossary.

Oregon Department of Forestry. 1993. Elliott State Forest Draft Management Plan. Oregon Department of Forestry, Salem, OR. December 1993.

Oregon Department of Forestry. 1995. Eastern Region Long-Range Forest Management Plan. Oregon Department of Forestry, Salem, OR. May 1995.

USDA Forest Service, et al. 1994. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. Also known as the Clinton Forest Plan or the Final SEIS. USDA Forest Service, Pacific Northwest Region, Portland, OR. February 1994.

Acknowledgment	Approval by the Land Conservation and Development Commission (LCDC) of a city or county's comprehensive plan; acknowledgment of compliance with the Statewide Planning Goals.
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.
Activity center	A nest site or primary roost area for northern spotted owls.
Adaptive management	An approach to resource assessment and management that explicitly acknowledges uncertainty about the outcomes of management policies, and deals with this uncertainty by treating management activities as opportunities for learning how to manage better. Adaptive management is a system of making, implementing, and evaluating decisions, which recognizes that ecosystems and society are always changing. It is a systematic, rigorous approach for learning from our actions, improving management, and accommodating change.
Aggregate	Sand and pebbles added to cement to make concrete, or used in road construction.
Alluvial	Describes soil, debris, and other materials that have been deposited by currents of water.
Ambient	Surrounding.
Anadromous fish	Those species of fish that mature in the ocean and migrate into freshwater rivers and streams to spawn; an example is salmon.
Anchor habitat	An existing key habitat area for a specific species; these blocks of habitat are left in place on the landscape as "anchors." An example is an aquatic anchor or terrestrial anchor.
Andesites	A type of volcanic rock; its composition is intermediate between basalt and rhyolite. The most common rock in the Cascades.
Annosum	A root disease in trees, caused by *Heterobasidion annosum*.
Aquatic	In or on the water; aquatic habitats are in streams or other bodies of water, as contrasted to riparian habitats, which are near water.
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	Those districts, sites, buildings, structures, and artifacts which 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. (ORS 358.905)
Armillaria ostoyae	A fungus that infects many tree species, causing armillaria root disease.
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.
Basal area	The area of the cross-section of a tree stem near the base, generally at breast height (4.5 feet above the ground) and including the bark. The basal area per acre is the total basal area of all trees on that acre.
Best Management Practices	Oregon Forest Practices Act rules adopted by the Board of Forestry to minimize the impact of forest operations on water quality. These rules ensure that, to the maximum extent practicable, forest operations meet the water quality standards established by the Environmental Quality Commission. The rules focus on reducing nonpoint source discharges of pollutants resulting from forest operations.
Biodiversity	Society of American Foresters defines biodiversity as “the variety and abundance of species, their genetic composition, and the communities, ecosystems, and landscapes in which they occur.” Gast et al. 1991 characterizes biodiversity operationally as: “... the variety, function, distribution, and structure of ecosystems and their components, including all successional stages, arranged in space over time that support self-sustaining populations of all natural and desirable naturalized flora and fauna.”
BMPs	See “Best Management Practices.”
Board foot	The amount of wood equivalent to a piece of wood one foot wide by one foot high, by one inch thick.
BOFL	Board of Forestry Lands.

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 is dominated by ground mosses, especially sphagnum. Bogs are distinguished from other wetlands by the dominance of mosses and the presence of extensive peat deposits.
Breccias	Aggregates composed of angular fragments of the same rock, or of different rocks united by a matrix.
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)
Certification	Approval by LCDC of a state agency program found to be consistent with the Statewide Planning Goals.
Channel migration zone (CMZ)	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.
Class I areas	National park lands and some wilderness areas are designated as federal mandatory Class I areas under the Clean Air Act.
Class I-III	The Clean Air Act divides clean air into three classes; Class I allows for minimal degradation of air quality, while Class III allows a relatively greater degree of degradation.
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 act is implemented, in part, through a permit system.
Closed single canopy (CSC)	This stand type occurs when new trees, shrubs, and herbs no longer appear in the stand, and some existing ones begin to die from shading and competition, in a process called stem exclusion.
CMZ	See “channel migration zone.”
Colluvial	Describes soil, debris, and other materials that have been moved downslope by gravity and biological activity.
Common School Forest Lands	Common School trust lands that have been listed by the State Land Board for the primary use of timber production. See “Common School trust lands.”
Common School	State lands owned by the State Land Board; the primary goal in managing these lands is the generation of the greatest amount of

trust lands income for the Common School Fund over the long-term, consistent with sound techniques of land management. Common School trust lands that have been listed by the State Land Board for the primary use of timber production are called Common School Forest Lands. Other Common School trust lands are designated as rangelands or for other uses.

Composition The different species of plants and animals that live in an ecosystem.

Corridor Areas of habitat that connect separate but similar habitat patches, within the landscape mosaic. For example, an area of mature timber may connect larger patches of mature timber.

CSC See “closed single canopy.”

CSFL See “Common School Forest Lands.”

Debris slide Rapid landslide occurring on a slope. The material moved may include soil, wood, and vegetation. The slide may or may not reach a stream channel. See also “landslide.”

Department of Land Conservation and Development (DLCD) State agency that administers Oregon’s statewide planning program and provides professional support to the LCDC.

DEQ Oregon Department of Environmental Quality.

Desired future condition (DFC) An explicit description of the physical and biological characteristics of the northwest Oregon state forests in the future, as described in the forest vision.

DFC See “desired future condition.”

Dispersion The spreading or scattering of smoke.

Disturbance A force that causes significant change in an ecosystem’s structure and/or composition; can be caused by natural events or human activities.

Drainage basin The large watersheds of major rivers. The Oregon Water Resources Department and the Oregon Department of Environmental Quality have delineated 18 major drainage basins in Oregon.

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.”

EPA Environmental Protection Agency. This federal agency administers the Clean Air Act, among other responsibilities.

ESU	See "evolutionarily significant unit."
Evolutionarily Significant Unit (ESU)	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. (NMFS 1991). This term is used by the National Marine Fisheries Service as guidance for determining what constitutes a "distinct population segment" for the purposes of listing Pacific salmon species under the Endangered Species Act. 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.
Fragmentation	The relationship of the landscape matrix to other types of patches; as fragmentation increases, the matrix becomes smaller and geometrically more complex. Maximum landscape fragmentation occurs when no dominant patch exists. Also defined as the spatial arrangement of successional stages across the landscape as the result of disturbance; often used to refer specifically to the process of reducing the size and connectivity of late successional or old growth forests.
Function	Activity or process that goes on in an ecosystem; some typical functions are plant growth, animal reproduction, decay of dead plants.
Geographic information system (GIS)	A computer system that stores and manipulates spatial data, and can produce a variety of maps and analyses.
Geotechnical	The study of soil stability in relation to engineering.
Geothermal	Of or relating to the internal heat of the earth.
GIS	See "geographic information system."
Goals	In Oregon Department of Forestry forest management plans, goals are general, non-quantifiable statements of direction.
Grave	See "Burial."
Groundwater	The subsurface water supply in the saturated zone below the water table.
Guiding principles	The overall rules, goals, and responsibilities that guide the planning process for the northwest Oregon state forests.
Headwall	The steep slope or rocky cliffs at the head of a valley.
Heterobasidion annosum	The fungus that causes annosum root disease.

Historic artifacts	Three-dimensional objects including furnishings, art objects and items of personal property which have historic significance. "Historic artifacts" does 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.
Human remains	The physical remains of a human body, including, but not limited to, bones, teeth, hair, ashes or mummified or otherwise preserved soft tissues of an individual. (ORS 358.905)
Hydrocarbon	Any compound containing only hydrogen and carbon, such as natural gas.
Hydrological maturity	The degree to which hydrologic processes (e.g., interception, evapotranspiration, snow accumulation, snowmelt, infiltration, runoff) and outputs (e.g., water yield and peak discharge) in a particular forest stand approach those expected in an older forest stand under the same climatic and site conditions. In this document, for rain-on-snow runoff, a well-stocked conifer stand is defined as hydrologically mature when it is at least 25 years old.
Hydrology	Study of the properties, distribution, and effects of water on the landscape, under the surface, in the rocks, and in the atmosphere.
IHA	See "interior habitat area."
Indian tribe	Any tribe of Indians recognized by the Secretary of the Interior or listed in the Klamath Termination Act, 25 U.S.C. 3564 et seq., or listed in the Western Oregon Indian Termination Act, 25 U.S.C. 3691 et seq., if the traditional cultural area of the tribe includes Oregon lands (ORS 97.740).
Induced landscape diversity	Aspects of the landscape that change as a result of disturbances such as fire, windstorms, human activities, and animals; for example, the successional stages of vegetation that occur after a wildfire.
Inherent landscape diversity	Aspects of the landscape that are relatively permanent (changing only slowly over long periods of time) in any particular landscape, but that vary among landscapes. Examples are climate, soils, topography, and aspect (such as south-facing aspect).
Inner gorge	An area next to a stream or river where the adjacent slope is significantly steeper than the gradient of the surrounding hillsides. In the absence of an on-site inspection and determination by a Department of Forestry geotechnical

	specialist or other qualified person, these areas are defined as having a slope gradient adjacent to the stream of 70 percent (35 degrees) or greater, and where the height of the slope break is at least 15 feet (measured vertically) above the elevation of the channel.
Interior habitat area	That portion of the older forest patch that remains effective when the negative effects of high contrast edge are removed.
Land Conservation and Development Commission (LCDC)	A seven-person commission that sets the standards for Oregon's statewide planning program. Members are volunteers appointed by the Governor and confirmed by the State Senate.
Land Use Board of Appeals (LUBA)	Established in 1979 essentially as a state court that rules on matters involving land use. Appeals from LUBA go to the State Court of Appeals and finally to the Supreme Court.
Landscape	An area of land containing a mosaic of habitat patches, often within which a particular "target" habitat patch is embedded. Also defined as a unit of land with separate plant communities or ecosystems forming ecological units with distinguishable structure, function, geomorphology, and disturbance regimes.
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.).
Layered (LYR)	This stand type occurs as the process of understory reinitiation progresses where openings in the canopy persist. Shrub and herb communities are more diverse and vigorous, and two or more distinct layers of tree canopy appear.
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.
LYR	See "layered."

Management basin	An area used for forest planning. Management basins range from 5,000 to 8,000 acres. Their boundaries are based primarily on drainage and topographic patterns within the major drainage basins and watersheds, with some adjustments to follow roads or obvious topographic features.
Matrix	The dominant landscape element in which patches are embedded.
MBF	Thousand board feet.
MMBF	Million board feet.
Monitoring	The measurement of environmental characteristics and conditions over an extended period of time, in order 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?"
NAAQS (National Ambient Air Quality Standards)	Under the federal Clean Air Act, the Environmental Protection Agency was responsible for setting air quality standards. They developed NAAQS, which establish the maximum concentration for various pollutants that may be present in the ambient (surrounding) air. Standards are measured on short-term (3, 8, or 24 hours) or annual basis.
National Environmental Policy Act	Commonly known as NEPA; became law in 1969. NEPA is the basic national charter for the protection of the environment. The Act 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.
Neotropical migrant birds	Birds that migrate annually to the biogeographic realm that includes South America, the Indies, Central America, and tropical Mexico.
NEPA	See "National Environmental Policy Act."

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*; may be resident or anadromous; examples are Pacific lamprey and sculpins.
Northwest Oregon state forests	Includes all state forest lands within the planning area.
Northwestern Oregon	In this document, the term "northwestern Oregon" is used to describe the planning area, as shown on the vicinity map.
OFS	See "older forest structure."
OHV	Off-highway vehicle.
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**.)
Older forest structure (OFS)	This stand type occurs when forest stands attain structural characteristics such as numerous large trees, multi-layered canopy, substantial number of large, down logs, and large snags. It is not the same as old growth, although some of its structures are similar to old growth.
OSCUR	This acronym refers to the Department of Forestry's current computerized forest inventory system. The acronym's letters stand for Ownership, Site, Cover, Use, and Recommendations. It includes 1:12,000 scale maps and overlays, data files by type and various sorts, and data summaries. OSCUR was developed by the Department of Forestry.
Owl circle	Area defined for the purpose of identifying the home range of a spotted owl pair or resident single owl; 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 U.S. Fish and Wildlife Service (later rescinded) required protecting 70 acres of owl habitat immediately around an owl activity center, 500 acres within 0.7 miles, and 1,906 acres within 1.5 miles.

Particulate	Small particles that are in smoke produced by burning wood and other forest debris. Two kinds of particulate are controlled under federal and/or state requirements: TSP and PM-10.
Patch	The landscape patch is an environmental unit between which "quality" differs, such as a habitat patch.
Phellinus weirii	A fungus that infects some species of trees, causing laminated root rot.
PM-10	Particles smaller than 10 microns in diameter, present in wood smoke.
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.
Pollutant	Any substance of such character and in such quantities that when it reaches a body of water (or the air or the soil), it degrades the resource by impairing its usefulness (including its ability to support living organisms).
Population	The organisms that make up a particular group of a species, or that live in a particular habitat or area. For fish: "A group of fish spawning in a particular area at a particular time which 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." [Oregon Administrative Rule, Division 7, 635-07-501(38)]. For example, "Nehalem River fall chinook salmon" are a population.
Prescribed burning	Controlled fire burning under specified conditions in order to accomplish planned objectives; also called slash burning, as a frequent objective is to reduce the amount of slash left after logging.
Recognized Indian tribe	A tribe of Indians with federally acknowledged treaty or statutory rights.
Recreation Opportunity Spectrum (ROS)	A framework for understanding and defining various settings of recreation environments, activities, and experiences. The settings are defined in terms of the opportunities to have different sorts of experiences, and range from primitive to urban. They are defined by setting indicators such as access, naturalness, facilities, and social encounters.
REG	See "regeneration."
Regeneration (REG)	This stand type occurs 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.

Resident fish	Fish species that complete their entire life cycle in freshwater; non-anadromous fish; an example is a resident population of cutthroat trout.
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 (RMA)	A protected area with site-specific boundaries established by the Department of Forestry; 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 the riparian area. Aquatic resources include water quality, water temperature, fish, stream structure, and other resources.
RMA	See "riparian management area."
Rock block slide	Type of landslide in which the weakness and initial breaking is in the underlying rock, not the soil. See also "landslide."
ROS	See "Recreation Opportunity Spectrum."
Sacred object	An archaeological object that is demonstrably revered by any ethnic group, religious group or Indian tribe as holy; is used in connection with the religious or spiritual service or worship of a deity or spirit power; or was or is needed by traditional native Indian religious leaders for the practice of traditional native Indian religion. (ORS 358.905)
Salmonid	Fish species belonging to the family *Salmonidae*; includes trout, salmon, and whitefish species.
SBM	See "structure-based management."
Seral stages	Developmental stages that succeed each other as an ecosystem changes over time; specifically, the stages of ecological succession as a forest develops.
SHPO	See "State Historic Preservation Office."
SIP	State Implementation Plan. This plan implements the Clean Air Act and contains general provisions for protecting air quality in all areas of the state.

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 biotic or geological remains or deposits. (ORS 358.905) See specific types of sites on next page, as defined in Oregon law. **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 below and/or above-ground diminishing remains. **Historic site** — Created and/or used by humans since the time of Euro-American inhabitance; usually above-ground structural 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)
Site class	Site class is a measure of an area's relative capacity for producing timber or other vegetation. It is measured through the site index. The site index is expressed as the height of the tallest trees in a stand at an index age (King 1966). In this document, an age of 50 years is used. The 5 site classes are defined below. Site class I — 135 feet and up Site class II — 115-134 feet Site class III — 95-114 feet Site class IV — 75-94 feet Site class V — Below 75 feet
Slope stability	The degree to which a slope resists the downward pull of gravity. The more resistant, the more stable.
Slump	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."
Source/sink relationships	"Source patches" are more productive areas in the landscape, which supply emigrants to less productive patches, termed

	"sinks."
Species	"…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 Endangered Species Act]
Species of Concern	Fish and wildlife species that have been identified as being at risk due to declining populations or other factors (e.g., having a limited range)
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 Historic Preservation Office	Oregon's SHPO 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.
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.
Stock	"For the purposes of fisheries management, a stock is an aggregation of fish populations which typically share common characteristics such as life histories, migration patterns, or habitats." [Oregon Administrative Rule, 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	In Oregon Department of Forestry forest management plans, strategies are specific actions that will be taken to achieve the management goals. (See also "goal.")
Stream	A 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 since 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 classification	Under the Department of Forestry'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. **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 we can see and touch; typical structures in a forest are tree sizes, standing dead trees (snags), fallen dead trees.
Structure-based management	A silvicultural approach that produces and maintains an array of forest stand structures across the landscape. The existing forest is gradually moved toward a desired range of stand structures through active management, using sound silvicultural practices.
Succession	A series of changes by which one group of organisms succeeds another group; a series of developmental stages in a plant community.

Threatened and endangered species

Federal and state agencies make formal classifications of wildlife species, according to standards set by federal and state Endangered Species Acts. The various classifications are defined below. Federal designations are made by the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (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 species 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 Oregon Department of Fish and Wildlife, 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.

Tillamook decline

A condition that has been observed in many Douglas-fir plantations in coastal northwest Oregon. Only Douglas-fir is affected; tree symptoms include chlorosis (yellowing), needle loss, and reduced growth (both height and diameter).

TMDLs Total maximum daily loads; one measure of water quality.

TSP Total suspended particulate in smoke; one measure of air quality.

UDS See “understory.”

Understory (UDS) This stand type occurs after the stem exclusion process has created small openings in the canopy, when enough light and nutrients become available to allow herbs, shrubs, and new trees to grow again in the understory.

Unrecognized Indian tribe A tribe of Indians that has never been recognized by the federal government, or whose federal relations were terminated by the Klamath Termination Act or the Western Oregon Indian Termination Act.

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.

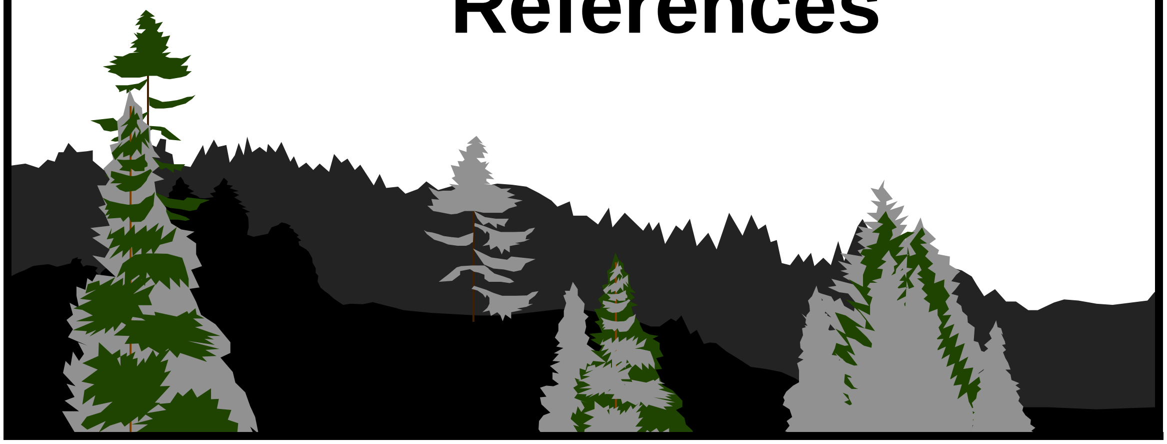
Watershed In general, a watershed is defined as an area within which all water that falls as rain or snow drains to the same stream or river. There are different levels of watersheds, from the watershed of a small stream to the watershed of the Willamette River. In this document, the large watersheds of major rivers are called “drainage basins.”. The term “watershed” is used to describe the drainages of mid-sized rivers, such as the Nehalem, Siuslaw, and North Santiam.

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.” The process to determine the presence of wetlands will be consistent with the method described in the 1989 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (USDI Fish and Wildlife Service et al. 1989). Common examples are marshes, swamps, and bogs, although these are not the only types of wetlands.

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

The references begin on the next page.

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Appendix C
Concepts for the Integrated Strategies

Chapter 4 presented the strategies, and some background on the concepts behind those strategies. This appendix provides more detailed information on these concepts.

The main headings in Appendix C are listed below. Important connections between these headings and Chapter 4 are summarized briefly below the headings.

Stand Type Definitions

Pacific Northwest forests follow a typical progression of stand structures over time, after a major stand-replacement disturbance. Forest stands develop along continuums. The stand type definitions given here represent snapshots of stand conditions taken along the various continuums.

Because the definitions describe points along continuums, it will not always be apparent how a particular stand should be classified. The numerical guidelines given in this section can help the field manager to classify stands. In cases where stands do not quite match the numerical guidelines, the stand should be classified as the type indicated by the majority of factors. Some tips are given here for the stands most likely to be confusing.

The stand types are defined briefly in the sidebar on the next page. In the following pages, a detailed description and computer-modeled example are given for each type.

Each of the stand descriptions on the next few pages has four parts: a description of the stand characteristics, an explanation of the stand development process that occurs in that stand type, classification guidelines, and management concepts for that type. The terms for both stand types and development processes are used throughout the FMP. The stand type names are used when the discussion refers to stand condition. The process names are used when the discussion refers to stand development process. The table on the next page shows the relationship of stand types and stand development processes.

Five stand types are described. The stand types apply to conifer, hardwood, and mixed stands. It is anticipated that the landscape will consist primarily of conifer stands with some hardwood component.

This section ends with a brief discussion of old growth and hardwoods.

Stand Type Definitions

Structure-based management (SBM) classifies the many diverse forest stand structures into five basic types.

Regeneration (REG) — This stand type occurs 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.

Closed single canopy (CSC) — This stand type occurs when new trees, shrubs, and herbs no longer appear in the stand, and some existing ones begin to die from shading and competition, in a process called stem exclusion.

Understory (UDS) — This stand type occurs after the stem exclusion process has created small openings in the canopy, when enough light and nutrients become available to allow herbs, shrubs, and new trees to grow again in the understory.

Layered (LYR) — This stand type occurs as the process of understory reinitiation progresses where openings in the canopy persist. Shrub and herb communities are more diverse and vigorous, and two or more distinct layers of tree canopy appear.

Older forest structure (OFS) — This stand type occurs when forest stands attain structural characteristics such as numerous large trees, multi-layered canopy, substantial number of large, down logs, and large snags. It is not the same as old growth, although some of its structures are similar to old growth.

Table C-1. Relationships between Stand Type Definitions and Stand Development Processes

Stand Type		Stand Development Process
Regeneration (REG)	—	Stand Initiation (SI)
Closed Single Canopy (CSC)	—	Stem Exclusion (SE)
Understory (UDS) Layered (LYR) Older Forest Structure (OFS)	}	Understory Reinitiation (UR)

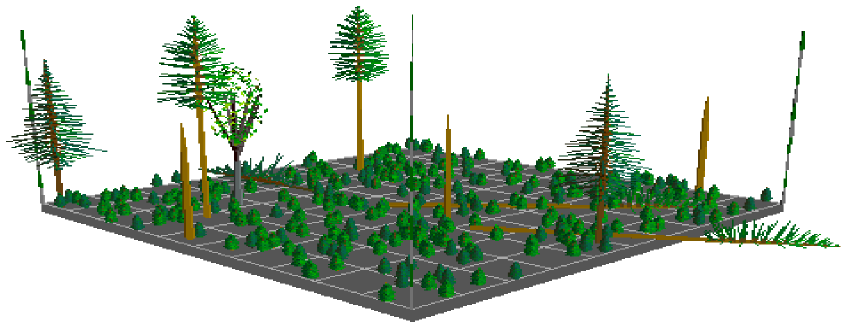


Figure C-1. Stand Type 1 — Regeneration (REG)
(Shrubs and Herbs Not Displayed)
Stand Development Process — Stand Initiation (SI)

Stand Characteristics

The site is occupied primarily by tree seedlings or saplings, and herbs or shrubs. The trees can be conifers or hardwoods. Competition among the trees and other vegetation is not yet resulting in widespread loss of herb or shrub layers. The herbs and/or shrubs are widespread and vigorous. This type includes first year regenerated stands, and continues to the stage when the trees approach crown closure. At that point, the increasing crown closure shades the ground, and causes a significant loss of vigor or death of understory vegetation.

Stand Initiation Process

This 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 undesirable vegetation is cleared for planting. Varying levels of herbs, shrubs, or advanced tree regeneration may remain from the previous stand, as well as such stand components as snags, live green trees, and down wood. New plants (trees, shrubs, and herbs) begin growing from seed, sprouts, artificial regeneration, or other means in the early years of this stage. In the later years of this stage, trees begin shading out the other stand components.

Classification Guidelines for Regeneration Stands

Numerical guidelines	Herbs, shrubs, and grasses cover 20 to 80 percent of the ground.
Examples	In most cases, these stands will be stocked predominantly with Douglas-fir, western hemlock, or other conifers. Many of these stands will have 200-400 trees per acre and will range from 1-15 years old. These numbers are not requirements, but descriptions of what to expect.
Classification tips	Regeneration stands that are precommercially thinned and/or pruned should be classified as regeneration stands until either the shrub and herb layer diminishes to the point that the stand is closed single canopy or until the average stand diameter reaches 6-10 inches and adequate understory exists to meet the definition of an “understory” stand.

Management Concepts for Regeneration Stands

- Snags, down wood, and residual live green trees will be carried over or recruited from the previous stand.
- Deciduous trees and fruit-bearing shrubs and trees are desirable components.

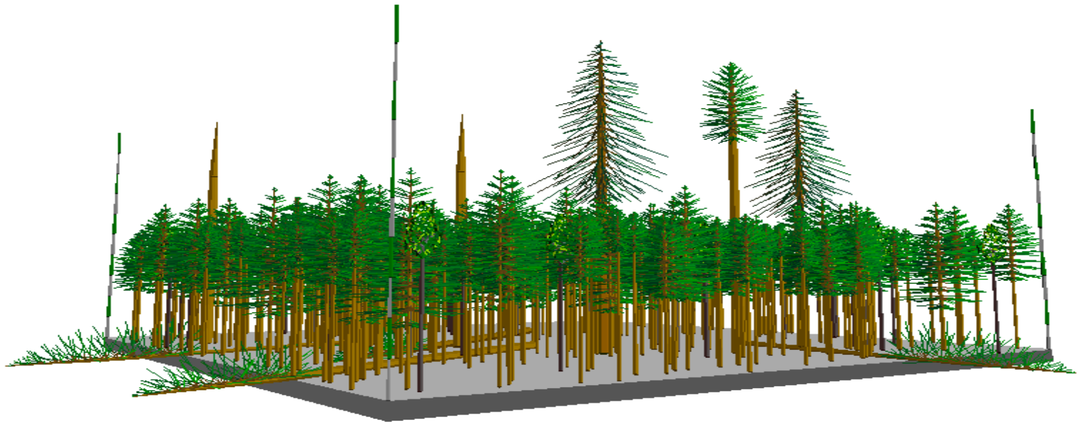


Figure C-2. Stand Type 2 — Closed Single Canopy (CSC)
Stand Development Process — Stem Exclusion (SE)

Stand Characteristics

Trees fully occupy the site and form a single, main canopy layer. There is little or no understory development. Where understory vegetation exists, there is low shrub and herb diversity. The shrub and herb layers may be completely absent or may be short and dominated by one or two shade-tolerant species, such as sword fern, Oregon grape, oxalis, or salal.

Stem Exclusion Process

As the trees established in the regeneration stage grow larger in height, crown size, and root development, they eventually begin to compete significantly for moisture, light, and nutrients. The stem exclusion process begins when new trees, shrubs, and herbs no longer appear and existing ones begin to die, due to shading and other competitive factors. The shrubs and herbs begin to die out of the understory first, and later in the stage, may essentially die out of the stand altogether. The trees begin to show decreasing limb sizes, diameter growth rate, and crown length. Later, less competitive trees die. If root diseases are present they cause additional trees to die. As some trees die, snags and coarse down wood begin to appear in the stand. The surviving trees grow larger and have more variation in height and diameter. Near the end of the stage, enough trees have died and the living trees have enough variation that small gaps form and understory trees, shrubs, and herbs begin to reappear.

Classification Guidelines for Closed Single Canopy Stands

Numerical guidelines	A variety of herbs, shrubs, and grasses usually cover less than 30 percent of the ground, or only one or two shade-tolerant species cover most of the ground.
Examples	Stands in this category include: (listed on next page)

1. Unthinned stands where competition has virtually eliminated or prevented significant herb or shrub development. Any understory trees provide minimal layering and are not vigorous.

   A range of stand types exists in this category. One example is a sapling stand where the trees have recently attained crown closure. In this stand the lack of light and possibly lack of nutrients cause the shrub and herb layers to lose their vigor and in many cases die. In this relatively early stage of CSC the trees are just beginning to significantly compete with each other for light and nutrients. Loss of vigor or death of some individual trees may be evident. However, most of the trees in the stand have not yet lost much of their crowns and they are growing rapidly. Live crown ratios would likely be in excess of 70 percent. If silvicultural thinning or significant natural disturbance does not occur, the stem exclusion process will guide the further development of this stand for some time.

   A second example demonstrates the range of stand conditions that exist in the CSC type. If a stand develops under high stocking densities over an extended period of time, numerous outcomes are possible. One frequent outcome in unthinned stands is that the diameter growth of the individual trees slows, the tree crowns recede, and eventually height growth slows. There is intense competition among the trees for light and nutrients. Minimal light reaches the forest floor. The result can be densely stocked stands with individual trees that have very short crowns (live crown ratios less than 25 percent) and very limited to no understory tree, shrub, or herb development. Stands may remain in this condition for decades. Eventually individual trees may dominate or a disturbance such as windthrow, landslide, or fire will thin the stand out and encourage the onset of the next stage of stand development — understory reinitiation.

2. Thinned stands where the overstory occupies most of the site, preventing development of a diversity of understory trees, shrubs, or herbs. A diversity of herbs and shrubs did not develop after thinning, or all but a few shade-tolerant herb or shrub species have died or will soon die, due to the effects of overstory competition.

   Thinned stands may react similarly to unthinned stands once the stocking density returns to high levels. Stands that are thinned to very low densities or are thinned more frequently may quickly move into the understory reinitiation phase of stand development.

Management Concepts for Closed Single Canopy Stands

- Snags, down wood, and residual live green trees will be recruited from the existing stand through natural processes, carried over from the previous stand, or created from the existing stand in cases where the trees are large enough to be effective habitat components.
- Deciduous trees and fruit-bearing shrubs and trees are desirable components.

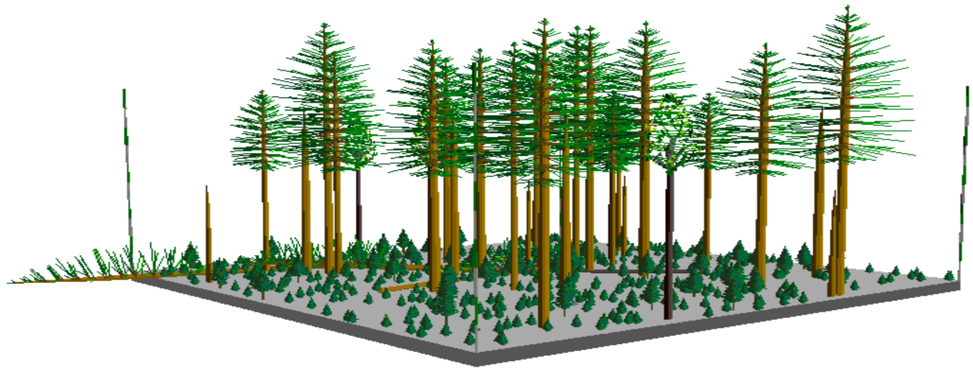


Figure C-3. Stand Type 3 — Understory (UDS)
Stand Development Process — Understory Reinitiation (UR)

Stand Characteristics

These stands have developed more diverse herb or shrub layers than CSC stands and have trees larger than sapling size. Tree canopies may range from a single species, single-layered, main canopy with associated dominant, codominant, and suppressed trees, to multiple species canopies. However, significant layering of tree crowns has not yet developed.

The least developed stands included in this category are stands that consist of a single species, single-layered, main tree canopy with an understory of shrubs and herbs that is more diversified than simply having one or two shade-tolerant species. Adequate light is entering the stands to allow tolerant and intolerant herb and shrub species (e.g., Oregon grape, sword fern, blackberry, huckleberry, twinflower) to develop and flourish through continued stand management or natural processes. This type also includes stands where the herbs, shrubs, and understory trees are vigorous and beginning to diversify. Vertical layering may be developing but is not yet extensive.

In all UDS stands, the shrub and herb layers are likely to continue to diversify and maintain or improve their vigor. These stands offer good potential to develop into highly diversified vegetative communities. Depending on the intensity and timing of density management activities, stands could shift back and forth between the CSC and UDS stand types over time.

Understory Reinitiation Process

The understory reinitiation process occurs after stem exclusion, when enough light and nutrients become available to allow forest floor herbs, shrubs, and tree regeneration to again appear in the understory. The new understory may grow very slowly at higher stand densities. The amount of understory brush and herbaceous species is minimal at the beginning, but increases to a substantial component of the stand by the end of the stage. In a stand where density management activities occur frequently, the understory may never be completely absent. UDS stands are in the early or developmental stages of this process.

Classification Guidelines for Understory Stands

Numerical guidelines	A variety of herbs, shrubs, and grasses cover 40 percent or more of the forest floor. Average tree size is at least 6 to 10 inches DBH, and tree heights are generally approaching 40 to 50 feet.
Classification tips	Stands that have an actively developing understory of tree species may also be included in this type — even if other herbs and shrubs are not flourishing. Specifically, alder or Douglas-fir stands with developing understories of western hemlock/Sitka spruce would fit this description.

Management Concepts for Understory Stands

- Snags, down wood, and residual live green trees will be carried over from the previous stand.
- Deciduous trees and fruit-bearing shrubs and trees are desirable components.

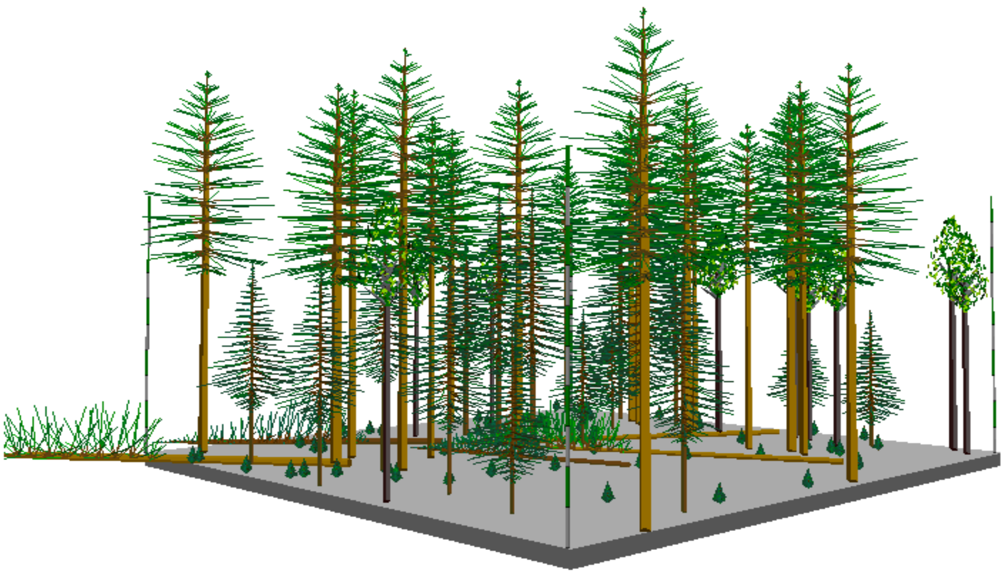


Figure C-4. Stand Type 4 — Layered (LYR)
Stand Development Process — Understory Reinitiation (UR)

Stand Characteristics
The vertical organization and structure of the living plant community are more complex than in the understory type. Vertical layering of herbs, shrubs, and tree crowns is extensive. Plant communities are complex in terms of numbers of species and in vertical arrangement. Shrub or herb layers and tree canopies in two or more layers are present.

At the more ecologically complex end of the range for the LYR stand type are stands that have a mixture of tree cohorts or tolerant (e.g., western redcedar, western hemlock) and intolerant tree species (e.g., Douglas-fir, noble fir), and shrub and herb species (vine maple, huckleberry, rhododendron, Indian plum, prince's pine). The tree crowns are arranged in a variety of configurations with significant layering of tree crowns from the tallest trees to the forest floor. The shrub and herb layers are diverse in terms of species and in vertical arrangement. Overall, the plant community provides a wide range of habitat niches from the forest floor to the top of the tree canopy.

If substantial amounts of down wood and snags exist and stand size is large enough, LYR stands are assumed to provide habitat for species commonly associated with older forests. Older Forest Structure, as defined later in this section, is merely a Layered stand type that has attained some specific measure of these stand attributes. Highly diverse Layered stands that contain all the required attributes of Older Forest Structure but may lack the minimum tree diameters are assumed to provide significant value to wildlife species commonly associated with older forests, such as northern spotted owls, pileated woodpeckers, and flying squirrels.

Understory Reinitiation Process
The understory reinitiation process occurs after stem exclusion, when enough light and nutrients become available to allow forest floor herbs, shrubs, and tree regeneration to appear again in the understory. The new understory may grow very slowly at higher stand densities. The amount of understory brush and herbaceous species is minimal at the beginning of the stage, but increases to a substantial component of the stand by the end of the stage. In a stand where density management activities occur frequently, the understory may never be completely absent. LYR stands are in the later or more developed stages of this process.

Classification Guidelines for Layered Stands

Numerical guidelines	Trees of 18 inches or larger DBH and reaching 100 feet or more tall are predominant in the overstory. At least 30 percent of the stand is comprised of layered patches. A patch is defined as layered when at least 60 percent of the vertical space from the top of the main tree canopy to the forest floor is filled with layered tree crowns, branches with foliage, and a significant amount of shrubs.
Examples	An example is a Douglas-fir stand that has patches of a younger cohort of western hemlock developing under the main canopy; the younger cohort should be at least 30 feet tall. A second type of patch that may be considered as layering occurs when the main canopy is interrupted with patches of another, shorter cohort or species throughout at least 30 percent of the stand. In this situation the patches are not subordinate to a higher canopy, but instead exist in groups where the trees are at least 30 feet tall and the tallest tree layer in the patch forms the canopy. These patches are generally no bigger than two acres. An example of this type of Layered stand would be a 150 foot tall conifer stand with patches of 80 foot tall hardwoods scattered through at least 30 percent of the stand.
Classification tips	Shrubs and herbs are an important component in the overall stand. However, there may be few shrubs or herbs in some parts of the stand. For stand classification, it does not matter if shrubs and herbs are missing from some patch types within the stand.

Management Concepts for Layered Stands
- Snags and down wood are recruited from the existing stand to supplement those components carried over from the previous stand.

Figure C-5. Stand Type 5 — Older Forest Structure (OFS)
Stand Development Process — Understory Reinitiation

Stand Characteristics

This stand type occurs when a Layered stand attains the structural characteristics listed below. These characteristics are typically linked with older forests or old growth. The definition is derived from consultation with foresters and biologists and represents their best professional judgment, based on experience and current scientific literature review.

OFS is not intended to be old growth or necessarily to be retained as permanent reserves. It is intended to provide some or all of the structural components commonly associated with old growth. OFS will not necessarily emulate all the processes and functions of very old forests. Over time, research and monitoring will provide better understanding about the similarities and differences between OFS and older forests.

In addition to the variety of trees typically found in a layered stand, Older Forest Structure includes each of the following four characteristics.

- At least 8 or more live trees per acre that are at least 32 inches in diameter at breast height. For site classes 3, 4, or 5 on the Santiam State Forest at elevations greater than 3,000 feet, the diameter standard is lowered to at least 8 or more live trees per acre that are at least 24 inches in diameter at breast height.
- Two or more tree canopy layers. Frequently one of the layers will be a shade-tolerant species.
- Snags — at least 6 per acre, 2 of which must be at least 24 inches in diameter breast height; the remaining 4 must be at least 12 inches in diameter breast height.
- 600 to 900 cubic feet per acre of sound down logs (decay class 1 or 2), or 3,000 to 4,500 cubic feet of down logs in any or all decay classes 1-5.

In addition, the following characteristics are normally associated with older forest conditions, but they may be present to varying degrees and widely differing distributions. These conditions are not required to be present to meet the OFS definition. Managers should retain these components when they are present and should develop them in stands on the OFS management pathway.

- At least one large remnant tree per five acres. The tree must have some of the following characteristics — deeply fissured bark, large limbs or “platforms”, broken tops, evidence of fungal decay, dwarf mistletoe, or other evidence of decadence.
- Multiple tree species — at least 2 species including an understory shade-tolerant tree species.
- Some trees within the stand contain defect or indicators of decadence.
- Diverse understory vegetation including herbs and tall shrubs.

Understory Reinitiation Process

The understory reinitiation process described under the Understory and Layered stand types is also the developmental process occurring in OFS stands. The understory reinitiation process occurs after stem exclusion, when enough light and nutrients become available to allow forest floor herbs, shrubs, and tree regeneration to again appear and survive in the understory. The new understory may grow very slowly at higher stand densities. The amount of understory brush and herbaceous species is minimal at the beginning of the stage, but increases to a substantial component of the stand by the end of the stage. In a stand where density management activities occur frequently, the understory may never be completely absent.

OFS stands are essentially LYR stand types that have achieved the structural characteristics identified in the definition of OFS. The characteristics identified are not “magical” thresholds that define a sharp line between use or non-use by species associated with older forests. The characteristics reflect specific structural characteristics often found in old growth conifer stands in the Pacific Northwest.

Old Growth

Numerous definitions exist for old growth. The one used here is taken from the glossary of the FEMAT Report (Forest Ecosystem Management Assessment Team) (USDA Forest Service et al., 1993).

> "Old-growth conifer stand — Older forests occurring on western hemlock, mixed conifer, or mixed evergreen sites that differ significantly from younger forests in structure, ecological function, and species composition. Old growth characteristics begin to appear in unmanaged forests at 175-250 years of age. These characteristics include (1) a patchy multi-layered canopy with trees of several age classes, (2) the presence of large living trees, (3) the presence of larger standing dead trees (snags) and down wood, and (4) the presence of species and functional processes that are representative of the potential natural community. Definitions are from the Forest Service's Pacific Northwest Experiment Station Research Note 447 and General Technical Report 285, and the 1986 interim definitions of the Old-Growth Definitions Task Force."

On the northwest Oregon state forests, large disturbances or timber harvest eliminated almost all old growth stands before the state acquired the lands. Currently only scattered old growth trees and a few remnant patches of old growth are known to exist in the planning area. In the future, old growth will likely occur on state forest lands in areas managed for special purposes such as riparian areas, nesting habitats for bald eagles or northern spotted owls, genetic stock of residual old growth trees remaining from the Tillamook Burn, or other areas of special concern.

Older Forest Structure is the managed stand type that is intended to emulate some, and possibly many, of the functions of old growth. As the *Northwest Oregon State Forests Management Plan* is implemented, scientific research and monitoring will be necessary to determine if Older Forest Structure can provide the functions of Old Growth or if the characteristics of Older Forest Structure should be modified to better emulate specific Old Growth functions.

Hardwoods

Hardwood stands are classified along with conifer stands in one of the five stand structure types. However, for the purpose of facilitating discussion, hardwood stands are defined as those stands where hardwood tree species comprise more than 70 percent of the tree canopy. Seventy percent is a subjectively set measure that identifies when the hardwood canopy is the dominant vegetative feature that characterizes the stand tree canopy and thus will likely control the focus of stand management practices. Seventy percent is also being used to identify hardwood stands by current research such as the "Coastal Landscape Analysis and Modeling Study" (CLAMS) (Tom Spies 1996). Common hardwood tree species include red alder, bigleaf maple, and Oregon white oak.

Field managers may choose to manage hardwood stands on the landscapes for a variety of reasons, such as to obtain economic benefits from hardwood products, to manage tree diseases in the stand, or to introduce or maintain additional vegetative diversity within conifer-dominated landscapes.

At this time it is assumed that a small percentage (probably 10 percent or less) of the landscape will be managed as hardwood stands. Maintaining a component of hardwoods within conifer stands is encouraged and it is anticipated that most stands will have some hardwoods. Implementation plans will better estimate how much of the landscape currently consists of hardwood stands and what portions of the landscape may be managed as hardwood stands in the future. If managers determine it is desirable to manage greater portions of the landscape in hardwoods, the forest management plan may have to be adjusted.

Landscape Management Principles

A **landscape** is defined as an area of land containing a mosaic of habitat patches, often within which a particular “target” habitat patch is embedded (Dunning et al. 1992). There is no one size of landscape for all classes of wildlife since each organism scales the landscape differently. What constitutes a single patch for a deer may be a landscape for a salamander. Planning for wildlife diversity at the landscape level requires consideration at a range of spatial scales. Landscapes are not necessarily defined by size; rather, they are defined by an interacting mosaic of patches related to the wildlife management objective in question.

The landscape **patch** may be defined as an environmental unit between which “quality” differs (Wiens 1976). While the stand may be the management unit “patch”, it may or may not be synonymous with the habitat patch required for a particular class or individual wildlife species in question. Patches are dynamic occurring on a variety of spatial and temporal scales. In the case of a forested landscape, patches will change with changes in forest development or with disturbance.

Patches at any given scale have an internal structure that is a reflection of patchiness at finer resolutions. Any patch, therefore, is represented by finer scale patches, each of which is capable of supporting some portion of the habitat needs of the entire wildlife component inhabiting the forest. The lower size limit of a patch for a particular organism is that scale at which the organism no longer perceives it as suitable habitat. The upper limit of size is defined by an individual’s home range (Kotliar and Wiens 1990). Patch size for populations or subsets of populations (metapopulations) will be larger. Patch boundaries are only meaningful when considered at a particular scale. An apparent abrupt edge is actually a continuous gradient of patches when viewed at a finer scale resolution.

The term **matrix** refers to the dominant landscape element in which patches are embedded. The matrix is the dominant and most connected landscape element and therefore exerts the greatest habitat contribution to the landscape in question. The relationship between patch and matrix is again dependent on scale, as shown in the figure below. Scale needs to be defined for the organism in question.

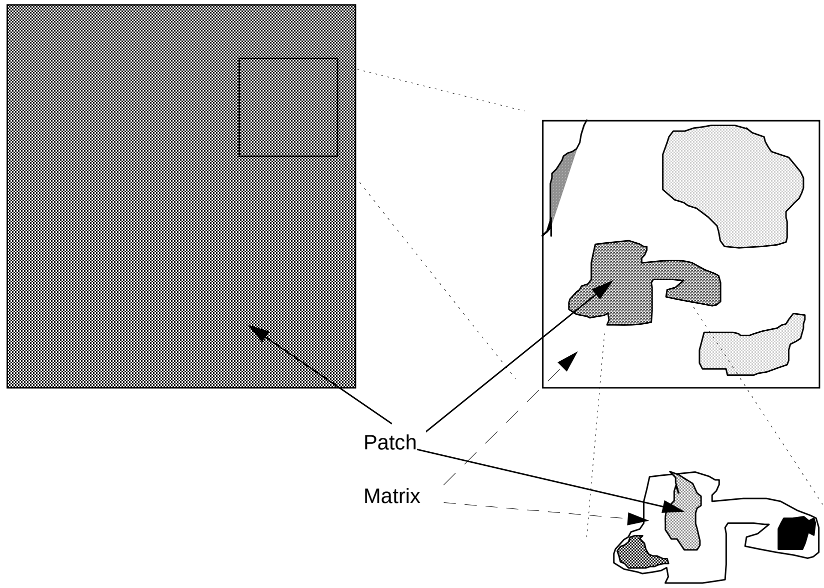


Figure C-6. Change in Patch Characteristics at Different Scales

As a general rule, fine scales can be assembled into coarser scales without the loss of information, but a loss of information will result if coarser scales are evaluated below the level at which the information was obtained.

The relationship of the dominant landscape patch (matrix) to other types of patches on the landscape is known as **fragmentation** (Franklin and Forman 1987). As fragmentation increases, the matrix becomes smaller, geometrically more complex, and more isolated over time. Maximum landscape fragmentation occurs when no dominant patch exists, as shown in the figure on the next page. In forests of the Pacific Northwest, fragmentation of the older forest matrix is of great concern. While experimental information for Pacific Northwest forests does not provide clear evidence (McGarigal and McComb, 1995), studies from other areas have been generalized to forest lands (Whitcomb et al. 1981, Robbins et al 1998). Classes of wildlife generally considered most sensitive to fragmentation in Pacific Northwest forests are habitat specialists preferring late seral forest interiors and wide-ranging species with low reproductive rates (Thomas et al 1990). Rather than representing a single trajectory, fragmentation in forested landscapes is probably both temporally and spatially dynamic. The mix of seral conditions across a given forested landscape may not represent clear distinctions in habitat suitability but rather gradations in suitability. The degree to which any class of wildlife is affected depends on the amount of habitat fragmentation and the relative suitability and pattern of surrounding habitat patches.

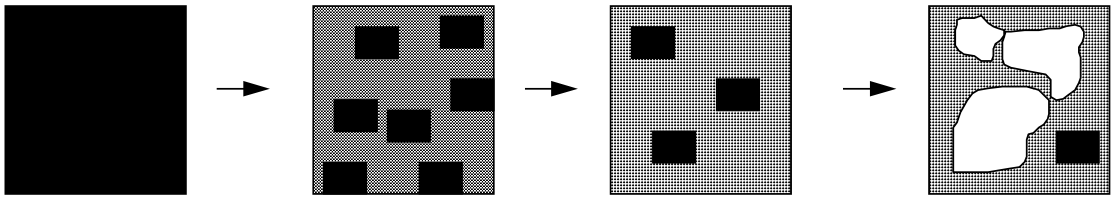


Figure C-7. A Landscape with Increasing Habitat Fragmentation

Landscapes do not exist alone. There is always a larger scale **context** within which several landscapes exist. This larger context provides the setting within which landscapes are evaluated. Context is most important when organisms can easily move between landscapes. Landscapes are generally evaluated at the watershed or several watershed level. A watershed may represent a useful landscape unit for purposes of planning but may not represent a useful scale for certain bird populations that migrate between watersheds. Recognition of the relationship of a particular species to its landscape and surrounding landscapes (context) is essential in order to provide the proper context for management. Proper landscape planning provides an obvious link between larger scales and implementation at the stand level.

Landscape structure is composed of two key landscape elements: **pattern** and **composition**. Both affect ecological processes and related wildlife populations. Landscape composition refers to the presence and amount of each patch type within the landscape independent of placement. Landscape composition is important to many ecological processes. Many species require habitat types of sufficient size and number to maintain themselves on the landscape. Composition alone may fulfill their population requirements.

Other organisms require additional considerations including those of patch size, shape, and placement of patch types relative to other patch types within the landscape. These attributes refer to landscape pattern. Both the distance between suitable patches and the spatial arrangement of suitable patches can influence population dynamics. Using computer modeling, McKelvey et al. (1992) has shown that both factors are important in northern spotted owl use of Pacific Northwest forests. Population dynamics of species with limited dispersal ability, such as amphibians, are affected by the distribution of suitable habitat patches. Likewise, organisms that require two or more different habitat patches may require patches in juxtaposition to assure that their entire life history requirements are met. Individual patch characteristics that have been found important for evaluating wildlife at the landscape scale include the mean and variability of patch size, shape, core area, and density. Similarly, important considerations that affect the relationship among patches comprising the landscape include nearest neighbor distance and connectivity (McGarigal and Marks, 1995). When viewed from a landscape perspective, structure-based management, which focuses on individual forested stands, will influence both pattern and composition.

For wildlife populations that benefit from the juxtaposition of different habitat patches, it is the combination rather than the type of individual patch that is most important. The response of wildlife to this type of landscape is referred to as **landscape complementation** and **landscape supplementation**.

Landscape complementation occurs when the presence of one type of resource in one patch is complemented by the close proximity of a different resource in a second patch so that larger populations can be supported in a given area. Deer and elk are examples of species benefiting from different habitats in close proximity (Wisdom et al. 1986). These wildlife species require both older forests and young forests for different life history requirements. Similarly, certain bird species such as the olive-sided flycatcher in the Coast Range are most abundant when older forest patches are next to patches with open canopies. Suitable nesting habitat is provided by older forests while foraging habitat is found in the open-canopy areas (McGarigal and McComb, 1995).

Landscape supplementation occurs when the juxtaposition of patches (similar or different) provides sufficient amounts of a given resource to sustain a population level above that provided in an individual patch. An example is brown creepers, which require some maximum amount of large saw timber over some area to successfully occupy and breed (McGarigal and McComb, 1995). Northern spotted owls require some cumulative amount of older forest patches within some maximum area for occupancy (Thomas et al 1990). Depending on the species in question, these needs may also reflect landscape composition and/or landscape pattern needs.

Certain landscapes can affect wildlife populations through **source/sink relationships**. In these landscapes, productive source patches supply emigrants to less productive patches termed sinks. Subpopulations within the sink areas are considered unstable and subject to extinction without new immigration from the source areas. In this manner, the total landscape functions to increase overall populations from a relatively small amount of source habitat. Maintenance of local sink populations within the landscape is dependent on the continued presence and proximity to source areas. Both landscape composition and pattern of source and sink patches can have an influence on overall population size (Thomas et al 1990).

Three factors have been found to define the functional patch size: 1) actual size; 2) distance from a similar patch; 3) degree of habitat difference of the intervening matrix (Harris 1984). These considerations are particularly important when dealing with older forest patches and their relationship to interior-dwelling wildlife species. The presence and abundance of a species in a particular patch can be strongly affected by the composition of adjacent patches.

The table on the next page illustrates this relationship. The table is taken from Harris (1984) and adjusted to structural characteristics defined within the *Northwest Oregon State Forests Management Plan*. Data in the table indicate that while different wildlife species prefer different structural categories, overlap in preference is greatest between similar structural types than between those more dissimilar.

These **neighborhood effects** or **edge contrasts** can be both positive or negative. In the case of habitat generalists such as deer and elk, the edge between different patches of habitat is generally considered important to the population. For other species, notably interior habitat specialists, high contrast edge can have negative effects. Rosenberg and Raphael (1984) found that for mature forest patch sizes less than 120 acres the frequency of interior habitat species observations was negatively correlated with the presence and amount of adjacent regeneration and young forest patches. The decrease in interior habitat specialists noted by these authors could have resulted from several factors including predation, competition, and nest parasitism from species occupying adjacent patches. It could also be the result of changes in habitat quality due to microclimatic changes within older forest patches due to increased light intensities, wind, and other unbuffered climatic factors from surrounding open areas (Chen et al. 1992, Harris 1984).

Table C-2. Similarity Coefficients between Stand Structure Types

(Coefficients are between designated pairs of structure types, for wildlife species using each stand type as primary habitat.)

	REG	CSC [1]	CSC [2]	UDS	LYR	OFS
REG	1.0	.91	.53	.52	.43	.42
CSC [1]		1.0	.60	.59	.47	.46
CSC [2]			1.0	.96	.69	.67
UDS				1.0	.73	.70
LYR					1.0	.97
OFS						1.0

Source: Based on Harris 1984, adjusted for *Northwest Oregon State Forests Management Plan*.
1. Seedling/sapling stage.
2. Pole-sized stage.

The degree of isolation between suitable habitat patches due to the influence of edge contrasts can range from complete isolation to partial or only small influences on access to adjacent habitats. **Corridors** have the opposite function of boundaries. Corridors facilitate movement of individuals between habitat patches, serving to connect separate but similar habitat patches within the landscape mosaic. They may act to channel dispersing individuals into pathways between patches or provide “intermediate” habitat of sufficient quantity and quality for survival until the species can find suitable habitat in another patch. The presence and location of corridors provide important contributions to the functionality of patches within a landscape.

The most important wildlife habitat to consider in landscape planning is older forests. This habitat is considered important because of its limited supply within western Oregon and because over 118 species rely on this habitat for most or all of their life history requirements (Harris 1984). Management emphasis of this element also ensures that other developmental phases will be maintained during the course of expected forest development.

The quantity of effective older forest habitat is often smaller than the total amount within a given landscape. **Interior habitat area (IHA)** is defined as that portion of the older forest patch that remains effective when the negative effects of high contrast edge are removed. Three factors influence the amount of IHA in relation to total patch size: 1) degree of edge contrast with surrounding patches; 2) patch configuration which changes the amount of edge and hence the amount of IHA; and 3) size of the older forest patch.

For a given patch configuration, the amount of IHA is smallest when edge contrast is highest. IHA also decreases when the shape of the patch increases the amount of edge. Harris (1984) states that for landscapes where older forest patches are adjacent to high contrast edge (REG or early CSC) patches, habitat conditions within the older forest patch can be negatively affected up to six tree heights (600 feet) from the boundary (see also Chen et al. 1992). A 775 acre circular patch (smallest edge to interior ratio), for example, would consist of 35 percent edge area and provide only 504 acres of IHA. Similarly, a circular stand would need to be 7,000 acres in size to reduce the 600 foot edge influence below 10 percent of the total area. Surrounding patches (late CSC, UDS, or LYR) can be used to moderate climatic and predation influences within older forest patches. Data from Table C-2 suggests IHA can even be increased for certain older forest-dependent species by juxtaposition of complementary structural stages.

Not all older forest-dependent wildlife needs the same size IHA to assure maintenance of wildlife diversity. To assure adequate IHA patch sizes are maintained across the landscape, three factors must be considered: 1) the size frequency distribution; 2) a measure of the central tendency (mean); and 3) a measure of dispersion (variance). Several arguments have been put forth for using a log-normal distribution to define the size and number of habitat patches for maintenance of wildlife diversity. The first argument relates to the relationship between trophic level, home range size, abundance, and spatial movement of wildlife, which tend to follow a log-normal distribution. Second, energy flow within landscapes is related to certain disturbance processes such as fire and windstorms, and landscape features (watershed area and the distribution of stream lengths), which also follow a log-normal distribution (Strahler 1957, Shugart 1984). A theoretical variance for many of these relationships has been calculated to be 0.2. Mean size is dependent on the type of species in question. For those with larger home ranges, a larger mean patch size is necessary than for species with smaller home range sizes. A mean patch size somewhere in the middle of this range is best for conserving overall wildlife diversity.

Concepts for the Landscape Management Strategies

Landscape Management Strategies 1 through 4 are the heart of structure-based management. These strategies are presented in Chapter 4. This section of Appendix C provides a detailed explanation of the concepts behind those strategies.

The Array of Stand Structure Types

Landscape Management Strategy 1 states that the Oregon Department of Forestry will “actively manage the state forest landscape and forest stands to produce [an] array of stand structure types across the landscape…” Table 4-2, on page 4-43 of the plan, displays the long-range desired future percentages for the five different stand types, across the state forest landscape.

The stand structures are not an end in themselves. The stand structures are designed to emulate the diversity of stand types historically associated with conifer forests in the Coast Range and Cascades. Several studies have been done on the historical distributions of older stand types (old growth) in the Oregon Coast Range (Juday 1977, Teensma et al. 1991, Zybach 1993, Spies et al.). These studies have produced a range of possible answers. At the province scale, research suggests that the percentage of older stand types ranged from 30 to 70 percent of the landscape at any point in time. At smaller scales, the variability was even greater, ranging from 15 to 85 percent of the landscape at any point in time.

Once the range of stand types reaches the desired future condition, individual stands on the landscape will continue to change; however, the relative abundance of the different types will be reasonably stable. At some point decades in the future, a dynamic balance will be achieved of the stand types in the desired percentages, and individual stands will move in and out of the various types at a relatively even rate.

Stands will vary in size and exist in a variety of arrangements (see Landscape Management Strategy 2 in Chapter 4, and the other concepts discussions in this appendix). Generally speaking, individual watersheds will have a mix of all stand types. However, some watersheds may have only one or two of the stand types at any point in time. Interior forest habitats will be part of the mix. Decisions on the mix in any given basin will be made at the district level in implementation plans (see Landscape Management Strategy 4).

Determining the landscape percentages — Both objective and subjective processes were used to determine the plan's desired future percentages for the stand structure types. Foresters and biologists from the planning team considered the following factors.

- The available information on historical distributions of older stand types in the planning area (as referenced above). Although the goal was not to re-create these same conditions, the historical patterns helped the team to evaluate what array of stand types might emulate habitat functions for native species.
- The array of habitats necessary to support populations of all native wildlife species, with particular concern for having enough older forest stands to provide for key species of concern (northern spotted owl, marbled murrelet). This decision was based on available information and the professional judgment of wildlife biologists.
- The array of stand types and conditions that could concurrently provide the needed habitats, enhance and maintain biodiversity, and provide for sustainable timber and revenue levels consistent with the plan's goals.
- The current array of stand types on lands in the planning area, and the knowledge that it will take many decades to achieve the desired future amounts of the older stand types. As part of the adaptive management strategy, the plan includes requirements for periodic reviews, as part of implementation. Through these reviews, the desired future condition for stand types can be changed as better information comes available.

The stand structure types correlate with at least four different types of habitats. Open habitats occur during the regeneration stage, and closed canopy habitats are associated with the closed single canopy stage. In the understory and layered stand types, habitats have more horizontal and vertical diversity and offer a variety of habitat niches. Older forest structure and some layered stands provide habitats commonly associated with older forests or old growth.

Precise percentages vs. ranges of stand types — There are several reasons for using percentage ranges for the desired future array of stand types instead of setting an exact percentage, such as 20 percent, for each type. First, the stand types as defined do not always appear on the landscape as clearly defined, discrete types. Regeneration stands blend into closed single canopy stands with the onset of crown closure. A newly developing understory may be short-lived or it may become established. The exact point at which a closed single canopy stand should be classified as understory or an understory stand as layered is open to individual interpretation.

Second, there is no single right answer for the appropriate balance of the stand structures. Historically, the stand structures present in the northwest Oregon state forests have varied greatly. Large wildfires like the Tillamook Burn have significantly reduced the diversity of stand structure types within specific watersheds or regions. Wildlife populations have always fluctuated in accordance with the amount of available habitat, as well as from other natural factors.

There is currently no research that supports one specific, idealized array of stand structures optimal for all species. It is clear, however, that providing for the habitat needs of all native species will require producing all habitat types or surrogates.

For all these reasons, precise numbers are unnecessary for the stand structure percentages, and the loss of flexibility could lead to poor long-term forest management. The planning team identified ranges that would provide a reasonable chance of successfully providing the full array of habitats for native species, without boom and bust cycles.

Regional percentages vs. planning area-wide percentages — The planning team also considered setting regional stand type percentage goals to reflect the local conditions in each management district. Oregon Department of Forestry district personnel, Oregon Department of Fish and Wildlife (ODFW) field biologists, and members of the planning team discussed issues to clarify the regional context for each district. The discussions focused on physiographic conditions that might require different structural goals, based on the different habitat needs of wildlife in various parts of the Coast Range, or differences between the Coast Range and the Cascades. Variations in land ownership patterns among districts were also discussed as a basis for setting different targets.

ODFW biologists from the North Coast Range, Central Coast Range, and Cascades all concurred that although some differences in habitat needs may exist between the Coast Range and Cascades, there was no basis for setting different ranges of stand structure arrays for these two geographic areas. There was no biological reason to use different percentages within the northern and central Coast Range.

The team considered adjusting the desired array at the landscape level based on the habitats that are likely to be provided on adjacent forest lands owned by others. However, history suggests that it is difficult to predict exactly how other landowners will manage their lands over the long term. The one thing that is certain is that these landowners will change their management over time. The team concluded that forest management on adjacent forest lands should be considered at the level of district implementation plans.

Management Pathways

Landscape Management Strategies 1 and 2 state that the Oregon Department of Forestry will use active management to move stands toward the stand structure and landscape design goals. The following descriptions should give the reader a better understanding of how management will proceed with SBM. The management pathways described here are examples, not prescriptions. Silvicultural practices mentioned in this section, such as regeneration harvests, shelterwood cuts, and group selection, are explained later in this appendix, under the heading, "Silvicultural Practices."

Management Pathways for Achieving Stand Types

- ❑ **Stand Type: Regeneration (REG)**

Pathways — Regeneration harvests must occur to maintain or achieve open habitats and stand initiation on 5-15 percent of state forest lands on each district. Clearcuts, patch cuts, shelterwood cuts, and group selection cuts are types of regeneration harvests that will create REG. These harvests will maintain a sustainable flow of timber and revenue to local markets, economies, and governments, and will maintain the desired amount of REG on the landscape.

- ❑ **Stand Type: Closed Single Canopy (CSC)**

Pathways — Many of these stands originate from REG stands that have reached crown closure, or they are stands that have been so densely stocked that virtually no understory exists. They may persist for a long time unless density management activities are carried out to produce understory (UDS) stands, or regeneration harvest returns the stands to the REG stage.

Stands in the closed single canopy stage will be managed to meet the whole range of desired stand structure conditions and products. Each stand will be managed based upon its potential to meet the planning goals. Some of these stands will lack many of the essential components or have low potential to produce more complex forest structures — these same stands may have high value for timber production. Others will have greater potential to develop into more complex forest structures over time. Field foresters will evaluate each stand's potential and determine how many stands are available to produce the array of stand structures. Then they will decide which stands will be managed to produce understory (UDS), layered (LYR), or older forest structure (OFS). See the text box on the next page for an example of the decision process that could be used to develop silvicultural prescriptions for closed single canopy stands.

Example: Developing Prescriptions for Closed Single Canopy Stands

If a stand is in the closed single canopy stage and:

1. It offers good silvicultural potential for future wood growth or development of desirable stand characteristics, then prescribe for:
   A. Pathway that does not head for OFS; retain biodiversity components such as snags, coarse down wood, etc.; or —
   B. Pathway that heads for UDS, LYR, or OFS; retain biodiversity components and develop multi-canopied structure, or —
   C. General density management for vigorous growth that defers the decision on the ultimate stand structure for the given stand.
   D. Regeneration harvest — if there are excess acres in CSC, prescribe regeneration harvest to meet REG goals or to realize timber value.
2. It does not offer good silvicultural potential, then prescribe for regeneration harvest in near future, unless other management priorities exist.

❑ **Stand Types: Understory (UDS) and Layered (LYR)**

Pathways — A broad range of stand conditions exists in these stages. Stands in both stages are dominated by trees (rather than shrubs or herbs). Stands of trees may range from larger than sapling size to the very largest conifers. The following four conditions represent the range.

- The least developed of these stands consist of a single species, single-layered main tree canopy with an understory of shrubs and herbs that is more diversified than simply having one or two shade-tolerant species (UDS).
- The understory appears vigorous and is beginning to diversify. However, herbs, shrubs, and understory trees are not yet fully diversified. Some vertical layering occurs but is not extensive (UDS).
- The organization and structure of the living plant community is complex. Vertical layering of tree crowns, shrubs, and herbs is well developed (LYR).
- Plant communities are complex, layering is extensive, and snags, down wood, tree litter, and soil organic matter are present (LYR).

Field foresters will evaluate each stand’s potential and determine how many stands are available to produce the array of stand structures. Then they will decide which stands will be managed for UDS, LYR, or OFS. Stands with more complex structural development will be more likely to be managed to produce OFS. See the text box on the next page for some possible silvicultural prescriptions for UDS and LYR stands.

Example: General Prescriptions for Understory or Layered Stands

Here are some possible general prescriptions for stands in the understory stage.

A. Pathway that does not lead to OFS; retain biodiversity components such as snags, down wood, etc.

B. Pathway that maintains understory condition or leads to layered or OFS; retains biodiversity components and develops multi-canopied structure.

C. General density management for vigorous growth that defers the decision on the ultimate structure for the given stand.

D. Regeneration harvest for excess acres in this type that are not necessary contributors for other structure types.

- [ ] **Stand Type: Older Forest Structure (OFS)**

In this stage, further LYR stand development features include large trees, canopy layering, snags, and substantial down wood. Time has allowed functional processes to develop among a broad biotic community. These stands should be maintained on the landscape for a period of time (generally 20 or more years) to allow them to function ecologically.

These stands will be managed to maintain their desirable biodiversity characteristics, vigorous growth, and timber yield. These stands will be valuable for their outstanding timber production and standing volume, and for their biodiversity benefits.

Example: General Prescriptions for Older Forest Structure Stands

At least two general prescriptions are likely.

- Pathway for vigorous stand growth, biodiversity components, and multi-canopied structure.
- Regeneration harvest of excess acres in this stand type.

Patch Types, Patch Sizes, and Patch Placement

Landscape Management Strategy 2 states that the Oregon Department of Forestry will "actively manage the forest stand types to create a variety of patch types, patch sizes, and patch placement on the state forest landscape."

In order to conserve biodiversity at the landscape level, planning must address both fine and coarse scale resolutions. This strategy is a coarse scale approach. The **coarse scale** includes all scales from the regional context down to the stand (fine scale). The number of different patches and their size, shape, location, and relationship to other patches (landscape composition) determine landscape structure. Coarse scale planning is accomplished by using individual stands of similar structure as the basic building blocks to form different sized patches of similar habitat value. These patches are then arranged across the landscape to optimize habitat connectivity through time and space.

This strategy describes the patch types, and addresses considerations for landscape planning at the regional, district and management basin level. In this plan, the stand is the **fine scale** unit of analysis. Composition at this scale will be addressed using the within-stand approaches identified in SBM Strategy 4. These include considerations of stand vertical stratification, snags, residual live trees, down wood, and species composition.

Wildlife use discriminates between three fundamental patch types on forest land: young, pole-sized, and mature forests. The table below compares patch types to the stand types used in this plan.

Table C-3. Comparison between Landscape Patch Types and Stand Types

Landscape Patch	Stand Type
Young forest	Regeneration through closed single canopy sapling stands
Pole-sized forest	Closed single canopy pole-sized through layered stands
Mature forests	Closed single canopy, understory, layered, and older forest structure stands (trees larger than pole-sized)

It is difficult to plan simultaneously for sufficient patch structures within all patch types. But because forest stands develop through a typical progression of stages, it is possible to plan for some specific patch types and then assume that the stands will progress through the other stages. We emphasize mature forest patches and interior habitat area (IHA) in our planning. This does not mean that other patch types are any less essential. All stand types and the corresponding patch types are essential if habitats for all species are to be provided. This approach simply chooses to anchor landscape design to the development of interior habitat areas. The rationale for this decision is given on the next page.

- IHAs are only associated with mature forest patches.
- The wildlife component associated with IHAs is usually the component limiting our ability to reach wildlife diversity goals in forested landscapes.
- Acreage of mature forest conditions that produce IHAs are limited within the planning area.

We know that IHAs are critical for many wildlife species that prefer mature forests and that older forest structure, layered, and to a lesser extent, understory structural stages are components of mature forests. Associating layered/understory structural stages with older forest structure can increase functional IHA size for these species. This allows us to increase the amount of IHA above that possible if we assumed that older forest structure is the only stand type that can produce IHA. Forest management can help to develop a landscape where older forest, layered, and understory stands are next to each other, and maintain greater amounts of IHA than would occur if these stands were scattered. An increased number of IHAs and resulting decreases in average nearest-neighbor distance across the landscape will benefit wildlife associated with IHAs in the ways listed below.

- Facilitating conservation of endemic species in unique habitats and genetic variation within species.
- Providing improved linkage to similar habitats.
- Facilitating potential immigration and genetic interchange within wildlife populations.
- Increasing the probability for frequent colonization of species extinct from a particular portion of the landscape.
- Increasing use by territorial wildlife species.
- Providing buffers against widespread disease or catastrophic events.

Guidelines for IHAs and Other Patch Types across the Landscape

Each scale of consideration addresses different landscape functions and different wildlife conservation issues. The table on the next page is a matrix that identifies the types of landscape considerations to be addressed at each scale.

Regional Scale

The regional scale is the largest scale considered. Decisions at this scale typically address regional conservation goals such as threatened species recovery strategies and are therefore generally broad. Decisions made at this level generally do not consider the importance of IHAs specifically. This is left to the implementation planning, typically conducted at the district and basin levels. It is important to emphasize that this forest plan alone cannot solve regional conservation issues. Consideration at this scale does, however, provide a rational basis to assess the contribution of state forests to these larger management issues and to determine the appropriate role of this plan within this larger context.

Table C-4. Matrix of Planning Decisions Appropriate at Various Scales of Landscape Planning

Considerations	Region	District	Basin	Stand
Contribution to population goals for T&E and sensitive species	X	X		
Structural goals		X		
Patch size distribution		X		
Recreational sites		X		
Sites with operational constraints (unstable/steep slope)		X	X	X
Unique habitats such as wetlands, eagle sites, etc.		X		
Scenic corridors and viewsheds		X		
Desired basin stand structures		X	X	
Current stand condition			X	
Riparian management strategies			X	
Placement of patch & stand structure types			X	
Consideration of isolated stands			X	
Consideration of adjacent land uses and adjacent basin patch location			X	
Edge considerations			X	
Connectivity between patches		X	X	
Patch relationships between aquatic and upland management units			X	
Location of replacement stands/patches		X	X	
Big game management considerations		X	X	
Timber harvest plans and operation-specific decisions			X	X
Structural components (down wood, layered canopy, snag goals)			X	X
Within stand diversity (gaps)				X
Species composition				X

District Scale

The district scale is where stand structural goals are set and the frequency distribution of IHA patch sizes is defined. It is also at this level where decisions are made on how the overall frequency distribution of IHA patch sizes should be allocated across various basins based on current age structure, regional conservation contributions, and the relationship with other plan considerations including recreation, scenic quality, operational constraints, etc. Decisions can lead to allocation of certain basins to emphasize different parts of the distribution, for example, high fragmentation versus low fragmentation basins.

The frequency distribution should act as a guideline rather than specific allocation targets. Questions asked should revolve around whether the general proportion of stand sizes and numbers are represented district-wide, and how each management basin plan individually and collectively contributes to the range of patch sizes and numbers. As an example, a size frequency distribution has been developed for the Tillamook State Forest in the table below and the figure on the next page. The example illustrates the criteria described earlier to define the number and size of IHA patches required to meet biodiversity objectives for a specific land unit. The following assumptions apply to the example.

- Total acreage is 250,000 acres, 90 percent of which is managed forest land.
- Percent allocated for structural types LYR and OFS is at low end of range.
- 90,000 acres possible in LYR/OFS patches.
- Average patch size of 250 acres.
- Minimum patch size of 40 acres.
- Variance of 0.4.

Table C-5. Example: Summary of Patch Sizes for the Tillamook State Forest

Number of Patches	IHA Patch Acreage Range and (midpoint)	
63	0-80	(40)
128	80-120	(100)
85	120-200	(160)
68	200-320	(260)
41	320-520	(420)
19	520-840	(680)
7	840-1360	(1100)
2	1360-2180	(1780)
0.5	>2180	(2880)

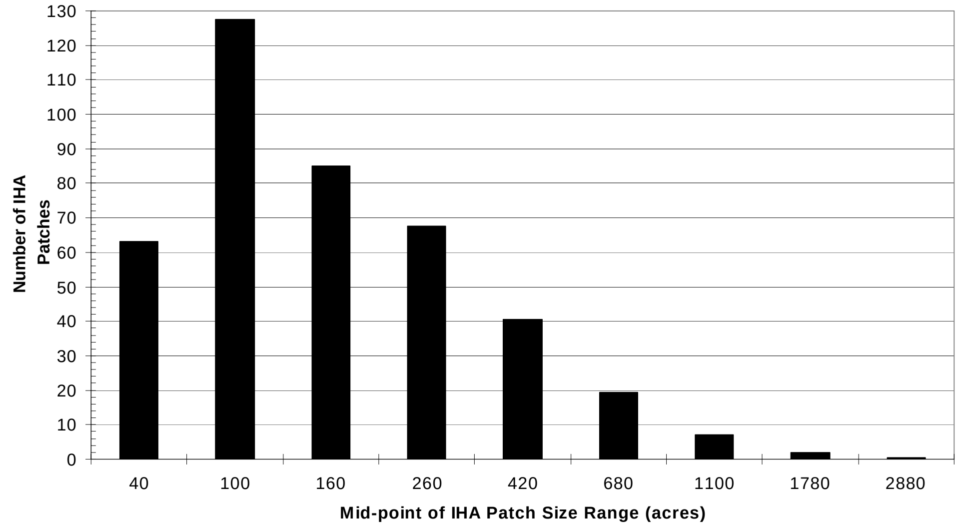


Figure C-8. Frequency Distribution of IHA Patch Sizes for the Tillamook State Forest

Management Basin Scale

The management basin is the scale at which most implementation planning decisions are made. Broad decisions have already been made at the district level that recognize relative contributions of the basin to district-wide distribution of patch sizes based on certain constraints and management options. These decisions indicate, generally, how much fragmentation exists or will occur, and the mix of large and small patches desired. Based on this information, management basin planning will make refinements to define the desired range of stand structures for the area.

Considerations in Determining The Location, Number, Size, and Configuration of IHAs (Interior Habitat Areas)

I. Size, composition, and configuration

- IHAs can include OFS, or OFS with some combination of UDS/LYR/UDS when adjacent or in the immediate proximity to each other. Whenever possible OFS should be located near the center of the patch.
- Minimum patch size 40 acres IHA, with minimum edge to interior ratio. This lowest size class must be made up of only the OFS structural stage. OFS patches less than 40 acres do not count toward the OFS percentage of stand structures.
- OFS/LYR/UDS in juxtaposition can be used to define IHA patches above the minimum (midpoint 100 acres) when:
  1. 50 percent or more of the IHA patch is OFS, and
  2. 15 percent or less is UDS, and
  3. OFS stands contributing to the patch have 15 percent or less insularity (border REG, CSC, UDS).

- For larger patch sizes (greater than the midpoint of 420 acres), the percentage of LYR and UDS can increase. The UDS patch contribution cannot exceed 40 percent.
- Larger IHA patch sizes are necessary to obtain similar function if the patch is oriented in a manner (rectangular, oblong) that increases the ratio of edge to interior habitat. A long, narrow IHA patch such as one associated with a riparian management area may not represent any IHA unless it extends upslope to decrease its edge to interior ratio. It is best to make a rough approximation of the edge influence from adjacent REG, CSC, or UDS patches in determining the correct patch size.

II. Corridor and patch placement

Patch placement will be a function of topography, relationship to corridors, and silvicultural considerations.

- Laying out riparian protection areas with scenic, recreational, unique habitat, unstable slope, and owl conservation areas (if applicable) and using natural drainage patterns can give a first approximation of where IHA patches can be located to serve several complementary functions.
- Final locations should include consideration of how the patches are linked together using habitat corridors. Smaller or narrow patches scattered throughout the planning area act as corridors to enhance wildlife movements between suitable habitat patches. Such areas may be smaller than the minimum patch size for IHAs and may not contribute to the OFS percentage in the array. Nonetheless they enhance the function of IHA patches. Corridors can be as narrow as riparian management areas and as small as unique habitat areas. Riparian management areas can be used effectively to link patches within a drainage. This will also provide linkages between upland and riparian mature forest areas. Corridors can also be dispersal habitat linking northern spotted owl conservation areas. For spotted owl emphasis areas, corridors can link a series of IHAs to form a patch of larger suitable habitat. See Figure 8 on the next page as an example of patch placement within a drainage.
- Minimum patch distance between IHA patches should be a function of size and frequency within a management basin. Smaller patches should be placed closer together than larger patches.
- For an isolated patch, with greater than 50 percent of its boundary adjacent to REG/CSC or surrounded by forest land where future patch contributions are not anticipated, such as plantations on other land ownerships, the minimum size should be increased to 120 acres. Isolated patches below 120 acres will provide benefits for only a limited array of species inhabiting older forest conditions. Retention of isolated patches below 120 acres should only be maintained when addressing short-term biodiversity goals. Long-term biodiversity is best accomplished where corridors and similar habitats are in close proximity.

- Anticipate patch placement through time. It is important to maintain IHA habitat until sure that replacement patches will be available. This can best be done by focusing on maintenance of the entire patch and how forest management will maintain similar habitat through time rather than on individual stands making up the patch.
- As a general rule, the size of the IHAs should follow the size of other landform units within the basin. This means that smaller IHAs would be placed higher in the drainage associated with smaller stream and corridor networks. IHAs placed in headwater areas can function as Amphibian Emphasis Areas as detailed in the riparian management strategies.
- Place IHAs near drainage divides to enhance species movements between watersheds.

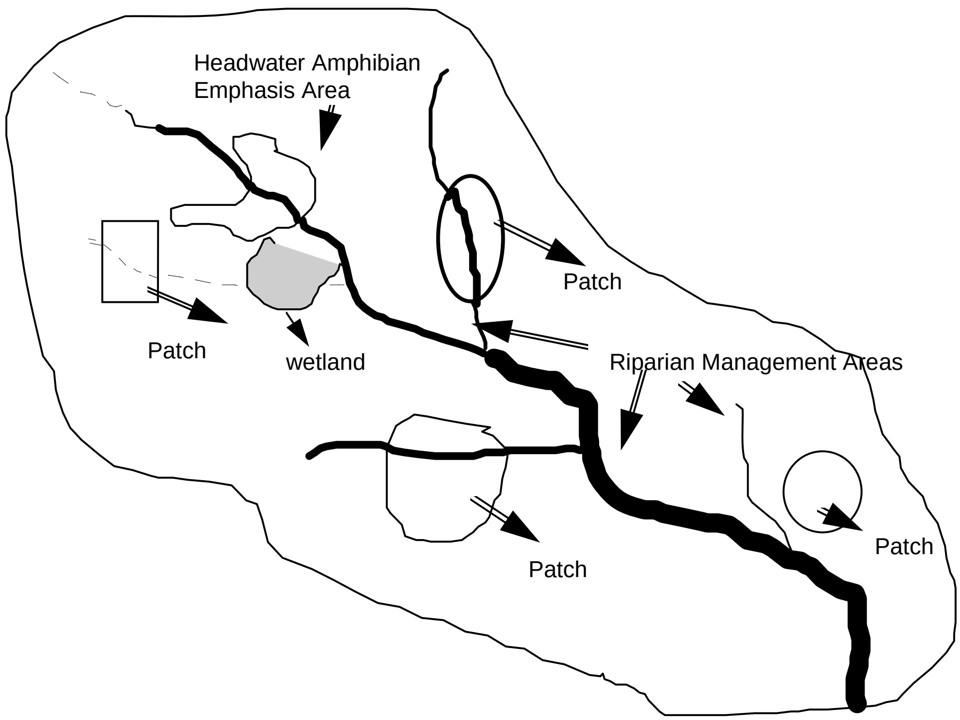


Figure C-9. Example: Patch Placement in a Drainage

The figure shows corridor linkages with riparian management zones of different sizes.

III. Relationships between basins and adjacent land ownerships

Each basin will have a different amount and placement of IHAs, 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 (see the figure above) as well as in relation to similar habitat within adjacent basins.

- Consider basins collectively rather than in isolation when establishing patch placement. Plan from larger scales to smaller.
- Consider adjacent land ownership. If the adjacent ownership emphasizes late successional forests, location of smaller patches along the boundary can increase the effective size of the patch. Similarly, if adjacent land ownership manages primarily for early seral types, the patch size to produce IHA habitat will need to be larger to be functional because of the expected high edge effect.
- Effective IHAs can be increased by sharing structural stages (UDS/LYR/OFS) across basin boundaries. A small habitat area (less than 40 acres) may not count toward the OFS percentage of the stand array by itself, but placement of it next to similar habitat in an adjoining basin may make it sufficiently large to count.

Managing for Key Structural Components

Landscape Management Strategy 3 presents approaches for managing the key habitat components listed below, followed by the reasons why it is important to provide these habitat components within the managed forest.

- Remnant old growth trees
- Residual live trees
- Snags
- Down wood
- Multi-layered forest canopies
- Multiple native tree species (conifers and hardwoods)
- Herb/shrub considerations
- Gaps

Structure-based management requires managing the structural components of stands, as well as arranging structure types on the landscape. This challenge requires managers to weigh all factors important to the long-term sustainability of the forest ecosystem, and also to consider the short and long-term productivity of the forest for human needs. Effective control of wildfires may be adversely affected by multi-layered canopies, down wood, and tall snags. Through careful planning of the spatial arrangement and temporal occurrence of stands and structural components on the landscape, managers can find reasonable approaches to develop the desired forest structural characteristics for wildlife and biodiversity, while still protecting the forest from unwanted wildfire. It is likely that trade-offs will have to be made in specific locations within districts. However, on a district-wide basis, both fire control and the desired array of stand structures can be accomplished.

The structural components will be retained during any management activities 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. Examples of unacceptable operational difficulties include situations where the location of a tree might require relocating a road to a less stable place, or require that a substantially longer road be built to avoid the tree. Examples of situations where a decision may be made to remove a residual tree, snag, or patch of trees include situations where if the tree(s) came down through windthrow or other natural causes, they would likely damage improvements such as bridges or buildings, or cause road washouts or other road damage. It is expected that the vast majority of structural components will be retained, and there will be few situations where these components must be removed.

Remnant old growth trees — Existing old growth in the planning area occurs as widely scattered individual trees, and occasionally as small isolated patches. Because the occurrence is limited, the Department of Forestry’s intent is to retain all existing old growth to provide this element of diversity in present and future stands. The discussion below about residual live trees applies to remnant old growth trees also.

Residual live trees — Residual live trees help to meet the short-term habitat needs of species, to serve as a source of future snags and down 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 they will remain.

When remnant trees survive a disturbance or are retained after regeneration harvest, they have major effects on the forest stand that grows on that site. Remnant trees are important for recruitment of snags and down wood within the developing stand. Patches of green trees of various sizes, ages, and species promote species diversity and may act as refugia or centers of dispersal for many organisms including plants, fungi, lichens, small vertebrates, and arthropods (USDA Forest Service et al., 1993). In addition to providing raptor perches and foraging substrate for animals living in young plantations, residual green trees in regeneration harvest units may allow development of structurally diverse stands and landscapes in later stages of forest development (Zenner 2000).

A key structural component of older forest structure stands is the presence of large trees. One way to sustain this structural component within a managed forest is to retain enough residual green trees in regeneration harvest units to provide the required level of large trees in a future older forest structure stand.

Diversity of tree structure should be considered when selecting trees for retention. Complex canopy structure and especially leaning boles are beneficial for some lichens. Trees that are asymmetrical provide a diversity of habitat substrates and often have more lichen and moss epiphytes on large lateral limbs than symmetrical trees (USDA Forest Service et al., 1993). Trees with some level of defect are likely to die and become snags sooner than straight, healthy trees. Relatively sound trees with healthy crowns are more likely to survive and contribute to habitat structure throughout the next rotation.

Distribution — Live trees can be left in either a scattered or clumped distribution in final harvest units. Both distributions provide many of the same wildlife benefits, but each provides unique benefits not provided by the other distribution.

Providing leave trees in a scattered distribution over part of the landscape may substantially reduce the amount of the time it takes for the stand and the landscape to develop multi-storied canopies.

On the other hand, patches or clumps of trees may provide better protection for special micro sites such as seeps, wetlands, or rocky outcrops (USDA Forest Service et al., 1993) than scattered individual trees. Placement of clumps of leave trees in headwater drainages may protect important habitats for amphibians.

Providing a diversity of arrangements is the key to managing for a range of species. Managers must combine these habitat ideas with operational considerations to make decisions on a site by site basis, within the landscape context of providing a diversity of arrangements.

Diversity of tree structure should be considered when selecting trees for retention. Complex canopy structure and especially leaning boles are beneficial for some lichens. Trees that are asymmetrical provide a diversity of habitat substrates and often have more lichen and moss epiphytes on large lateral limbs than symmetrical trees (USDA Forest Service et al., 1993). Trees with some level of defect are likely to die and become snags sooner than straight, healthy trees. Relatively sound trees with healthy crowns are more likely to survive and contribute to habitat structure throughout the next rotation.

Snags — Snags help to meet the habitat needs of cavity-using species and to serve as a source of future down wood. Snags can be provided in all stand types, through a combination of existing snag retention, natural mortality in maturing stands, and artificial creation.

Standing dead trees are important to many species of wildlife, including woodpeckers, other cavity-nesting birds, raptors, bats, marten, bear, and many other birds and mammals. In fact, 55 species of wildlife require or frequently use snags for breeding, roosting, or denning in the Pacific Northwest (Weikel and Hayes 1999).

The number and diversity of cavity-using species in a forest stand are heavily dependent on the number of suitably sized snags within that stand. In natural forest stands, the highest level of cavity-nesting bird habitat is usually found in old growth forests, followed by newly regenerating stands (Mannan et al. 1980, Nelson 1989). With sufficient snag retention, managed forest stands in the regeneration stage may support healthy populations of cavity-using species; however, clearcuts where snags have been removed support very few (Schreiber 1987, Morrison and Meslow 1983).

It is apparent that, without special management, the number and diversity of cavity-using wildlife will decline within forests managed under traditional silvicultural systems. Current projections suggest that few commercial forests will be allowed to develop beyond 80 years of age (Sessions et al. 1990). Stands with an 80-year rotation will not be able to develop naturally the biological legacies of snags and down wood that are currently found in many plantations. However, if snag recruitment is properly managed during the rotation, snag management can retain a functional community of cavity nesters within the managed forest.

The snag management guidelines presented in this forest management plan are designed to provide nesting, roosting, foraging, perching, and denning habitat for the various species of wildlife that use snags in the forests of northwest Oregon.

Very little information exists on the size and abundance of snags required to maintain viable populations of species that use snags for part of their life history. Neitro et al. (1985) developed a model to determine the number of snags needed to maintain specific population levels of certain species of cavity-nesting birds. A critical assumption of this model is that if there are enough snags to provide nesting habitat for the target species, there will also be sufficient foraging habitat available to provide for the desired population levels. Weikel and Hayes (1999) contend that consideration of nesting resources alone in managing for cavity-nesting birds is probably inadequate, and that foraging resources also need to be considered. An adequate prey base cannot necessarily be supported when providing only for nesting trees. Given the uncertainties of the model's assumptions, the department is taking a different approach to snag management on state forest lands.

The department's approach is to manage for snags at levels approaching known historical levels. Spies et al. (1988) characterized snags and down logs in fire-originated stands in western Oregon and Washington, offering a view of the historical condition of snags in these areas. In the Oregon Coast Range, they found an average of 2 to 4 snags per acre greater than 20 inches dbh and more than 16 feet tall. In the Cascade Range they reported an average of 3 to 6 snags per acre of this size. These researchers included snags in all decay classes, from old, soft snags, to recently created hard snags. Soft snags may take many years or even decades to develop. The Department of Forestry's strategy is to retain all existing snags wherever possible and to provide at least 2 hard snags per acre across the landscape. In stands designated for older forest structure, the strategy is to manage for 6 snags per acre.

Spies et al. (1988) found that old growth stands had the greatest abundance of large snags, and younger stands had higher densities of small snags. Preference for large diameter snags has been documented for several species of cavity-nesting birds (Mannan et al. 1980, Schreiber and deCalesta 1991, Zarnowitz and Manuwal 1985, Bull et al. 1997). Neitro et al. (1985) reports that 10 of 11 species of cavity-nesting birds occurring in western Oregon and Washington used snags with diameters of 15 inches and greater. In the Coast Range, the overall mean snag diameter for 26 species of cavity-using species ranged from 12 to 29 inches, with only 2 species using cavities in trees less than 20 inches dbh (Weikel, unpublished data). The Department of Forestry's strategy is to provide snags of at least 15 inches dbh across the landscape, and in older forest structure at least 2 of the 6 snags per acre will be greater than 24 inches in diameter.

Rationale for snag distribution requirements — The distribution of snags is an important consideration. Most cavity-nesting birds defend nesting and foraging territories and exclude all other individuals. Snags may be distributed in either a clumped or scattered distribution.

Cavity nesters in natural forest stands tend to nest within aggregations of snags, or snag patches (Nelson 1989). However, this tendency may occur simply because snags in natural stands tend to occur in clumps (Cline 1977, Hemstrom and Logan 1986, Spies et al. 1988). A given number of snags uniformly or randomly distributed over a stand may provide habitat for more individuals of a given species than the same number of snags in one clump within the stand. Such a scattered distribution may allow the "packing" of more territories within a stand. However, a scattered distribution also has the potential to create many perches for hawks and other predators.

The key to managing for a range of species is to provide a diversity of arrangements. Managers will combine habitat considerations with operational requirements to make decisions on a site by site basis, within the landscape concept of providing diverse habitat conditions on the forest.

Down wood — Down wood on the forest floor provides many important functions in forested ecosystems. Some of the identified functions are mineral cycling, nutrient mobilization, maintenance of site productivity, natural forest regeneration (nurse logs), substrates for mycorrhizal formation, and provision of diverse habitats for wildlife species.

Wildlife use down wood for a variety of habitat needs including thermal and hiding cover, dispersal pathways, denning, feeding, food storage, reproduction (nesting), and resting (Franklin 1982, Bartels et al. 1985, Franklin et al. 1981, Maser et al. 1979). Studies have correlated or predicted that the abundance of small mammal and amphibian species in Douglas-fir forests is related to the abundance, size, and decay class of down wood (Corn and Bury 1991, Bury and Corn 1988, Aubrey et al. 1988, Corn et al. 1988). Carey and Johnson (1995) also found that species biomass and relative productivity of small mammals was greater in old growth than managed forests, and suggested that the amount of down wood and understory vegetation development appeared to play important roles in the observed differences.

Wildlife species have also shown preferences for different attributes of down wood structure, including debris size and decay condition. For example, in a study in the Oregon Coast Range, Corn and Bury (1991) found that clouded salamanders preferred large Douglas-fir logs with attached bark, an early decay stage, but ensatinas were found more often in well-decayed logs. The study also found that clouded salamanders appeared to prefer larger logs, in both diameter and length. Another study of amphibian species in southwestern Oregon and northern California found that large, well-decayed logs were the most heavily used down wood, though the use of particular size and decay classes of debris varied among salamander species (Welsh and Lind 1991).

Down wood is an integral component of the structure of old forest stands and provides a biological legacy from old stands to young stands after catastrophic events. This legacy can also be provided in managed stands if appropriate requirements are incorporated into timber harvest plans.

Over the life of a stand, the abundance of down wood tends to follow a U-shaped curve with high abundance in early stand ages (30 to 80 years), a low point during the mature stand phase (100 to 200 years), with increasing amounts and a peak as logs accumulate faster than they decompose during the old forest stage (Franklin et al. 1981; Spies and Cline 1988; Franklin and Spies 1991). After a catastrophic event in an older forest stand, such as a fire or windstorm, a biological legacy of down wood and snags remains as the new stand develops. This material gradually decomposes and the abundance declines, reaching a low point during the mature stand phase. Once the stand reaches the old growth stage, the recruitment of dead material begins to increase. In old growth stands of western Oregon and Washington, the volume and biomass of woody debris (snags and logs combined) average more than twice the amount found in mature stands (Spies and Cline 1988).

In young managed stands growing after a clearcut harvest, the abundance of down wood can be substantially less than in natural stands, due to the loss of down logs from salvage during harvest and site preparation activities, and the lack of large trees left as a source of future down wood (Spies and Cline 1988; Carey and Johnson 1995). Down wood in managed stands also tends to be of smaller average diameter than found in natural stands (Spies and Cline 1988). This pattern may be caused by the removal of down logs during timber harvest for utilization of the material, to clear sites for tree planting, and to reduce the risk of fire (Spies and Cline 1988). Periodic thinning and removal of trees in managed stands may also reduce the abundance of down wood, since the self-thinning processes found in natural stands are reduced in the managed stand.

The size class distribution of fallen logs varies among young, mature, and old growth stands. Old growth stands have the highest number of large fallen trees, defined as greater than 24 inches dbh (Spies and Cline 1988). The size of down logs can affect the functions of this material and its suitability as wildlife habitat. The size of the log affects its decomposition rate and, therefore, its longevity on the site. Since large logs decay more slowly than small logs, large logs will persist longer and will provide wildlife with habitat continuity over longer periods of time (Franklin et al. 1981). For this reason, this plan contains strategies to replicate old forest conditions that include requirements for the size of down logs.

Large logs typically persist in the forest environment for substantial time periods, often up to several centuries, due to slow decay rates (Franklin and Spies 1991). Since decomposition of this material is gradual, down logs in natural stands are present in a variety of decay stages. These stages are classified as decay classes I-V. The distribution of total down wood biomass in these decay classes has been shown to vary with stand age (Spies and Cline 1988).

In old growth stands, the greatest proportion of down wood occurs in decay class III (the intermediate class), with the remainder of the down wood nearly equally distributed between heavily decayed and nearly new fallen logs (Spies and Cline 1988). Highly decayed material (decay classes IV and V) only accounts for 26 percent of the total biomass of snags and logs in these old forest stands (Spies and Cline 1988). Young stands tend to be more dominated by heavily decayed down wood (Spies and Cline 1988). To replicate old forest conditions, it may be necessary to maintain or create these decay class distributions.

Given the variety of habitat preferences of wildlife species using down wood, a wide range of down wood should be maintained, by retaining or creating the debris in a diverse array of size classes and decay stages. Replicating old forest structural patterns of down wood is a logical strategy for maintaining a diverse wildlife community.

Currently, there is no scientific quantification of the exact amount of down wood needed to maintain a diverse community of forest wildlife species. Scientific research has documented that this structural material is important to many species, but detailed information is lacking on the minimum amount necessary to support the habitat requirements of the many species that use it. For example, Carey and Johnson (1995) suggest that 15 to 20 percent ground cover of down wood, well-distributed over the forest floor, appears to be adequate to maintain small mammals, whereas a 5 to 10 percent cover would not allow the animals to reach their potential abundance. These authors also caution that this substrate is not only important for small mammals but also provides critical habitat for birds and amphibians. Currently, there does not appear to be a definitive estimate of the amount of down wood needed to maintain all these groups of wildlife.

The Department of Forestry's approach is to manage for down wood at levels approaching known historical levels. Spies et al. (1988) characterized snags and down logs in fire-originated stands in western Oregon and Washington, offering a view of what the historical condition of snags in these areas may have been. In stands in the Oregon Coast Range, they found an average of 1,000 to 3,200 cubic feet of down wood per acre, and in the Cascade Range they reported an average of 2,200 to 4,900 cubic feet per acre. In their inventories, Spies et al. (1988) included down wood in all decay classes, from very decayed wood, to down logs that showed little evidence of decay. Approximately 20 percent of the down wood measured was in early stages of decay and considered hard down wood (T. A. Spies, personal communication). It may take many years or even decades to develop down wood that is very decayed. The department's strategy is to protect existing down logs wherever possible and to supplement existing down wood by providing additional logs during harvest entries. In regeneration harvest units, an average of at least 600 to 900 cubic feet of hard down logs per acre will be provided. In stands designated for older forest structure, the strategy is to manage for 3,000 to 4,500 cubic feet per acre of down wood in all decay classes.

Multi-layered forest canopies — Complex layering of forest canopies generally creates diverse habitat niches and benefits biodiversity. The more heterogeneous and complex the physical environment becomes, the more complex the plant and animal communities that can be supported, and the higher the species diversity (Krebs 1972). This is because structurally diverse habitats provide more available niches than do more homogeneous habitats.

Research has demonstrated that several closely related species with similar habitat requirements are able to live within the same area and avoid competitive exclusion by partitioning the available resources into several distinct subsets. For example, MacArthur (1958) observed that five species of similar-sized insect-eating warblers were able to co-exist within the same forest primarily because they fed at different positions in the canopy. Furthermore, MacArthur and MacArthur (1961) found that foliage-height diversity (a measure of stratification and evenness in the vertical distribution of vegetation) was even more valuable in predicting bird-species diversity than was plant-species diversity. This evidence indicates that a heterogeneous canopy structure provides more available niches that would allow the presence of a greater number of wildlife species.

The uniform, even-aged forest stands produced under traditional forest management can not support the diversity of species found in most natural stands, or in managed stands that have a complex vertical structure. The species found in low-diversity plantations usually are habitat generalists or aggressive habitat specialists that exclude other species from the limited number of available niches. As increasing acreages are managed in low diversity stands, the species that are excluded from low-diversity plantations may become scarcer, some even to the point of classification as threatened or endangered. For this reason, under this forest management plan, forest management will be used to develop complex stands with multi-layered forest canopies.

Multiple native tree species (conifers and hardwoods) — Increased tree species diversity within and among stands generally creates more diverse habitat niches and benefits biodiversity. Structurally diverse habitats provide more available habitat niches and can support a greater wildlife species diversity than do more homogeneous habitats (Krebs 1972). Hagar (1992) found that the presence of hardwoods within Douglas-fir stands was an important factor influencing the presence and abundance of several species.

Multiple tree species in a stand may lead to several wildlife habitat benefits.

- Different growth rates, tree forms, and shade tolerance result in increased vertical and horizontal within-stand diversity.
- Different tree species support different insect communities, which may lead to a greater diversity of foliage- and bark-gleaning wildlife species.
- Presence of short-lived species, such as red alder, may lead to an important source of within-stand decadence within younger stands as individuals begin to decline and die around age 40 to 65.

Herb/shrub considerations — Diverse herb and shrub vegetation layers provide important forage for wildlife, provide diverse habitat niches, and benefit biodiversity. Herbs and shrubs in recently harvested units provide an important source of forage for big game species. Other native plants, such as bitter cherry and elderberry, provide important forage for a large variety of non-game species. Large bigleaf maple trees are an important source of natural cavities and habitat structure in the forest. Unfortunately, these same plants compete with the planted and seeded trees that will grow to form the new forest stand. Plantation vegetation management is designed to control vegetation that is competing with commercial tree species. Overly aggressive vegetation management assures a successful plantation, yet greatly reduces the habitat value of the young plantation for wildlife. Aggressive vegetation management also truncates the herb-shrub (regeneration) stage and accelerates the onset of the closed single canopy stage, which has a much lower wildlife habitat value.

Morrison and Meslow (1984) studied differences in habitat structure and bird communities between young plantations in the Oregon Coast Range that were sprayed with phenoxy herbicides (2,4-D and/or 2,4,5-T) and unsprayed controls. Four years after spraying, the main vegetative difference between the control units and treatment units was a reduction in vegetative complexity on treated sites. This simplification in vegetation was primarily due to reduced deciduous tree cover. Although rapid re-growth of shrubs was evident following treatment, deciduous trees remained suppressed at least four years after spraying. The researchers found that bird communities were similar between the control and treatment units. They speculated that this was because of a rapid recovery of the shrub component after phenoxy herbicide spraying. The greatest impact of spraying was on bird species that mainly used hardwoods for foraging, although some of these birds modified their behavior and foraged on shrubs in the treatment units.

The researchers concluded that by maintaining a shrub component within the unit and by maintaining small patches of deciduous trees, managers could maintain bird communities similar to those on untreated sites. In other words, as long as the vegetation control practices are designed to control, rather than to eliminate competing vegetation, the impact of vegetation management on bird communities is minimal.

Wildlife habitat can also be affected by changes that occur in the vegetation community as stands progress from the regeneration to closed single canopy stage. Wildlife species that prefer the open habitats of the regeneration stage will gradually become excluded as canopy closure progresses. As the overstory reaches full canopy closure, understory vegetation will be severely reduced or eliminated and the wildlife values provided by this vegetation will be lost. Specifically, the abundance of forage, cover, and the vertical diversity provided by tall shrubs becomes reduced. However, succession into the closed single canopy stage can create other important wildlife habitat elements. The closed single canopy stands can provide thermal, hiding, and escape cover, especially for big game mammals. For these reasons, it is important to have closed single canopy stands as a part of the forest landscape.

As stand development progresses through the regeneration stage, the changes in the understory vegetation community cause changes in wildlife habitats and wildlife communities in the stand. As these stands become more open and the understory develops, wildlife habitat components such as forage and cover are provided and some species that prefer more open habitats may begin to recolonize the site. Development of multiple layers of vegetation will increase the amount of vertical diversity in the stand, and provide additional habitat niches that can support increasing numbers of wildlife species. However, the response of wildlife to these vegetative changes will also be affected by the abundance of other important structural habitat components, such as snags and down wood.

Gaps — Gaps increase the horizontal diversity within stands, provide important forage for wildlife, provide diverse habitat niches, and benefit biodiversity. A within-stand "gap" is an interruption in the continuity of the vegetative community in a stand. These gaps are generally small openings (½ to 2 acres) where herbs, shrubs, and new trees are being established, within larger stands with a dominant overstory tree canopy. One example of a gap is an opening created by windthrow in a densely stocked stand of trees.

Much research has been done on the ecology and wildlife dynamics of large, between-stand gaps in forests, such as those created by wildfire or clearcutting (Dyrness 1973, Agee and Huff 1981, Hemstrom and Franklin 1982, Halpern 1987). However, relatively little information is available on the ecology of small canopy (within-stand) gaps. Spies et al. (1990) presented data supporting the concept that small-scale gap disturbances and vegetation response are important driving forces in the dynamics of Douglas-fir/western hemlock forests. They found that gap formation rates and vegetative responses were slower in these forests than in other forest types.

Understories in old growth stands tend to be much patchier than in younger forest stands. This patchiness is partially a response to varied overstory conditions. Gaps are important structural features of old growth stands and typically persist for long periods. Well-developed understories of herbs, shrubs, and small trees characterize such open habitats. Heavily shaded sites ("anti-gaps"), also characteristic of old-growth forests, produce areas from which green plants may be almost totally absent (Franklin and Spies 1991, Spies et al. 1990).

Silvicultural Practices

The application of silvicultural tools to achieve the long-term goals of SBM is based on identifying the current options for the management of existing stands, understanding the future options likely to result from current silvicultural manipulations, and effectively implementing the necessary silvicultural prescriptions to achieve the desired future condition. These are the everyday skills that foresters have used for decades. The key adaptation that must be made is to focus is on a different desired future condition.

Each basin or grouping of stands will differ in their current condition and potential for future stand development. Therefore the range of options that can be created within stands or the speed with which the desired future condition can be achieved will vary (for example, a basin consisting largely of unmanaged older stands will often have fewer future options than younger managed stands that have been subjected to appropriate density management).

There are no specific single or fixed set of treatments that can be applied to all stands to achieve the desired future condition. Specific prescriptions must be developed for each set of stand and environmental conditions. The silvicultural tools themselves will have to be applied in a variety of ways to meet the various goals in the forest management plan.

Over the long term, SBM focuses on producing a desired array of stand structures across the landscape. However, most planning will focus on a shorter time frame — perhaps the next 10 years for planning and accomplishing specific management practices, and the next 20 years for projecting stand and landscape development and tentatively scheduling future activities. Adaptive management approaches and monitoring will provide the feedback and tools to make future prescriptions.

This shorter time frame is a more realistic planning period within which current stand and forest conditions can be assessed in light of the long-term goals, various management scenarios can be analyzed, and future stand options considered. Stand conditions as they exist today are the basis for silvicultural manipulations, which will be planned to move the northwest Oregon state forests toward the desired future conditions.

In the short term, silvicultural treatments will aim to create diverse options for stand and forest management in the future, while providing timber and revenue, improving wildlife habitats, and maintaining biodiversity today.

In stands not planned for short-term regeneration harvest, SBM's basic approach is active management of vigorous stands to maintain vigorous tree growth, produce valuable forest products within practical economic timeframes, encourage shrub and herb development, and to retain, maintain, or enhance the structural complexity of those stands to the extent possible. Where regeneration harvests occur, structural components will be retained in order to enhance the complexity of new stands.

The silvicultural tools that will be used are listed below, and discussed in the following pages.

a. Regeneration harvests
   - Clearcuts
   - Clearcuts with modifications
   - Seed tree cuts
   - Shelterwood cuts
   - Selection harvests, single-tree and group selection
   - Modifications to retain structure and snags
   - Rehabilitation of brush and serious plantation failure areas

a. Reforestation
   - Site preparation: fire, mechanical, chemical
   - Planting (and rarely seeding) — species, selection, appropriate stock, and genetics
   - Natural regeneration
   - Introduction of additional species (for example, forage seeding)
   - Seedling animal damage control
   - Vegetation management: manual and chemical
   - Interplanting and replanting
   - Control of bear foraging

a. Density management
   - Cleaning and thinning through precommercial thinning and hand release
   - Commercial thinning

a. Combination regeneration harvests/ density management treatments

b. Laminated root rot control

c. Pruning

d. Fertilization

e. Genetics

Silvicultural Tools, Silvicultural Practices, and Forest Management

Silvicultural practices are the tools available to achieve the desired future condition described in this plan. Many tools are available. Silvicultural results depend on the practice chosen, the way the treatment is applied, and the conditions in the treated stand. Silviculture works with stands (groups of trees that interact with each other over areas of several acres to several hundred acres). In the northwest Oregon planning area, most stands are even-aged.

Silviculture works with the ecological processes of stand development and stand recovery following disturbance. Disturbance is a part of nature. Forests are affected by windstorms, fire, drought, soil movements, insects, animals, and disease organisms. Forests are adapted to respond and recover from disturbances. Most silvicultural practices deliberately disturb stands and/or remove parts or all of the stands to encourage subsequent stand development along desired pathways. Some of these removals provide the harvests from the forest.

Stand response to a treatment depends on the stand's condition before and after the treatment. Two key attributes of stand condition are the variation in tree size(especially diameter) and stand density (the number of trees, considering their diameter). Stand density is explained in the sidebars on the next two pages.

Stands with different structures develop differently after silvicultural treatments. Natural stands and plantations react differently. Existing plantations generally have less variability and less structure than natural stands. They are usually in more need of deliberate treatment to maintain stand vigor and development. Silvicultural practices may enhance or decrease stand structure.

Stand development is driven by density. Individual trees must grow larger or die. They cannot mark time unchanged. This means that any group of trees will eventually grow large enough to interact and interfere with each other. This process drives stand development. Active management adds nothing new, but may sharply increase the pace of stand development or forestall negative developments.

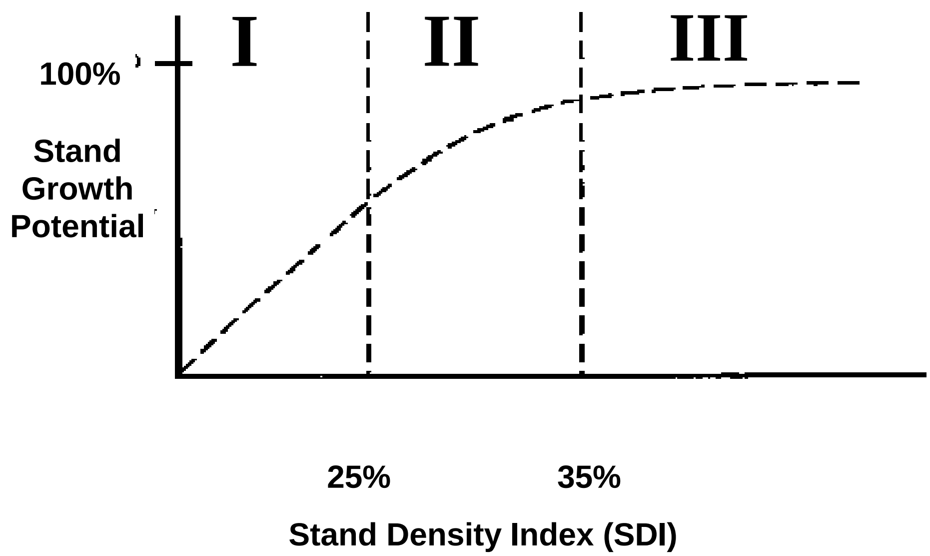
Silvicultural practices can only be prescribed and evaluated when management has clearly described the desired future condition. Silvicultural practices may be chosen to take stands along different paths depending on the management goal. For example, precommercial thinnings may be prescribed to produce a uniform stand of large diameter evenly-spaced trees or to produce a more varied stand of large and small trees with clumps and open areas. The former may be most appropriate to optimize certain values and the latter more appropriate for others.

Silvicultural accomplishment must be measured against the management goal. For example, 95 percent plus reforestation success may be an appropriate goal for optimal young stand management; it may or may not be necessary or desirable for wildlife goals. Economic considerations are an essential part of silvicultural practice. There are often several ways of achieving the same results. Rational choice of silvicultural methods requires explicit identification of objectives and calculation of costs and revenue, including the time value of investments.

Stand Density

Foresters have found that the total production of cubic volume, by a stand of given age and species on a given site, is for all practical purposes, constant and optimum for a wide range of stand density. This is the basis of all thinning. Foresters can grow the same volume in many small trees or fewer large trees.

From a density standpoint, there are three stages of stand growth.



I. Open growth — Stand is in the regeneration stage. There are no density-related light, water, or soil nutrition limitations. Non-tree vegetation is often lush. Trees grow at their full potential unless affected by competing vegetation other than trees (such as shrubs).

II. Onset of competition — Stand enters the closed single canopy stage. Trees compete for light, water, and/or soil nutrients, and not all trees can grow at their optimum rate. Understory vegetation declines.

III. Maximum stocking — Density-related mortality occurs. Understory vegetation is minimal or absent.

Stand Density

Department foresters measure stand density with Reineke's Stand Density Index (SDI). This index is calculated from the stand's average diameter and the trees per acre:

$$SDI = TPA \times (Diameter/10)^{1.6}$$

The maximum SDI is 600 for Douglas-fir, 800 for the more tolerant western hemlock, and 440 for the more intolerant red alder. Stand density is often expressed as a percentage of these maximum values. For example, a Douglas-fir stand with 300 trees per acre and an average diameter of 10 inches has an SDI of 300 and a relative density of 50 percent.

The silvicultural significance of several key SDI values is explained below.

SDI	Silvicultural Interpretation
25%	Crown closure and onset of self-pruning, competition, and discouragement of understory.
35%	Lowest limit of full site occupancy. Self-pruning, competition, and halt in understory development become significant.
55-70%	Trees stressed. Self-thinning begins — earlier in stands with well-developed stand structure; later in stands without stand structure. Understories disappear.
100%	Maximum stocking; rarely observed.

Density management prescriptions for wood growth are thus straightforward. To grow the most wood, help the stands reach 35 percent SDI as quickly as possible, use precommercial or commercial thinning to keep them between 35 and 55 percent during their growing years, and let them reach 70 percent just before final harvest. However, foresters modify these prescriptions to achieve other management objectives besides wood growth. Examples of other objectives are the retention of understories, the development of larger trees, or the production of natural mortality. These stand characteristics produce diversified wildlife habitat, meeting the needs of wildlife species.

This theory applies to idealized, average stand conditions. Stands in the real world are rarely homogeneous. Understories may develop and persist in less stocked areas of otherwise well-stocked stands. Thinned stands are particularly variable due to variations in individual trees, skid road and cable corridor openings, etc.

Regeneration Harvests

Regeneration harvests are intended to replace an existing stand. The trees are removed and the stage is set for reforestation. Regeneration harvests are appropriate prescriptions where the existing stand is mature by the management objectives, contains defective or undesirable growing stock as defined by the management objectives, or has low vigor with a significant risk of loss.

To trigger reforestation and allow it to develop, stand density must be reduced below 25 percent SDI and maintained below 35 percent until the new trees are part of the stand. This density level differentiates regeneration harvest from thinnings. Regeneration harvests may be referred to as reinitiation harvests.

There are several types of regeneration harvest. For most stands in northwest Oregon state forests, the most appropriate type to assure successful establishment of new trees is the clearcut or clearcut with modifications. A group selection harvest may be appropriate in some circumstances. The seed tree or shelterwood method may be appropriate for regeneration of western hemlock. Single tree selection may be appropriate for certain mixed western hemlock, Sitka spruce, or western redcedar stands. Elsewhere, seed tree, shelterwood, and single tree selection methods will rarely be appropriate.

Clearcuts — Clearcuts remove all trees in a stand. On almost all sites in northwest Oregon state forests, clearcuts will provide the best conditions for successful plantation establishment. However, clearcuts, by definition, eliminate the carryover of residual stand characteristics.

Clearcuts with modifications — In this plan, clearcuts are modified to leave residual green trees, snags, or trees destined to become snags specifically for their biological or environmental values. In this harvest method, the intent of the modifications is not to help achieve regeneration, but rather to provide for the other values. In fact, these modifications may detract from reforestation. In other harvest methods, such as seed tree cuts, shelterwoods, and selection harvests, trees are left to help achieve regeneration. Thus, trees left for biological or environmental values may be of significantly different species, condition, or location than trees left to help regeneration. In a clearcut with modifications, overstory trees, if alive and reasonably vigorous, will contribute to the overall stand stocking and may compete with the regeneration. SDI may be approximated by calculating and summing the overstory and understory SDIs.

Seed tree cuts — Seed tree cuts leave scattered stable trees of appropriate species for natural seeding of a new stand. This method works well with western hemlock on moist sites. With all other species and on other sites it cannot be considered sufficiently reliable to meet the Oregon Forest Practices Act.

Shelterwood harvests — In this method, the original overstory is removed in two or three stages over several years. This method will work with most conifer species found in northwest Oregon state forests, but is not necessary to regenerate any of them. Because of its logistical difficulty and careful timing requirements, it will rarely be appropriate on northwest Oregon state forests. The exception may be western hemlock stands where western hemlock regeneration is desired but the overstory trees are not considered sufficiently windfirm for seed tree methods.

Selection harvests: single-tree and group selection — Unlike the previous even-aged regeneration methods, selection harvests develop and maintain many-aged stands. Regeneration harvests, precommercial thinnings, and commercial thinnings are combined in this method. Trees are removed individually (single-tree selection) or in groups of half-acre to several acre patches. As the patch size increases, group selection tends toward clearcutting. The operative difference is whether the regeneration develops under the influence of the overstory.

Individual tree selection may be appropriate for mixtures of tolerant western hemlock, Sitka spruce and western redcedar where stand continuity of older forest characteristics is desired. With proper attention to vegetation management and reforestation, group selection methods should work with any tree species in the northwest Oregon state forests other than red alder, though growth of the new stand should not be expected to be as high as with clearcut methods.

Rehabilitation methods — Where desired by management, the replacement of brush fields, grass areas, and/or failed plantations will generally be by methods similar to clearcuts. Only minor acreages of these remain in northwest Oregon state forests. An exception is the extensive acreage of Swiss needle cast-infected Douglas-fir plantations in Tillamook County. Regeneration may be the most appropriate practice for these areas.

Comparison of regeneration harvest methods — Regeneration harvests will have obvious impacts on stand structure. Selection methods will retain the most structure. Clearcuts with modifications will retain some structure. Regular clearcuts have the least structure and provide more limited opportunities for structural development in the future. Seed tree and shelterwood cuts retain and promote a fair degree of stand structure, primarily through their less certain and more variable regeneration. Stand structure also influences selection of the regeneration harvest method. Dense stands, with skinny, crowded trees (often referred to as “doghair” stands), often are not windfirm enough to handle partial cutting; clearcutting may be the only practical method for these stands.

Reforestation

Reforestation to the standards and timeframes of the Oregon Forest Practices Act is not easy or automatic in the conditions found in the northwest Oregon state forests. Reforestation requires various combinations of site preparation, planting, animal damage control, vegetation management, and occasionally interplanting or replanting. These practices must be considered and prescribed for individual stands on a site-specific basis.

Common silvicultural practices for reforestation are discussed briefly on the next page.

Site preparation — In many circumstances, the harvest operation provides sufficient site preparation for planting. In other circumstances, slash, organic debris, and duff are physical barriers to planting, or the site is already occupied with existing or sprouting competing vegetation that will prevent or delay tree establishment. In these cases, site preparation by fire, mechanical means, or chemicals is appropriate.

Planting — In most circumstances trees are hand-planted. Natural regeneration, as a primary mechanism for reforestation, is usually restricted to western hemlock on moist sites or to fill-in with additional trees. Appropriate species selection and use of the appropriate nursery stock are important. These procedures are well worked out with Douglas-fir, and to a large extent, with western hemlock, but it has been difficult to obtain appropriate planting stock for western redcedar, true firs, and hardwoods.

Tree improvement — Trees are genetically adapted to certain sites. Selection and control of seed source is critical. Unimproved seed is collected from local seed zones. Tree improvement programs are underway for Douglas-fir and western hemlock; most trees being planted today are from the tree improvement program. These trees are expected to display better health and more vigorous growth.

Introduction of additional species — In some cases wildlife forage crops may be seeded in order to benefit wildlife. Reforestation may be aided if the crop displaces what would otherwise be a more competitive species.

Tree protection — Seedlings may be harmed or destroyed by animal browsing. Elk, deer, mountain beaver, rabbits, and rodents may all be problems. Some species, such as western redcedar, are particularly favored by animals and often eliminated. Thorough site preparation and large planting stock are the best indirect controls; these get the trees off to a good start and allow them to outgrow damage. In many other cases direct control or prevention of animal damage is essential. Significant mountain beaver populations must be trapped. Seedling protection by bud caps, netting, or Vexar tubes is appropriate in many circumstances. Repellents have potential, but results have been erratic.

Vegetation management — The northwest Oregon planning area has some of the most productive tree-growing areas in the world. However, it also supports some of the most competitive native and introduced herbs, shrubs, and hardwood trees in the world. Vegetation management is usually needed to allow conifers to reach full stocking within Oregon Forest Practice Act timeframe requirements. Chemical applications are usually the preferred method of vegetation management as they allow precise targeting with minimal site damage or side effects.

Cleaning (hand release) — A common practice in conifer stands is the removal of red alder stems, vine maple stems, and/or bigleaf maple sprouts that are overtopping conifers. This is usually done with hand-applied chemicals (hack and squirt). The current emphasis is to leave any individuals that are not overtopping conifers or any areas of only minor overtopping, in order to encourage biodiversity.

Interplanting and replanting — These practices are now infrequent.

Control of bear foraging — Black bears may forage on conifer trees in the spring, damaging or killing individual trees or patches. Bears attack vigorous trees 6 inches in diameter and larger. Control methods include feeding bears and/or snaring individual problem bears.

Status of reforestation in the northwest Oregon state forests — Department foresters have worked out excellent methods of reforestation. Fully stocked Douglas-fir plantations occupy over 95 percent of most past sale areas. However, management objectives are changing for many stands, and foresters must adapt their reforestation methods to meet the new objectives. More work and adaptive management procedures will be needed to achieve successful reforestation with different and multiple tree species, to incorporate modifications to clearcuts, and to meet the needs for a diversity of stand structures and wood quality.

Most young stand management practices in reforestation have produced plantations with reduced stand structure. Good planting stock is uniform. Site preparation, vegetation management, and control of animal damage all make growing conditions more uniform. Given this, subsequent silvicultural practices will be needed to introduce or encourage stand structure in managed plantations.

Most Coast Range plantations developed over the last 20 years are growing well in excess of expectations. Individual trees are reaching 4.5 feet heights in 2 or 3 years and crowns in unthinned plantations are closing in about 5 or 6 years. Many stands on site class II and III soils are growing at rates expected on site class I soils. Biomass volumes may be 50 to 75 percent ahead of projections. This result is probably due to the reforestation practices listed above, and early precommercial thinning. However, there is serious concern about the wood quality of many of these fast-growing trees. The trees have frequent multiple tops, large and persistent ramicorn branches, excessive sinuosity and deformations in the main stem, and patterns of many large branches in multiple whorls. These problems are most serious over the lower 10 to 30 feet, which normally becomes the most valuable log in the mature tree. The extent of these problems has encouraged agency foresters to increase initial planting density and delay precommercial thinning, to let greater density slow the vigor. Other possible solutions are removal of poorly formed trees or marking during initial commercial thinning.

Density Management: Precommercial and Commercial Thinning

Thinning regulates stand density. In precommercial thinning, the cut trees are left unused and the operation is carried out at cost. In commercial thinning, some or all of the cut trees are used and the operation produces revenues. Both practices have the same silvicultural impact. Thinning decreases natural mortality, maintains stand vigor, and develops healthier, larger, more windfirm, and generally more valuable trees. By removing trees that would otherwise die in the competition for light, nutrients, and water, commercial thinning increases net stand production over time. Thinning may also directly improve tree quality and tree size through selection of the better and larger trees for the residual stand. Potential drawbacks to thinning are the lower wood quality associated with larger branch diameters and increased stem defects in young stands thinned before crowns close and growth slows on lower branches; loss of snags for wildlife in thinned older stands; and decreased stand structure. Residual stand damage is minimal with proper contract administration.

Both precommercial and commercial thinning are optimally carried out before density-related competition reduces tree vigor, i.e., between SDI 25 and 55 percent. Precommercial thinning may be delayed to the higher end of this range to suppress branch growth. Commercial thinning is usually delayed to the upper end of the range to maximize harvest volumes, in order to improve sale revenues and reduce the number of stand entries. Thinning reduces the stand density to the point from which the stand will grow back to the desired stand density at the projected next entry, either another thinning or a regeneration harvest. This point may be anywhere from 25 to 45 percent. Some very vigorous young stands may be taken temporarily below 25 percent SDI, as these stands recover and quickly exceed 25 percent SDI. Thinning is marginal or inappropriate in overly dense stands with high height/diameter ratios.

Tree selection in precommercial thinnings is carried out by tree cutters, with species selection and the number of residual trees specified by foresters. Tree selection in most commercial thinnings is also done by cutters, with foresters specifying the minimum average diameter of residual trees and acceptable residual stand basal area. These “auto-mark” thinnings have provided better results than thinnings where trees are individually marked. Fallers can consider all aspects including tree selection, lead, and location of skid roads and cable corridors. Individual wildlife trees, trees of minor species desired in the residual stand, or any other exceptions to auto-mark specifications need to be individually marked or otherwise specified. In the future more individual tree marking or alternate contract specifications may be necessary due to the increased stem defects in managed plantations and the need to carefully select against these.

In the short term thinning may reduce the range of tree diameters through removal of smaller trees and forestalling future mortality. However, in the long term, thinning may increase future stand structures by developing larger, more windfirm trees that will respond to future treatments designed to enhance stand structures. Thinning also encourages the development of a more diverse group of shrubs and herbs. Modifications can be made to maintain and/or enhance stand structure. These modifications include maintenance of existing older or larger overstory trees and snags, deliberate creation of snags, and retention of unthinned areas within stands.

Regeneration Harvests and Density Management Treatments Combined

In the Oregon Coast Range, many stands consist of mixtures of clumps of mature or slow-growing red alder with scattered emergent conifers and generally over-stocked stands of conifers. The conifers are chiefly planted or seeded Douglas-fir but include natural western hemlock and scattered western redcedar, Sitka spruce, and true firs. In the absence of management, these stands will quickly lose vigor through density-related competition. With management, stand structure can be maintained and greatly enhanced.

Department foresters have developed sale prescriptions that simultaneously: 1) thin over-stocked but still vigorous conifer areas; 2) regeneration harvest mature hardwood areas and over-stocked and non-vigorous conifer areas; and 3) retain most emergent established conifers and many of the existing snags, as modifications to the regeneration harvests. Regeneration harvest areas included in these sales range from small clearcuts to group selection openings. Reforestation and management of competing vegetation is planned on the regeneration harvest areas; natural regeneration of minor species is also likely to occur in many areas.

Regenerated areas in these sales are not expected to produce as much timber volume as plantations on clearcut areas. However, the commercially thinned stands produced by these treatments will be much more productive than if regeneration harvested and converted at this time. There are many future silvicultural options for these stands. They could be rethinned a number of times and carried to long rotations; they could be gradually converted to many-aged stands through group selection harvests; or they could be regeneration harvested through clearcuts and be replaced by plantations. In many cases, decisions on these options need not be made for many years, even decades.

Laminated Root Rot Control

Laminated root rot is the most widespread disease in the northwest Oregon state forests. It occurs in scattered clumps on about 10 percent of the forest area. It is most damaging to Douglas-firs and true firs. Western hemlock is affected but is not lost to the disease. Hardwoods are immune. Western redcedar, western white pine, and ponderosa pine are resistant. The only known control is to remove affected conifers from infected areas until all conifer roots are completely decayed.

The main silvicultural option for control is to remove all affected conifers from infected areas and buffer zones and to keep affected conifers out of these zones. This treatment has been done during commercial thinnings. Foresters have attempted to regenerate treated areas to red alder, western white pine, and western redcedar. This has been only partly successful due to the difficulty of regenerating these species. Options are to continue these practices, regenerate appropriate areas with the more easily reforested western hemlock, or accept continued losses. Another option would be to reforest the openings with bigleaf maple, a more appropriate hardwood species for many higher elevation areas in northwest Oregon. However, techniques for successful establishment of bigleaf maple seedlings are not currently known. Another silvicultural option is stump removal. Final harvest removal of large stumps is expensive, impacts the soil, and may leave some root rot. Tree pushing instead of felling may also be effective for stump removal. Removal of smaller stumps at commercial thinnings may be more feasible wherever ground logging equipment is working. With stump removal, regeneration to any conifer, including Douglas-fir, would be appropriate.

Stand structure will be maintained or enhanced by laminated root rot control since the stand will contain openings with or without control.

Pruning

Production of structural grade wood generally requires that knots be kept to 1.5 inches diameter or less. This standard can be achieved by maintaining Douglas-fir plantations at 250 to 300 trees per acre or more, until crowns close and are 30 to 40 feet above the ground. Larger knots may be tolerated in very large diameter trees. Where such management is not desired; where stands have already been spaced to lower stocking; or where plantation losses to competing vegetation, bears, mountain beaver, deer, and elk have reduced stocking to lower levels; pruning is appropriate. Pruning will also create clear wood wherever it is carried out. It is the only method of producing clear wood over rotations of less than 100 years.

Pruning is optimally done to maintain a small diameter, cylindrical, defect core in the center of the tree. Pruned trees must maintain a minimum of 50 percent live crowns. The percentage of live crown equals the percentage of the tree bole that has live branches, i.e., a tree 40 feet tall must have live branches on at least 20 feet of its trunk. To maintain the live crown and minimize the core, pruning should be done in several lifts as the tree grows. The first log up from the ground is the most valuable part of the tree, and the most vulnerable to large branches in plantation culture. Pruning should be carried out to as high a point as is practical (at least 18 to 24 feet and possibly to 40 feet) where large valuable trees are expected.

Effective techniques for pruning with loppers and ladders have been developed based on New Zealand experience.

Pruning is not needed to grow structural wood in western hemlock stands. It would be needed to grow clear wood. Pruning, along with early trimming to one central stem, is also anticipated as a necessary practice in red alder plantations. However, this pruning need not reach as high up the tree.

Pruning should not alter stand structure. Pruning most trees in a stand, especially when combined with early precommercial thinning, will significantly increase light to the forest floor, thereby prolonging the regeneration stage and herb and shrub forage values.

Fertilization

Many forest stands are deficient in nitrogen. Douglas-fir and true fir stands have been shown to respond to nitrogen fertilization by increasing volume growth for 4 to 12 years after fertilization. Average response is 1,000 or more board feet per acre to fertilization with 200 pounds N (nitrogen) in urea. Response is better in thinned stands than in unthinned stands, and better on lower sites than on higher sites. Response is especially likely in the Tillamook Burn because the fires undoubtedly released much of the nitrogen on the sites. Where intermixed red alder has added nitrogen to stands, response is less likely. Response is limited on site I soils and does not occur in western hemlock or red alder stands. Response has been demonstrated for the period following stand closure up to about age 80. Stand response past that age is unknown. Applications may be repeated, with similar response, at 4 to 8 year intervals. Application is via helicopter in the winter.

The optimum extent and frequency of fertilization are economic investment questions. Fertilization adds volume, and therefore value. However the effects on overall stand development have not been well documented and different situations will likely result in different outcomes. In some circumstances, fertilization may accelerate stand development, but it is unlikely to significantly change other forest attributes. Fertilization will not necessarily increase stand structural complexity. In other cases it may slow the stand development progression by improving the diameter growth of smaller trees and delaying mortality.

Fertilization prescriptions may change in the future for plantations. In the Coast Range, many of these plantations are observed to be growing at significantly higher rates than previously expected. They may well respond differently or not at all to nitrogen fertilization. Foresters are considering trying balanced application of multiple nutrients with prescriptions tailored to individual sites after analysis of foliage. Response may be very significant, especially where response to nitrogen alone is not observed. Application of minor nutrients may also reduce the incidence of stem defects frequently observed in high site Douglas-fir plantations in the Coast Range. These stem defects are of serious concern for wood quality.

Some studies have been done on tree response to urea fertilization in managed stands, and additional studies are being done. Formal research work with balanced nutrition has not been carried out.

Genetics

Reforestation projects on state forest lands will take advantage of the highest quality seed to assure that forest trees and forest stands are well-adapted to planting locations and are capable of growing vigorously with resilience to forest health threats.

The Department of Forestry has initiated genetic tree improvement efforts for several forest tree species like Douglas-fir, western hemlock, western redcedar, western white pine, Sitka spruce, and red alder. The principle objective of improvement efforts is to ensure that high quality, well-adapted forest tree seed is available for reforestation programs. The breeding phase includes the selection and breeding of healthy, vigorous trees and field testing across a variety of environmental conditions. The production phase involves the propagation of the best selections into a seed orchard to enable the cost-efficient production of genetically improved seed.

The Department of Forestry's J. E. Schroeder Seed Orchard produces seed from a wide variety of forest tree species for general, specific, and forest structure silvicultural objectives. For species like Douglas-fir and western hemlock, seed orchard seed will be used for planting and seeding programs on state forests. Seed is mixed from a number of selected families to insure that an adequate level of genetic diversity is maintained in planted forest stands. Seed from certain selected seed orchard trees may be used to achieve specific objectives such as improvement in wood quality characteristics and the value of timber at maturity.

The Department of Forestry is also involved in genetic improvement efforts to improve levels of pest resistance. Douglas-fir tree selections that demonstrate a tolerance to Swiss needle cast are being used in planting projects in cooperation with other landowners. The Department of Forestry is also working to develop tip weevil-resistant Sitka spruce. This pest has caused extensive damage to this conifer species. Field trials to test potential tip weevil-resistant spruce trees have been planted on two state districts, Astoria and Tillamook. In a cooperative project with the U.S. Forest Service, the Department has access to western white pine seed that is genetically resistant to blister rust, a deadly pathogen that kills almost all natural white pine trees. All western white pine currently planted on state forest land comes from blister rust-resistant seed stocks.

The development and use of appropriate genetic stocks that survive well, are adapted to a variety of environmental conditions, and produce healthy, vigorous forest trees is a basic tool that helps provide forest stands that meet landscape and the desired future condition for stand structure.

Appendix D

Legal and Policy Mandates

This section describes in detail the main legal and policy mandates that affect state land management. It is divided into the five sections listed below.

- **Board of Forestry Land —** This section discusses the history, legal mandates, policy mandates, and funding mechanisms for these lands.
- **Common School Forest Land —** This section discusses the history, legal mandates, policy mandates, and funding mechanisms for these lands.
- **Comparison of state and federal legal mandates —** The legal mandates for state forests are very different from the legal mandates for national forests. This section discusses the key differences.
- **Other legal mandates —** This section discusses other legal mandates that affect the management of state forests, including a 1992 Attorney General's opinion on the objective of Common School Forest Land management; federal and state Endangered Species Act requirements; Oregon Forest Practices Act requirements; and Oregon land use laws.
- **Legal and policy mandates for specific resources —** This section discusses mandates that apply to specific resources.

Board of Forestry Land

History

Board of Forestry (BOF) lands were acquired by the Board of Forestry in two ways: 1) through direct purchase; and 2) through transfer of ownership from counties in exchange for a portion of the future revenue produced by these lands.

Under the Board of Forestry's supervision, the Department of Forestry manages BOF lands to provide 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.

Legal Mandates

Forest Management Planning

The Oregon Revised Statutes refer to forest management planning in ORS 526.255, which calls for "long-range management plans based on current resource descriptions and technical assumptions, including sustained yield calculations for the purpose of maintaining economic stability in each management region." Oregon Administrative Rule 629-035-0030 provides more specific direction on what information these forest management plans must contain and the mechanisms for Board of Forestry approval.

Other Key Statutes and Rules

Oregon Revised Statutes 530.010 through 530.170 guide the acquisition, management, and development of state forests that are under the jurisdiction of the Board of Forestry. The statutes are discussed below and on the next page.

1. ORS 530.010 authorizes the Board of Forestry, in the name of the State of Oregon, to acquire lands which are chiefly valuable for forest crop production, watershed protection and development, erosion control, grazing, recreation, or forest administrative purposes.

   The lands may be acquired by purchase, donation, devise, or exchange from any public, quasi-public, or private landowner. All land acquisitions are subject to the prior approval of the county commissioners of the county in which the lands are located. The lands so acquired are designated as "state forests."

2. ORS 530.030 deals with the conveyance of county forest lands to the state. This statute recognizes that BOF lands are managed to produce income for the counties.

   Most of these lands were originally acquired by the counties through foreclosure of tax liens. Under county ownership, the lands provided revenue to the counties. The statute maintains this revenue source by allowing ownership to be conveyed to the state "in consideration of the payment to such county of the percentage of revenue derived from such lands." The percentage distribution of revenue between counties and the state is addressed in ORS 530.110.

3. ORS 530.050 directs that BOF lands shall be managed so as "to secure the greatest permanent value of such lands to the state." To this end, the State Forester, under the authority and direction of the State Board of Forestry, is given the latitude to:
   - Sell forest products.
   - Reforest and protect from fire.
   - Execute mining leases and contracts.
   - Sell rock, sand, gravel, pumice, etc.
   - Produce minor forest products.
   - Grant easements, and charge fees for road use.
   - Permit the lands to be used for other purposes (e.g. fish and wildlife environment, landscape effect, flood and erosion protection, recreation, domestic livestock, and water supplies), provided such uses are "not detrimental to the best interest of the state" in the opinion of the Board of Forestry.
   - Do all things and make all rules necessary for the "management, protection, utilization, and conservation of the lands."

4. Oregon Administrative Rules 629-035-0000 through 629-035-0110 provide direction for state forest management policy and planning, and further define how the lands are to be managed to achieve "greatest permanent value" to the citizens of Oregon.

   The rules provide the following direction:
   - As provided in the statutes, "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.
   - To secure the greatest permanent value, the lands are to be maintained as forest lands and actively managed 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.
   - Forest management plans are to be developed and implemented that will secure the greatest permanent value.

Analysis of Legal Mandates

The Board of Forestry's legal mandates for managing BOF lands include the dual obligations of sharing income with the counties (ORS 530.030) and conserving, protecting, and using a variety of natural resources (ORS 530.050). The administrative rules governing state forest management policy and planning provide direction on how to balance these dual obligations. The rules' primary findings and directions are summarized below and on the next page.

1. These lands must be managed to achieve the greatest permanent value to the state.
2. The counties in which these forest lands are located have a protected and recognizable interest in receiving revenues from these forest lands; however, the Board and the State Forester are not required to manage these forest lands to maximize revenues, exclude all non-revenue producing uses on these forest lands, or to produce revenue from every acre of these forest lands.
3. Based on existing Board principles and policies and current scientific and silvicultural information, the uses set forth in the rules are compatible over time and across the landscape when the lands are actively managed in an environmentally and silviculturally exemplary manner.
4. Based on existing Board principles and policies and current scientific and silvicultural information, forest lands that are actively managed as provided for in the rules can produce economic value over the long term and promote healthy, sustainable forest ecosystems.
5. Actively managing forest lands for the purposes described in the rules is in the best interest of the state.

Policy Mandates

The Forestry Program for Oregon

The Forestry Program for Oregon (FPFO) is a broad policy statement that outlines the Board of Forestry's role in serving the citizens of Oregon. The Board performs three primary functions.

1. Promoting certain forestry objectives by serving as an advocate of good stewardship in forest resource management.
2. Encouraging certain objectives by providing a climate to meet these needs through proposed legislation, incentives, and services.
3. Directing that certain actions take place where the Board has a specific regulatory or managerial responsibility.

The FPFO's Timber Growth and Harvest Objective is to "promote healthy and productive forests to provide a maximum, sustainable, supply of timber." Under this objective there is an explicit reference to state-owned timberlands: "The department will intensively manage state forest lands (Board of Forestry and Common School Lands) in an exemplary fashion for the sustained production of timber in a cost-effective and an environmentally sound manner. Such intensive management is designed to generate revenue for the beneficiaries of the land, including county government, local taxing districts and the Common School Fund."

Fish and Wildlife Policy

OAR 629-035-0020 provides policy direction for the management of fish and wildlife resources on Board of Forestry Lands. This rule specifies that the lands will be managed to provide 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. Specifically, these benefits include properly functioning aquatic habitats for salmonids and other native fish and aquatic life; and habitats for native wildlife. The rule further requires that forest management plans comply with all applicable provisions of the State and Federal Endangered Species Acts concerning state and federally listed threatened and endangered species.

Funding

Out of the revenues derived from BOF lands, 36¼ percent is used by the Department of Forestry to pay for the management and protection of the land. The department's budget request is subject to the approval of the Board of Forestry and the Governor. Final authorization of the budget is determined by vote of the state legislature. The BOF and CSF budgets are considered as a whole, and are categorized as "other funds" that are separate from the state's general fund. The Board of Forestry Lands and Common School Forest Lands budgets and expenditures are accounted for separately within the Department of Forestry.

Common School Forest Land

History

Only a minor portion of the western Oregon state forests is classified as Common School Forest (CSF) Land. The history of these lands can be traced to the Land Ordinance of 1785, the creation of the Territory of Oregon in 1848, and the Admission Act of 1859. The federal government's policy at the time Oregon gained statehood was to grant sections 16 and 36 of every township to the new state for the use of schools. Oregon's grant included 3.5 million acres of grazing and forest lands. Eventually, all but 130,000 acres of the forest lands was either sold for the benefit of schools or lost through fraudulent land deals.

By the time Oregon gained statehood, Congress had taken steps to define the trust nature of the CSF grants. This was in response to early abuses of the land grant system as states disposed of their school lands without restraint. As a result, Congress stipulated that the grant lands be managed for the use of schools and not for other public needs. Permanent investment trusts were established to protect the financial principal derived when grant lands were disposed. Lands that were retained were to be managed by the states in accordance with the beneficiary trust interest. These obligations are spelled out in the Oregon Constitution and the Admission Act of 1859.

Legal Mandates

The Oregon Constitution

The Oregon Constitution (Article VIII, Section 5) authorizes the State Land Board to manage CSF lands. The Land Board is directed to "manage lands under its jurisdiction with the object of obtaining the greatest benefit for the people of this state, consistent with the conservation of this resource under sound techniques of land management." This responsibility has been clarified through the 1992 opinion of state Attorney General Charles S. Crookham, which is discussed below.

The Oregon Constitution provides for revenues derived from CSF lands and other specified sources to be deposited into the Common School Fund. It also authorizes the State Land Board to withdraw money from the Common School Fund to carry out its powers and duties to manage the lands. The State Land Board has implemented its authority through a contract with the Department of Forestry to manage CSF lands.

Oregon Revised Statutes

Statutes concerning CSF lands are found in ORS 530.450 through 530.520.

ORS 530.450 gives the name "Elliott State Forest" to any lands in the national forests on February 25, 1913 that were patented to the State of Oregon for the purpose of establishing a state forest. Besides the Elliott, there are other lands under the jurisdiction of the Division of State Lands that are suitable for use as state forests. These include some lands in the western Oregon state forests plan area. ORS 530.460 and 530.470 describe the process by which the Division of State Lands and the State Board of Forestry may "designate" these lands for the primary purpose of "growing timber and other forest products." Lands so designated are named "Common School Forest Lands." Through a similar process, CSF lands may be reverted to their original status.

Under ORS 530.490, the State Forester is directed to manage Common School Forest Lands so as to "secure the greatest permanent value of the lands to the whole people of the State of Oregon." Although the statutes again refer to timber production as the dedicated use of the land, much of the statutory language has been found to be inconsistent with constitutional mandates. Oregon's Attorney General has opined that the land's various other natural resources must also be considered as long-term sources of revenue. The Attorney General's opinion is discussed on the next page.

The statutes refer to forest management planning in ORS 526.255, which calls for "long-range management plans based on current resource descriptions and technical assumptions, including sustained yield calculations for the purpose of maintaining economic stability in each management region."

Attorney General's Opinion

Currently, the fullest description of the Oregon Constitution's mandates for managing Common School Forest Lands is found in a July 24, 1992 opinion of Oregon Attorney General Charles S. Crookham. (46 Op. Atty. Gen. 468 (1992), Opinion No. 8223, July 24, 1992) (Crookham 1992). This opinion addresses the lawful uses of Admission Act lands and the effect of federal or state regulations on such uses. The issue at hand was the State Land Board's compliance with the federal and state Endangered Species Acts.

Admission Act lands are those lands offered by the federal government to the State of Oregon for the use of schools upon Oregon's admission to the United States in 1859. The Attorney General's opinion discussed the restrictions that Congress intended to impose on Oregon's use of these lands.

According to Crookham, a binding obligation was imposed on Oregon when it accepted the Admission Act lands "for the use of the schools." The Oregon Constitution dedicates the proceeds of Admission Act lands to the Common School Fund and gives the State Land Board responsibility to manage these lands in trust for the benefit of the schools. The State Land Board has a further constitutional obligation to manage lands under its jurisdiction "with the object of obtaining the greatest benefit for the people of this state, consistent with the conservation of this resource under sound techniques of land management." Crookham noted 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.

It was Crookham's opinion that the resources of Admission Act lands are not limited to those, such as timber, that are currently recognized as revenue generators for the Common School Fund, but include all of the features of the land that may be of use to schools. Other resources, such as minerals, water, and plant materials that may offer revenue for the fund should be considered.

The State Land Board may incur present expenses or take management actions that reduce present income if these actions are intended to maximize income over the long run. Lands may be temporarily set aside for the purpose of "banking" an asset while its economic value appreciates if the Land Board has a rational, non-speculative basis for concluding that such action will maximize economic return to the Common School Fund over the long term.

Neither the Oregon Admission Act nor the Oregon Constitution exempts the State Land Board from complying with the federal and state Endangered Species Acts (ESA), in the opinion of the Attorney General.

Crookham felt it is unlikely that the courts would exempt the State Land Board from complying with the federal ESA. Even if the grant of Admission Act lands were viewed as a contract or trust arrangement between the state and the federal government, Congress retains the authority to alter the terms of the arrangement by virtue of its sovereign power to legislate.

Because the state ESA does not explicitly require or prohibit any particular action with respect to the management of Admission Act lands, Crookham felt that the state ESA does not restrict the State Land Board's exercise of its constitutional powers over the disposition and management of Admission Act lands. The State Land Board must comply with the state ESA unless it unduly burdens the State Land Board's constitutional responsibility to manage the Admission Act lands. Only if the state ESA fundamentally impaired the Board's ability to maximize revenue over the long term from the Admission Act lands would there be an undue burden on the State Land Board's management and powers.

Finally, the Attorney General said it is not possible to predict whether the application of the federal ESA to Admission Act lands could result in a claim against the federal government for a taking of property. However, the state ESA definitely could not result in a taking because the State Land Board would not be required to comply with a law that prevented it from its constitutional responsibility to maximize revenue from Admission Act lands over the long term.

Policy Mandates

Further management direction for Common School Forest Lands is given in the Forestry Program for Oregon, and the Policies for Fish and Wildlife Management on State Forest Land.

These policies are discussed under the section on Board of Forestry Lands.

Funding

Receipts from the CSF Lands enter the Common School Fund. The Department of Forestry is reimbursed on a quarterly basis for management expenses incurred on these lands. The Department's biennial budget request is subject to the approval of the State Land Board and the Governor. Final authorization of the budget is determined by vote of the state legislature. The Common School Forest Lands and Board of Forestry Lands budgets are considered as a whole, and are categorized as "other funds" that are separate from the state's general fund. The Common School Forest Lands and Board of Forestry Lands budgets are accounted for separately within the Department of Forestry.

Comparison of State and Federal Management Mandates

Many people are already familiar with the laws that guide the planning and management of the national forests. State forests operate under a completely different set of mandates. This section outlines the fundamental differences between the state and federal requirements.

National Forests (U.S. Forest Service)

National forests must be managed in accordance with multiple use and sustained yield principles. The Multiple-Use Sustained-Yield Act of 1960 calls for renewable surface resources (e.g. outdoor recreation, range, timber, watershed, wildlife, and fish) to be managed in the combination that will best meet the needs of the American people. These resources are to be managed to achieve a perpetually high level of output.

The requirement to develop management plans for national forests comes from the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA). This was later amended through the National Forest Management Act of 1976 (NFMA) and pursuant regulations.

National forest management plans are considered to be major federal actions that significantly affect the quality of the human environment. Therefore, each plan must be accompanied by an environmental impact statement (EIS) in accordance with the National Environmental Policy Act of 1969 (NEPA) and Council on Environmental Quality (CEQ) regulations that implement NEPA.

The Resources Planning Act and National Forest Management Act provide for public participation in national forest planning processes. CEQ regulations provide for public involvement in the NEPA processes. Federal actions that require an EIS have a greater level of public involvement than those that require an environmental assessment (EA).

State Forests

State law (ORS 526.255) calls for a biennial report to the Governor and legislature that contains "The long range management plans based on current resource descriptions and technical assumptions, including sustained yield calculations for the purpose of maintaining economic stability in each management region."

ORS 530.050 directs that BOF lands shall be managed so as "to secure the greatest permanent value of such lands to the state." OAR 629-035-0000 through 629-035-0110 provide direction on how forest management plans are to secure "greatest permanent value."

Unlike the Forest Service, "multiple use" management is not a legal mandate for either Board of Forestry Lands or Common School Forest Lands. However, the conservation and use of renewable and non-renewable resources must necessarily be balanced using the direction provided in the administrative rules referenced above. These rules specify that state forest lands be managed to provide 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. Common School Forest Lands are managed under the Oregon Constitution with the object of "obtaining the greatest benefit for the people of this state, consistent with the conservation of this resource under sound techniques of land management."

Environmental impact statements and environmental assessments are not required for state forest planning, unless there is a federal action involved. In the course of its planning process, the Department of Forestry may decide to apply to the U.S. Fish and Wildlife Service for an incidental take permit, in order to meet requirements of the federal ESA. Granting an incidental take permit is a federal action because the U.S. Fish and Wildlife Service must approve the application for the permit. **If** the Department of Forestry requests an incidental take permit, then the Department of Forestry will prepare a habitat conservation plan to accompany the permit application. Then the U.S. Fish and Wildlife Service would complete the NEPA-required analysis of the permit application and habitat conservation plan. The U.S. Fish and Wildlife Service would complete environmental analysis only on the federal action, which is the decision on the permit application. They would not have any legal jurisdiction to analyze state forest management planning.

Public involvement in the state forests planning reflects the requirements of OAR 629-035-0080 and the Department of Forestry's desire to use public comments as a planning resource. Specific goals and methods for public involvement in state forest planning processes are provided by the rule and state forest policy (Oregon Department of Forestry 1999a). Public involvement also furthers understanding, acceptance, and support of the plan. If the process involves an incidental take permit and habitat conservation plan, as described above, the U.S. Fish and Wildlife Service also includes public participation in their NEPA process.

Other Legal Mandates

Federal Endangered Species Act

The federal Endangered Species Act (ESA) was enacted in 1973 to preserve species that are at risk of becoming extinct. The ESA has been modified several times since 1973. Administration of the ESA falls under the authority of the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service.

The ESA protects species that have been designated as "threatened" or "endangered" (T&E) through a listing process. The federal ESA defines an "endangered" species as one which is in danger of extinction throughout all or a portion of its range. A "threatened" species is likely to become an endangered species within the foreseeable future.

The USFWS maintains two categories of "candidate" species that are not protected under the law. These species remain in candidate status because there is not sufficient information to list them or because the listing process has not been completed.

As explained below, various provisions of the ESA may distinguish between federal and non-federal lands, plant and animal species, and species listed as threatened or endangered.

The ESA directs federal agencies to carry out programs for the conservation of T&E species. Also, agencies of the federal government are prohibited from jeopardizing the existence of any T&E species and from destroying or adversely modifying "critical habitat." Neither of these provisions distinguishes between plant and animal species.

The designation of critical habitat occurs at the time a species is listed. Only federal lands are directly subject to the restrictions pertaining to critical habitat. However, critical habitat designations on non-federal lands could have indirect effects on management of those lands, if an incidental take permit is requested.

Critical habitat is defined in section 3(5)(A) of the federal ESA as "(i) the specific areas within the geographical area occupied by the species *** on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management or protection ..." Note that the actual presence of a listed species is not required for critical habitat designation, only presence of features that the species would use if it were present. Critical habitat designations are not necessarily limited to federal lands.

“Critical habitat receives consideration under section 7 of the Act with regard to actions carried out, authorized, or funded by a federal agency. Federal agencies must ensure that their actions do not result in destruction or adverse modification of critical habitat.” (Federal Register / Vol. 59, No. 18 / page 3816). Issuance of an incidental take permit is a federal action. As such, USFWS is required to do a section 7 consultation (within agency) prior to issuing the permit. This combination of legal requirements would likely lead to USFWS being unable to grant an incidental take permit that would involve timber harvest on lands designated as critical habitat.

The ESA’s prohibition against “take” applies equally to non-federal and federal lands, and specifically to fish and wildlife species. 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. The USFWS has further defined harm as “... an act which actually kills or injures wildlife. Such acts may include significant habitat modifications or degradation when it actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering” (50 CFR & 17.3).

A significant revision of the ESA occurred in 1982, when provisions allowing for “incidental take” were added. Such taking must be incidental to, and not the main purpose of, the carrying out of an otherwise lawful activity. In order to obtain an incidental take permit, an applicant must submit a conservation plan, sometimes known as a habitat conservation plan, or HCP. An incidental take permit may be granted if the following conditions are satisfied: 1) the taking will be incidental; 2) the applicant will minimize and mitigate the impacts of taking; 3) there will be adequate funding to implement the conservation plan; and 4) the likelihood of the survival and recovery of the species will not be reduced.

The ESA does not merely protect surviving populations; it directs the Secretary of Interior to develop a “recovery plan” for each T&E species. The objective is to enable each species to recover to the point that protection under the ESA is no longer necessary and it can be taken off the list.

The term “take” does not apply to plant species. Instead, for endangered plants, the ESA prohibits the removal, damage, or destruction of plants on federal lands; and certain other activities on non-federal lands. Prohibited activities on non-federal lands include to remove, cut, dig up, damage, or destroy any endangered plant species in knowing violation of any law or regulation of any state, or in the course of any violation of a state criminal trespass law. The activities prohibited for endangered plants are not automatically prohibited for threatened plants. However, according to the federal ESA, such prohibitions may be established for threatened plants through regulation, if they are found to be “necessary and advisable for the conservation of such species.”

State Endangered Species Act

The Oregon laws covering threatened and endangered species of plants and animals are found in Oregon Revised Statutes 496.172 through 496.192 (for wildlife) and ORS 564.010 through 564.994 (for plants). Further legal requirements are given in the Oregon Administrative Rules.

Wildlife Species

The state Endangered Species Act was originally passed in 1987 and revised in 1995. Under the 1995 state ESA, the Oregon Fish and Wildlife Commission retains the authority for listing wildlife species as threatened or endangered. The statute recognizes cooperative state or federal programs protecting and recovering threatened or endangered species (such as a habitat conservation plan).

When a species is listed as threatened or endangered, the Oregon Fish and Wildlife Commission must establish, by rule, measurable guidelines to ensure the survival of individual members of the species. These guidelines may include take avoidance and protection for specific resource sites. Under state law, "take" means to kill or obtain possession or control of any wildlife.

For threatened species, if a state agency determines that a proposed action has the potential to violate the guidelines established by the Oregon Fish and Wildlife Commission, it shall notify the Oregon Department of Fish and Wildlife. That department will then recommend reasonable and prudent alternatives, if any, to the proposed action, which are consistent with the guidelines.

For endangered species, agencies managing state lands, such as the Department of Forestry, are responsible for developing endangered species management plans. The Oregon Fish and Wildlife Commission, in consultation with the land management agency, shall determine if state land can play a role in the conservation of the endangered species. Endangered species management plans will be reviewed and approved by the Oregon Fish and Wildlife Commission.

Plant Species

Oregon's threatened and endangered plant species are managed under the authority of the Director of Agriculture, with administrative responsibilities delegated to the Oregon Department of Agriculture (ODA).

The statutes pertaining to listing and conserving T&E plant species are nearly identical to those described above for wildlife. One difference is that, with respect to plant conservation programs, state agencies must consult not only with the Department of Agriculture, but with any other state agency that has established programs to conserve or protect threatened or endangered species.

By administrative rule, state agencies are directed to ascertain the occurrence, or likely occurrence, of any listed species before taking any action on state-owned land. This may be done by conducting field surveys, consulting with ODA, or consulting with the Oregon Natural Heritage Program. If the determination should be positive, a process that is detailed in the administrative rules must be followed to conserve the species.

The term "action" has been defined by administrative rule to include activities that disturb the ground or vegetation or suppress plant growth. A sale or exchange of state-owned land, such that a listed species would be removed from state jurisdiction, would also be considered an action.

Oregon Forest Practices Act

Activities on lands managed by the Department of Forestry are subject to the Forest Practices Act (FPA), which is found in Chapter 527 of the Oregon Revised Statutes, and the Oregon Administrative Rules pursuant to these statutes.

The FPA declares it public policy to encourage economically efficient forest practices that assure the continuous growing and harvesting of forest tree species consistent with sound management of soil, air, water, fish, and wildlife resources as well as scenic resources within visually sensitive corridors. The Board of Forestry is granted the exclusive authority to develop and enforce rules protecting forest resources and to coordinate with other agencies concerned with the forest environment.

The Forest Practices Act has developed in an evolutionary manner since the original act was passed in 1971. The 1971 law established minimum standards for reforestation, road construction and maintenance, timber harvesting, application of chemicals, and disposal of slash. Subsequently, administrative rules were written to define the "waters of the state" and to protect streams and riparian areas. Rules were adopted to prevent soil damage resulting from logging and to prevent mass soil movement.

The Forest Practices Act was strengthened in 1987 with the passage of House Bill 3396. The concept of sensitive resource sites was introduced, along with the requirement that written plans be approved prior to operating near those sites. Provisions were added that allow interested citizens to review and comment on notifications of operations and written plans.

The 1991 enactment of Senate Bill 1125 added new standards for reforestation, wildlife habitat, and scenic considerations. The new requirements included timeframes and trees per acre standards for reforestation, limits on the size and proximity of clearcuts, visual standards for logging in visually sensitive highway corridors, and specifications for wildlife trees and downed woody debris retained after logging. The Board of Forestry was directed to reclassify and develop appropriate protection levels for the waters of the state. In 1994, revised waters of the state rules were adopted by the Board of Forestry and assigned to Division 57 of the Oregon Administrative Rules.

In 1999, following Governor Kitzhaber's Executive Order on salmon and healthy watersheds, the Board of Forestry formed an advisory committee to study forest practices in light of restoring native fish and their habitat to productive and sustainable levels. The Forest Practices Advisory Committee on Salmon and Watersheds is preparing a final report for fall 2000. Implementation, including any changes to the forest practice rules, is expected to last through 2002.

The following is a summary of key recent changes to the Forest Practices Act.

Definition of "clearcut" — The following definition has been added. In western Oregon, a

clearcut is defined as "any harvest unit that leaves fewer than 50 trees per acre that are well distributed over the unit and that measure at least 11 inches at DBH [diameter breast height] or that measure less than 40 square feet of basal area per acre." To be counted as a tree, the top one-third of the bole must support a green, live crown. Trees larger than 20 inches are considered 20-inch trees for the purpose of computing basal area.

Timber harvesting — Changes are summarized in the following bullet list.

- **Clearcut size —** Clearcuts are now limited to 120 acres. The area occupied by riparian management areas or other resource sites within a clearcut boundary does not count as clearcut acreage. The 120 acre limit has no relationship to harvesting on adjacent ownerships.
- **Clearcut spacing and greenup requirement —** Clearcuts must be separated by at least 300 feet if their combined area exceeds 120 acres. A reforested area is considered a clearcut for this purpose until it has at least 200 trees per acre which are four feet tall or four years of age.
- **Snag and green tree retention —** In all clearcuts over 10 acres in size, a minimum of two snags or two green trees per acre must be reserved after harvesting. These must be at least 30 feet in height, 11 inches DBH or larger, and at least 50 percent must be conifer. A uniform distribution across the clearcut is not required. The selection of snags and green trees is left to the discretion of the operator or landowner.
- **Downed woody debris —** In all clearcuts over 10 acres, a minimum of two downed logs or downed trees per acre must remain after harvesting. These must be at least 12 inches in diameter at the widest point, 16 feet long, and at least 50 percent must be conifer.

Reforestation — Site preparation and reforestation of clearcut units must commence within 12 months and be completed by the end of the second planting season after the completion of harvesting. By the end of the fifth growing season after planting or seeding, at least 200 healthy conifer or suitable hardwood seedlings must be established per acre. These must be well distributed over the area and "free to grow." Previously, the Forest Practices Act called for 100 conifer seedlings to be established per acre after 4 years. Hardwood seedlings were not an option.

Scenic highways — Special rules now apply to timber harvesting within "visually sensitive corridors" along designated highways. These corridors are defined as "forestland located within the area extending 150 feet measured on the slope from the outermost right of way boundary of a scenic highway." Harvesting within the corridor must retain at least 50 healthy trees per acre of at least 11 inches DBH, which total at least 40 square feet of basal area per acre. These trees may be removed (a) when the reproduction understory reaches an average of 10 feet in height and has at least 250 trees per acre; or (b) when the timber stand 150 to 300 feet from the corridor has attained 10 feet in height and has at least 200 trees per acre or contains at least 40 square feet of basal area.

This provision will apply to any portions of the western Oregon state forests that are adjacent to State Highways 6, 18, 20, 22, 26, 30, 34, 36, 58, 101, and 126, which are designated "scenic highways" in ORS 527.755.

Streams and riparian areas — New comprehensive riparian protection rules were adopted by the Board of Forestry on September 1, 1994. The new rules focus on improving stream habitat by addressing the following critical elements.

- Maintaining live trees and vegetation along streams and other waters to provide biodiversity, cover, shade, sediment reduction, adequate stream temperature levels, snags, downed wood, nutrients and bank protection.
- Development of woody debris to provide stream structure resulting in increased fish habitat. This happens over time as trees mature and fall into streams.
- Maintaining adequate fish passage up and down the length of a stream. Ensuring that fish have opportunities to move along the length of streams is important for spawning, feeding, and avoiding reaches of streams with high temperature or low flows.
- Stream and landscape variation. The new classification system creates nine different stream classifications and additional lake and wetland classifications, providing the most appropriate protection to a variety of streams and waters.

All fish-bearing streams will have a riparian management area (RMA) between 50 and 100 feet, that includes vegetative and conifer retention. Within these riparian management areas, all fish-bearing or domestic use streams, and all other medium and large streams, will require a 20-foot no-harvest buffer on each side of the stream unless stand restoration is needed.

The new classification system contains nine classes compared to two under the old rules. The new system identifies seven geographic regions, distinguishes between streams with fish or domestic use, and classifies streams as large, medium, or small based on water volume.

Rules related to harvest practices, road construction, stream crossings, and fish passage have been strengthened considerably.

The volume of conifer trees retained along fish-bearing streams will substantially increase over the old rules to ensure that they provide future opportunities for conifer trees to fall naturally into streams, creating stream structure and fish habitat. The new rules will also provide additional shade to maintain stream temperatures.

The Department of Forestry (with the help of the Department of Fish and Wildlife) is conducting a comprehensive fish use survey of forest streams.

Oregon Land Use Laws

Since 1973, with the passing of The Oregon Land Use Act, Oregon's land use has been guided by local comprehensive planning under a number of Statewide Planning Goals (ORS 195, 196 and 197; OAR Chapter 660). State forest land management complies with this law by following the Department of Forestry's current State Agency Coordination Program, described in OAR Chapter 629, Division 20.

To date, nineteen Statewide Planning Goals have been adopted by the Land Conservation and Development Commission (LCDC). These include goals on citizen involvement, the planning process, farm lands, forest lands, natural resources, development and coastal resources (Oregon Department of Land Conservation and Development 1995). These goals are quite detailed and have the force of law. As part of the 1973 law, the Department of Land Conservation and Development (DLCD) was established to implement the policies and goals of the Commission. Later, in 1979, the legislature created the Land Use Board of Appeals (LUBA) to rule on matters involving land use.

Key Terms

Acknowledgment — Approval by the Land Conservation and Development Commission (LCDC) of a city or county's comprehensive plan; acknowledgment of compliance with the Statewide Planning Goals.

Certification — Approval by LCDC of a state agency program found to be consistent with the Statewide Planning Goals.

Department of Land Conservation and Development (DLCD) — State agency that administers Oregon's statewide planning program and provides professional support to the LCDC.

Land Conservation and Development Commission (LCDC) — A seven-person commission that sets the standards for Oregon's statewide planning program. Members are volunteers appointed by the Governor and confirmed by the State Senate.

Land Use Board of Appeals (LUBA) — Established in 1979 essentially as a state court that rules on matters involving land use. Appeals from LUBA go to the State Court of Appeals and finally to the Supreme Court.

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.

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.

State law requires each city, county, and special district to have a comprehensive plan, as well as the zoning and ordinances needed to put the plan into effect (ORS 197.175). Locally adopted land use plans are reviewed by LCDC to make sure they are consistent with the state-wide goals. After LCDC has officially approved a local government's plan, the plan is said to be "acknowledged." An acknowledged local comprehensive plan is the controlling document for land use in the area covered by the plan. Thus, management of state lands must be compatible with local comprehensive plans and land use regulations (ORS 197.180).

In 1978, LCDC approved the Oregon Department of Forestry's State Agency Coordinating Agreement. This agreement, required of all state agencies, describes the department's rules and programs that affect land use, and spells out how the agency will coordinate its functions with local governments, other state agencies, and federal agencies.

In 1987, the Oregon Legislature passed House Bill 3396, which resolved issues between the Forest Practices Act and the land use programs. Specifically, the Statewide Planning Goals do not apply to programs, rules, procedures, decisions, determinations, or activities carried out under the Forest Practices Act (ORS 197.180 and 197.277). The FPA prohibits local governments from regulating, prohibiting, or limiting forest practices in any way on forest lands outside an urban growth boundary unless an acknowledged exception has been taken to a forest land goal (ORS 527.722). In 1991 LCDC certified that the Department of Forestry's new State Agency Coordination Program (OAR 629-20) was compatible with the Statewide Planning Goals.

Goal 4 of the Statewide Planning Goals, "Forest Lands," is "To conserve forest lands by maintaining the forest land base and to protect the state's forest economy by making possible economically efficient forest practices that assure the continuous growing and harvesting of forest tree species as the leading use on forest land consistent with sound management of soil, air, water, and fish and wildlife resources and to provide for recreational opportunities and agriculture." (Oregon Department of Land Conservation and Development 1995)

Goal 4 allows the following land uses on forest land: "(1) uses related to and in support of forest operations; (2) uses to conserve soil, water and air quality, and to provide for fish and wildlife resources, agriculture and recreational opportunities appropriate in a forest environment; (3) locationally dependent uses; (4) dwellings authorized by law." In addition, "Forest operations, practices and auxiliary uses shall be allowed on forest lands subject only to such regulation of uses as are found in ORS 527.722" [the Forest Practices Act]. (Oregon Department of Land Conservation and Development 1995)

Two other Statewide Planning Goals are of particular interest. Goal 5 (Open Spaces, Scenic and Historic Areas, and Natural Resources) is "To conserve open space and protect natural and scenic resources." Goal 6 (Air, Water and Land Resources Quality) is "To maintain and improve the quality of the air, water and land resources of the state."

The Department of Forestry has established procedures under OAR 629-20, its State Agency Coordination Program, to assure that land use programs comply with Statewide Land Use Planning Goals and are compatible with acknowledged city and county comprehensive plans and land use regulations. In the case of a state forest plan, the District Forester will notify local governments when a forest plan is being developed, and will request their review and comment on the compatibility of the draft forest plan with the local governments' comprehensive plans. If a conflict is found between the Department's statutory obligations and land use compatibility, OAR 629-20-050 describes the dispute resolution process to be followed. OAR-629-20 also describes procedures to be followed if land use classifications are updated; land is acquired, sold or exchanged; non-forest uses must be approved; or when block plans, annual operations plans, and transportation plans are developed. OAR 629-20-000 states that "it is not the intent of these rules to prevent either the Board of Forestry or the Department of Forestry from carrying out their statutory responsibilities."

Mandates for Specific Resources

Legal and policy mandates apply specifically to some resources. These resources are listed below in alphabetical order, with relevant information under each heading.

Agriculture and Grazing

Agricultural activities are permitted under ORS 530.050(4) and ORS 530.490(2). These laws authorize the State Forester to grant easements on Board of Forestry Lands and Common School Forest Lands. Board of Forestry Policy No. 3-1-4-002 allows non-exclusive permits to be granted for special uses. Agriculture is considered a special use, and is allowed when it doesn't interfere with forest management activities. Any revenue from agriculture permits is shared with the county where the activity takes place.

Grazing on Board of Forestry Lands is permitted by ORS 530.010, 530.030, and 530.050. These statutes allow the State Forester to permit domestic livestock grazing in order to secure the greatest permanent value to the state, as long as this use is not detrimental to the best interest of the state. There are no administrative rules to regulate livestock grazing on Board of Forestry Lands. The Department of Forestry manages any grazing that occurs on Board of Forestry Lands, and shares any income from grazing leases with the county where the land is located.

The Department of Forestry manages Common School Forest Lands under a contract with the State Land Board. The December 20, 1993 contract describes the roles of the Oregon Department of Forestry and the Division of State Lands for these lands. Under this contract, grazing and mineral leases on Common School Forest Lands are managed by the Division of State Lands.

Air Quality

The federal Clean Air Act, as amended in 1977 and 1990 (42 U.S.C. 7401, et seq.), is the main law regulating air quality. The law's goal is "to protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." Under the law, the Environmental Protection Agency (EPA), a federal agency, sets air quality standards (National Ambient Air Quality Standards).

The authority to implement the law is delegated to the states. In Oregon, the Department of Environmental Quality (DEQ), a state agency, develops and carries out programs to meet the national air quality standards, through the State Implementation Plan (SIP). The goal of the SIP is to attain and maintain the national air quality standards, known as NAAQS. Sub-plans have been developed by other state agencies to address specific air quality concerns. Two air quality plans affect forest management directly: the Oregon Smoke Management Plan and the Oregon Visibility Protection Plan.

The Oregon Smoke Management Plan — Oregon Department of Forestry districts issue site-specific and time-specific burning permits under conditions adjusted daily to the weather. The conditions are designed to avoid smoke contamination of certain population centers (designated areas) and popular recreation areas (smoke-sensitive areas). These burning instructions specify geographic locations and fuel to be consumed. Permits may also specify fire protection and mop-up criteria. During burning, smoke behavior is monitored from the ground and at times from the air, and results are compiled on an annual basis by Department of Forestry smoke management staff. The Smoke Management Plan has established special protection zones for some cities.

The Oregon Visibility Protection Plan — Prescribed burning strategies to protect visibility are implemented under the Smoke Management Plan. Visibility is a consideration for wilderness areas, such as the Mount Hood, Mount Jefferson, Mount Washington, and Three Sisters wilderness areas. Due to fire season restrictions and department policy, no prescribed burning takes place from May-June until rains begin, about November.

Cultural Resources

Several federal and state laws and one state-wide land use planning goal regulate cultural resource management on state forest lands. Goal 5, Open Spaces, Scenic and Historic Areas, Natural Resources, and Cultural Resources, requires counties and local governments to inventory cultural resources and manage them to preserve their original character if there are no conflicting uses or consequences. Administrative rules which apply to cultural resources on state forest lands are OAR 690-51-240 (1991) and OAR 736-51-070 (1995, updated version). Archaeological sites are defined as sites over 75 years old. Some sites over 50 years old qualify for limited protection. Oregon statutes do not mandate archaeological surveys or mitigation of impacts by state agencies as part of conducting land management activities. However, artifacts and sites found on public lands must be protected from harm, alteration, or removal. If a sacred object is found, the State Historic Preservation Office (SHPO) and appropriate group or tribe must be notified. Anywhere in Oregon, state law protects Native American cairns and graves.

Information relating to the location of archaeological sites and objects is usually not released to the public unless the public interest requires the disclosure or if the governing body of a Native American tribe requests the information.

The State Historic Preservation Office (SHPO), which is part of the Oregon Parks and Recreation Department, administers the Statewide Plan for Historic Preservation and submits Oregon's nominations for the National Register of Historic Places.

Energy and Mineral Resources

Several state laws regulate energy and mineral resources on state forests, including ORS 273.551, 273.780, and 273.785. The Division of State Lands (DSL) has jurisdiction for the leasing of oil, gas, and minerals on state-owned lands. Before a lease is issued, the law directs DSL to consult with the State Department of Geology and Mineral Industries (DOGAMI) and to get concurrence of the state agency responsible for the surface rights of the land involved. Leases are auctioned when more than forty acres are involved. On less than forty acres, leases are handled through negotiations. DSL also administers a prospecting permit system that could eventually lead to applications for leases.

The Department of Forestry does have the right to use gravel, sand, stone, and soil from state forest lands to repair or construct roads or other state facilities without going through DSL.

Fish and Wildlife

The primary laws specific to fish and wildlife are the state and federal Endangered Species Acts. These were discussed earlier in this appendix.

Land Base and Access

Land Base

The following laws and policies provide direction for the acquisition, exchange, and management of state forest lands.

ORS 530.010 — ORS 530.040 Acquisition, Management and Development of State Forests — These statutes give the Board of Forestry authority and means through the Department of Forestry to acquire forest land by "purchase, donation, devise or exchange." Any acquisition of forest land must be approved by the board of county commissioners in the county where the lands are located. An administrative rule is now being developed for land acquisitions and exchanges, and is expected to be adopted in 2001.

Board of Forestry Policies

Land Acquisition and Exchange Policy For State Forests — Through this policy the Board of Forestry has reaffirmed that the Department of Forestry will actively pursue acquisitions and exchanges as a means to consolidate state forest lands for management efficiencies, economic values, or enhanced stewardship practices.

Forestry Program for Oregon (FPFO) — The Forestry Program for Oregon is the strategic planning document for the Oregon Board of Forestry (Oregon Board of Forestry 1995a). The policies and programs of the FPFO support the land acquisition and exchange policy above.

Two objectives in the FPFO are particularly important for the state forest land base.

- **Objective 1: Forest Land Base —** Under this objective, the Board of Forestry promotes preserving and expanding the forest land base in Oregon.
- **Objective 4: Timber Growth and Harvest —** Under this objective, the Board of Forestry directs that the management of state forest land will be done in an efficient and cost-effective manner, which supports the reasoning for most land exchanges.

The purpose of acquiring and exchanging land is to increase the amount of state forest land and/or to block up state forest ownership (consolidate state forest lands in contiguous blocks, instead of in scattered parcels). The consolidation of state forest lands will increase management efficiencies and long-term economic values, and enhance stewardship practices and other forest resource values. The Department of Forestry has worked to block up state forest lands for many years. The land exchange and acquisition program operates from statutory authority and requirements (ORS 530.010 - ORS 530.040) and Board of Forestry policies described above. Each district has its own land exchange plan, with parcels identified for acquisition and divestment.

Access

The following laws and policies provide direction for access to and roads on state forest lands.

Forest Practices Administrative Rules, Chapter 629, Division 24 — State forest land is subject to all the Oregon Forest Practices administrative rules. Rules 629-24-520 through 629-24-524 specifically address road location, road design, road construction, and road maintenance. These rules recognize the necessity of roads for forest management and protection, and set minimum construction and maintenance standards intended to protect water quality, forest productivity, and fish and wildlife habitat.

Motorized Recreation Administrative Rules, Chapter 629, Division 26, 629-26-005 through 629-26-025 — These rules govern the use of recreational ORVs (off-road vehicles) on state forest land and give the State Forester authority to designate off-road riding areas, to close riding areas, and to permit organized recreation events. As of summer 1995, these rules are in the process of being repealed, amended, and incorporated into a new set of comprehensive rules, Chapter 629, Division 25, Recreational Use of State Forest Land.

Oregon Vehicle Code, Off-Road Vehicles, ORS 821.010 through 821.320 — These statutes govern the use of recreational ORVs on all lands in Oregon, including state forest lands. They set standards for registration, equipment, and operation, and also set penalties for violations, including penalties for ORV-caused damage to trees, vegetation, or soil.

Forestry Program For Oregon, Objective 5: Stewardship Through Regulation of Forest Practices — Through the FPFO, the Board of Forestry directs the Department of Forestry to promote the management of forest roads to minimize the number and width of roads, and the disturbance of soil.

Department of Forestry, Forest Road Manual for State Forests, Forest Roads Policy — The Forest Road Policy 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 further states that forest roads will be designed, constructed, and maintained to meet or exceed rules of the Forest Practices Act. The road 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 2000b)

Plants

Federal Endangered Species Act

The federal Endangered Species Act (ESA) was enacted to preserve plant and animal species that are at risk of becoming extinct. The federal ESA is administered for plants by the U.S. Fish and Wildlife Service (USFWS). For endangered plants, the federal ESA prohibits the removal, damage, or destruction of plants on federal lands; and certain other activities on non-federal lands. Prohibited activities on non-federal lands include to remove, cut, dig up, damage, or destroy any endangered plant species in knowing violation of any law or regulation of any state, or in the course of any violation of a state criminal trespass law. The activities prohibited for endangered plants are not automatically prohibited for threatened plants. However, according to the federal ESA, such prohibitions may be established for threatened plants through regulation, if they are found to be “necessary and advisable for the conservation of such species.”

State Endangered Species Act

The Oregon laws covering threatened and endangered species are found in Oregon Revised Statutes 496.172 through 496.192 (for wildlife) and ORS 564.010 through 564.994 (for plants). Further legal requirements are given in the Oregon Administrative Rules.

The state Endangered Species Act was first passed in 1987. Oregon’s threatened and endangered plant species are managed under the authority of the Director of Agriculture, with administrative responsibilities delegated to the Oregon Department of Agriculture (ODA). Protection and conservation programs are established through administrative rules. State agencies such as the Department of Forestry are directed to cooperate in furthering conservation programs for T&E species.

If the Department of Forestry determines that a conflict exists, then the conservation requirements of OAR 603-73-090 (5)(b) through (5)(h) apply. ODF’s procedures further outline the steps for compliance with these rules.

Recreation

Public use rules for state lands (Recreational Use of State Forest Land, Chapter 629, Division 25) establish standards for recreational use. The rules regulate off-road vehicle use, camping, firearm use, disposal of garbage and human waste, and other activities associated with recreational activity.

Tillamook State Forest — In 1991, the Oregon Legislature passed House Bill 2501, which called on the Oregon Department of Parks and Recreation and the Oregon Department of Forestry to prepare a comprehensive recreation plan for the Tillamook State Forest, to interpret the forest's history, and to provide for diverse outdoor recreation on the forest. The bill required that the plan be consistent with the primary purpose of timber production and of state forests as described in ORS 530.050. The *Tillamook State Forest Comprehensive Recreation Management Plan* was published in January 1993, and provides direction for recreation management on the Tillamook State Forest (Oregon Department of Forestry and Oregon Department of Parks and Recreation, 1993). This plan is currently being updated.

Scenic Resources

Generally, most state forest land adjacent to visually sensitive highway corridors is considered to be of high scenic quality. Along major highways, the immediate visual foreground is protected either by Department of Transportation-owned scenic buffers or by scenic statutes and Oregon Forest Practices Act rules. For areas farther back from highways but still visible from the road, which are considered mid-ground and background scenic areas, many acres are designated as scenic, allowing management activities for these areas to be adjusted for visual considerations.

The following highways in northwest Oregon are designated as scenic for the purpose of visual corridor management, and are adjacent to state forest lands in the districts indicated. 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.

Highway 6	—	Forest Grove and Tillamook Districts
Highway 20	—	West Oregon District
Highway 22	—	North Cascade District
Highway 26	—	Forest Grove and Astoria Districts
Highway 30	—	Astoria District
Highway 34	—	West Oregon District
Highway 36	—	Western Lane District
Highway 101	—	Tillamook District
Highway 126	—	Western Lane District

State Scenic Waterways Program

The state scenic waterways program applies only to the Nestucca River Scenic Waterway in Forest Grove and Tillamook districts. The program is designed to protect and enhance the special attributes and natural values of designated scenic waterways. These values include recreation, fish, wildlife, water quality, geology, historical and botanical resources, aesthetics, and the freeflowing character of the rivers. Dams, reservoirs, impoundments, and placer mining are prohibited. The Oregon Department of Parks and Recreation has general administrative rules for scenic waterways, and has developed specific administrative rules for some individual scenic waterways. Administrative rules for the Nestucca Scenic Waterway were published in July 1994 (OAR 736-40).

There is a review and approval process for land uses that may noticeably alter or modify property within the scenic waterway corridor. Land uses that require review and approval include timber harvest and road construction, among others. The Department of Parks and Recreation must be notified one year in advance of activities requiring review and approval. Approval is based on criteria established in the administrative rules.

Soils

The Department of Forestry manages state forest lands in accordance with the Oregon Forest Practices Act rules (Division 24) for soil protection. These rules define Best Management Practices for protecting soil and forest productivity when conducting timber harvest, prescribed burning, or road construction activities. The department uses the professional expertise of foresters, geotechnical specialists, soil scientists, and forest engineers to evaluate proposed activities.

Water Resources

In 1909, the Oregon Legislature declared that all water in the state belongs to the public. In the years since then, many state agencies have been given the job of helping manage the public’s water.

The Water Resources Commission (WRC) is responsible for the development of an integrated, coordinated state program for managing Oregon’s water (ORS 536.300). Other state agencies and public corporations are directed to conform to statements of water resources policy (ORS 536.360). Oregon Revised Statutes Chapters 536 through 543 guide the WRC on water management policies.

Oregon Administrative Rules (OAR), Chapter 690, contain rules developed by the WRC that address water management. In addition, the Water Resources Department is in the process of proposing new rules for the protection of instream flows for certain fish species. These rules could limit the issuance of new water permits in some areas.

Oregon Revised Statutes Chapter 527, known as the Forest Practices Act, regulates forest operations. For protecting water resources, the primary focus of the regulations is on controlling activities around all types of water bodies and stream channels.

Water Resources Department Programs

Basin management programs — Basin programs establish water management policies and objectives that govern the appropriation and use of surface and ground water within each drainage basin. These programs are in Chapter 690, Division 500, of the Oregon Administrative Rules, and are found in the publication, Oregon Water Management Programs (Oregon Water Resources Department, date unknown). OAR, Division 410, establishes state-wide policies and principles pertaining to a wide range of existing water rights for instream use. The Water Resources Commission has recently adopted amendments to OAR, Division 77, that set up a process for leasing existing water rights for instream use.

The North Coast Basin Program, Mid Coast Basin Program, and Draft Willamette Basin Plan cover the three basins in the planning area. These programs specify the allowable uses of the waters within the basins. Applications for new water rights will only be approved for the uses specified under the conditions of adequate water supply.

Water Quality

Water quality protection is mandated by both federal and state laws.
The most important federal law for water resources is the Clean Water Act (CWA), first passed in 1972 and amended several times since then. The Clean Water Act's goal is to restore and maintain the chemical, physical, and biological integrity of the nation's waters to protect beneficial uses such as public water supply, recreation in and on water, and propagation of fish and wildlife. The states are responsible for implementing the law and meeting its water quality standards.

Oregon forest practices rules are approved as sufficient to implement water quality standards under the Clean Water Act . Section 303(d) of the Clean Water Act requires states to identify and list threatened and impaired waterbodies. Rules describing beneficial uses, policies, standards and treatment criteria (OAR Chapter 340, Division 4) are enforced by the Oregon Department of Environmental Quality. ORS 468B contains the state laws pertaining to water pollution control. OAR Chapters 40-55 contain water quality regulations.

The state's water quality is under the authority of the Environmental Quality Commission, and is regulated by the Department of Environmental Quality (DEQ). ORS 468B contains the state laws pertaining to water pollution control. DEQ's water quality program for forest lands is administered by the Board of Forestry through the Forest Practices Act's administrative rules. These rules specify Best Management Practices (BMPs) for forest operations, which ensure that water quality will meet DEQ standards. Any forest operation that complies with the rules is deemed to comply with the state's water quality standards. ORS 527.710, 527.765, and 527.770 contain the Forest Practices Act rules to achieve these water quality standards.

The Oregon Water Resources Commission (WRC) is responsible for the development of an integrated, coordinated state program for managing Oregon's water. Other state agencies and public corporations are directed to conform to statements of water resources policy. Oregon

Revised Statutes Chapters 536 through 543 guide the WRC on water management policies. Oregon Administrative Rules (OAR), Chapter 690, contain rules developed by the WRC that address water management. The state's laws and administrative rules are designed to achieve the goals of the federal Clean Water Act, as well as to achieve state goals for water resources.

The Oregon Plan for Salmon and Healthy Watersheds (OPSHW) (Governor's Natural Resources Office 1998) is a comprehensive plan for the recovery of salmon and steelhead stocks in much of Oregon, and also a plan for improving and preserving water quality in hundreds of "water quality-limited streams" through the Healthy Streams Partnership. Many state agencies, including the Department of Forestry, are involved in carrying out the plan, which was developed by a special task force working for the governor. OPSHW's mission is "to restore our native fish populations — and the aquatic systems that support them — to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits."

Wetlands

Federal laws and policies — At the federal level, the U.S. Army Corps of Engineers regulates the discharge of materials into waters of the United States, which includes wetlands. This authority is derived from Section 404 of the Clean Water Act. Key exemptions exist under federal law for obtaining individual dredge and fill permits for: 1) normal farming, ranching, and forestry activities, such as plowing, minor draining, and harvesting; 2) constructing or maintaining stock ponds or irrigation ditches; and 3) constructing or maintaining farm, forest, or mining roads. Essentially, all normal silvicultural activities are exempt as long as they do not convert a wetland to an upland.

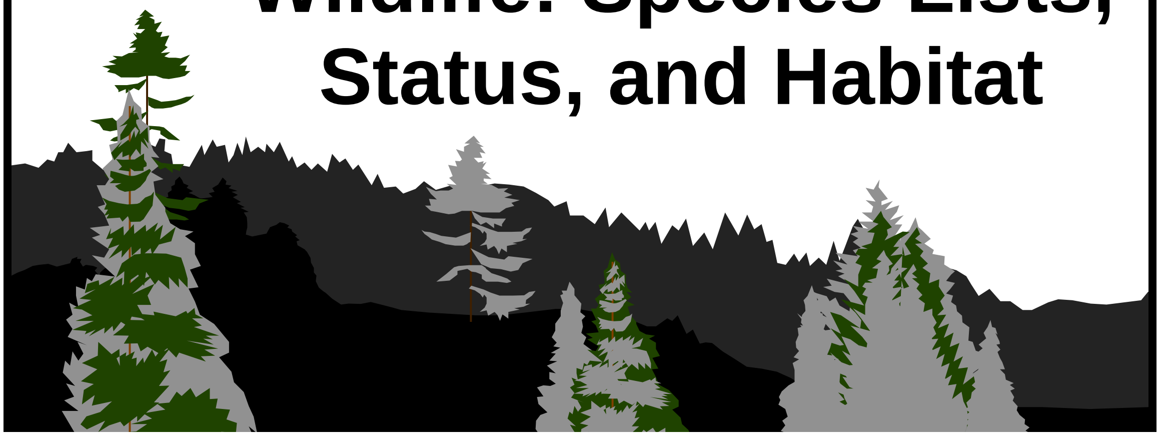
State laws and policies — The Division of State Lands administers several aspects of regulation and management of wetlands, that are relevant to state forest lands. These statutes include the state's Removal-Fill Law, Senate Bill 3, and the Mitigation Bank Act.

- The Removal-Fill Law (ORS 196.800-196.990) requires permits from the Division of State Lands for removal, fill, or alteration involving 50 cubic yards or more of material in any water of the state, including wetlands.
- Senate Bill 3, passed in 1989, is primarily intended to promote protection and conservation of wetlands and is in many ways an adjunct to the Removal-Fill Law.
- The Mitigation Bank Act of 1987 is a state statute that provides for the acquisition and protection of wetlands, and for the establishment of wetlands mitigation banks by the Division of State Lands.

The Oregon Department of Forestry's Forest Practices Act identifies three major types of wetlands: significant wetlands, stream-associated wetlands, and other wetlands. The Forest Practices Act also regulates activities that affect these areas. The Water Protection Rules (ORS 629-645 and 629-655) in the Forest Protection Rules identify the protection measures required for riparian areas and wetlands.

Appendix E

Wildlife: Species Lists, Status, and Habitat



This appendix is a matrix that lists the amphibian, reptile, bird, and mammal wildlife species likely to be present in the planning area, by common name and species name. The matrix provides basic information on the status of each species, and the habitats used by the species. The categories used in the matrix are defined on the next several pages. This appendix includes the following subsections.

Sources

A number of sources were used in developing the matrix. The references used are given on pages E-8 and E-9, and also in Appendix B, References. The list of species was compiled by Charles Bruce, wildlife biologist (shared employee, Oregon Department of Fish and Wildlife and Oregon Department of Forestry), with the assistance of the Oregon Department of Fish and Wildlife (Boechler 1996; Marshall et al. 1996). Important literature references include: for amphibians: Leonard et al. 1993; for reptiles: Nussbaum, Brodie, and Storm 1983; for mammals: Hall 1981, Burt and Grossenheider 1972, and Christy and West 1993; for birds: Puchy and Marshall 1993, and Gilligan et al. 1994.

The Oregon Species Information System database provided the data on special status, and on species occurrence in the Coast Range and Cascades (West Slope and Crest) provinces within the counties in the planning area (Oregon Department of Fish and Wildlife 1995).

The Oregon Department of Fish and Wildlife's *Oregon Wildlife Diversity Plan* provided most information on the relative abundance of a species within the Coast Range or Cascades provinces, and its specific use of riparian/aquatic habitats, snags, and down wood for breeding, feeding, or shelter/cover (Puchy and Marshall 1993). Some comments are also from this source.

Status

Federal or State of Oregon Endangered or Threatened Species (FE, FT; SE, ST)

- **Endangered —** Species in danger of extinction throughout all or a significant portion of their range.
- **Threatened —** Species likely to become endangered in the foreseeable future.

(Federal Endangered Species Act of 1973, as amended; Oregon Endangered Species Act of 1987, ORS 496.172; OAR 635-100-100 to 635-100-130.)

Federal Candidate Species and Species of Concern (FC, FSOC)

The U.S. Fish and Wildlife Service (USFWS) also maintains a list of candidate species (FC) and federal species of concern (FSOC). Candidate species are taxa for which the USFWS has sufficient biological information to support a proposal to list as endangered or threatened. Species of Concern are taxa whose conservation status is of concern to the USFWS (many previously known as Category 2 candidates), but for which further information is still needed.

State Sensitive Species (SSC, SSV)

Sensitive species are those likely to become threatened or endangered throughout all or any significant portion of their range in Oregon. This list is updated biennially. Sensitive species are broken into the two categories listed below (ODFW 2008).

- **Critical (SSC) —** Species that are imperiled with extirpation from a specific geographic area of the state because of small population sizes, habitat loss or degradation, and/or immediate threats. Critical species may decline to point of qualifying for threatened or endangered status if conservation actions are not taken.
- **Vulnerable (SSV) —** Species facing one or more threats to their populations and/or habitats. Vulnerable species are not currently imperiled with extirpation from a specific geographic area or the state but could become so with continued or increased threats to populations and/or habitats.
-

(ORS 496.012 (1); OAR 635-100-040.)

Other Designations

Neotropical migratory birds (NTMB) — These species breed mainly in temperate North America and winter primarily south of the border between the United States and Mexico. The federal Migratory Bird Treaty Act protects not only neotropical migratory birds, but also nearly all other native birds; this designation is not shown.

State game species (SG) — Designated game species can be hunted. State laws regulate the hunting season, allowable methods of capture, and bag limits.

Plant Communities

Red Alder Forest (RA)

Red alder forest is generally considered to be a community that will be succeeded by western hemlock or western redcedar. However, red alder can dominate sites in nearly pure stand conditions for long periods of time and thus create distinctive wildlife habitat that can be maintained by silvicultural treatment. Red alder must compose at least 70 percent of the stand.

The red alder forest stand is dominated by red alder, but may have some bigleaf maple or some climax coniferous trees such as western hemlock, western redcedar, or Sitka spruce. Ground vegetation is commonly dominated by salmonberry, sword-fern, and herbs.

Red alder stands go through only the stand initiation and stem exclusion processes. Unlike other types of forest communities, they do not continue on through the understory reinitiation process. (Brown 1985)

Temperate Coniferous Forest (TC)

These low to mid-elevation coniferous forests are in the western hemlock zone and are generally associated with big game winter range. Conifers must exceed 70 percent of the crown cover for the stand. More than one conifer species is common, and the species are typical of the areas west of the Cascade Range.

Commonly dominant trees are Douglas-fir, western hemlock, white and grand firs, western redcedar, and Sitka spruce. Some Pacific silver fir or Shasta red fir may be found at upper limits of the elevation zone. Common shrubs are vine maple, salal, evergreen huckleberry, Pacific rhododendron, Oregon boxwood, red bilberry, salmonberry, thimbleberry, giant chinkapin, Oregon grape, Pacific yew, and hazelnut. Common herbs are sword-fern, vanilla leaf, trillium, twinflower, bedstraw, oxalis, deer-fern, inside-out flower, violet, and lady-fern. (Brown 1985)

High Temperate Coniferous Forest (HTC)

These mid-elevation to moderately high elevation coniferous forests are in the silver fir zone and are generally associated with big game summer range. This plant community has a closed canopy. Conifers must exceed 70 percent of the crown cover for the stand. When more than one conifer species is common, the type is dominated by upper elevation species.

Commonly dominant trees are Douglas-fir, Pacific silver fir, noble fir, Shasta red fir, and mountain hemlock. Some pioneer species may be present, such as sugar pine, white pine, and lodgepole pine. At times subalpine pine or Engelmann spruce may be present. Common shrubs are big huckleberry, Alaska huckleberry, whortleberry, vine maple, salal, Oregon grape, Pacific rhododendron, copper-bush, and rusty-leaf. Common herbs are beargrass, woodrush, twinflower, prince's pine, bunchberry, vanilla leaf, clintonia, false Solomon's seal, trillium, oak-fern, and twisted-stalk.

High temperate coniferous forests are the common mid-elevation to upper elevation types west of the Cascade Range — the general upper forest zone. (Brown 1985)

Deciduous Hardwood (DH)

This plant community has tree heights greater than 15 feet at maturity, crown cover greater than 40 percent, but less than 30 percent cover of conifers, and less than 50 percent evergreen hardwoods.

Tree species may be Oregon white oak or California black oak with some Douglas-fir, ponderosa pine, Jeffrey pine, incense-cedar, Pacific madrone, and tanoak. Shrub species may be poison-oak, snowberry, hazelnut, ceanothus, manzanita, blackberry, bitter cherry, and ocean spray. Herbaceous species may be grasses, forbs, or both, at times rather sparse.

Deciduous hardwood stands characteristically occur in the interior valleys, and may occur on the fringes of the Willamette Valley. Historically, only a small percentage of state forest lands was deciduous hardwood stands. (Brown 1985)

Conifer-Hardwood Forest (CH)

This plant community is comprised of a mixture of coniferous trees and hardwood trees, where 30 to 70 percent of the crown cover is hardwoods. The hardwoods may be deciduous, evergreen, or any combination. When hardwoods exceed 70 percent of the crown cover, the type is "hardwood"; when they are less than 30 percent, the type is "conifer."

Common tree species are Douglas-fir, incense cedar, ponderosa pine, sugar pine, Pacific madrone, tanoak, red alder, bigleaf maple, and at times Oregon white oak, western hemlock, Port Orford-cedar, and white fir. Shrubs vary, and include salmonberry, manzanita, poison-oak, salal, ceanothus, hazelnut, ocean spray, and Oregon grape. Herbs are generally common.

Conifer-hardwood forest is a reasonably stable plant community in which hardwoods maintain a significant status. Often these types remain as conifer-hardwood mixtures after regeneration cutting because new hardwood trees sprout from the stumps of the old hardwoods. These stands grade into mixed conifer types, hardwood types, and red alder. (Brown 1985)

Stand Type Definitions

Over the years, data on wildlife use of different habitats has been collected using various definitions of stand types. Therefore, the data does not always fit perfectly with the stand type definitions used in the *Northwest Oregon State Forests Management Plan*. The matrix uses stand type definitions that best fit the available data on wildlife use of stand types. The first four definitions (regeneration, closed single canopy, understory, and layered) are approximately the same as the stand type definitions in the forest plan. However, there is no data on wildlife use of the older forest structure stand type. Instead, the wildlife matrix shows use of old growth stands, as defined in Brown 1985. Wildlife use of older forest structure stands may or may not be similar to wildlife use of old growth.

Stand Type 1 — Regeneration (REG)

Stand Development Process — Stand Initiation

This stand type occurs 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. The site is occupied primarily by tree seedlings or saplings, and herbs or shrubs. The trees can be conifers or hardwoods. Competition among the trees and other vegetation is not yet resulting in widespread loss of herb or shrub layers. In the following matrix, regeneration stands are taken to be equivalent to the following three stand conditions described in Brown 1985.

- **Grass-forb stand condition —** Shrubs less than 40 percent crown cover and less than 5 feet tall; unit may range from mainly devoid of vegetation to dominance by herbaceous species (grasses and forbs); tree regeneration generally less than 5 feet tall and 40 percent crown cover.
- **Shrub stand condition —** Shrubs greater than 40 percent crown canopy; they can be any height; trees less than 40 percent crown canopy and less than 1 inch DBH (diameter breast height). When the average tree diameter for the stand exceeds 1 inch DBH, the stand should be classified in the “open sapling” or “closed sapling” category.
- **Open sapling-pole stand condition —** Average stand diameter greater than 1 inch DBH and tree crown canopy less than 60 percent. Saplings are 1 to 4 inches DBH; poles 4 to 9 inches DBH.

Stand Type 2 — Closed Single Canopy (CSC)

Stand Development Process — Stem Exclusion

This stand type occurs when new trees, shrubs, and herbs no longer appear in the stand, and some existing ones begin to die, due to shading and other competitive factors. Trees fully occupy the site and form a single, main canopy layer. There is little or no understory development. Closed single canopy stands are approximately equivalent to the “closed sapling-pole-sawtimber” stand condition in Brown 1985.

- **Closed sapling-pole-sawtimber stand condition —** Average stand diameters between 1 and 21 inches DBH and crown cover exceeding 60 percent.

Stand Type 3 — Understory

Stand Development Process — Understory Reinitiation

This stand type occurs after the stem exclusion stage, when enough light and nutrients become available to allow herbs, shrubs, and new trees to grow again in the understory. These stands have developed more diverse herb or shrub layers than CSC stands and have trees larger than sapling size. Tree canopies may range from a single species, single-layered, main canopy with associated dominant, codominant, and suppressed trees; to multiple species canopies. However, significant layering of tree crowns has not yet developed. Average tree size is at least 6 to 10 inches DBH, and tree heights are generally approaching 40 to 50 feet.

Stand Type 4 — Layered

Stand Development Process — Understory Reinitiation

The vertical organization and structure of the living plant community are more complex than in the understory type. Vertical layering of herbs, shrubs, and tree crowns is extensive. Plant communities are complex in terms of numbers of species and in vertical arrangement. Shrub or herb layers and tree canopies in two or more layers are present. The amount of understory brush and herbaceous species is minimal at the beginning of the stage, but increases to a substantial component of the stand by the end of the stage. The overstory is dominated by trees of 18 inches or larger DBH and approximately 100 feet or more tall. At least 30 percent of the stand is comprised of layered patches. Layered stands are approximately equivalent to the “large sawtimber” stand condition in Brown 1985.

- **Large sawtimber stand condition —** Stand with average diameters exceeding 21 inches DBH; crown cover may be less than 100 percent, decay and decadence required for old growth characteristics are generally lacking, successional trees required by old growth may be lacking, and dead and down material required by old growth is lacking.

Stand Type 5 — Older Forest Structure

Stand Development Process — Understory Reinitiation

This stand type occurs when layered forest stands attain structural characteristics such as numerous large trees; a multi-layered canopy; a substantial number of large, down logs; and large snags. It is not intended to be old growth, although it is intended to provide some or all of the structural components commonly associated with old growth. Brown 1985 does not include this habitat. Instead, the matrix shows wildlife use of old growth. Wildlife use of older forest structure may or may not be similar to wildlife use of old growth.

- **Old growth stand condition —** Stands over 200 years old with at least two tree layers (overstory and understory), decay in living trees, snags, and down woody material. Some of the overstory layer may be composed of long-lived successional species (that is, Douglas-fir, western redcedar).

References for Appendix E

The following references were used in developing this appendix. Listings are alphabetical. The following format is used.

Author's name in bold. Year published. Title of publication. Publisher, publisher's location, any additional information.

The abbreviations below are used in the references. Standard two-letter postal abbreviations are used for the names of states.

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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Legal References

Federal Endangered Species Act of 1973, as amended.

Oregon Endangered Species Act of 1987.

ORS 496.012 (1).

ORS 496.172.

OAR 635-100-040.

OAR 635-100-100 to 635-100-130.

Key to the Matrix

Status

FE	Federal endangered species
FT	Federal threatened species
FSOC	Federal species of concern
SE	State endangered species
ST	State threatened species
SSC	State sensitive species: critical status
SSV	State sensitive species: vulnerable status
SG	State game species
NTMB	Neotropical migratory bird

Plant Community

RA	Red alder forest (defined as stand initiation and stem exclusion only)
TC	Temperate coniferous forest
HTC	High temperate coniferous forest (winter snow cover)
DH	Deciduous hardwood
CH	Conifer-hardwood forest
*****	Species either not listed in Brown 1985, or a species “whose habitat requirements are such that there is only a slight chance of forestry related impacts”, or a rare species in the planning area (Brown 1985).

Stand Types

REG	Regeneration
CSC	Closed single canopy
UDS	Understory
LYR	Layered
OFS	Older forest structure
OG	Old growth
X	General occurrence in the stand, for breeding, feeding, cover or resting.
S	Occurs if special or unique habitat is available.

Amphibians and Reptiles

See the key on page E-10 for explanations of the codes used in the matrix.

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	Stand Types				
				REG	CSC	UDS	LYR	OFS/ OG
Northwestern salamander *Ambystoma gracile*		Cascades, Coast Range. Widespread. Aquatic and terrestrial. Requires quiet water for breeding and feeding. Adults use downed woody debris and forest floor for resting and feeding.	Riparian/aquatic, ponds, lakes, coarse woody debris, forest litter and humus	X	X	X	X	X
Long-toed salamander *Ambystoma macrodactylum*		Cascades, Coast Range. Widespread. Aquatic and terrestrial. Requires quiet water for breeding and feeding. Adults use downed logs or rock for cover and resting.	Riparian/aquatic, ponds, coarse woody debris, rock	X	X	X	X	X
Cope's giant salamander *Dicamptodon copei*	SSV	North Coast Range and north Cascades only. Aquatic and terrestrial. Requires clear, high to low gradient streams for breeding.	Riparian/aquatic, coarse woody debris, rock	S	S	S	S	S
Pacific giant salamander *Dicamptodon tenebrosus*		Cascades, Coast Range. Widespread. Aquatic and terrestrial. Requires clear, high to low gradient streams, lakes, and ponds for breeding. Moist forest environments.	Riparian/aquatic, ponds, lakes, coarse woody debris, rock	X	X	X	X	X
Cascade torrent salamander *Rhyacotriton cascadae*	SSV	Cascades. Discontinuous distribution. Breeds and lives in streams, springs and seeps, splash zone.	Riparian/aquatic, stream splash zone	S	S	S	S	S

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	Stand Types				
				REG	CSC	UDS	LYR	OFS/ OG
Columbia torrent salamander *Rhyacotriton kezeri*	SSV	Coast Range north of Little Nestucca. Breeds and lives in streams, springs, seeps	Riparian/aquatic, stream splash zone	S	S	S	S	S
Southern torrent salamander *Rhyacotriton variegatus*	FSOC SSV	Coast Range south of Little Nestucca to California. Breeds and lives in streams, springs, seeps, splash zone.	Riparian/aquatic, stream splash zone	S	S	S	S	S
Clouded salamander *Aneides ferreus*	SSV	Cascades, Coast Range. Widespread. Requires abundant coarse woody debris and moist microhabitat for breeding and feeding.	Snags, downed logs, rocky talus	X	X	X	X	X
Oregon slender salamander *Batrachoseps wrighti*	FSOC SSV	Endemic to Oregon, Cascades only. Depends on logs and woody debris for reproduction and feeding, especially older decaying fir logs.	Downed logs and other coarse woody debris, rocky talus	X	X	X	X	X
Ensatina *Ensatina eschscholtzii*		Cascades, Coast Range. Widespread. Found in coniferous and deciduous forests in dryer conditions.	Downed logs and other coarse woody debris, rocky talus	X	X	X	X	X
Dunn salamander *Plethodon dunni*		Cascades, Coast Range. Widespread. Most common in riparian areas with moss-covered rock rubble or seeps.	Riparian, seeps, rock and talus	X	X	X	X	X
Western red-backed salamander *Plethodon vehiculum*		Cascades, Coast Range. Found in moist microhabitat with rocks, logs, moss and other down material. More common in deciduous forest types in the Coast Range.	Downed logs and other coarse woody debris and talus	X	X	X	X	X
Roughskin newt *Taricha granulosa*		Cascades, Coast Range. Widespread and abundant. Aquatic and terrestrial. Breeds in ponds and lakes, slow-moving streams, wetlands. Toxic skin.	Riparian/aquatic, coarse woody debris, rocks	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	Stand Types				
				REG	CSC	UDS	LYR	OFS/ OG
Western toad *Bufo boreas*	SSV	Cascades, Coast Range. Discontinuous distribution. Requires quiet, slow-moving water for breeding. Frequents meadow areas around water. Population declining for unknown reasons.	Riparian/aquatic, lakes and ponds, coarse woody debris	X	X	X	X	X
Coastal tailed frog *Ascaphus truei*	FSOC SSV	Cascades, Coast Range. Discontinuous distribution. Requires clear, cold, rocky streams for breeding. More common in headwater streams. Sensitive to habitat change.	Riparian/aquatic, coarse woody debris, rocks	X	X	X	X	X
Pacific chorus frog *Pseudacris regilla*		Cascades, Coast Range. Common and widespread. Needs slow, open water for breeding.	Riparian/aquatic, wetlands, ponds, lakes, meadows	X	X	X	X	X
Northern red-legged frog *Rana aurora*	FSOC SSV	Cascades, Coast Range. Widespread. Requires quiet water with surrounding vegetation. Found in damp, wooded areas. Populations declining for unknown reasons.	Riparian/aquatic, wetlands, ponds, lakes	X	X	X	X	X
Foothill yellow-legged frog *Rana boylii*	FSOC SSC	Cascades and southern Coast Range. Discontinuous distribution. Stays within a few feet of water. Prefers streams with rocky bottoms.	Riparian/aquatic, streams, ponds	S	S	S	S	S
Cascades frog *Rana cascadae*	FSOC SSV	Cascades. Discontinuous distribution. Occurs from 3,000 to 9,000 ft. in ponds and wet meadows.	Riparian/aquatic, ponds, wet meadows	S	S	S	S	S
Oregon spotted frog *Rana pretiosa*	FC SSC	High Cascades. Discontinuous distribution. Requires cold, permanent, marshes and ponds. Declining due to bullfrog predation. Probably extirpated from state lands.	Riparian/aquatic, wetlands, ponds	S	S	S	S	S

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	Stand Types				
				REG	CSC	UDS	LYR	OFS/ OG
Bullfrog *Rana catesbeiana*	SG	Cascades, Coast Range. Introduced species. Common below 4,000 ft. Predator on native frogs and turtles.	Riparian/aquatic, wetland, ponds	S	S	S	S	S
Western pond turtle *Actinemys marmorata*	FSOC SSC	Cascades, Coast Range. Discontinuous distribution. Needs quiet water with rocky or mud bottom and vegetation. Nests on land in sunny location within ¼ mile of water. Winters in water or on land.	Riparian/aquatic, rivers, streams, ponds, lakes, downed logs, forest litter and humus (winter)	S	S	S	S	S
Northern alligator lizard *Elgaria coerulea*		Cascades, Coast Range. Widespread in Coast Range. Requires cool, damp areas with vegetation and downed material or rocks.	Coarse woody debris, rocky soils	X	X	X	X	X
Western skink *Eumeces skiltonianus*		Cascades, Coast Range. Discontinuous distribution. Absent from coast areas and Coast Range north of Coos Bay. Prefers abundant herbaceous cover. Uses rocks, down logs, brush for cover and feeding.	Coarse woody debris, downed logs, rocks	X	S	S	S	S
Western fence lizard *Sceloporus occidentalis*		Cascades, Coast Range. Widespread in western interior valleys. Uses down logs, rocky areas, old fences for elevated perches. In open, dry sites.	Coarse woody debris, downed logs, rocks and talus	X	S	S	S	S
Rubber boa *Charina bottae*		Cascades, Coast Range. Widespread in Cascades. Found in open to forested areas.	Coarse woody debris, forest litter, rocky talus	X	X	X	X	X
Racer *Coluber constrictor*		Cascades, Coast Range. Discontinuous distribution. Uncommon. Found in a variety of open habitats including meadows, forest edges, south-facing slopes. Seldom in dense forests.	Meadows, grassland	X				
Ringneck snake *Diadophis punctatus*		Cascades. Discontinuous distribution. Requires moist areas. Open to woody habitats.	Coarse woody debris, rock and talus	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	Stand Types				
				REG	CSC	UDS	LYR	OFS/ OG
Gopher snake *Pituophis melanoleucus*		Cascades. Discontinuous distribution. Found at lower elevations, generally open, drier habitats but not in moist dense forests. More common near agricultural areas.	Coarse woody debris, rock and talus	X	X	X	X	X
Western terrestrial garter snake *Thamnophis elegans*		Cascades. Discontinuous distribution. Lower elevations from open to forested habitats but more common in moist habitats.	Riparian, meadows	X	X			
Northwestern garter snake *Thamnophis ordinoides*		Cascades, Coast Range. Widespread. More common in meadows, brushy areas.	Forest litter and humus, meadows, talus	X				
Common garter snake *Thamnophis sirtalis*		Cascades, Coast Range. Widespread. Inhabit grassland to forested areas. Winter in rocky den sites.	Forest litter and humus, meadows, riparian, rocky areas	X	X	X	X	X

Birds

See the key on page E-10 for explanations of the codes used in the matrix.

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Marbled murrelet *Brachyramphus marmoratus*	FT ST	Coast Range. Uncommon. Present year-round, breeds in forests.	Coast Range old-growth, trees with large limbs and or mistletoe.	TC			X	X	X
				CH			X	X	X
Blue grouse *Dendragapus obscurus*	SG	Cascades, Coast Range. Uncommon. Year-round resident.	Down wood for breeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Ruffed grouse *Bonasa umbellus*	SG	Cascades, Coast Range. Uncommon. Year-round resident.	Riparian/aquatic for feeding, down wood for breeding.	RA	X	X			
				TC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
California quail *Callipepla californica*	SG	Cascades, Coast Range. Uncommon or rare. Permanent resident.	Riparian/aquatic for feeding and breeding.	RA	X				
				TC	X				
				DH	X				
Mountain quail *Oreortyx pictus*	FSOC SG	Cascades, Coast Range. Uncommon. Year-round.	Down wood for breeding.	TC	X				
				HTC	X				
				DH	X				
				CH	X				

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Double-crested cormorant *Phalacrocorax auritus*		Cascades, Coast Range. Abundant. Permanent, winter and migrant populations on the coast, may be on inland freshwater lakes.	Riparian/aquatic for feeding and breeding.						
Common merganser *Mergus merganser*	SG	Cascades, Coast Range. Common. Permanent resident.	Riparian/aquatic for feeding and breeding; snags for breeding; down wood for resting.	TC HTC DH CH			X X X X	X X X X	X X X X
Red-breasted merganser *Mergus serrator*	SG	Coast Range. Common. Does not breed in Oregon.	Riparian/aquatic for feeding.	*					
Hooded merganser *Lophodytes cucullatus*	SG	Cascades, Coast Range. Uncommon. Year-round.	Riparian/aquatic for feeding and breeding, snags for breeding, down wood for resting.	RA TC HTC DH CH		X	 X X X X	 X X X X	 X X X X
Mallard *Anas platyrhynchos*	SG	Cascades, Coast Range. Abundant. Permanent-round, winter and migrant populations.	Riparian/aquatic for feeding and breeding, down wood for resting.						
Wood duck *Aix sponsa*	SG	Cascades, Coast Range. Uncommon. Year-round.	Riparian/aquatic for feeding and breeding, snags for breeding, down wood for resting.	RA TC DH CH		X	 X X X	 X X X	 X X X
Greater scaup *Aythya marila*	SG	Cascades, Coast Range. Abundant on coast. Nonbreeder.	Riparian/aquatic for feeding.						
Lesser scaup *Aythya affinis*	SG	Cascades, Coast Range. Abundant on coast. Nonbreeder.	Riparian/aquatic for feeding.						
Common goldeneye *Bucephala clangula*	SG	Cascades, Coast Range. Common. Winter resident, nonbreeder.	Riparian/aquatic for feeding.						

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Barrow's goldeneye *Bucephala islandica*	SG	Cascades, Coast Range. Rare on coast, uncommon breeder on high lakes of Cascades.	Riparian/aquatic for feeding and breeding, snags for breeding.	TC HTC CH			X X X	X X X	X X X
Bufflehead *Bucephala albeola*	SG	Cascades, Coast Range. Abundant on coast, common breeder in Cascades.	Riparian/aquatic for feeding and breeding, snags for breeding.	TC HTC CH			X X X	X X X	X X X
Harlequin duck *Histrionicus histrionicus*	FSOC SG	Cascades, Coast Range. Uncommon. On coast, winters in rocky, intertidal areas, nonbreeder. Breeds along Cascade streams.	Riparian/aquatic for feeding and breeding, snags for breeding, down wood for resting.	TC HTC	S S	X X	X X	X X	X X
Canada goose *Branta canadensis*	SG	Cascades, Coast Range. Abundant on coast, uncommon in Cascades. Year-round.	Riparian/aquatic for feeding and breeding.						
Great blue heron *Ardea herodias*		Cascades, Coast Range. Common on coast, uncommon in Cascades. Year-round.	Riparian/aquatic for feeding and breeding.	RA TC DH CH	S S S S	X S S S	 X X X	 X X X	 S X S
Green (green-backed) heron *Butorides striatus*		Cascades, Coast Range. Uncommon to rare. Year-round.	Riparian/aquatic for feeding and breeding.						
Sora *Porzana carolina*		Cascades, Coast Range. Uncommon on coast, common in Cascades. Summer breeder. Inhabits low elevation wetlands.	Riparian/aquatic for feeding and breeding.						
Common snipe *Capella gallinago*	SG	Coast Range, Cascades. Abundant on coast, nonbreeder. Common in Cascades, breeding.	Riparian/aquatic for feeding and breeding.						
Spotted sandpiper *Actitis macularia*		Cascades, Coast Range. Uncommon. Breeds in Cascades. Uses suitable habitat at all elevations.	Riparian/aquatic for feeding and breeding.						

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Killdeer *Charadrius vociferus*	NTMB	Cascades, Coast Range. Common on coast, uncommon in Cascades. Year-round, breeder.	Riparian/aquatic for feeding and breeding.						
Band-tailed pigeon *Patagioenas fasciata*	FSOC NTMB SG	Cascades, Coast Range. Common, breeder. Uses mineral springs; minerals essential to reproduction.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Mourning dove *Zenaida macroura*	NTMB SG	Cascades, Coast Range. Uncommon. Year-round, breeder.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Turkey vulture *Cathartes aura*	NTMB	Cascades, Coast Range. Uncommon. Summer resident, breeder.	Riparian/aquatic for feeding, snags for perching, down wood for breeding.	RA	X				
				TC	X				X
				HTC	X				X
				DH	X				X
				CH	X				X
Northern harrier (marsh hawk) *Circus cyaneus*	NTMB	Cascades, Coast Range. Uncommon, year-round resident at coast. Rare, nonbreeder, in Cascades. Uses marshes and meadows.	Riparian/aquatic for feeding and breeding.						
Sharp-shinned hawk *Accipiter striatus*	NTMB	Cascades, Coast Range. Uncommon. Year-round resident.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Cooper's hawk *Accipiter cooperii*	NTMB	Cascades, Coast Range. Uncommon. Year-round resident.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Northern goshawk *Accipiter gentilis*	FSOC SSV NTMB	Cascades, Coast Range. Rare, breeder in Coast Range, uncommon year-round resident in Cascades. Inhabits heavily forested areas.	Riparian/aquatic for feeding, snags for perching, down wood for feeding.	TC		X	X	X	X
				HTC		X	X	X	X
				CH		X	X	X	X
Red-tailed hawk *Buteo jamaicensis*	NTMB	Cascades, Coast Range. Uncommon. Year-round resident.	Riparian/aquatic for feeding and breeding.	RA	X	X			
				TC	X		X	X	X
				HTC	X		X	X	X
				DH	X		X	X	X
				CH	X		X	X	X
Golden eagle *Aquila chrysaetos*	NTMB	Cascades, Coast Range. Rare in Coast Range, rare breeder. Uncommon, year-round resident in Cascades. Uses marshes and meadows.	Riparian/aquatic for feeding.	RA	X				
				TC	X		X	X	X
				HTC	X		X	X	X
				DH	X				
				CH	X		X	X	X
Bald eagle *Haliaeetus leucocephalus*	ST	Cascades, Coast Range. Uncommon, year-round resident.	Riparian/aquatic for feeding, snags for perching.	TC	X	S	X	X	X
				HTC	X	S	X	X	X
				DH	X	S	S	S	X
				CH	X	S	X	X	X
Peregrine falcon *Falco peregrinus*	SSV NTMB	Cascades, Coast Range. Uncommon in Coast Range, rare in Cascades. Year-round resident, breeder. Uses lakes, pond, marshes and meadows.	Riparian/aquatic for feeding.	TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Merlin *Falco columbarius*		Coastal areas and valleys, winter migrant. Rare.		RA	X				
				TC	X				
				HTC	X				
				DH	X				
				CH	X				
American kestrel *Falco sparverius*	NTMB	Cascades, Coast Range. Uncommon. Year-round resident.	Snags for breeding.	RA	X				
				TC	X		X	X	X
				HTC	X		X	X	X
				DH	X		X	X	X
				CH	X		X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Osprey *Pandion haliaetus*	NTMB	Cascades, Coast Range. Uncommon. Summer resident, breeder.	Riparian/aquatic for feeding, snags for breeding.	TC	S	S	X	X	X
				HTC	S	S	X	X	X
				DH	S	S	X	X	X
				CH	S	S	X	X	X
Barn owl *Tyto alba*		Cascades, Coast Range. Uncommon to rare. Year-round resident. Nests in old barns and buildings. Low elevation agricultural lands.		RA	X	X			
				TC	X		X	X	X
				DH	X	X	X	X	X
				CH	X		X	X	X
Long-eared owl *Asio otus*	NTMB	Cascades, Coast Range. Irregular occurrence. Year-round resident and breeds in Cascades, nonbreeder in Coast Range. Rare in west Oregon.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Short-eared owl *Asio flammeus*	NTMB	Coast Range. Rare in west Oregon. Nonbreeder. Uses marshes and lowland meadows. Primarily lowland valleys and the coastal zone.	Riparian/aquatic for feeding.						
Barred owl *Strix varia*		Cascades, Coast Range. Rare. Year-round resident. Increasing, spreading north to south.	Snags for breeding.	RA	X	X			
				TC		X	X	X	X
				HTC		X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Spotted owl *Strix occidentalis*	FT ST	Cascades, Coast Range. Uncommon. Year-round resident.		TC		X	X	X	X
				HTC		X	X	X	X
				CH			X	X	X
Great gray owl *Strix nebulosa*	SSV	Cascades. Rare. Year-round resident.		*					

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Northern saw-whet owl *Aegolius acadicus*		Cascades, Coast Range. Uncommon. Year-round resident.	Riparian/aquatic for feeding, snags for breeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Western screech-owl *Otus kennicottii*		Cascades, Coast Range. Uncommon. Year-round resident. Lower elevation.	Riparian/aquatic for breeding and feeding, snags for breeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Great-horned owl *Bubo virginianus*		Cascades, Coast Range. Common. Year-round resident.	Riparian/aquatic for breeding and feeding, snags for breeding.	RA	X	X			
				TC	X		X	X	X
				HTC	X		X	X	X
				DH	X		X	X	X
				CH	X		X	X	X
Northern pygmy owl *Glaucidium gnoma*		Cascades, Coast Range. Uncommon. Year-round resident.	Riparian/aquatic for breeding and feeding, snags for breeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Belted kingfisher *Ceryle alcyon*	NTMB	Cascades, Coast Range. Common in Coast Range, uncommon in Cascades. Year-round resident. Nests in burrows in earth banks.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Hairy woodpecker *Picoides villosus*		Cascades, Coast Range. Uncommon. Year-round resident.	Riparian/aquatic for breeding and feeding, snags for breeding and feeding.	TC	X	X	X	X	X
				HTC	X	X	X	X	X
				CH	X	X	X	X	X
Downy woodpecker *Picoides pubescens*		Cascades, Coast Range. Uncommon. Year-round resident.	Riparian/aquatic for breeding and feeding, snags for breeding and feeding.	RA	X	X			
				DH	X	X	X	X	X
				CH	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types REG	CSC	UDS	LYR	OFS/ OG
Red-breasted sapsucker *Sphyrapicus ruber*	NTMB	Cascades, Coast Range. Uncommon. Year-round resident. Feeds on sap of live trees.	Riparian/aquatic for breeding and feeding, snags for breeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Pileated woodpecker *Dryocopus pileatus*		Cascades, Coast Range. Uncommon. Year-round resident. (On critical species list for eastern Oregon; vulnerable on westside.)	Snags for breeding and feeding, down wood for feeding.	RA		X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH			X	X	X
				CH	X	X	X	X	X
Northern flicker *Colaptes auratus*	NTMB	Cascades, Coast Range. Common. Year-round resident.	Riparian/aquatic for breeding and feeding, snags for breeding and feeding, down wood for feeding.	RA	X	X			
				TC	X		X	X	X
				HTC	X		X	X	X
				DH	X		X	X	X
				CH	X		X	X	X
Common poorwill *Phalaenoptilus nuttallii*	NTMB	Cascades. Rare or uncommon. Breeder. Mainly east but occasionally west Oregon. May prefer forest openings (clearcuts).	Riparian/aquatic for breeding and feeding.	DH	X				
Vaux's swift *Chaetura vauxi*	NTMB	Cascades, Coast Range. Common. Summer resident, breeder.	Riparian/aquatic for breeding and feeding, snags for breeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Black-chinned hummingbird *Archilochus alexandri*	NTMB	Rare in the Coast Range and southern Oregon. No breeding records for western Oregon. Found primarily in eastern Oregon.	Riparian/aquatic for breeding and feeding.	*					
Anna's hummingbird *Calypte anna*	NTMB	Coast Range. Uncommon. Year-round, breeder. Maintained during winter by feeders.		RA	X				
				TC	X				X
				DH	X				X
				CH	X				X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Rufous hummingbird *Selasphorus rufus*	NTMB	Cascades, Coast Range. Common. Breeder.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Calliope hummingbird *Stellula calliope*	NTMB	Cascades, Cascades. Uncommon. Breeder.	Riparian/aquatic for breeding and feeding.	HTC	X				
Olive-sided flycatcher *Contopus cooperi*	FSOC SSV NTMB	Cascades, Coast Range.	Snags for perching and feeding.	TC	X		X	X	X
				HTC	X		X	X	X
				CH	X		X	X	X
Western wood-pewee *Contopus sordidulus*	NTMB	Cascades, Coast Range. Common. Breeder.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Pacific-slope (western) flycatcher *Empidonax difficilis*	NTMB	Cascades, Coast Range. Abundant. Breeder.	Riparian/aquatic for feeding.	RA		X			
				TC			X	X	X
				HTC			X	X	X
				DH			X	X	X
				CH			X	X	X
Little willow flycatcher *Empidonax traillii adastus*	FSOC SSV NTMB	Cascades, Coast Range. Abundant in Coast Range, common in Cascades. Breeder.	Riparian/aquatic for breeding and feeding.	RA	X				
				DH	X				
Hammond's flycatcher *Empidonax hammondii*	NTMB	Cascades, Coast Range. Uncommon. Breeder. Primarily higher elevations.		RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				CH		X	X	X	X
Dusky flycatcher *Empidonax oberholseri*	NTMB	Cascades, Coast Range. Rare in Coast Range, nonbreeder. Common, breeder, in Cascades. Primarily higher elevations.	Riparian/aquatic for breeding and feeding.	RA	X				
				HTC	X				

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types REG	CSC	UDS	LYR	OFS/ OG
Streaked Horned lark *Eremophila alpestris strigata*	FC SSC	Cascades, Coast Range. Uncommon in western Oregon, primarily in valleys. Year-round resident. Open grasslands, alpine meadows, mountain tops.							
Steller's jay *Cyanocitta stelleri*		Cascades, Coast Range. Common. Year-round resident.		RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Western Scrub jay *Aphelocoma californica*		Cascades, Coast Range. Uncommon. Year-round resident.	Riparian/aquatic for breeding and feeding.	RA	X				
				DH	X		X	X	X
				CH	X		X	X	X
Gray jay *Perisoreus canadensis*		Cascades, Coast Range. Year-round resident. Uncommon in Coast Range, common in Cascades.		TC	X	X	X	X	X
				HTC	X	X	X	X	X
				CH	X	X	X	X	X
Common raven *Corvus corax*		Cascades, Coast Range. Uncommon. Year-round resident.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
American crow *Corvus brachyrhynchos*	SG	Cascades, Coast Range. Abundant in Coast Range, uncommon in Cascades. Year-round resident.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Northwestern crow *Corvus caurinus*	SG	Coast Range. Rare. Nonbreeder. (Brown 1985 considers this the same species as the American Crow.)	Riparian/aquatic for feeding.	*					
Clark's nutcracker *Nucifraga columbiana*		Cascades, Coast Range. Irregular, nonbreeder in Coast Range. Uncommon, year-round resident of Cascades.		HTC	X		X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Brown-headed cowbird *Molothrus ater*	NTMB	Cascades, Coast Range. Abundant in Coast Range, uncommon in Cascades. Breeder. Lower elevations near agricultural land.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DC	X	X	X	X	X
				HC	X	X	X	X	X
Red-winged blackbird *Agelaius phoeniceus*		Cascades, Coast Range. Abundant. Year-round resident.	Riparian/aquatic for breeding and feeding.						
Western meadowlark *Sturnella neglecta*	NTMB	Cascades, Coast Range. Uncommon. Year-round resident. Generally non-forest; prairies and agricultural lands.		RA	X				
				DH	X				
				CH	X				
Northern oriole *Icterus galbula*	NTMB	Cascades, Coast Range. Irregular, nonbreeder in Coast Range. Rare, breeder in Cascades.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Brewer's blackbird *Euphagus cyanocephalus*	NTMB	Cascades, Coast Range. Abundant in Coast Range, common in Cascades. Year-round resident. Lower elevations.	Riparian/aquatic for breeding and feeding.	TC	X				
				HTC	X				
				DH	X				
				CH	X				
Evening grosbeak *Coccothraustes vespertinus*		Cascades, Coast Range. Abundant year-round resident. Nests at higher elevations.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Purple finch *Carpodacus purpureus*	NTMB	Cascades, Coast Range. Common, year-round resident.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types REG	CSC	UDS	LYR	OFS/ OG
Cassin's finch *Carpodacus cassinii*	NTMB	Cascades, Coast Range. Uncommon, year-round resident in Cascades. Rare visitor. More common in southwest Oregon.	Riparian/aquatic for feeding.	HTC	X	X	X	X	X
				CH	X	X	X	X	X
House finch *Carpodacus mexicanus*		Cascades, Coast Range. Common, year-round resident. Primarily around human habitation.		RA	X				
				DH	X		X	X	X
				CH	X				
Red crossbill *Loxia curvirostra*	NTMB	Cascades, Coast Range. Common, year-round resident. Nests at higher elevations.	Riparian/aquatic for feeding.	TC	X	X	X	X	X
				HTC	X	X	X	X	X
				HC			X	X	X
American goldfinch *Carduelis tristis*	NTMB	Cascades, Coast Range. Common in Coast Range, uncommon in Cascades. Year-round resident.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X				
				DH	X	X			
				CH	X	X			
Lesser goldfinch *Carduelis psaltria*		Coast Range. Irregular, nonbreeder. Mainly interior valleys.		DH	X	X	X	X	X
				CH	X				
Pine siskin *Carduelis pinus*	NTMB	Cascades, Coast Range. Abundant, year-round resident.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Oregon vesper sparrow *Pooecetes gramineus affinis*	FSOC SSC NTMB	Cascades, Coast Range. Uncommon in Coast Range, rare in Cascades. Breeder. Primarily open prairie and agricultural lands.		DH	X				

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Savannah sparrow *Passerculus sandwichensis*	NTMB	Cascades, Coast Range. Abundant on coast, year-round resident. Uncommon in Cascades, breeder. Breeds in marshes, meadows.	Riparian/aquatic for breeding and feeding.	DH	X				
White-crowned sparrow *Zonotrichia leucophrys*	NTMB	Cascades, Coast Range. Abundant in Coast Range, common in Cascades. Year-round resident.	Riparian/aquatic for breeding and feeding.	RA	X				
				TC	X				
				HTC	X				
				DH	X				
				CH	X				
Golden-crowned sparrow *Zonotrichia atricapilla*		Cascades, Coast Range. Abundant in Coast Range, common in Cascades. Nonbreeder.	Riparian/aquatic for feeding.	RA	X				
				TC	X				
				HTC	X				
				DH	X				
Chipping sparrow *Spizella passerina*	NTMB	Cascades, Coast Range. Uncommon in Coast Range, common in Cascades. Breeder.		RA	X				
				TC	X		X	X	X
				HTC	X		X	X	X
				DH	X		X	X	X
				CH	X		X	X	X
Dark-eyed junco *Junco hyemalis*	NTMB	Cascades, Coast Range. Abundant. Year-round resident.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Song sparrow *Melospiza melodia*	NTMB	Cascades, Coast Range. Abundant in Coast Range, common in Cascades. Year-round resident.	Riparian/aquatic for breeding and feeding.	RA	X				
				TC	X				
				DH	X				
				CH	X				
Lincoln's sparrow *Melospiza lincolnii*	NTMB	Cascades, Coast Range. Uncommon, nonbreeder in Coast Range. Common, breeder, in Cascades.	Riparian/aquatic for feeding.	RA	X				
				TC	X				
				HTC	X				
				DH	X				
				CH	X				

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Fox sparrow *Passerella iliaca*	NTMB	Cascades, Coast Range. Common, nonbreeder in Coast Range. Uncommon, year-round resident in Cascades.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X				
				HTC	X				
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Spotted towhee *Pipilo maculatus*		Cascades, Coast Range. Common, year-round resident.	Riparian/aquatic for breeding and feeding.	RA	X				
				TC	X		X	X	X
				DH	X		X	X	X
				CH	X		X	X	X
Black-headed grosbeak *Pheucticus melanocephalus*	NTMB	Cascades, Coast Range. Common, breeder. Primarily lower interior valleys.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Lazuli bunting *Passerina amoena*	NTMB	Cascades, Coast Range. Uncommon. Breeder.	Riparian/aquatic for breeding and feeding.	RA	X				
				DH	X				
				CH	X				
Western tanager *Piranga ludoviciana*	NTMB	Cascades, Coast Range. Common. Breeder.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Purple martin *Progne subis*	FSOC SSC NTMB	Cascades, Coast Range. Uncommon in Coast Range, rare in Cascades. Breeder.	Riparian/aquatic for breeding and feeding, snags for breeding.	RA	X				
				TC	X		X	X	X
				DH	X		X	X	X
				CH	X		X	X	X
Cliff swallow *Hirundo pyrrhonota*	NTMB	Cascades, Coast Range. Common. Breeder. Uses cliffs or manmade structures for nesting.	Riparian/aquatic for feeding.	RA	X				
				TC	X				
				DH	X				
				CH	X				

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Barn swallow *Hirundo rustica*	NTMB	Cascades, Coast Range. Abundant. Breeder. Only manmade structures used for nesting in the northwest.	Riparian/aquatic for feeding.	RA	X				
				TC	X				
				HTC	X				
				DH	X				
				CH	X				
Tree swallow *Tachycineta bicolor*	NTMB	Cascades, Coast Range. Abundant. Breeder.	Riparian/aquatic for breeding and feeding, snags for breeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Violet-green swallow *Tachycineta thalassina*	NTMB	Cascades, Coast Range. Abundant. Breeder.	Riparian/aquatic for breeding and feeding, snags for breeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Northern rough-winged swallow *Stelgidopteryx serripennis*	NTMB	Cascades, Coast Range. Uncommon in Coast Range, common in Cascades. Breeder. Nests in earth banks.	Riparian/aquatic for breeding and feeding.						
Bohemian waxwing *Bombycilla garrulus*		Cascades, Coast Range. Irregular. Nonbreeder. Unpredictable occurrence.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	
				CH	X	X	X	X	
Cedar waxwing *Bombycilla cedrorum*	NTMB	Cascades, Coast Range. Abundant in Coast Range, common in Cascades. Year-round resident.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Warbling vireo *Vireo gilvus*	NTMB	Cascades, Coast Range. Common. Breeder.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X				
				HTC	X				
				DH	X	X	X	X	X
				CH	X		X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types: REG	CSC	UDS	LYR	OFS/ OG
Cassin's vireo *Vireo cassinii*	NTMB	Cascades, Coast Range. Uncommon. Breeder.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Hutton's vireo *Vireo huttoni*		Cascades, Coast Range. Common in Coast Range, uncommon in Cascades. Year-round resident. Primarily lower elevations.		RA	X	X			
				TC	X				
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Nashville warbler *Vermivora ruficapilla*	NTMB	Cascades, Coast Range. Rare in Coast Range, uncommon in Cascades. Breeder.	Riparian/aquatic for feeding.	TC	X		X	X	X
				HTC	X		X	X	X
				DH	X	X	X	X	
				CH	X		X	X	X
Orange-crowned warbler *Vermivora celata*	NTMB	Cascades, Coast Range. Abundant. Year-round resident in Coast Range, breeder in Cascades.	Riparian/aquatic for breeding and feeding.	RA	X				
				TC	X				X
				HTC	X				X
				DH	X				
				CH	X				
Yellow warbler *Dendroica petechia*	NTMB	Cascades, Coast Range. Common in Coast Range, uncommon in Cascades. Breeder.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				CH	X	X			
Yellow-rumped warbler *Dendroica coronata*	NTMB	Cascades, Coast Range. Common. Year-round resident.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Black-throated gray warbler *Dendroica nigrescens*	NTMB	Cascades, Coast Range. Abundant. Breeder. Primarily lower valleys.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Townsend’s warbler *Dendroica townsendi*	NTMB	Cascades, Coast Range. Uncommon. Nonbreeder in Coast Range, breeder in Cascades.	Riparian/aquatic for feeding.	RA		X			
				TC		X	X	X	X
				HTC		X	X	X	X
				CH		X	X	X	X
Hermit warbler *Dendroica occidentalis*	NTMB	Cascades, Coast Range. Uncommon in Coast Range, abundant in Cascades. Breeder.		TC		X	X	X	X
				HTC		X	X	X	X
				DH			X	X	X
				CH		X	X	X	X
MacGillivray’s warbler *Oporornis tolmiei*	NTMB	Cascades, Coast Range. Common. Breeder.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X		X	X	
				HTC	X		X	X	
				CH	X		X	X	
Common yellowthroat *Geothlypis trichas*	NTMB	Cascades, Coast Range. Common. Breeder. Primarily around swamps and marshes at lower elevations.	Riparian/aquatic for breeding and feeding.						
Yellow-breasted chat *Icteria virens*	FSOC SSC NTMB	Cascades, Coast Range. Rare in Coast Range, uncommon in Cascades. Breeder.	Riparian/aquatic for breeding and feeding.	DH	X				
Wilson’s warbler *Wilsonia pusilla*	NTMB	Cascades, Coast Range. Abundant. Breeder. Primarily lower elevations.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X				
				CH	X	X	X	X	X
American dipper *Cinclus mexicanus*		Cascades, Coast Range. Common. Year-round resident. Found along mountain streams.	Riparian/aquatic for breeding and feeding.	RA	S	S			
				TC	S	S	S	S	S
				HTC	S	S	S	S	S
				DH	S	S	S	S	S
				CH	S	S	S	S	S
Rock wren *Salpinctes obsoletus*	NTMB	Cascades, Coast Range. Irregular, nonbreeder in Coast Range. Uncommon, year-round resident in Cascades.	Down wood for breeding and feeding.	DH	X				

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types REG	CSC	UDS	LYR	OFS/ OG
Bewick's wren *Thryomanes bewickii*		Cascades, Coast Range. Common. Year-round resident.	Riparian/aquatic for breeding and feeding, snags for breeding.	RA	X				
				DH	X		X	X	X
				CH	X				
House wren *Troglodytes aedon*	NTMB	Cascades, Coast Range. Uncommon. Breeder.	Riparian/aquatic for breeding and feeding, snags for breeding and feeding, down wood for breeding and feeding.	RA	X				
				DH	X		X	X	X
Winter wren *Troglodytes troglodytes*		Cascades, Coast Range. Common. Year-round resident.	Riparian/aquatic for breeding and feeding, snags for breeding, down wood for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH					X
				CH	X	X	X	X	X
Marsh wren *Cistothorus palustris*	NTMB	Cascades, Coast Range. Abundant in Coast Range, uncommon in Cascades. Year-round resident. Restricted to marshes or wetlands.							
Brown creeper *Certhia americana*		Cascades, Coast Range. Common. Year-round resident. Nests under loose bark.	Riparian/aquatic for feeding, snags for breeding and feeding.	RA		X			
				TC		X	X	X	X
				HTC		X	X	X	X
				DH		X	X	X	X
				CH		X	X	X	X
Slender-billed nuthatch *Sitta carolinensis aculeata*	SSV	Cascades, Coast Range. Rare in Coast Range. Uncommon in Cascades. Year-round resident.	Riparian/aquatic for breeding and feeding, snags for breeding and feeding.	DH	X	X	X	X	X
				CH	X	X	X	X	X
Red-breasted nuthatch *Sitta canadensis*		Cascades, Coast Range. Abundant. Year-round resident.	Snags for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH			X	X	X
				CH	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Black-capped chickadee *Poecile atricapillus*		Cascades, Coast Range. Common. Year-round resident.	Riparian/aquatic for breeding and feeding, snags for breeding and feeding, down wood for feeding.	RA	X	X			
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Mountain chickadee *Poecile gambeli*		Cascades, Coast Range. Irregular, nonbreeder on coast. Uncommon, year-round resident in Cascades. Mountainous areas.	Riparian/aquatic for breeding and feeding, snags for breeding and feeding, down wood for feeding.	HTC	X	X	X	X	X
				CH	X	X	X	X	X
Chestnut-backed chickadee *Poecile rufescens*		Cascades, Coast Range. Uncommon in Coast Range, abundant in Cascades. Year-round resident.	Riparian/aquatic for breeding and feeding, snags for breeding and feeding, down wood for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Wrentit *Chamaea fasciata*		Cascades, Coast Range. Abundant in Coast Range, uncommon in Cascades. Year-round resident.		DH	X				
Bushtit *Psaltriparus minimus*		Cascades, Coast Range. Abundant. Year-round resident.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				DH	X	X	X	X	X
				CH	X	X			
Golden-crowned kinglet *Regulus satrapa*		Cascades, Coast Range. Abundant. Year-round resident.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Ruby-crowned kinglet *Regulus calendula*	NTMB	Cascades, Coast Range. Common in Coast Range, uncommon in Cascades. Nonbreeder.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Townsend's solitaire *Myadestes townsendi*	NTMB	Cascades, Coast Range. Uncommon. Year-round resident.	Riparian/aquatic for feeding, down wood for feeding.	TC	X		X	X	X
				HTC	X		X	X	X
				DH	X		X	X	X
				CH	X		X	X	X
Swainson's thrush *Catharus ustulatus*	NTMB	Cascades, Coast Range. Abundant. Breeder. Prefers heavily forested areas.	Riparian/aquatic for breeding and feeding, snags for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Hermit thrush *Catharus guttatus*	NTMB	Cascades, Coast Range. Uncommon, nonbreeder in Coast Range. Common, year-round resident in Cascades.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
American robin *Turdus migratorius*	NTMB	Cascades, Coast Range. Abundant. Year-round resident.	Riparian/aquatic for breeding and feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Varied thrush *Ixoreus naevius*	NTMB	Cascades, Coast Range. Common in Coast Range, abundant in Cascades. Year-round resident.	Riparian/aquatic for feeding.	RA	X	X			
				TC	X	X	X	X	X
				HTC	X	X	X	X	X
				DH	X	X	X	X	X
				CH	X	X	X	X	X
Western bluebird *Sialia mexicana*	SSV NTMB	Cascades, Coast Range. Uncommon in Coast Range, rare in Cascades. Year-round resident. Decreasing due to loss of nesting habitat.	Snags for breeding.	DH	X	X	X	X	X
				CH	X	X	X	X	X

Mammals

See the key on page E-10 for explanations of the codes used in the matrix.

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Virginia opossum *Didelphis virginiana*		Cascades, Coast Range. Introduced species. Discontinuous distribution. May breed in lower elevation conifer forests.	Downed logs, riparian areas, man-made structures.	RA TC DH CH	X	X	X	X	X
Vagrant shrew *Sorex vagrans*		Cascades, Coast Range. Widespread in Coast Range. Most abundant near water. Common in alder stands.	Riparian areas, meadows. Down logs for breeding and feeding.	RA TC HTC DH CH	X	X	X	X	X
Pacific shrew *Sorex pacificus*		Cascades, Coast Range. Discontinuous distribution. Requires down logs, thickets, ground debris for cover and feeding.	Riparian areas, marshes, bogs, downed logs and woody debris.	RA TC HTC	X	X	X	X	X
Pacific water shrew *Sorex bendirii*		Cascades, Coast Range south of Marion and Tillamook counties. Found near streams, marshes. Uses down logs for cover.	Riparian, down logs.	RA TC HTC CH	X	X	X	X	X
Trowbridge’s shrew *Sorex trowbridgii*		Cascades, Coast Range; widespread in Coast Range. Uses drier sites than most shrews.	Down logs and woody debris.	RA TC HTC CH		X	X	X	X
Fog shrew *Sorex sonomae*		Cascades, Coast Range north of Douglas County. Discontinuous distribution.	Riparian areas, down logs and woody debris.	*	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Baird's shrew *Sorex bairdii*		Cascades, Coast Range south of Clackamas and Yamhill counties. Discontinuous distribution.	Riparian areas, down logs and woody debris.	*	X	X	X	X	X
Shrew-mole *Neurotrichus gibbsii*		Cascades, Coast Range; widespread in Coast Range. Needs deep, friable soils with high humus, abundant litter; uses stumps, down logs for nesting.	Riparian areas, down logs and woody debris.	RA TC HTC CH	X	X	X	X	X
Townsend's mole *Scapanus townsendii*		Local populations in Cascades; widespread in Coast Range. Primarily uses meadows, pastures, open forests.	Meadows, grasslands, burrows.	RA TC HTC CH	X	S	S	S	S
Coast mole *Scapanus orarius*		Cascades, Coast Range; widespread in Coast Range. Uses forest as well as meadows.	Meadows, burrows. Riparian areas, down logs.	RA TC HTC DH CH	X	X	X	X	X
Little brown myotis *Myotis lucifugus*		Cascades, Coast Range. Widespread. Hibernates. Prefers forests. Uses snags for breeding.	Riparian areas, snags, caves, buildings.	RA TC HTC DH CH	X	X	X	X	X
Yuma myotis *Myotis yumanensis*	FSOC	Local populations, Cascades, Coast Range. Unknown whether hibernates or migrates. Uses snags for breeding.	Riparian areas, snags, caves, buildings.	RA TC HTC DH CH	X	X	X	X	X
Long-eared myotis *Myotis evotis*	FSOC	Cascades, Coast Range. Widespread. Hibernates in caves. Uses snags for breeding.	Riparian areas, snags, caves, buildings.	RA TC HTC CH	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Fringed myotis *Myotis thysanodes*	FSOC SSV	Cascades, Coast Range. Widespread. Hibernates in caves. Uses snags for breeding.	Riparian areas, snags, caves, rock crevices, buildings.	RA TC HTC DH CH	X	X	X	X	X
Long-legged myotis *Myotis volans*	FSOC SSV	Cascades, Coast Range. Widespread. Hibernates in caves. Some may migrate. Uses snags for breeding.	Riparian areas, snags, caves, rock crevices, buildings.	RA TC HTC DH CH	X	X	X	X	X
Silver-haired bat *Lasionycteris noctivagans*	FSOC SSV	Cascades, Coast Range. Widespread. Unknown whether hibernates or migrates. Uses snags for breeding.	Riparian areas, snags, tree bark, rock crevices.	RA TC HTC DH CH	X	X	X	X	X
Big brown bat *Eptesicus fuscus*		Cascades, Coast Range. Widespread. Hibernates in caves.	Snags, caves, buildings, riparian areas for feeding.	RA TC HTC DH CH	X	X	X	X	X
Hoary bat *Lasiurus cinereus*	SSV	Cascades, Coast Range. Most widely distributed bat in North America. Migrates. Roosts in foliage of trees and shrubs.	Snags, caves, buildings, riparian areas for feeding.	TC HTC DH CH	X	X	X	X	X
Townsend's western big-eared bat *Corynorhinus townsendii townsendii*	FSOC SSC	Cascades, Coast Range. Discontinuous distribution. Hibernates and reproduces in caves and buildings.	Caves, mines, buildings.	TC HTC CH	X	X	S	S	S
Pallid bat *Antrozous pallidus*	FSOC SSV	Cascades. Discontinuous distribution. Hibernates. Uses caves and buildings for breeding.	Caves, mine, buildings; riparian areas for feeding.	DH	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
California myotis *Myotis californicus*	SSV	Cascades, Coast Range. Hibernates. Uses riparian areas, open brushy areas and meadows for feeding.	Riparian areas, snags, caves, buildings.	RA TC HTC DH CH	X	X	X	X	X
American pika *Ochotona princeps*		Higher elevation Cascades. Discontinuous distribution. Requires talus or lava flows within forest zones.	Talus slopes, rocks.	HTC	S	S	S	S	S
Brush rabbit *Sylvilagus bachmani*		Cascades, Coast Range. Discontinuous distribution. Requires dense, brushy edges.	Shrub/grass-forb edges.	RA TC HTC DH CH	X		X	X	X
Snowshoe hare *Lepus americanus*		Cascades, Coast Range. Widespread. Prefers brushy areas.	Shrubby areas, down woody debris.	RA TC HTC	X		X	X	X
Mountain beaver *Aplodontia rufa*		Cascades, Coast Range. Widespread in Coast Range. Prefer early seral brushy stages.	Burrows, downed wood.	RA TC HTC CH	X	X	X	X	X
Townsend's chipmunk *Tamias townsendii*		Cascades, Coast Range. Widespread in Coast Range. Enters torpor (inactive) during cold weather.	Burrows, woody debris, rocky areas.	RA TC HTC DH CH	X		X	X	X
California ground squirrel *Spermophilus beecheyi*		Cascades, Coast Range. Discontinuous distribution. Hibernates. Range is expanding northward. Prefers open shrubby areas.	Burrows.	RA TC HTC DH CH	X				
Golden-mantled ground squirrel *Spermophilus lateralis*		Cascades. Discontinuous distribution. Hibernates when snow covers the ground. Prefers open forest areas.	Rocky areas, burrows, woody debris.	TC HTC	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Western gray squirrel *Sciurus griseus*	SSVSG	Cascades, Coast Range but absent from the coast. Will build stick/leaf nests in live trees. Strongly associated with oak woodlands.	Snags, live tree cavities.	TC DH CH	X	X	X	X	X
Douglas' squirrel *Tamiasciurus douglasii*		Cascades, Coast Range. Widespread. Uses snags and trees for breeding. Prefers mature conifer forests, avoids shrubby areas.	Snags, woody debris, burrows.	RA TC HTC CH		X	X	X	X
Northern flying squirrel *Glaucomys sabrinus*		Cascades, Coast Range. Widespread. Fungi important in diet. Snags and high ground cover important. Important prey of spotted owls.	Snags, tree cavities, woody debris.	RA TC HTC DH CH			X	X	X
Western pocket gopher *Thomomys mazama*		Cascades, Coast Range. Widespread. Northern spotted owl prey, especially at higher elevations.	Open grass, shrub areas.	TC HTC DH CH	X				
American beaver *Castor canadensis*	SG	Cascades, Coast Range. Widespread. Streams, rivers, lakes.	Riparian areas, streams and lakes.	RA TC HTC DH CH	S	S	S	S	S
Deer mouse *Peromyscus maniculatus*		Cascades, Coast Range. Most widespread of all mammals.	Woody debris, rocky areas.	RA TC HTC DH CH	X	X	X	X	X
Dusky-footed woodrat *Neotoma fuscipes*		Southern Oregon and Willamette Valley margins. Prefer brushy habitat. Discontinuous distribution. Prey of northern spotted owl	Woody debris.	RA TC DH CH	X	X	X	X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Bushy-tailed woodrat *Neotoma cinerea*		Cascades, Coast Range. Widespread. Northern spotted owl prey.	Logs, woody debris, cliffs, caves, talus, snags.	RA TC HTC DH CH	X	X	X	X	X
Western red-backed vole *Clethrionomys californicus*		Cascades, Coast Range. Widespread. Found in dense, moist, coniferous forests. Associated with woody debris. Spotted owl prey.	Woody debris, logs.	TC HTC		X	X	X	X
White-footed vole *Phenacomys albipes*	FSOC	Cascades, Coast Range. Discontinuous distribution (rare). Uncommon but most abundant in riparian areas.	Riparian areas.	RA TC CH	X	X	X	X	X
Red tree vole *Phenacomys longicaudus*	FSOC SSV	Cascades, Coast Range. Discontinuous distribution. Primarily Douglas-fir stands. Northern spotted owl prey. Builds nests in live trees from needles.		TC HTC		X	X	X	X
Townsend's vole *Microtus townsendii*		Cascades, Coast Range. Widespread. Found primarily in riparian and marshy areas.		RA TC HTC DH CH	X				
Long-tailed vole *Microtus longicaudus*		Cascades, Coast Range. Widespread. More abundant in riparian areas and areas of grasses and sedges.		RA TC HTC	X	S	S	S	S
Creeping vole *Microtus oregoni*		Cascades, Coast Range. Widespread.	Down logs.	RA TC HTC DH CH	X	X	X	X	X
Water vole *Microtus richardsoni*		Higher elevations of Cascades. Found near clear, cold streams with dense vegetation.	Riparian, burrows.	TC HTC	S	S	S	S	S

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types REG	CSC	UDS	LYR	OFS/ OG
Common muskrat *Ondatra zibethicus*	SG	Cascades, Coast Range. Widespread. Aquatic vole. More common in lakes, rivers, and marshy areas.	Aquatic, riparian, burrows.	RA TC HTC DH	S	S	S	S	S
Pacific jumping mouse *Zapus trinotatus*		Cascades, Coast Range. Widespread. Hibernates. Requires moist areas with abundant ground vegetation. More abundant in riparian areas.	Riparian.	RA TC HTC DH CH	X	X	X	X	X
Common porcupine *Erethizon dorsatum*		Cascades, Coast Range. Widespread in Cascades. Uses cliffs, talus, rocks, caves, snags and down wood for breeding.	Snags, logs, caves.	RA TC HTC CH	X	X	X	X	X
Nutria *Myocastor coypus*		Coast Range. Introduced species. In or near water with aquatic vegetation. Lower elevation rivers and marshes.	Riparian areas.	TC DH	X	X	X	X	X
Coyote *Canis latrans*		Cascades, Coast Range. Widespread. Uses caves, logs, hollow trees, and burrows for dens.	Logs, caves, live tree cavities.	RA TC HTC DH CH	X	X	X	X	X
Red fox *Vulpes vulpes*	SG	Cascades, Coast Range. Prefers grasslands and open habitats. Discontinuous distribution. Native fox in high Cascades. Introduced in low elevations.	Burrows, logs, caves.	RA TC HTC DH CH	X				
Common gray fox *Urocyon cinereoargenteus*	SG	Cascades, Coast Range south of Clatsop County. Prefers open woodlands with hardwoods and riparian forests.	Logs, live trees cavities, rock crevices.	RA TC DH CH	X			X	X

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Black bear *Ursus americanus*	SG	Cascades, Coast Range. Widespread. May be dormant from October to March. Forages in open brushy areas and talus slopes.	Large downed logs, hollow trees, caves.	RA TC HTC DH CH	X	X	X	X	X
Raccoon *Procyon lotor*	SG	Cascades, Coast Range. Widespread. Riparian habitat important.	Riparian areas, snags, logs.	RA TC HTC DH CH	X	X	X	X	X
American marten *Martes americana*	SSV SG	Cascades, Coast Range. Discontinuous distribution. Uses snags and downed logs for denning and cover.	Snags, woody debris.	TC HTC CH	X	X	X	X	X
Ermine *Mustela erminea*		Cascades, Coast Range. Widespread. More common within brushy forest edges.	Logs, woody debris, burrows, rocks.	RA TC HTC DH CH	X	X	X	X	X
Long-tailed weasel *Mustela frenata*		Cascades, Coast Range. Widespread.	Logs, woody debris, burrows, rocks.	RA TC HTC DH CH	X	X	X	X	X
Mink *Mustela vison*	SG	Cascades, Coast Range. Widespread. Partially aquatic. Builds dens near water under tree roots, logs, natural cavities.	Riparian, logs, tree roots.	RA TC HTC DH CH	X	X	X	X	X
Western spotted skunk *Spilogale gracilis*		Cascades, Coast Range. Widespread in Coast Range.	Logs, hollow trees, burrows.	RA TC HTC DH CH	X				

SPECIES	STATUS	COMMENTS	HABITAT FEATURES	PLANT COMMUN	Stand Types				
					REG	CSC	UDS	LYR	OFS/ OG
Striped skunk *Mephitis mephitis*		Cascades, Coast Range. Widespread in Coast Range. Den site in burrows of other animals, logs. Prefer grass and shrub habitats.	Burrows, downed logs, rocky areas.	RA TC DH CH	X				
Northern river otter *Lutra canadensis*	SG	Cascades, Coast Range. Widespread. Streams, rivers and lakes. Important furbearer.	Riparian/aquatic, logs, burrows, natural cavities.	RA TC HTC DH CH	S	S	S	S	S
Mountain lion *Felis concolor*	SG	Cascades, Coast Range. Widespread in Cascades. Dens in downed logs, caves, talus.	Caves, rocky ledges, large down logs.	RA TC HTC DH CH	S	S	S	S	S
Bobcat *Lynx rufus*	SG	Cascades, Coast Range. Widespread. Important furbearer.	Rocky ledges, caves, down logs.	RA TC HTC DH CH	X	X	X	X	X
Elk or wapiti *Cervus elaphus*	SG	Cascades, Coast Range. Widespread. Prefer grass/forb habitats for foraging.	Meadows, open grassy areas.	RA TC HTC DH CH	X	X	X	X	X
Mule deer **(** black-tailed deer**)** *Odocoileus hemionus*	SG	Cascades, Coast Range. Widespread. Prefer open grass/shrub habitats for foraging.	Open grassy/shrub areas.	RA TC HTC DH CH	X	X	X	X	X

Fish

See the key on page E-10 for explanations of the codes used in the matrix.

SPECIES	STATUS	COMMENTS	HABITAT FEATURES
Pacific lamprey *Lampetra tridentata*	FSOC SSV	Most streams with ocean access; anadromous.	Builds redds in river rock and gravel; juveniles remain in freshwater up to 6 years.
Western Brook lamprey *Lampetra richardsoni*	SSV	Widely distributed in coastal streams and western Oregon. Status unknown; freshwater only.	Builds redds in gravel, head of riffles, smaller streams and rivers.
River lamprey *Lampetra ayresi*	FSOC	Columbia River and coastal streams; little known species; anadromous.	
Coast Range sculpin *Cottus aleuticus*		Coast Range, primarily on west side.	
Mottled sculpin *Cottis bairdi*		Lower elevations, Santiam and Cascades only.	Rock and gravel for nesting; male guards nest.
Torrent sculpin *Cottus rhotheus*		Western Oregon, lower elevations to the coast.	
Reticulated sculpin *Cottus perplexus*		Most common sculpin species; western Oregon, Willamette Valley and Coast Range.	
Riffle sculpin *Cottus gulosus*		Coast Range from Coquille River north; uncommon in Willamette Valley.	
Prickly sculpin *Cottus asper*		Willamette Valley to coast, and estuaries.	
Paiute sculpin *Cottus beldingi*		Lower elevations Cascades, Willamette Valley and east slope Coast Range.	
Lower Columbia River Coho salmon *Oncorhynchus kisutch*	FT SE	Lower Columbia ESU	
Oregon Coastal Coho salmon *Oncorhynchus kisutch*	FT SSV	Oregon Coast ESU	
Lower Columbia Winter Steelhead *Oncorhynchus mykiss*	FT SSC	Lower Columbia ESU, Winter Run	
Lower Columbia Summer Steelhead *Oncorhynchus mykiss*	SSC	Lower Columbia ESA, Summer Run	

SPECIES	STATUS	COMMENTS	HABITAT FEATURES
Upper Willamette Winter Steelhead *Oncorhynchus mykiss*	FT SSV	Upper Willamette ESU, Winter Run	
Coastal Steelhead *Oncorhynchus mykiss*	FSOC SSV	For federal SOC status, runs not specified. For state sensitive status, both Winter and Summer runs listed as SSV	
Lower Columbia Chinook salmon *Oncorhynchus tshawytscha*	FT SSC	Lower Columbia ESU Both spring and fall runs listed as state sensitive, critical.	
Upper Willamette Chinook salmon *Oncorhynchus tshawytscha*	FT SSC	Upper Willamette ESU	
Coastal Spring Chinook salmon *Oncorhynchus tshawytscha*	SSC		
Coastal Cutthroat Trout Oncorhynchus clarksi clarkii	FSOC	ESU not specified in FSOC list	
Coastal Cutthroat Trout Oncorhynchus clarksi clarkii	SSV	Lower Columbia River ESU	
Columbia River Chum salmon	FT SSC	Columbia River ESU	
Chum salmon *Oncorhynchus keta*	SSC	Pacific Coast ESU	
Rainbow trout *Oncorhynchus mykiss irideus (resident form)*		Statewide; provisional populations isolated above natural barriers to anadromous fish.	
Brook trout *Salvelinus fontinalis*		Non-native; planted in mountain lakes in Cascades.	
Tui chub *Gila bicolor*		Southwest Oregon basins; may be present in parts of northwest Oregon.	
Oregon chub *Oregonichthys crameri*	FE SSC	Willamette and Santiam basins, potentially adjacent to Santiam State Forest.	
Umpqua chub *Oregonichthys kalawatseti*	FSOC SSC	State sensitive species, vulnerable status, Umpqua Basin	

SPECIES	STATUS	COMMENTS	HABITAT FEATURES
Northern squawfish *Ptychocheilus oregonensis*		Columbia River drainage.	
Speckled dace *Rhinichthys osculus*		Several races in Columbia River drainage and central Coast Range rivers.	
Longnose dace *Rhinichthys cataractae*		Columbia River system and some coastal rivers.	
Leopard dace *Rhinichthys falcatus*		Columbia River system, including Willamette basin.	
Redside-shiner *Richardsonius balteatus*		Columbia River system, central and south Coast Range.	
Peamouth *Mylocheilus caurinus*		Columbia River system.	
Largescale sucker *Catastomus machrocheilus*		Columbia River, Coast Range north of Tillamook Bay, Siuslaw River south to Sixes River.	
Three-spine stickleback *Gasterosteus aculeatus*		Lowland drainages throughout western Oregon.	

Appendix F

Public Involvement

Public involvement is critical in developing the very best possible forest management plan for the northwest Oregon state forests. The public contributes information, ideas, and values that are essential to plan development. Also, the public involvement process can help to gain the public's understanding and support for management actions on the northwest Oregon state forests.

The planning team carried out extensive public involvement as it developed the 2001 forest management plan, as detailed in this appendix. The Oregon Department of Forestry's planning team provided information and sought public input at each step of the planning process, and solicited comments on the draft strategies and proposed actions. The two federal agencies involved with the incidental take permit, the U.S. Fish and Wildlife Service and National Marine Fisheries Service, began to participate in the public involvement process in 1997, after development began on the proposed *Western Oregon State Forests Habitat Conservation Plan* (HCP).

The public involvement process was integrated with the overall planning process, and covered all parts of the planning process: the two forest management plans (northwest and southwest Oregon state forests), the proposed habitat conservation plan (HCP), and the federal NEPA (National Environmental Policy Act) analysis, which will be documented in an environmental impact statement (EIS) that will accompany the proposed HCP.

This appendix describes all public involvement for all documents leading up to approval of the 2001 forest management plan. The 2009 plan revision was based on the Board of Forestry's deliberation on the balance of economic, social, and environmental values provided through implementation of the Northwest Forest Management Plan (NW FMP) on the Tillamook and Clatsop State Forests. As this plan has been implemented on the three North Coast Districts (Tillamook, Forest Grove, and Astoria), the Department has refined its information and learned from its management activities. With this updated knowledge, it had become apparent the expected economic outputs falls short of the predicted outputs, necessitating the adaptive management discussion with the Board. The process included meetings with stakeholders (e.g., timber and conservation interests), the Forest Trust Land Advisory Committee, and numerous Board of Forestry meetings where public testimony was heard. Further details on the Board of Forestry work can be found in the meeting materials prepared for each meeting posted on the Department web site.

History of Public Involvement

The public involvement process during development of the 2001 forest management plan included newsletters, public meetings and forest tours, a toll-free phone line, information on the world-wide web, a planning forum (focused on the forest management plan), a public interest committee (focused on the proposed HCP), peer review, an independent scientific review, and informal contacts with groups and individuals.

A chronological history of all public involvement activities is given on the next few pages, showing how all the activities fit together and in what sequence they occurred. After the history, each aspect of the process is described in detail; thus there are headings for the newsletters, for each committee, etc. The history includes only activities related to state forest policy and planning. For example, the Board of Forestry meets every month and considers many issues related to Oregon forests, but the chronological history shows only meetings where state forest planning was discussed or a decision relevant to state forest planning was made. Newsletters included a number of articles; only a few main articles for each issue are mentioned below.

The following acronyms are used in the history of public involvement.

BOF	Board of Forestry
EIS	Environmental Impact Statement for Western Oregon State Forests Habitat Conservation Plan
HCP	Proposed Western Oregon State Forests Habitat Conservation Plan
ISR	Independent scientific review
NMFS	National Marine Fisheries Service
NW FMP	Northwest Oregon State Forests Management Plan
ODF	Oregon Department of Forestry
PIC	Public interest committee
SW FMP	Southwest Oregon State Forests Management Plan
USFWS	U.S. Fish and Wildlife Service

Table F-1. Chronological History of Public Involvement

Date	Event
1994	
Early 1994	Planning process begins for northwest Oregon state forests. (NW FMP)
May 1994	First issue of *Horizons* newsletter published; draft guiding principles. (NW FMP) Toll-free phone line established. (NW FMP, HCP, EIS)
May 25-June 2, 1994	Five public meetings; focus on draft guiding principles: Tillamook, Warrenton, Forest Grove, Salem, Eugene. (NW FMP)
June 1994	Board of Forestry meeting. (NW FMP, SW FMP, HCP)
August 1994	Second issue of *Horizons* newsletter published. (NW FMP)
Sept. 17, 1994	Public tours: Santiam and Tillamook State Forests. (NW FMP)
Early fall, 1994	Planning forum established; meetings begin. (NW FMP)
Nov. 1994	Third issue of *Horizons* newsletter published; draft management goals.(NW FMP)
Nov. 29-Dec. 8, 1994	Five public meetings; focus on draft management goals: Astoria, Tillamook, Forest Grove, Stayton, Philomath. (NW FMP)
1995	
Early 1995	State forests planning information posted on Department of Forestry's world-wide web page. (NW FMP)
Jan.-Oct. 1995	Department of Forestry drafts administrative rules on purpose of state forest lands. (NW FMP, SW FMP)
July 1995	Fourth issue of *Horizons* newsletter published; initial resource assessments. (NW FMP)
Oct. 20, 1995	Board of Forestry meeting; review of draft administrative rules. (NW FMP, SW FMP)
1996	
Jan. 1996	Fifth issue of *Horizons* newsletter published; draft vision and strategies. (NW FMP)
Early 1996	Planning process begins for southwest Oregon state forests. (SW FMP)
Early 1996	Citizen advisory committee formed to advise on administrative rules. (NW FMP, SW FMP)

Table F-1. Chronological History of Public Involvement (continued)

Date	Event
Feb. 1996	Peer review of draft strategies begins. (NW FMP)
Feb.-April 1996	Public hearings and comment period on draft administrative rules; three hearings: Salem, Roseburg, and Forest Grove. (NW FMP, SW FMP)
March 5-13, 1996	Five public meetings; focus on draft vision statement and management strategies: Astoria, Tillamook, Forest Grove, Stayton, Veneta. (NW FMP)
June 5, 1996	Board of Forestry meeting; review of NW FMP progress.
Early fall 1996	Peer review group completes its work. (NW FMP)
Fall 1996	Planning process begins for HCP. (HCP)
Oct. 1996	Sixth issue of *Horizons* newsletter published; HCP, implementation planning, progress report NW FMP. (HCP, EIS, NW FMP)
1997	
Jan. 8, 1997	Board of Forestry meeting; report on draft administrative rules. (NW FMP, SW FMP)
Jan.-July 1997	Citizen's advisory committee meetings. (NW FMP, SW FMP)
Feb. 1997	Release of draft NW FMP (revised in response to previous public comments and peer review). (NW FMP)
Feb.-March 1997	Five public meetings; focus on draft NW FMP: Philomath, Astoria, Tillamook, Forest Grove, Stayton. (NW FMP)
Feb.-April 4, 1997	Open written comment period on draft NW FMP. (NW FMP)
April 1997	Release of draft SW FMP. (SW FMP)
April 14-15, 1997	Two public meetings; focus on draft SW FMP: Glendale, Grants Pass. (SW FMP)
April 29, 1997	Board of Forestry meeting: report on draft FMPs. (NW FMP, SW FMP)
July 1997	Board of Forestry tour and meeting: Forest Grove; includes state and federal agency officials, county commission chairs, advisory group members, and media representatives; NW FMP concepts and strategies. (NW FMP)

Table F-1. Chronological History of Public Involvement (continued)

Date	Event
August 26, 1997	Five public hearings; focus on draft administrative rules: Salem, Forest Grove, Roseburg, Cannon Beach, Portland. (NW FMP, SW FMP)
August-Dec. 1997	Public comment period on draft administrative rules; comment period extended several times. (NW FMP, SW FMP)
Sept. 3, 1997	Board of Forestry meeting: report on public hearings; report on HCP. (NW FMP, SW FMP, HCP)
Sept. 20, 1997	Public tour of the Tillamook State Forest.
Oct. 1997	Eighth issue of *Horizons* newsletter published: HCP strategies; integrating HCP, FMPs, and administrative rule. (HCP, NW FMP, SW FMP)
Oct. 1997- Jan. 1998	Board of Forestry subcommittee on administrative rule develops rules. (NW FMP, SW FMP)
Oct. 11, 1997	Public tour of the Tillamook State Forest.
Oct. 28, 1997	Notice of public scoping meetings: Federal Register Notice that the Oregon Department of Forestry is developing an HCP; and that ODF, together with USFWS and NMFS, has scheduled public scoping meetings. (HCP, EIS)
Nov. 1997	First draft of HCP released; second draft of SW FMP released. (HCP, SW FMP)
Nov. 3-4, 1997	Two public meetings; focus on SW FMP and HCP: Glendale, Grants Pass. (HCP, EIS, SW FMP)
Nov. 17 and Dec. 3, 1997	Five public meetings; focus on NW FMP and HCP: Astoria, Tillamook, Salem, Eugene, Portland. USFWS and NMFS involved in meetings. (HCP, EIS, NW FMP)
1998	
Jan. 7, 1998	Board of Forestry meeting; BOF adopts new administrative rules on state forest management policy and planning; decision PIC to be formed. (NW FMP, SW FMP, HCP, EIS)
March 4, 1998	Board of Forestry meeting; progress report on PIC, other state forest policy and planning activities. (NW FMP, SW FMP, HCP, EIS)
March 19, 1998	Oregon Fish and Wildlife Commission tour of Tillamook State Forest. (NW FMP, HCP)

Table F-1. Chronological History of Public Involvement (continued)

Date	Event
April 1998	PIC established. (HCP, EIS)
April 23-24, 1998	Board of Forestry meeting; report on state forest policy and planning activities.
April-Nov., 1998	PIC meetings, including tour of state forests in August. (HCP, EIS)
May 1998	April 1998 draft of NW FMP released. (NW FMP)
May-July 1998	Independent scientific review of HCP. (HCP, EIS)
June 1998	Ninth issue of *Horizons* published; information on HCP, NW FMP, PIC, ISR, and monitoring and adaptive management strategies. (NW FMP, HCP, EIS)
June 3, 1998	Board of Forestry meeting; status report on SW FMP development. (SW FMP)
June 17, 1998	Meeting of land management classification system external review group. (NW FMP, SW FMP)
June-July 1998	Release of interim implementation plans for districts: Astoria, Clackamas-Marion, Forest Grove, Tillamook, West Oregon, Western Lane; information in IIPs relates to all planning documents. (NW FMP, HCP, EIS)
June 23-July 1, 1998	Five public meetings; focus on draft NW FMP and HCP: Astoria, Tillamook, Salem, Corvallis, Portland. USFWS and NMFS involved with meetings. (NW FMP, HCP, EIS)
July 23-23, 1998	Board of Forestry tour and meeting; update on land base designation and land management classification process: Forest Grove. (NW FMP, SW FMP)
Sept. 9, 1998	Board of Forestry meeting; report on draft rule language for land management classification system. (NW FMP, SW FMP)
Sept. 18, 1998	September 1998 draft of HCP released. (HCP, EIS)
Oct. 22-23, 1998	Board of Forestry meeting; progress reports on PIC, HCP. (HCP, EIS)
Dec. 1998	Board of Forestry meeting; progress report on HCP. (HCP, EIS)
Feb. 1999	Letter to *Horizons* mailing list; update on the HCP, SW FMP, NW FMP.

Table F-1. Chronological History of Public Involvement (continued)

Date	Event
1999	
Jan. 1999	Five public hearings; focus on land classification and land designation rulemaking: Tillamook, Salem, Roseburg, Klamath Falls, Portland. (NW FMP, SW FMP)
April 1999	Board of Forestry meeting; review of proposed strategies and alternatives. (HCP, EIS)
April 1999	Tenth issue of *Horizons* published; update on timeline; information about ISR, PIC, review of public involvement. (HCP, EIS, NW FMP, SW FMP)
June 1999	Board of Forestry meeting; review of monitoring and adaptive management strategies. (HCP, EIS, NW FMP, SW FMP)
July 1999	Board of Forestry meeting; review of aquatic and riparian strategies. (HCP, EIS, NW FMP, SW FMP)
March 2000	Board of Forestry meeting and workshop; review of Sessions decadal analysis of alternatives, and report on NW FMP's connection to local economies. (NW FMP, SW FMP, HCP, EIS)
April 2000	Board of Forestry workshop; integration of HCP, FMP, implementation plans, and land management classification maps. (NW FMP, SW FMP, HCP)
May 2000	Board of Forestry workshop; review of FMP resource strategies, adaptive management strategies, monitoring plan, and working hypotheses. (NW FMP, SW FMP, HCP)
June 2000	Board of Forestry meeting; review of revised FMP resource strategies. (NW FMP, SW FMP)
July 2000	Board of Forestry meeting; decision to prepare FMP for administrative rule-making. (NW FMP, SW FMP)
September 2000	Board of Forestry meeting; direction to begin rule-making process. (NW FMP, SW FMP)

Horizons Newsletter

The Department of Forestry published the first issue of the *Horizons* newsletter in August, 1994, and continued to publish the newsletter throughout the planning process. The newsletter was dedicated to state forests management planning news and was published approximately twice each year, as work was accomplished and new steps taken. See the chronological history for the exact dates of publication.

At first, the newsletter focused on the northwest Oregon state forests. As work began on the habitat conservation plan for all western Oregon state forests, and the management plan for the southwest Oregon state forests, the newsletter also covered these plans. See the chronological history for information on focus points for each newsletter issue.

Horizons was mailed to an extensive list of interested individuals, organizations, and agencies. A broader audience was reached through press releases and articles in western Oregon newspapers. Interested persons and groups were invited to request one-on-one meetings or presentations.

Forest Log Newsletter

The Oregon Department of Forestry publishes a newsletter, the *Forest Log*, which covers all of the department's activities. Approximately 3,500 copies are mailed every two months to interested individuals, organizations, businesses, and agencies. Several articles covered the development of the forest management plans, the *Western Oregon State Forests Habitat Conservation Plan*, and the environmental impact statement for the HCP. The articles gave readers contact information and explained how they could get more involved in the planning process. The main articles in the *Forest Log* are listed below. The newsletter included many brief updates on the planning process, announcements of public meetings, and announcements of Board of Forestry actions related to planning.

- The November-December 1995 issue of the *Forest Log* had articles explaining the forest management planning process for the northwest Oregon state forests, the concepts of structure-based management, and how to sign up to receive the *Horizons* newsletter.
- The March-April 1996 issue, which was the department's 1995 annual report, stated as part of the report on state lands management, that a habitat conservation plan was being prepared for western Oregon state forests.
- The March-April 1998 issue, which was the department's 1997 annual report, had an article that reviewed the entire state forests planning process to date, including the draft forest management plans, the draft HCP, the new administrative rules, and the role of monitoring and adaptive management.

Public Meetings and Tours

Public meetings were held at each major step of the planning process. Along with discussion of the forest management plans, the meetings also included discussion of the need for the HCP, the planning process for the HCP, and the relationship between the two forest plans and the HCP.

Public meetings were publicized in the newsletters, through press releases and media coverage, and letters to the *Horizons* mailing list. Specific locations varied for each set of meetings. Written comments were received after the meetings.

The meetings in November-December 1997 and June-July 1998 were held jointly by state and federal agencies. Representatives of the U.S. Fish and Wildlife Service and National Marine Fisheries Service were present, along with staff from the Oregon Department of Forestry.

In addition, Department of Forestry planners met informally with interested people and groups over the course of the planning process. These contacts included informal meetings and tours, telephone conversations, distribution of informational materials, and outreach to local news media.

Toll-Free Telephone Line for Information

A toll-free information line was established in May 1994 (1-800-482-6866). The line provided recorded messages on the planning process and periodic updates; it also allowed people to give input by recording a message. The line was announced in the newsletters and kept in operation throughout the planning process.

World Wide Web Site: www.odf.state.or.us

The Department of Forestry has a world-wide web site. The department started to include information about state forests planning on the site in early 1995, and continued to do so after that time. The web site address is: www.odf.state.or.us, and includes information about all aspects of the department's work and responsibilities.

Notice of Intent

The U.S. Fish and Wildlife Service and National Marine Fisheries Service ("the Services") published a notice in the Federal Register on October 28, 1997, about the HCP. The notice stated that the Oregon Department of Forestry had started the development of the HCP and was applying to the Services for an incidental take permit. The notice further stated that the Services and the Department of Forestry had jointly scheduled a series of public scoping meetings on the project. Finally, the notice stated that NEPA analysis would be done on the proposal, but at that time, the decision had not yet been made on what level of NEPA analysis would be required for the project. (Federal Register, October 28, 1997, Volume 62, Number 208, pages 55822-55825.)

The U.S. Fish and Wildlife Service and National Marine Fisheries Service published the Notice of Intent to prepare an environmental impact statement on the *Western Oregon State Forests Habitat Conservation Plan* in the Federal Register on **.

Other Meetings

The National Wildlife Federation, a private nonprofit organization, held a meeting in July 1997, to discuss the HCP for western Oregon state forests. The Department of Forestry sent representatives to present information and answer questions.

Steering Committee

The planning process for the northwest Oregon state forests was guided by a steering committee comprised of Department of Forestry managers and county commissioners. The eleven-person group provided policy direction to the planning team and comment on key issues during the process. In addition, the steering committee members played a key role by informing community leaders and others of planning issues and progress.

Steering Committee Members

Mike Bordelon, Northwest Oregon Area Director (chair, 2000) and State Forests Program Director
Roy Woo, Northwest Oregon Area Director (chair, 1999-2000)
Lee Oman, Northwest Oregon Area Director (chair, 1994-1998)
Ray Craig, Assistant State Forester
Dr. Jill Bowling, State Forests Program Director
Stan Medema, Astoria District Forester
Mark Labhart, Tillamook District Forester
Dave Johnson, Forest Grove District Forester
Bill Lafferty, West Oregon District Forester
Mike Templeton, West Oregon District Forester
Dan Christensen, Clackamas-Marion District Forester
Rick Rogers, Western Lane District Forester
Darrel Spiesschaert, Western Lane District Forester
Dave Schmidt, Linn County Commissioner
Tim Josi, Tillamook County Commissioner
Jerry Dove, Tillamook County Commissioner

Planning Forum for *Northwest Oregon State Forests Management Plan*

The Department of Forestry developed a contact group, called the planning forum, to assist the planning team with the development and review of resource goals and strategies for the management of the northwest Oregon state forests. Members were selected by the steering committee for the forest plan. The planning forum had eight members representing a wide range of interests related to state forest resource management. The group held its first meeting in October 1994 and completed its work in 1998. Over the 4-year period that the group met, the group held regular meetings and went on field tours of the state forests in order to better understand the issues. Over this time, two original members resigned, and two new members were added.

The planning forum was a link between key constituencies and interests and the planning team, assisted the team with the development and review of resource goals and strategies, and helped clarify issues for the planning team.

Planning Forum Members

Dr. John Hayes, Department of Forest Science, College of Forestry, Oregon State University

Chris Jarmer, assistant to vice-president for resources, Stimson Lumber Company

Dr. Katy Kavanaugh, forestry extension agent, Oregon State University

Paul Levesque, executive assistant to county commission, Tillamook County

Jim McCauley (started in 1996), director, Oregon Forest Industries Council

Greg Miller (resigned in 1996), director, Oregon Forest Industries Council

Jim Myron (started in 1996), interim conservation director, Oregon Trout

Avis Rana, small woodland owner, member of Sierra Club

Doug Ray, small woodland owner, on board of directors for North Coast Land Conservancy and the Coast Range Association

Kathleen Williams (resigned in 1996), conservation planner, Oregon Trout

Peer Review

In February 1996, the Department of Forestry asked for professional review and critique of the draft strategies in the *Northwest Oregon State Forests Management Plan*. The peer review group included 10 recognized forestry and natural resource experts. The reviewers examined the structure-based management strategies and the other draft strategies in the forest plan, and provided extensive comments. The peer review of the draft strategies was completed by early fall 1996.

Peer Reviewers

Dr. Robert Anthony, leader, Oregon Cooperative Wildlife Research Unit, Oregon State University

Dr. Andrew B. Carey, principal research biologist, USDA Forest Service Pacific Northwest Research Station, Olympia, WA

Dr. Robert O. Curtis, principal mensurationist, USDA Forest Service Pacific Northwest Research Station

Dr. Malcolm L. Hunter, Jr., professor, Department of Wildlife, University of Maine

Dr. Larry L. Irwin, national wildlife program manager, National Council of the Paper Industry for Air and Stream Improvement

Dr. Bill McComb, professor, Department of Forest Science, Oregon State University

Dr. Chadwick D. Oliver, professor, College of Forest Resources, University of Washington

Dr. Thomas Spies, research forester, USDA Forest Service Pacific Northwest Research Station

Dr. John C. Tappeiner, National Biological Service, Corvallis, OR

Public Interest Committee for the *Western Oregon State Forests Habitat Conservation Plan*

In January 1998, the Board of Forestry directed the Department of Forestry to establish a public interest committee (PIC) of eight to eleven people, who would be appointed by the State Forester. The committee members represented various groups with a stake in the *Western Oregon State Forests Habitat Conservation Plan*. The PIC's goal was to clearly define and focus on scientific, technical, and policy issues in the draft HCP, with the intention of helping to resolve these issues.

The State Forester appointed the PIC members on March 25, 1998. The members represented interest groups for recreation, environmental, fishing, timber, and counties with forest trust lands. A citizen representative was selected to chair the PIC, and the Department of Forestry appointed an ex-officio member to be the department's spokesperson. The department also provided administrative, informational, and technical support for the committee, and contracted two facilitators to assist the group in working through the issues. A complete list of committee, resource, and administrative/logistical members is given below.

The PIC delivered their final report to the State Forester in December 1998 (Public Interest Committee 1998). The report's Appendix D describes in detail the group's process and meetings. For each major issue considered by the committee, the report gives a summary of the issue, the group's discussion, the Department of Forestry direction and proposed strategy, and PIC recommendation. The major issues discussed were: integration of planning documents, northern spotted owl, marbled murrelets, non-listed species, aquatic and riparian issues, landscape design and management, monitoring and adaptive management, cumulative effects, communication and public involvement, and implementing agreements and enforcement.

PIC Committee Members
Sybil Ackerman, National Wildlife Federation
Cliff Adams, The Confederated Tribes of Grand Ronde
Mickey Bellman, Quality Veneer and Lumber
Rod Brobeck, Oregon Wildlife Heritage Foundation
Sue Cameron, Tillamook County Commissioner
Ray Craig, Oregon Department of Forestry (ex-officio)
Bryan Johnston, (chair), citizen representative
Harold J. Kalleck, Jr., Pacific Northwest 4-Wheel Drive Association
James E. McCauley, Oregon Forest Industries Council
Mike Propes, Polk County Commissioner
Glen Spain, Pacific Coast Federation of Fishermen's Associations
Sara Vickerman, Defenders of Wildlife

PIC Committee Facilitators
Connie Green, Chemeketa Community College
Vicki Willis, Chemeketa Community College

PIC Coordination

Marcia Humes, Oregon Department of Forestry
(PIC Coordinator: August – November, 1998)
Jenny Walsh, Oregon Department of Forestry
(PIC Coordinator: April – July, 1998)
Jeri Chase, Oregon Department of Forestry

Resource Members

Jeff Boechler, Oregon Department of Fish and Wildlife
Mike Bordelon, Oregon Department of Forestry
Charlie Bruce, Oregon Department of Fish and Wildlife
Cary Greenwood, Oregon Department of Forestry
John Hayes, Oregon State University
Ross Holloway, Oregon Department of Forestry
Logan Jones, Oregon Department of Forestry
Dave McAllister, Oregon Department of Fish and Wildlife
Mike Parton, National Marine Fisheries Service
Jennifer Robison, Division of State Lands
Mike Schnee. Oregon Department of Forestry
Ian Whitlock, Department of Justice
Joe Zisa, US Fish and Wildlife Service

Independent Scientific Review of the *Western Oregon State Forests Habitat Conservation Plan*

In 1998, the Department of Forestry asked for an independent scientific review of the draft *Western Oregon State Forests Habitat Conservation Plan* and *Northwest Oregon State Forests Management Plan*. The intent was to receive input and critique from a diverse group of scientists. Dr. John P. Hayes (Department of Forest Science, College of Forestry, Oregon State University), coordinated the thorough and intensive review, which was done by 26 scientists, each expert in one or more of the major issues. The final report describes in detail the approach used, discussion of the review, the reviewers' complete comments and responses to the review questions, and other related information (Hayes 1998). The reviewers began their work in May 1998 and finished in July 1998.

The independent scientific review examined the scientific underpinnings of the objectives and strategies set forth in the HCP. It was not designed to evaluate policy. As pointed out in the report's preface, scientific truth is not established by voting, but through a rigorous and critical evaluation of the evidence. The team included reviewers with expertise in northern spotted owls, marbled murrelets, other birds, mammals, amphibians, fish, plants, silviculture, aquatic ecology, forest ecology, geomorphology, hydrology, and landscape strategies. For most topics, the team included more than one person with expertise in the area, with the intent of including a diversity of perspectives. The selection committee considered 105 nominees; the final team had 26 people. These people are listed below. The report's Appendix F includes brief resumes of each team member.

The Department of Forestry prepared a set of questions to help structure the review. These questions were based on concerns raised by department staff, the PIC (described later in this appendix), the U.S. Fish and Wildlife Service, and National Marine Fisheries Service. Reviewers were asked to critique the HCP and forest management plan, focusing on their areas of expertise, and to answer the subset of questions related to their expertise. They were encouraged to comment on any aspects of the two plans and answer any additional questions that they desired. The report includes the full text of the questions and instructions to reviewers, as well as their comments.

Reviewers for the Independent Scientific Review

Dr. Lee E. Benda, Earth Systems Institute
Dr. Andrew R. Blaustein, Department of Zoology, Oregon State University
Dr. Carol L. Chambers, School of Forestry, Northern Arizona University
Dr. Steven P. Courtney, Sustainable Ecosystems Institute
Dr. Dean S. DeBell, USDA Forest Service Pacific Northwest Research Station
Dr. Eric Forsman, USDA Forest Service Pacific Northwest Research Station
Dr. James G. Hallett, Zoology Department, Washington State University
Dr. Andrew J. Hansen, Biology Department, Montana State University
Dr. John A. Helms, Department of Environmental Science, Policy, and Management, University of California, Berkeley
Dr. David E. Hibbs, Department of Forest Science, Oregon State University
Dr. Thomas M. Hinckley, College of Natural Resources, University of Washington
Dr. Larry L. Irwin, NCASI
Dr. Sherri Lynn Johnson, Department of Geosciences, Oregon State University
Dr. John M. Marzluff, College of Forest Resources, University of Washington
Dr. William C. McComb, Department of Forestry and Wildlife Management, University of Massachusetts
Dr. E. Charles Meslow, Wildlife Management Institute
Ms. S. Kim Nelson, Department of Fisheries and Wildlife, Oregon State University
Dr. Reed F. Noss, Conservation Biology Institute
Dr. Deanna H. Olson, USDA Forest Service Pacific Northwest Research Station
Dr. Daniel K. Rosenberg, Department of Fisheries and Wildlife, Oregon State University
Dr. John C. Tappeiner, Forest and Rangeland Ecosystem Science Center
Dr. Dale A. Thornburgh, Natural Resources Management Department, Humboldt State University
Dr. James M. Trappe, Department of Forest Science, Oregon State University
Dr. Stephen D. West, College of Forest Resources, University of Washington
Dr. Robert C. Wissmar, Fisheries Research Institute, University of Washington
Dr. Donald B. Zobel, Department of Botany and Plant Pathology, Oregon State University

Process for Administrative Rules for Management of State Forest Lands

During the development of the HCP and forest management plans, it became apparent that new administrative rules on forest planning and the management of state forest lands would provide clear, overall direction for these lands, and would make permanent a number of temporary directives. Therefore, a process was started to develop draft rules, get public input, and establish permanent administrative rules.

The public input process included a citizens' advisory committee, public hearings, and a public comment period. Hearings on the draft rules were held in February-April 1996. A citizens' advisory committee formed at this same time to advise on revisions of the draft rules. This committee completed its work in July 1997. A second set of hearings was held on the new draft rules in August 1997. All five hearings were held on the same day, August 26, 1997; the locations were Cannon Beach, Forest Grove, Roseburg, Portland, and Salem. Written comments were accepted until January 1998.

The Board of Forestry unanimously approved new administrative rules for the management of state forest lands in January 1998.

Land Base Designation Public Involvement Process

On January 7, 1998, the Board of Forestry adopted new administrative rules on state forest management policy and planning (see above). Among other items, these rules require that state forest lands be designated either as 1) silviculturally capable of growing forest tree species; or 2) as not capable of such growth. Each district was required to determine the land base designations for state forest lands in their district, and then to develop maps displaying this information. The State Forester approved the draft maps in 1998. On September 9, 1998, the Board of Forestry authorized the State Forester to begin the rulemaking process to adopt OAR 629-035-0045 Forest Land Base Designation Maps and the draft maps as an administrative rule.

As part of the rulemaking process, public hearings were held on the land base designation maps in January 1999. Written comments were also accepted during January 1999.

The draft land base designation maps were submitted for adoption as administrative rule to the Board of Forestry at their April 1999 meeting. The land base designation maps were adopted, and are OAR 629-035-0045.

The forest land management classification system is OAR 629-035-0050. Actual land classifications will be approved after the forest management plan is approved.

Appendix G

State Lands Research Policy

The Board of Forestry’s Forestry Program for Oregon (FPFO) includes an objective related to research and monitoring: “Use research and monitoring of the forest condition to understand the effectiveness of forest regulations and management strategies, incorporate the knowledge gained into policies and programs.” As the FPFO notes, “Sound forest management is based upon decisions that take into account the best available information about all components of the forest — trees, fish, and wildlife, soil, air, water, and recreation. This requires a commitment to an ongoing research program that is targeted to meet overall objectives.”

The Board of Forestry Policy for Practicing Silviculture on State Forests notes that: “this policy commits ODF to an ongoing program of monitoring and research. Adaptive management will be used to incorporate new information as it becomes available.”

Research, in the context of this policy, includes formalized research, monitoring, and technology transfer. The Oregon Department of Forestry works closely with the Oregon Forest Research Laboratory and other research entities in obtaining the best available information in support of sound forest management.

Background and Situation

The Department of Forestry manages about 800,000 acres of forest land through the State Forest Management Program. Historically, the department has been actively involved in supporting research and participating with research institutions to design, develop, and implement research projects. The Department of Forestry recognizes the Oregon Forest Research Laboratory as the state entity with specific responsibility for the conduct of forestry research in Oregon. Federal Agencies (USDI, USDA) and other state agencies also have forestry related research programs which are relevant to the mission of the department.

Public funding for forestry research at state and federal institutions has declined markedly over the last decade. In 1995, Oregon rated thirteenth among the states in funding for forestry research. Forest land management organizations in Oregon are finding it increasingly difficult to acquire the necessary level of scientific knowledge through publicly funded research programs. Concurrently, threatened and endangered species considerations, and emphasis on providing for a range of resource values in managed forests, has accelerated the need for valid scientific information in support of sound forest management.

The level of the State Forest Management Program involvement and investment has not kept pace with the number and complexity of issues and opportunities that currently exist. In addition, a proactive approach is needed to ensure that priority scientific information needs are met in a systematic and logical manner.

Long-range management plans for state forest lands and the Policy for Practicing Silviculture emphasize the need for adaptive management approaches. Adaptive management requires a significant commitment to obtaining critical information over time and feeding the information back into the decision-making process. Current levels of research, monitoring, and technology transfer are inadequate to meet the standards established in long range management plans and by policy.

Research Policy Goal

The state forests research policy goal 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.

Funding

Financial resources will be committed to reaching the research goal. Approximately 5 percent of the state forest management program budget will be invested in this effort. Periodic evaluations will be undertaken to determine how the funding level contributes to achieving the goal. As necessary, funding will be increased in order to more effectively achieve the goal.

Guiding Principles

The policy is framed by the following guiding principles:

1. Research supported by the State Forest Management Program will contribute to achieving the program's mission.

2. The program will actively participate with research organizations to direct, design, and conduct research that meets the program mission.

3. The program will sponsor research rather than conduct research. For example, the program will not build a research organization such as the Forest Research Laboratory at Oregon State University.

4. Research will provide knowledge to support all aspects of the program.
   — It will include all relevant disciplines, e.g., insect and disease, forest genetics, silviculture, fish and wildlife, etc.
   — It will include a component of operational research to support timely decision-making by operational mangers, e.g., University of Washington Stand Management Cooperative.
   — It will include a component of strategic research to enable the program to be proactive in dealing with potential future issues and to create new opportunities, e.g., northern spotted owl retrospective study.
   — It will include short-term research that addresses immediate needs, as well as long-term research that requires more time to yield useful results.

5. Research priorities will be assessed using criteria developed by program employees.

6. The program will identify important information needs, prioritize support for research projects, and take a proactive approach to acquiring needed information.

7. Research cooperatives will be used where feasible to increase cost-effectiveness.

8. The program is committed to technology transfer and implementation of research and monitoring results.

State Forests Research Policy Implementation

To effectively implement this policy, the following process will be undertaken:

1. **Information needs assessment**

Conduct a periodic assessment of critical information needs that can be potentially addressed by research. This assessment will be used as the basis to determine important issues and opportunities that affect state forest lands that are potentially worthy of research support.

2. Evaluation

Using criteria, rank the relative merit of information needs that are identified in the needs assessment. Determine what methodology will be most effective and efficient to address priority information needs, e.g., literature review, transfer, and application of existing knowledge, monitoring, or formalized experimentation. The task of determining appropriate methodologies may be conducted by department personnel and/or a research institution that is responsible for addressing the specific information need.

3. Determine type and level of support

Organizational support for research may take several forms including direct funding, in-kind work or cooperative participation. For long-term projects the program will consider factors such as fluctuating revenues and budget levels when determining research priorities Long-term research will be designed to provide measurable interim products, when feasible, to insure that some benefits are provided even in the event of early termination due to funding constraints.

4. Determine appropriate organizational structure and staffing

State Forest Management Program personnel will work directly with research institutions to design appropriate studies. Personnel will work directly with principal investigators to ensure that research objectives reflect identified critical information needs. In addition, program employees will work with research personnel to insure that new information is transferred to appropriate levels, in an understandable manner. Using the adaptive management concept, ongoing monitoring will be needed to ensure that research results are valid when translated into practice.

Overall responsibility for implementing this policy will be the responsibility of the State Forest Management Program Director, with decisions and project management delegated to appropriate levels in the organization. Organizational structure and staffing levels may need to be adjusted to effectively implement this policy. The Forest Research Laboratory at Oregon State University and other stakeholders will be involved in the implementation of this policy.

This policy was approved by the State Forester on September 14, 1995.

Appendix H

History of the Northwest Oregon State Forests

The history of the state forests helps us to understand the state forests today, and provides us a context for making decisions about the future. The writer Wallace Stegner once said, "If you don't know where you are, you don't know who you are."

History can help us understand the development of the forest ecosystems, the patterns of natural resource use over time, the communities near the state forests, and the interests that people have in management of the state forests. It would take a long book to tell the complete story of northwestern Oregon. The next few pages tell the story very briefly. References cited provide more detail. The intent is to focus on events that shaped the state forests of northwestern Oregon.

Early History — Native Americans, Explorers, Traders, and Settlers

Many tribes and bands of Native Americans lived in northwestern Oregon. The Clatsops and Clatskanies lived around the Columbia estuary. The northern coastal river valleys were inhabited by a number of bands known collectively as the Tillamooks, and the central Oregon coast was inhabited by the Siletz, Yaquina, Alsea, and Siuslaw tribes. The Kalapuyans lived in the Willamette Valley, with several distinct bands. Along the west slopes of the Cascades lived the Molallas, who had many bands, including the Clackamas and Santiam bands. (Zucker et al. 1987, Minor et al. 1980)

Native Americans relied on the natural resources around them for their survival. They managed these resources to benefit their fishing, hunting, and gathering lifestyle, using the tools they had. One of their most important tools was fire. The Native Americans burned large areas of the Willamette Valley in late summer or fall. The fires maintained grasslands and open savannahs of pine and oak. Fire was used to drive wild game into areas where hunters waited. The repeated fires favored grassland plants collected for food, such as wild wheat. They also kept underbrush down, making travel easier and making it more difficult for war parties to approach unseen. (Pyne 1982, Zybach 1993)

Forest fires outside the river valleys came from two sources: lightning and Indian fires. Fires set to burn grasslands sometimes spread into forests. Lightning strikes also started forest fires. In the Coast Range, forest fires were relatively infrequent, but could be very large. In the Cascades, more lightning led to moderate fire frequencies. Fire severity was often high. (USDA Forest Service et al., 1994a)

The Native Americans of northwestern Oregon traveled seasonally to use various food sources at their peak seasons. They gathered at the best fishing spots when the salmon runs were coming in, traveled to the mountains when berries were ripe, and returned to protected villages for the winter. In their permanent villages, they built large, plank houses that held several related families. Both men and women were involved in tribal decision-making.

The coastal Indians relied on fish and other seafood as their main food resource. Salmon were a major and dependable food source. They also caught smelt and collected shellfish. Food was plentiful and reliable, so they traveled less than inland tribes and developed many permanent villages along the river valleys and coast. (Zucker et al. 1987)

In the Cascades, the Molallas relied on a wider variety of foods, with no one food dominating. They collected many plant foods, including acorns, hazelnuts, camas bulbs, blackberries, and huckleberries. They caught salmon, and hunted deer, elk, and small game. Food was generally available, but not as plentiful as it was on the coast. The Molallas traveled more than the coastal Indians, and had a lower population density. (Zucker et al. 1987)

Early European-American exploration began in the 1700s. It consisted of Spanish ships sailing up the coast from their settlements in California, and British ships exploring the coastline. Russian exploration stayed mainly north of the Pacific Northwest, along the Alaskan coastline. The 1770s were a decade of increased interest and exploration along the Pacific Northwest coast, with fur trade beginning between Indians and European-American captains. By the end of the 1700s, Spanish, British, and American explorations had mapped a broad outline of the Pacific Northwest coast. Mariners had given new names to headlands, rivers, and bays. They had met the native peoples and "introduced to them smallpox, tuberculosis, and trade goods." (Beckham et al. 1982)

The coast of Oregon was only vaguely known, because there were few good anchorages and sea otter, the most desired fur, was less abundant here than farther north. Although there were some glowing descriptions of the wooded areas around Tillamook, most mariners gave the area that would be Oregon little attention. (Beckham et al. 1982)

Lewis and Clark were the first European-American explorers to reach Oregon by coming overland. They reached the lower estuary of the Columbia River in November, 1805. They built Fort Clatsop, spent the winter there, and left for St. Louis in the spring. Hudson's Bay Company trappers explored Oregon coastal areas further in the 1820s. During the 1830s and 1840s, the company built small forts and trading posts at key spots along coastal rivers. (Minor et al. 1980)

The Native Americans had little resistance to many illnesses carried by the European-American people. Diseases killed many Native Americans. From 1830 to 1833, an epidemic of an unidentified fever killed as many as 80 percent of the Indians of the Willamette Valley and Columbia River. A great deal of Indian culture was lost as a result of this epidemic. Surviving Indian children were often taken in by missionaries. With few tribal elders left, the Indians lost their tradition of sending young people on spirit quests to find their guardians. The remaining Indians were unable to resist the growing numbers of settlers on their lands. By the 1840s, Indians had adopted white dress, although they still depended on traditional food sources and continued to fish for salmon at Willamette Falls. (Minor et al. 1980)

During the 1830s and 1840s, the European-Americans shifted from exploration and trade to settlement. Their early settlements in northwestern Oregon were on the broad plains along the lower Columbia River and in the Willamette Valley. These areas were easily reached by water, had level land for farming, and had plenty of water and good soil (Minor et al. 1980). Events along the Columbia and Willamette corridors often affected the adjacent regions, where the state forest lands are located.

The rate of European-American settlement increased in the 1840s after the Oregon Trail was established. New settlers traveled overland all summer, and arrived in Oregon in a wave each fall. By the late 1840s, a few people began to settle in Clatsop Plains, Tillamook Bay, and other desirable areas along the northern Oregon coast. Settlers began moving into the mid-Willamette Valley in the 1840s, and in 1845 new settlements were started in the Corvallis and Kings Valley areas. (Zucker et al. 1987)

Oregon's first lumber mills were established in the 1830s and 1840s in the Willamette Valley. Although there were lots of trees, the industry developed slowly at first due to a lack of markets. The influx of settlers in the 1840s and the California gold rush in 1849 created demand for lumber. Eventually the timber industry emerged as a major industry. (Minor et al. 1980)

Settlers logged the most easily reached trees first. There were limited means for transporting the huge logs that came from northwestern Oregon forests. Settlers cut trees and let the logs slide or roll into rivers and coastal bays, then floated the logs to sawmills. Later horses and oxen were used to move logs, and sawmills were set up farther inland.

Settlement and Development: 1850s to the Turn of the Century

Fire was always part of the northwest Oregon landscape. However, the evidence indicates that the frequency of large fires increased in the 1840s, with the increasing number of European-American settlers (Pyne 1982). Between 1846 and 1853, a series of large fires burned over 800,000 acres in the central Oregon Coast Range. The largest fire, known as the Yaquina Burn, covered 480,000 acres, including the area that is now state forest land (West Oregon District). It is not known whether the fires were caused by lightning, Indians, or settlers. There were a number of large fires throughout the Pacific Northwest in 1868, with the largest fire in northwestern Oregon burning around Yaquina Bay.

Congress passed the Oregon Donation Land Act in 1850. The act allowed settlers in Oregon to receive up one square mile of land free. Under the act, 7,437 settlers filed on 2.5 million acres in western Oregon, including almost all of the Willamette Valley and the bottomlands of other rivers. Only after this, did Congress settle claims with Indians for these lands. The Palmer Treaty on January 4, 1855, ended most Indian land claims. Two Indian reservations were created in northwestern Oregon.

The Siletz Reservation was established in 1855. The original reservation was 1,382,400 acres, and included a large chunk of the northwest Oregon Coast Range. The reservation reached from Lookout Point in Tillamook County to a point south of the Siuslaw River, a distance of nearly 125 miles; and from the coast to the crest of the Coast Range. Tillamook, Siletz, Alsea, Yaquina, Siuslaw, and Lower Umpqua Indians were placed here. The federal government later moved in bands of southwest Oregon Indians. The Siletz Reservation was guarded by Fort Umpqua on the south, at the mouth of the Umpqua River, and on the east by Fort Hoskins in Kings Valley, northwest of Corvallis. (Beckham et al. 1982)

The Grand Ronde Reservation was established in 1857. It was east of the Siletz Reservation, at the northern end, and was much smaller, at 60,000 acres. The Indians brought to this reservation were from the Clackamas, Santiam, Tualatin, Luckiamute, Mary's River, Yamhill, and other tribes. (Beckham et al. 1982)

The town of Oysterville was established in 1863 as an outpost on Yaquina Bay for buying oysters from the Indians. Willamette Valley settlers wanted to gain a harbor and build a railroad from Corvallis to Newport. Under pressure from these settlers, in 1865 the federal government opened a wide section across the middle of the Siletz Reservation to non-Indian settlement. In 1866, Yaquina Bay was removed from the reservation. Later that year, a wagon road was built from Corvallis to Yaquina Bay. Elk City was established at the confluence of the Yaquina River and Elk Creek, and Newport was established at the mouth of Yaquina Bay. In 1875, the entire southern end of the reservation was opened for European-American settlement, as well as an area at the northern end. (Minor et al. 1980)

Oregon's agricultural base sustained rural and urban populations. The Oregon Donation Land Act of 1850 and the Homestead Act of 1862 encouraged more people to come to Oregon and begin farming. Portland, Oregon City, Salem, Albany, and Corvallis emerged as trade centers that could ship or process the commodities produced on farms.

As Oregon's population increased and the valleys filled up, people had to go deeper into the forested valleys and foothills to find sites for new homesteads. Not until the 1870s, and from then to roughly 1900, did people begin to settle the hill country, where they saw the dense forests as an obstacle to be cleared so farming could begin. Homesteaders worked hard to make a living from their "stump farms." It was difficult to preserve and ship products from these isolated farms. Farmers in the Tillamook area solved this problem by developing cheese factories, with the first one built in Cloverdale in 1894. Cheese factories gave farmers the chance to sell their milk in a form that could be preserved and shipped to markets. (Minor et al. 1980)

Several factors helped Oregon's timber industry grow in the last half of the nineteenth century. The population growth in the cities increased the demand for lumber, providing a market. By the 1870s, railroads were linking the Pacific Northwest and making it possible for lumber produced in valley mills to be sold on a regional or world market. By the late 1800s, the development of extensive logging railroad systems enabled loggers to reach timber in the mountains that was previously inaccessible. Now the logs could be moved easily "from hills to mills", and the finished products from mills to markets. (Minor et al. 1980)

Meanwhile, people in the Willamette Valley had survived the first generation of homesteading and settled into comfortable farms and cities. These people now had the leisure to seek recreation in the mountains on both sides of the Willamette Valley. The children and grandchildren of the first homesteaders enjoyed camping, fishing, hiking, and hunting as recreational activities, not as survival necessities. (Minor et al. 1980)

The Twentieth Century

Life was hard for the Native Americans on the Siletz and Grand Ronde Reservations. At both reservations, the death rate exceeded the birth rate throughout the 1800s. The population on the Siletz Reservation dropped from 2,026 people in 1856 to only 483 in 1900. The population at the Grand Ronde Reservation fell from 1,826 in 1857 to 298 in 1902. Not until the 1920s did the Indian populations stabilize. (Minor et al. 1980)

By then the reservations were gone. The Dawes Act of 1887 established a new federal policy called allotment. The idea was to allot land parcels to individual Indians, end the reservations, and assimilate Indians into the dominant white culture.

The federal government had removed land from the Siletz Reservation several times since 1855. By 1892, just before the lands were allotted, the Siletz Reservation had 225,280 acres left. After allotment, the Indians had 46,000 acres. The rest of the land went to the federal government, who opened the land to homesteaders until 1916.

Allotment was carried out on the Grand Ronde Reservation in 1904. At the Grand Ronde, 33,148 acres were allotted to Indians, and 26,111 acres ceded to the federal government. As part of assimilation, Indian children were taken from their parents and sent to boarding schools. (Zucker et al. 1987)

After 1917, the coastal tribes tried to get compensation for the land taken from them in the 1800s. Some claims were denied, and some claims resulted in modest settlements. In 1956, Congress terminated official federal recognition of 44 Indian tribes and bands in western Oregon. The Indians of northwestern Oregon were no longer recognized legally as Indians. (Zucker et al. 1987)

Between 1890 and 1910, the timber industry in the region changed. Lumbermen from midwestern and southern states came to Oregon, invested in timberlands of the Coast Range and lower slopes of Cascades, and began to market Oregon lumber on a vast scale. In these decades, the industry changed from small, locally-owned mills to large sawmills, with hundreds of loggers in the field. In 1910, the mills in Portland alone milled 700 million board feet. Logging was a seasonal occupation, but sawmills operated year-round.

The lower Columbia River, including Clatsop County, was the first major source of logs. Next, loggers turned to the Clackamas area, Tillamook County, and Columbia Gorge. The timber around Tillamook Bay was logged shortly after a railroad was built into the area in the early twentieth century. Logging began in the Cascade foothills in the 1880s and 1890s, and increased in the early twentieth century, especially in the Silverton and Sweet Home areas. As areas around the northern Willamette Valley were logged, the rate of logging increased in the southern Willamette Valley. In the 1940s and 1950s, logging trucks replaced logging railroads and chainsaws replaced crosscut saws.

After forest areas of gentle and moderate topography were logged, they were generally converted to farmland, grazing land, or towns. Even into the 1940s, many farmers burned off the “fir brush” to improve or maintain grazing conditions. Despite the forest fires and agricultural conversions, there were always enough forests for timber to be a major industry in northwestern Oregon. The timber supply seemed unlimited. Loggers burned the slash after harvest to reduce the fire hazard, but did not plant trees. Many acres of timberland were allowed to go tax-delinquent after timber harvest. This practice increased during the Great Depression, and was common in areas burned by forest fires, such as the Tillamook Burn (Fick and Martin 1992).

In the final decades of the twentieth century, northwestern Oregon continued to grow and change. The population grew slowly in coastal areas, and rapidly in cities throughout the Willamette Valley. High tech industries, such as computer chip factories, located in Portland, Salem, and Eugene, creating an important regional industry. Pacific Rim trade grew, and included agricultural products, wood products, and manufactured goods.

In 1977, the Siletz Restoration Act established the Siletz Indians as an officially recognized tribe again. Later, 3,000 acres of federal lands were restored to them as a new reservation. Other coastal tribes did not regain tribal status. There are Indians living throughout the Willamette Valley today, but they generally know little of their Indian heritage. (Zucker et al. 1987)

The landscape of the Coast Range and western Cascades today is different from the landscape that trappers explored in the early 1800s. Most Coast Range forests in northwestern Oregon are second growth or even third growth forests, due to logging and fires during the last 150 years. In the western Cascades, areas of old growth forest are generally found in patches. Many salmon, steelhead, and trout populations in the region have declined. The declining salmon and steelhead fisheries led to very restricted or even closed commercial fishing seasons in the early 1990s.

Mountains, forests, rivers, and natural resources are still important to the people of northwestern Oregon. The timber industry is still an important part of the region’s economy. Forest management continues to evolve. The Oregon Forest Practices Act regulates logging on private and state forest lands, and requires that loggers use practices that protect soils, streams, and wildlife trees, and that they reforest an area after logging. Forest management on privately owned timberlands is focusing on managing second and third growth forests, and using smaller diameter trees. Concerns about endangered species, old growth forests, and fisheries have led to a reduction of logging on federal lands in northwestern Oregon. The state forests are discussed below.

People from all parts of northwestern Oregon continue to use a large variety of wood products in their daily lives, from lumber for construction, to paper for laser printers. Oregonians also use their forests for recreation, with the number of people hiking, camping, fishing, and hunting steadily growing. As the economy of northwestern Oregon continues to diversify, a smaller percentage of the population works in natural resource-related jobs. Many people also collect special forest products for extra income or personal use, collecting products such as firewood, cascara bark, ferns, and edible mushrooms.

The Origin and Development of the State Forests

The Oregon Department of Forestry was created in 1911. Its main purpose was to control forest fires, but it was also authorized to acquire forest land to manage. However, the department did not actually acquire any lands until legislative actions made it more feasible. The 1925 Legislature passed a law allowing the Board of Forestry to accept gifts or donations of forest land. The State Forests Acquisition Act of 1939 created procedures for the Board of Forestry to acquire tax-delinquent forest lands from the counties, manage the land, and return most net revenues from the land to the counties. In later years, amendments fine-tuned the distribution of revenues and legal direction for forest management on these lands (Fick and Martin 1992). Lands owned by the Board of Forestry are known as Board of Forestry Lands (BOFL), and are actively managed in a sound environmental manner to provide sustainable timber harvest and revenues to the state, counties, and local taxing districts.

Some land in the state forests is owned by the State Land Board, which consists of the Governor, the Secretary of State, and the State Treasurer. When Oregon became a state in 1859, the federal government granted sections 16 and 36 of every township to the new state for the use of schools. Oregon's grant included 3.5 million acres of grazing and forest lands. Eventually, much of the land was either sold for the benefit of schools or lost through fraudulent land deals. The state also exchanged some lands in order to consolidate land in larger blocks. The remaining forest lands owned by the State Land Board are known as Common School Forest Lands (CSFL). Eventually, the State Land Board signed a contract with the Department of Forestry, authorizing the Department to manage the Common School Forest Lands, with the goal of generating income for the Common School Fund. For more information on legal and policy mandates for CSFL and BOFL, see Appendix D.

The specific events that led to the establishment of the state forests in northwestern Oregon are described below, organized by forest and district names.

Tillamook State Forest — Much of the area that is now Tillamook State Forest was burned in a series of wildfires in the years 1933, 1939, 1945, and 1951. See the sidebar "The Tillamook Burn" on the next two pages for more information on these fires and the rehabilitation program. The Board of Forestry began to acquire land in the Tillamook Burn in 1940. Land acquisition accelerated after the Legislature authorized bonds to rehabilitate the Burn. Eventually, the Board of Forestry acquired roughly 255,000 acres of the Tillamook Burn, mostly from counties who had foreclosed on tax-delinquent lands. (Oregon Department of Forestry 1993b)

The Department of Forestry carried out a massive reforestation and rehabilitation project in the Tillamook Burn between the years 1948 and 1973. During the 24 years of the rehabilitation project, the state invested $12 million. In 1993, foresters estimated that timber alone will return about $6 billion in the first cycle of growth and harvest. Many other benefits that can't be measured in dollars are expected from the forest, including watershed protection, fish habitat, wildlife habitat, and outdoor recreation.

("The Origin and Development of the State Forests" continues on page H-11)

The Tillamook Burn

The summer of 1933 was hot and dry in Oregon. By August, the fire danger was extreme. August 14 was hot and dry, with low humidity and a hint of east wind. In those days foresters could only ask loggers to shut down their operations, not require it. A logger was still operating in Gales Creek Canyon, fifteen miles west of Forest Grove. The Tillamook Fire broke out on his operation, perhaps from the friction of one log being yarded over another log. Loggers attacked the fire immediately, but the fire spread to a snag. The snag became a torch, and the wind carried burning embers across the canyon. The Tillamook Fire burned out of control.

Over a thousand men fought the fire for ten days. At that point, the fire had burned 40,000 acres, and a slight rain gave the firefighters hope that the fire would soon be controlled. But on the eleventh day, humidity dropped and the east wind returned. The Tillamook Fire blew up. The fire burned another 200,000 acres in just 20 hours. Huge mushroom clouds of smoke rose to 40,000 feet. The fire uprooted entire trees in hurricane-force winds created by the fire itself. Ashes and burnt needles landed on ships 500 miles out to sea. The next day, fog rolled in and the fire stopped moving. Incredibly, only one firefighter died.

The forest that burned was mostly old growth — huge Douglas-firs, cedars, and hemlocks. Loggers had just started to log the edges of the mountainous area. Now, 240,000 acres were covered with black snags and hillsides of soft, black ash.

In what seemed to be a six-year jinx, new fires burned across the area in 1939, 1945, and 1951. Each fire reburned some of the previously burned area, and consumed new areas of green forest too. In each new fire, millions of snags from the old fires became torches, spreading embers over firelines and across canyons. The Saddle Mountain Fire in 1939 burned 190,000 acres, with 50,000 acres of that being new area previously unburned. In 1945, the Wilson River and Salmonberry Fires burned 180,000 acres, with 65,000 acres being newly burned area. The North Fork and Elkhorn Fires burned 33,000 acres in 1951, all in previously burned areas.

By the end of 1945, a total of 355,000 acres had been burned over and 13.1 billion board feet of timber killed. Some areas had reburned two or three times. Although some burned timber had been salvaged, much of the Tillamook Burn, as it was now known, was hillsides of snags, turned white over the years. In many places the soil had been so severely burned that nothing grew there for many years. Streams and fisheries were severely affected by the loss of forest cover and erosion after the fires.

The Tillamook Burn (continued)

After the 1945 fire, the public wanted something done to stop these fires and rehabilitate the Tillamook Burn. The state government took on the job. In 1948 Oregonians approved a bond issue to finance the project. Nobody had ever before attempted a rehabilitation project of this size. The Oregon Department of Forestry had to figure out what to do as they went along.

Before 1933, almost all of the land that became the Tillamook Burn was privately owned. After the fires, about 255,000 acres eventually came under state ownership. (See "The Origin and Development of the State Forests" for details on the transfer of lands to state ownership.) Most of the remaining 100,000 acres is owned by private timber companies and BLM (Bureau of Land Management). These owners have also carried out rehabilitation on their land. The statistics below are for state forest land only.

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

The Department of Forestry carried out a massive rehabilitation project in the Tillamook Burn between the years 1948 and 1973. The first step was to protect the burn from new fires. There wasn't any point in planting trees unless the new forest could be protected from the repeated fires. Crews cut more than 220 miles of snag-free corridors as firebreaks, felling an estimated 1.5 million snags. Access roads were built near the main firebreaks. Lookouts were built and suppression crews hired in summers. The developing prevention system got its first test in 1951, when the last of the six-year interval fires broke out. These final large fires were held at 33,000 acres, all on previously burned ground.

Reforestation was the next task. Over the next 24 years, tree planting crews planted 72 million Douglas-fir seedlings. A total of 36 tons of Douglas-fir seeds were spread on the burn through aerial seeding, pioneering the first use of helicopters in aerial seeding. In 1973, the Tillamook State Forest was created. Approximately 255,000 acres of the old Tillamook Burn were included in the new 364,000 acre state forest.

The Department of Forestry's experience with the Tillamook Burn became a model for fire prevention and fire rehabilitation projects. The Department pioneered many techniques that have become standard practice in fire rehabilitation projects and forest management, such as cutting snag-free corridors as firebreaks and using helicopters for aerial seeding. The Department was also a leader in intensive forest management techniques, using various brush control and animal damage control techniques to help the young forests on the Burn become firmly established.

("The Origin and Development of the State Forests" continued from page H-8)

In June 1973, the former Tillamook Burn was dedicated as the new Tillamook State Forest. The 364,000 acre forest includes 255,000 acres from the Tillamook Burn, and other unburned forest land. The first timber sale in the former Tillamook Burn, a commercial thinning, took place in 1983. From 1983 to 1992, commercial thinning has been done on 1,925 acres in the Burn. These small diameter logs are used to produce small-dimension lumber and pulp chips for paper and other wood fiber products. Department of Forestry staff are using modern silvicultural practices in the Tillamook State Forest, including precommercial thinning and fertilization. Pruning has been done experimentally on a few hundred acres. The forest is popular for recreation and environmental education also.

Clatsop State Forest — The Clatsop State Forest is 98 percent Board of Forestry Lands. These lands were privately owned, logged between 1910 and 1940, and then became tax-delinquent. Clatsop and Columbia counties foreclosed when landowners couldn't pay their taxes, and ownership reverted to the county. Many landowners went broke and lost their land during the Great Depression. Eventually, the counties deeded these cutover and unmanaged forest lands to the Board of Forestry to manage as a state forest. According to the trust agreement, the Department of Forestry would replant the lands, protect them from fire, and manage the new forest. Then, as timber was harvested, the counties would receive two-thirds of the net revenue. The remaining 2 percent of the Clatsop State Forest are Common School Fund Lands.

Today, Clatsop State Forest has mostly second growth Douglas-fir, from 30 to 70 years old. The forest has been progressively consolidated through a land exchange program that began in the mid-1940s. District staff are still actively pursuing land exchanges, working on a priority list of exchanges with several private landowners in the area. The purpose of the exchanges is to block up the state forest land.

Santiam State Forest — Much of the land now in the Santiam State Forest used to be owned by large timber companies, who typically owned railroad interests also. Some individuals and families also owned parcels of forest land. From about 1880 until 1930, most lands were logged by their owners. These lands were of little value to the owners once the timber was removed. Forest fires burned large areas. During the Great Depression, many landowners allowed their forest lands to be foreclosed by the county in place of back taxes. Marion, Clackamas, and Linn Counties suddenly owned thousands of acres of timberland.

The counties eventually deeded these lands to the Board of Forestry. Santiam State Forest land in Linn County was acquired by the Board of Forestry between 1939 and 1949. Marion County lands were acquired between 1940 and 1953, and Clackamas County lands between 1942 and 1950. Some land was also acquired from individuals through both charitable donations and purchases, between 1943 and 1952.

Natural regeneration successfully reforested most of the Santiam State Forest. However, a fire in 1951 burned nearly half the forest, and the Department of Forestry replanted the most damaged areas. In the early 1950s, the Department of Forestry's management activities were conducted by foresters working out of the Salem offices. In 1968 the current headquarters for management of the Santiam State Forest was built in Mehama.

West Oregon District — During the Great Depression, most isolated farms in the West Oregon District were abandoned to the counties in place of back taxes. Some more desirable parcels of land were bought by T. J. Starker, John Thompson, and others who saw the land's value for timber production. But by the late 1930s, Benton, Lincoln, and Polk Counties had many parcels of land that they couldn't sell or manage. Between 1938 and 1948, most of this land was deeded to the Board of Forestry. During that same decade, several small parcels were also purchased. Currently, the West Oregon District manages approximately 38,000 acres of land. Of that total, 75 percent is Board of Forestry Lands, and 25 percent is Common School Forest Lands.

Western Lane District — The Nelson Mountain Fire was one of the many large fires in 1910 that motivated people to start the Department of Forestry. The fire burned most areas that are now state forest lands in western Lane County. Large fires burned again in western Lane County in 1917 and 1922. Then in 1929, a number of large fires burned most of the central Coast Range of Lane County, covering a total of nearly 80,000 acres. The fires reburned some previously burned areas, as well as burning across new areas. With the timber gone, the Great Depression starting, and the land unsuitable for homesteading, many landowners allowed their land to revert to the county in place of back taxes. Lane County deeded its timberlands to the Board of Forestry in the mid-1940s.

The land base remained constant for the next 50 years except for 5 small land exchanges in the 1950s. In the early 1990s, two larger exchanges reshaped the state forest lands in the Western Lane District by exchanging one-quarter of the acres. These exchanges increased the land base by 10 percent and started to block up the state forest lands. Today, state forest lands in Western Lane District are mostly covered by a 50 to 60 year old forest.

Appendix I

Decadal Analysis of Alternatives

Improved Harvest Scheduling Model

The Harvest Scheduling Model used by the ODF to evaluate policy alternatives for State Forests has been significantly improved through two major projects since the adoption of the Northwest Oregon State Forest Management Plan in 2001: the Harvest and Habitat Model Project (2004 through 2006); and the Clatsop and Tillamook State Forests Strategies for the Achievement of the Board of Forestry Performance Measures (2008 and 2009). These model projects evaluated a range of alternatives similar to those examined when the FMP was initially developed. These updated models informed the Board of Forestry's deliberations on the balance of economic, social, and environmental values provided through implementation of the Northwest Forest Management Plan on the Tillamook and Clatsop State Forests. The Board of Forestry's discussions led to the adoption of a revised plan in 2010.

The Harvest and Habitat Model Project (H&H) was undertaken to address seven key elements of the Harvest Scheduling Model. These key elements were described in the *Work Plan to Address Harvest Schedule Modeling and Sustainable Harvest Levels in the District Implementation Plans*[1] and included developing and incorporating into the model transportation systems, harvest units, landscape design maps, improved inventory, more comprehensive silvicultural prescriptions, and more accurate growth modeling. The last key element included the development of a field review process for the model outputs. The H&H Project also made numerous other improvements to the Harvest Scheduling Model. The H&H Project developed four scenarios for modeling different strategies,

[1] See the Implementation Plans for Northwest and Southwest Oregon Forest Management Plans notebook (2003)

including: Forest Management Plan using the Draft Western Oregon Habitat Conservation Plan Strategies; Forest Management Plan using the State Forests Take-Avoidance Strategies; Wood Emphasis; and Reserve Based. More information on this project and the model outputs can be found in the *Harvest & Habitat Model Project Final Report* (March 8, 2006).

The primary purpose of the *Clatsop and Tillamook State Forests Strategies for the Achievement of the Board of Forestry Performance Measures* (CTS) project was to develop several model scenarios to achieve the Performance Measure targets for the Clatsop and Tillamook State Forests set by the Board of Forestry.[2] The CTS project also made improvements to the yield tables used in the model by incorporating a larger number of inventoried stands and using a better method of estimating stand conditions where inventory information is not available. The CTS project developed two model scenarios and reported the outputs to the Board of Forestry at its November 6, 2008 meeting.[3] These two scenarios included: a 'Base Case' that represented the Forest Management with Habitat Conservation Plan, as applied through the district implementation plans; and a scenario that strived for the achievement of Performance Measure 1 (Revenue) or Performance Measure 6 (Wildlife Habitat).

Additional model scenarios were developed between November 2008 and April 2009 under the CTS project. These scenarios included three different Wood Emphasis scenarios, two scenarios that focused on either Performance Measure 1 (Revenue) or Performance Measure 6 (Wildlife Habitat), two scenarios based on a modified Forest Management Plan with Species of Concern Strategies, and two scenarios based on the Forest Management Plan with the Draft Western Oregon Habitat Conservation Plan Strategies. The results of these model scenarios were reported to the Board at its April 24, 2009 meeting.[4]

Harvest Scheduling Model

The Harvest Scheduling Model used to inform adoption of the plan in 2001 was developed by Professor John Sessions of Oregon State University. The model assisted the Oregon Department of Forestry (ODF) in evaluating policy alternatives for the *Northwest Oregon State Forests Management Plan* and *Western Oregon State Forests Habitat Conservation Plan* by providing decadal information on harvest levels, revenue, and vegetation conditions for a planning horizon of 200 years.

The model combines a spatial timber (inventory) layer, ODF inventory data, tree growth and yield projections, and management goals with a search technique to allocate timber management activities over the planning area and planning horizon.

[2] Reference to the Board of Forestry minutes from the November 2007 meeting, including the performance measure report.
[3] Reference to the Board of Forestry minutes from the November 2008 meeting, including the performance measure report.
[4] Reference to the Board of Forestry minutes from the April 2009 meeting.

The spatial timber inventory database maintained by ODF was stratified into groups of stands of like species, size, and stocking. 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 growth and yield for the strata under the potential management regimes for twenty 10-year periods.

ODF has five primary management goals: 1) provide a sustainable supply of timber, 2) improve riparian habitat, 3) reach and maintain a specified percentage of mature forest structure, 4) reach and maintain a spatial distribution of forest structures (patches) across the landscape, and 5) provide a reasonable present net value.

A search technique was developed to assign the potential management regimes to timber stands to meet management goals. Feasible assignment of management regimes to timber stands required tracking contiguous areas of mature forest habitat, contiguous areas of young stands and coordination of riparian and upslope management regimes. To maintain spatial feasibility, a heuristic search procedure was chosen. The search procedure is guided by an objective function that seeks to maximize present net value while minimizing deviations between goals for timber supply and forest structure.

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 may be accepted anyway 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.

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 Astoria-Tillamook-Forest Grove planning area contains approximately 25,000 stands divided into 130,000 upland and riparian parcels with a planning horizon of twenty 10-year periods. Depending on the degree of spatial representation, up to 2.6 million 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. 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.

Alternatives for Harvest Scheduling Model

Seven alternatives were constructed in order to compare different management approaches. All of the alternatives were modeled except Alternative 5 that was not fully developed. Additional optional runs were made on 4 of the 6 remaining alternatives to demonstrate the effect of certain constraints or strategies.

All alternatives were initially run with the constraints of non-declining even flow of harvest volume using a guiding discount rate of 4.5 percent. However, additional runs were made in response to issues that arose during the presentation of preliminary model outputs: using a higher guiding discount rate, removal of the flow constraints and operability reductions, lower complex structure targets, and an aggressive Swiss needle cast strategy.

Guiding discount rate — To test the sensitivity of a higher discount rate on the net present value of the solution, several runs were made earlier in the modeling process using a 7 percent guiding discount rate. Although they are not included in the summary options below, it was concluded that under non-declining even flow with a minimum final harvest age between 45 and 50 there was no significant difference in the net present value between 4.5 percent and 7 percent.

Constraints removed — To see the maximum net present value that could be achieved while modeling the proposed aquatic and riparian strategies, an option was run with most constraints to high net present value removed. Alternative 3, option E, has constraints removed for even-flow, minimum final harvest age, and operability reductions.

Reduced complex structure target — Alternative 4 option B was constructed to compare the harvest volume outputs from an option with a 30 percent complex stand structure target to that of the proposed structure-based management complex structure targets of 40 percent to 60 percent.

Swiss needle cast strategy — Alternative 1, option C, and Alternative 4, option B, have the same assumptions as option A of the same alternative, except that they aggressively treat severely affected SNC stands within the first 2 decades. A departure from even flow was allowed in decade 1 and 2 to accommodate the higher level of harvest.

The alternative approaches are:

Alternative 1: Structure-based management (SBM) with Habitat Conservation Plan (HCP)

- SBM (target in OFS and LYR of 20% - 30% each, with average of 25%)
- Proposed northern spotted owl (NSO) and marbled murrelet (MM) strategies
- Proposed aquatic and riparian strategies
- 4.5% discount rate

Objectives: Achieve Stand Structure targets as soon as possible, secondarily emphasize net present value (NPV).

Option A: Non-declining even flow (of volume)

Option C: Same as Option A, but with Swiss needle cast strategy and a departure from even flow allowed in the first 2 periods

Alternative 2: SBM with no HCP

- SBM (target in OFS and LYR of 20% - 30% each, with average of 25%),
- Take avoidance for NSO and MM
- Proposed aquatic and riparian strategies
- 4.5% discount rate

Objectives: Achieve Stand Structure targets as soon as possible, secondarily emphasize NPV.

Option: Non-declining even flow

Alternative 3: Emphasize net present value (NPV)

- No targets for stand structure types
- Take avoidance for NSO and MM
- Proposed aquatic and riparian strategies

Objectives: Emphasize NPV.

Option A: Non-declining even flow @ 4.5% discount rate

Option E: Unconstrained flow @ 7.0% discount rate, no operability reductions, and no minimum final harvest age

Alternative 4: SBM with reduced complex stand structure targets:

- SBM with reduced complex structure targets
- Take avoidance for NSO and MM
- Proposed aquatic and riparian strategies
- 4.5% discount rate

Objectives: Achieve Stand Structure targets as soon as possible, secondarily emphasize NPV.

Option A: Complex structure target in OFS and LYR of 5% each, non-declining even flow

Option B: Complex structure target of 30% in combined OFS and LYR, Swiss needle cast strategy, non-declining even flow with a departure in first 2 periods for SNC strategy

Alternative 5: Balance mean annual increment and NPV

- This alternative was not modeled

Alternative 6: 50% reserves

- 50% reserved management basins have limited thinnings allowed in first few decades only
- Remaining 50% managed as in Alternative 1, Option A
- Assumes HCP based on reserve areas. All NSO and MM habitat is located within 50% reserve acres; no proposed NSO or MM strategies or take avoidance in managed 50%
- All riparian buffer zones are "no harvest"

Objective: Achieve Stand Structure targets as soon as possible, secondarily emphasize net present value (NPV).

Option B: No flow constraint

Alternative 7: Exclusive reserve approach

- 100% reserves.

Objective: Grow only.

Summary of Model Run Outputs

The tables on the next few pages summarize the outputs of the model runs for nine alternative options. Table I-1 is a summary of the 20-decade outputs for the combined North Coast districts, Astoria, Tillamook, and Forest Grove. Table I-2 summarizes the 20-decade outputs for four alternative options for the North Cascade, Western Lane, and West Oregon districts.

Table I-3 summarizes the time projected for each alternative option to reach the desired future condition for complex stand structure (layered and older forest structure stand percentages). Note that different alternatives have different desired future conditions. Alternatives 3-A, 3-E and 7 have no desired future condition for complex stand structure percentages. Not all options were run for the three Willamette Region districts (North Cascade, Western Lane, and West Oregon). This table also shows the long-term average percent of layered and older forest structure stands on the landscape for each alternative option.

Table I-1. Summary of North Coast Outputs: Astoria, Tillamook and Forest Grove Districts, January 2001

Alternative	20 Decade Total MMBF Harvest	20 Decade Total Thinned Acres	20 Decade Total Clearcut Acres	20 Decade Total Net Cash Flow in Millions	20 Decade Net Present Value in Millions	20 Decade Average Clearcut Harvest Age	20 Decade Average OFS %	20 Decade Average LYR %
1-A SBM/HCP	59,910	1,428,540	646,970	$25,680	$2,168	114	20.3%	22.7%
1-C SBM/HCP (SNC)	58,630	1,333,710	651,280	$25,254	$2,256	114	20.5%	21.6%
2 SBM/no HCP	52,360	1,245,080	563,440	$22,210	$1,934	109	25.4%	20.9%
3-A emphasize NPV	59,760	868,900	861,350	$26,800	$2,594	87	15.0%	2.3%
3-E no op. reductions	47,110	1,163,090	1,100,440	$19,068	$4,028	64	14.2%	4.1%
4-A 5%OFS, 5% LYR	59,270	1,100,520	856,120	$25,240	$2,451	88	16.4%	6.0%
4-B SBM/No HCP 30% OFS/LYR	56,210	1,212,400	785,670	$23,678	$2,641	89	21.0	9.7
6-B 50% reserves/SBM	22,710	636,460	273,970	$8,888	$1,367	91	43.2%	10.3%
7 grow only	0	0	0	$0	$0	0	58.3%	1.7%

Key Drivers for the Alternatives

This summary analyzes alternatives as applied to the three North Coast Districts, Astoria, Tillamook and Forest Grove.

Most of the following assumptions do not apply to Alternative 7, which allows no harvest.

All alternatives assume proposed aquatic and riparian strategies.

All alternatives emphasize net present value (NPV) at 4.5% discount rate.

For all alternatives except Alternatives 3-E, operability reductions are applied to the first 3 periods (period 1 – 25%, period 2 – 15%, period 3 – 5%).

Two alternatives, 1-C and 4-B harvest all merchantable stands that are severely affected by Swiss needle cast (SNC) in the first two decades.

For all except Alternatives 3-A and 3-E, there is no clearcut harvest below age 50. Alternative 3-A has a minimum harvest age of 45, and 3-E has no minimum final harvest age. In addition, during the first 2 decades of Alternatives 1-C and 4-B, severely affected Swiss needle cast stands may be harvested with a 25 year minimum harvest age.

All alternatives except 3-A, 3-E and 7 assume structure-based management (SBM). The goals for complex stand structures (LYR and OFS) in Alternatives 1-A, 1-C, and 2 are 20-30% each, average 25%. Alternatives 4-A and 4-B have reduced goals for complex stand structures of 10% and 30% respectively (combined OFS and LYR stands).

Alternatives 1-A, 1-C, and 6-B assume an HCP; Alternatives 2, 3-A, 3-E, 4-A, and 4-B use take avoidance strategies (no HCP). Alternative 7 needs no HCP.

Table I-2. Summary of Willamette Area Outputs: North Cascade, Western Lane and West Oregon Districts, January 2001

Alternative	20 Decade Total MMBF Harvest	20 Decade Total Thinned Acres	20 Decade Total Clearcut Acres	20 Decade Total Net Cash Flow in Millions	20 Decade Net Present Value in Millions	20 Decade Average Clearcut Harvest Age	20 Decade Average OFS %	20 Decade Average LYR %
Outputs for North Cascade District								
1-A SBM/HCP	6,460	162,770	70,930	$2,831	$292	114	18.1	23.0
2 SBM/no HCP	5,410	134,620	61,530	$2,391	$232	111	21.9	21.4
3-A emphasize NPV	5,640	88,340	84,370	$2,585	$275	91	15.1	2.7
4-B SBM/No HCP 30% OFS/LYR	5,280	104,840	72,190	$2,358	$249	97	21.3	8.8
Outputs for Western Lane District								
1-A SBM/HCP	4,470	79,540	39,430	$2,018	$185	122	21. 3	19.7
2 SBM/no HCP	2,560	47,950	22,930	$1,157	$82	130	37.3	14.5
3-A emphasize NPV	2,690	33,740	29,470	$1,236	$95	110	32.1	1.7
4-B SBM/No HCP 30% OFS/LYR	2,770	43,670	29,630	$1,226	$91	111	35.4	4.7

Table I-2. Summary of Willamette Area Outputs (cont.)
January 2001

Outputs for West Oregon District								
1-A SBM/HCP	6,480	140,850	52,820	$2,827	$296	114	20.7	20.5
2 SBM/no HCP	4,340	99,380	38,280	$1,924	$184	108	28.8	19.2
3-A emphasize NPV	6,400	89,720	68,770	$3,012	$290	87	14.2	1.6
4-B SBM/No HCP 30% OFS/LYR	5,930	103,020	56,230	$2,678	$263	96	21.6	8.6

Key Drivers for the Alternatives

All alternatives assume proposed aquatic and riparian strategies and emphasize net present value (NPV) at 4.5% discount rate.

All alternatives have non-declining even flow, except as affected by the Swiss needle cast (SNC) strategy in Alternative 4-B. In that alternative, all merchantable stands that are severely affected by Swiss needle cast are harvested in the first 2 decades, with non-declining even flow in decades 3-20.

Alternatives 1-A and 2 assume Structure-Based Management (SBM) with goals for OFS and LYR of 20%-30% each, with average of 25%. Alternative 4-B has reduced goals for complex stand structures of 30% OFS/LYR stands (combined).

Alternative 1-A assumes an HCP. Other alternatives use take avoidance strategies.

The minimum age for clearcuts is 50 years, except in Alternative 3-A where the minimum age is 45 years, and the first 2 decades (SNC strategy) of Alternative 4-B, where there is a 25 year minimum harvest age.

All alternatives have operability reductions applied to first 3 periods. From draft implementation plans:

North Cascade (5% all periods)
West Oregon (period 1 – 10%, period 2 – 7%, period 3 – 3%)
Western Lane (period 1 – 21%, period 2 – 15%, period 3 – 5%)

Table I-3. Summary of Model Results on Desired Future Condition

Alternative	NW Districts (Astoria, Tillamook, Forest Grove Districts)		Willamette Districts (North Cascade, Western Lane, West Oregon Districts)	
	Decade When Complex Stand DFC Met	Long-Term Average LYR/OFS %	Decade When Complex Stand DFC Met	Long-Term Average LYR/OFS %
1-A SBM/HCP	7 (40% LYR/OFS)	49.3%	8 (40% LYR/OFS)	47.5%
1-C SBM/HCP (SNC)	7 (40% LYR/OFS)	49.7%	—	—
2 SBM/no HCP	7 (40% LYR/OFS)	56.0%	7 (40% LYR/OFS)	57.4%
3-A emphasize NPV	N/A	21.7%	N/A	27.6%
3-E no op. reductions	N/A	24.1%	—	—
4-A 5%OFS, 5% LYR	2 (10% LYR/OFS)	27.3%	—	—
4-B SBM/No HCP 30% OFS/LYR	7 (30% LYR/OFS)	36.3%	7 (30% LYR/OFS)	38.4%
6-B 50% reserves/SBM	8 (40% LYR/OFS)	74.6%	—	—
7 grow only	N/A (40% LYR/OFS at decade 8)	88.4%	—	—

Appendix J

Management Standards for Aquatic and Riparian Areas

The *Northwest Oregon State Forests Management Plan* uses a blended approach for the aquatic and riparian strategies. The first component is the landscape management strategies described in Chapter 4 of the plan. Over time, these strategies will create properly functioning riparian and aquatic conditions and processes. The second component a set of more site-specific strategies for aquatic and riparian areas, is discussed in detail in this appendix.

The second component of the blended approach is a set of more site-specific or prescriptive strategies designed to protect key resource elements or provide for specific functional elements not necessarily addressed by the landscape strategies.

In Chapter 4, Aquatic and Riparian Strategy 2 states:

Apply management standards for aquatic and riparian areas. Establish and maintain riparian management areas adjacent to all streams, in accordance with the standards described in Appendix J of this plan and species of concern where they apply.

The site-specific, prescriptive standards in this appendix will guide forest management activities to achieve properly functioning aquatic and riparian habitat conditions over time. Management actions will be consistent with these standards, except where specific exceptions are documented and authorized by the District Forester. As information from monitoring efforts, watershed assessment and analysis, and other sources becomes available, specific standards may be changed or modified as necessary to meet the overall goal of maintaining and restoring properly functioning aquatic habitats.

Riparian Management Areas (RMAs)

Riparian management areas will be established immediately adjacent to waterways for the purpose of protecting aquatic and riparian resources, and maintaining the functions and ecological processes of the waterways. Within these areas, special management considerations and operational restrictions will be applied, and the protection of aquatic resources will be a high priority.

The width of riparian management areas will vary by the 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 width of a riparian management area (RMA) 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 inner gorge areas, or other special sites noted in the management prescriptions. See the “Key Terms” box on the next page for definitions.

Riparian management area 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 will 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.

On the next several pages, guidelines are given for defining the four zones of a riparian management area and classifying streams. See “Basic Concepts for Aquatic and Riparian Conservation” in Chapter 4 for discussion of the functions and processes of healthy aquatic systems and the desired future condition for streams.

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 is 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 (CMZ) — 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.

Inner gorge — An area next to a stream or river where the adjacent slope is significantly steeper than the gradient of the surrounding hillsides. In the absence of an on-site inspection and determination by a Department of Forestry geotechnical specialist or other qualified person, these areas are defined as having a slope gradient adjacent to the stream of 70 percent (35 degrees) or greater, and where the height of the slope break is at least 15 feet (measured vertically) above the elevation of the channel.

Guidelines: The Four Zones of a Stream Riparian Management Area

Riparian management areas established along streams will contain four zones. The purposes and differences between these four zones are defined below and on the next page.

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 riparian management area are established upslope from the outer edge of these features.

Stream bank zone — The stream bank zone is the land closest to the stream, including the stream banks. Most riparian functions are supported to some extent by vegetation in this zone, including providing aquatic shade, the delivery of down wood and organic inputs (leaves and tree litter) to the stream and riparian area, stabilizing the stream bank, contributing to floodplain functions, and influencing 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 is the next area away from the stream, adjacent to the stream bank zone. 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.

- The inner RMA zone extends from 25 feet (the outer edge of the stream bank zone) to 100 feet from the stream. This zone exists on both sides of a stream.

Outer RMA zone — The outer RMA zone is the portion of the riparian management area farthest away from the stream. Vegetation within this zone may still contribute to certain riparian functions and processes, but to a lesser extent than the two zones closest to 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.

- The outer RMA zone extends from the edge of the inner zone at 100 feet out to 170 feet from the stream. This zone exists on both sides of a stream.

Guidelines: 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 Oregon Forest Practices Act, as described in the Department of Forestry’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 Endangered Species Acts.

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

Flow Pattern Classifications

Small non-fish-bearing (Type N) streams are also classified according to the flow pattern exhibited in normal water years. For the purposes of this plan, 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 woody materials during high flow events. For the purposes of this plan, and in the absence of specific geomorphologic identification, stream reaches with an average gradient exceeding 15 percent, and an active channel width of five (5) feet or more will be defined as seasonal high energy streams.
- **Potential debris flow track reaches —** Potential debris flow track reaches are reaches on seasonal Type N streams that have been determined to have a high probability of delivering woody debris to a Type F stream.

Oregon Department of Forestry field staff will make the determination of the probability that a reach will deliver woody debris to a Type F stream, using the following criteria:

1. The seasonal stream reach must terminate at or below a high risk site. High risk sites include:
   a. Active landslides (slopes with tension cracks, unvegetated soil scarps, or jackstrawed trees caused by slope movement).
   b. Slopes steeper than 80 percent, excluding competent rock outcrops.
   c. Headwalls or draws steeper than 70 percent.
   d. Abrupt slope breaks, where the lower slope is the steeper and exceeds 70 percent, except where the steeper slope is a competent rock outcrop.
   e. Incised channels (hill slopes adjacent to the channel and steeper than the upland slope) with slopes steeper than 60 percent.
   f. Any other site determined to be of marginal stability by a Department of Forestry geotechnical specialist.

2. The path of a potential debris flow and the likelihood that a debris flow will reach a Type F stream. If any one of the following three conditions is present along the path from the high risk site to the Type F stream, then a debris flow is likely to stop and the stream reach would be determined to have a low probability of woody debris delivery:
   a. 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.
   b. The presence of a stream reach which is less than 6 percent gradient for at least 300 feet.
   c. An average slope from the high risk site along the potential landslide path to the stream that is less than 20 percent.

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 J-1 and J-2.

Table J-1. Management Standards for Type F Stream RMAs

All Stream Sizes: Large, Medium, and Small	
Stream bank zone 0-25 ft.	• No harvest. • Less than 10% vegetative disturbance. • Full suspension required during cable yarding. • No ground-based equipment operation. • Leave any trees damaged or felled from yarding activities.
Inner RMA zone 25 to 100 ft.	• Manage for mature forest condition.[1] • No management activity where mature forest condition (MFC) exists, or where conditions are suitable for development of MFC in a reasonable time frame without further treatment. • Actively manage 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 density of at least SDI 25%, and will retain at least 50 TPA. • No more than 10% vegetative disturbance allowed from cable yarding. • Full suspension wherever possible, or one-end suspension on all cable-yarded material. • Ground-based equipment operation limited to area more than 50 ft. from aquatic zone and slopes less than 35%, and allowed on no more than 10% of area. • Leave any trees damaged or felled from yarding activities and additional felled, girdled or topped trees to contribute toward down wood targets.[2] • Retain all dead and down material that was present prior to the operation.
Outer RMA zone 100 to 170 ft.	• Retain at least 10 to 45 [3] conifer trees and snags per acre (15 to 70 trees per 1,000 ft. of RMA). [4] • Retain all snags as safety permits. • Less than 10% ground disturbance from yarding activities. • Retain all dead and down 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 (80-100 years or greater), this equals 40-45 conifer trees 32 inches in DBH per acre.
2. Up to 10 trees per acre will be retained as felled, girdled, or topped trees during partial cutting, to reach a target of 600-900 cubic feet per acre of hard down 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). In order 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 closest to the channel.

Table J-2. Management Standards for Type N Stream RMAs

	Large and Medium Type N Streams
Stream bank zone 0-25 ft.	• No harvest. • Less than 10% vegetative disturbance from cable yarding. • Full suspension required. • No ground-based equipment operation. • Leave any trees damaged or felled from yarding activities.
Inner RMA zone 25-100 ft.	• Manage for mature forest condition.[1] • No management activity where mature forest condition target already exists. • Actively manage 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 density of at least SDI 25%, and will retain at least 50 TPA. • No more than 10% vegetative disturbance allowed from cable yarding. • Full suspension wherever possible, or one-end suspension on all cable-yarded material. • Ground-based equipment operation limited to area more than 50 ft. from aquatic zone and slopes less than 35%, and allowed on no more than 10% of area. • Leave any trees damaged or felled from yarding activities and additional felled, girdled or topped trees to contribute to down wood targets.[2] • Retain all dead and down material that was present prior to the operation.
Outer RMA zone 100-170 ft.	• Manage to retain at least 10 conifer trees and snags per acre (15 trees per 1,000 ft. 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 (80-100 years or greater), this equals 40-45 conifer trees 32 inches in DBH per acre.
2. Up to 10 trees per acre will be retained as felled, girdled, or topped trees during partial cutting, to reach a target of 600-900 cubic feet per acre of hard down wood.
3. All trees retained will be dominant or co-dominant conifer trees (if available). In order 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 closest to the channel.

Table J-2 continued. Management Standards for Type N Stream RMAs

Small Perennial Type N Streams (applied to at least 75% of reach)[1]	
Stream bank zone 0-25 ft.	• No harvest. • No ground-based equipment operation.
Inner RMA zone 25-100 ft.	• Manage to retain at least 15-25 conifer trees and snags per acre (25-40 trees per 1,000 ft. of RMA).[2,3] • Retain all other snags as safety permits. • Within 500 ft. of a confluence with a Type F stream, retain all hardwoods, non-merchantable trees, and other conifers as necessary, to achieve 80% shade over aquatic zone. • Retain all dead and down material that was present prior to the operation.
Outer RMA zone 100-170 ft.	• Manage to retain 0-10 conifer trees and snags per acre (0-15 trees per 1,000 ft. of RMA).[2,3] • Retain all snags as safety permits.

1. Prescription to be applied to at least 75% of perennial stream reach, including the first 500 ft. above the confluence with a Type F, and areas that meet the definition of a Special Emphasis Area (SEA) according to the definitions in the section following these tables.
2. All trees retained will be dominant or co-dominant conifer trees (if available). In order 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 closest to 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 ft.), then no additional leave trees are required in the outer zone.

Table J-2 continued. Management Standards for Type N Stream RMAs

Small Seasonal Type N Streams: High Energy Reaches (applied to at least 75% of reach)[1]	
Stream bank zone 0-25 ft.	• No harvest. • No ground-based equipment operation.
Inner RMA zone 25-100 ft.	• Manage to retain at least 15-25 conifer trees and snags per acre (25-40 trees per 1,000 ft. of RMA).[2,3] • Retain all other snags as safety permits. • Retain all dead and down material that was present prior to the operation.
Outer RMA zone 100-170 ft.	• Manage to retain 0-10 conifer trees and snags per acre (0-15 trees per 1,000 ft. 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% of reach)[1]	
Stream bank zone 0-25 ft.	• No harvest. • No ground-based equipment operation.
Inner RMA zone 25-100 ft.	• Manage to retain at least 10 conifer trees and snags per acre (15 trees per 1,000 ft. of RMA).[2,4] • Retain all other snags as safety permits. • Retain all dead and down material that was present prior to the operation.
Outer RMA zone 100-170 ft.	• Retain trees and snags sufficient to meet landscape management strategy targets.
Other Small Seasonal Type N Streams (applied to at least 75% of reach)	
Stream bank zone 0-25 ft.	• Maintain integrity of stream channel. • No ground-based equipment operation.
Inner RMA zone 25-100 ft.	• Manage to retain at least 10 conifer trees and snags per acre where operationally feasible (16 trees per 1,000 ft. of RMA).[2] • Retain all other snags as safety permits. • Retain all dead and down material that was present prior to the operation.
Outer RMA zone 100-170 ft.	• Retain trees and snags sufficient to meet landscape management strategy targets.

1. Prescription to be applied to at least 75% of stream reach, including the first 500 ft. above the confluence with a Type F stream.
2. All trees retained will be dominant or co-dominant conifer trees (if available). In order 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 closest to 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 ft.), then no additional leave trees are 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.

Increasing Outer Zone Conifer Retention on Type F Streams

On Type F streams, in situations where the number of conifers available for retention within the inner zone 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 TPA (100 trees per 1,000 lineal feet of stream for a 100-foot inner zone).

The number of additional conifers to be retained in the outer zone will be equal to the deficit from the inner zone target, adjusted to account for the different widths of the zones. For example, if the inner zone has an average of 70 suitable conifers per 1,000 feet of stream, then the additional retention level for the outer zone would equal 30 times 0.7, or an additional 21 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. This means no more than 70 conifers per 1,000 feet of outer zone or 45 TPA 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 J-1 and J-2: dominant or co-dominant trees, with preference given to retaining trees on adjacent slopes, trees leaning toward the aquatic zone, and trees closest to the channel.

Perennial Type N Stream Special Emphasis Areas

On small Type N streams, the required riparian management areas 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.

Inner Gorge Areas

- A no-harvest zone will be extended to the top of the slope break that defines the inner gorge.
- If the slope break is less than 100 feet from the edge of the CMZ, then the applicable inner zone standard will be applied for the remaining distance (out to a maximum of 100 feet), and the applicable outer zone standard will be applied out to 170 feet.
- If the slope break is greater than 100 feet from the edge of the CMZ, then the outer zone standard will be applied from the slope break out to 170 feet.

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.

Landscape Green Tree Retention and RMA Conifer Retention Targets

It is recognized that conifer trees retained on the landscape during regeneration harvests provide benefits to both upland and riparian species, as well as contributing to aquatic habitats. Although any given tree or group of trees retained may provide multiple benefits, it is assumed that it would be undesirable for all leave trees to be concentrated in riparian management areas, with few or none in upslope areas, or vice-versa. Therefore, the following standards and guidelines will be used in accounting for the required RMA and landscape-level live tree retention targets.

Management Standards

- Conifers retained to meet the requirements in the inner zone of streams managed for mature forest condition (Type F, and large or medium Type N) will not be counted towards achieving the landscape-level live tree retention standard.
- Conifer trees retained to meet the requirements on all other RMA zones may be counted towards achieving the landscape-level leave tree retention standard.

Management Guidelines

- On regeneration harvest units, leave trees should be arranged to meet the intent and functional objectives for both riparian and upslope habitat values.
- On average, at least 25 percent of the leave trees required to meet the landscape standard should be located in riparian areas that extend well into upslope areas, or in upslope areas that are outside of riparian areas.

Other Aquatic Habitats

The northwest Oregon state forests contain other aquatic habitats besides 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. The following strategies apply to these other aquatic habitats.

Prescriptions

The prescriptions for other aquatic habitats are presented in the following two tables.

Key Terms

Wetland — An area that is inundated or saturated by surface or ground water 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 1989 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (USDI Fish and Wildlife Service et al. 1989).

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 is dominated by ground mosses, especially sphagnum. Bogs are distinguished from other wetlands by the dominance of mosses and the presence of extensive peat deposits.

Table J-3. 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 a riparian management area (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 riparian management area (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% 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% 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 waters containing fish (Type F), or 25 feet for non-fish-bearing (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% 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% 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 J-4. Management Prescriptions for Estuaries, Bogs, Seeps, and Springs

Estuaries
• Establish a 25-foot no harvest zone, starting from the high water line or estuarine wetland boundary (whichever is greater). • Establish a riparian management area (RMA) of 200 feet from the high water line, or estuarine wetland boundary (whichever is greater). • Manage vegetation within the RMA to achieve and maintain mature forest conditions.
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 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 were described earlier in the section titled "Perennial Type N Stream Special Emphasis Areas."

Appendix K

Management of State Forest Lands

The Oregon Administrative Rules contain OARs filed through January 15, 2009

DEPARTMENT OF FORESTRY

DIVISION 35

MANAGEMENT OF STATE FOREST LANDS

629-035-0000

Definitions

(1) "Active management" means applying practices, over time and across the landscape, to achieve site-specific forest resource goals using an integrated and science-based approach that promotes the compatibility of most forest uses and resources over time and across the landscape.

(2) "Adaptive management" means the process of implementing plans in a scientifically based, systematically structured approach that tests and monitors assumptions and predictions in management plans and uses the resulting information to improve the plans or management practices used to implement them.

(3) "Biological diversity" means the genetic variation and the abundance and variety of microbial, plant, and animal life, the range of ecological functions, and the physical processes at any local or landscape scale.

(4) "Board" means the Oregon Board of Forestry.

(5) "Compatible" or "compatibility" means capable of existing or operating together in harmony.

(6) "District" means a defined geographic area that is an administrative unit of the Department, within which a District Forester manages the Department's programs.

(7) "Forest conditions" means stand types, structures, and landscape patterns.

(8) "Forest lands" means lands acquired under ORS 530.010 to 530.040.

(9) "Forest resources" includes, but is not limited to:

(a) Timber production and harvest;

(b) Salmonid, and other native fish and wildlife habitats;

(c) Soil, air, and water;

(d) Forage and browse for domestic livestock;

(e) Landscape effect;

(f) Protection against flood and erosion;

(g) Recreation;

(h) Mining;

(i) Use of water resources; and

(j) Administrative sites.

(10) "Forest tree species" means trees ecologically suited to the site.

(11) "Integrated Management" means bringing together knowledge of various disciplines (forestry, fisheries, wildlife, water) to understand and promote land management actions that consider effects and benefits to all.

(12) "Landscape" means a broad geographic area that may cover many acres and more than one ownership, and may include a watershed, or sub-watershed areas.

(13) "Native" means indigenous to Oregon, not introduced.

(14) "Planning area" means the appropriate management district, or districts, or other specified geographic area determined by the State Forester.

(15) "Wildlife" means fish, wild birds, amphibians, reptiles, wild mammals, and other indigenous animal organisms.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.010 - ORS 530.050
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98

629-035-0010

Findings and Principles Concerning Lands Acquired under ORS Chapter 530

(1) ORS Chapter 530 authorizes the Board of Forestry to acquire forest lands which by reason of their location, topographical, geological, or physical characteristics are chiefly valuable for:

(a) Production of forest crops;

(b) Watershed protection and development;

(c) Erosion control;

(d) Grazing;

(e) Recreation;

(f) Forest administrative purposes.

(2) These lands must be managed to achieve the greatest permanent value to the state.

(3) For purposes of achieving the greatest permanent value of these forest lands to the state, the Board may direct the State Forester to:

(a) Protect these forest lands from fire, disease, and insect pests, sell forest products from these forest lands, and execute mining leases and contracts as provided for in ORS 273.551; and

(b) Permit the use of these forest lands for other purposes, when such uses are not detrimental to the best interest of the state. These other purposes include, but are not limited to:

(A) Forage and browse for domestic livestock;

(B) Fish and wildlife environment;

(C) Landscape effect;

(D) Protection against floods and erosion;

(E) Recreation;

(F) Protection of water supplies.

(4) The counties in which these forest lands are located have a protected and recognizable interest in receiving revenues from these forest lands; however, the Board and the State Forester are not required to manage these forest lands to maximize revenues, exclude all non-revenue producing uses on these forest lands, or to produce revenue from every acre of these forest lands.

(5) Based on existing Board principles and policies and current scientific and silvicultural information, the Board finds that uses for purposes set forth in subsections (3)(a) and (b) of this section are compatible over time and across the landscape when the lands are actively managed in an environmentally and silviculturally exemplary manner, as set forth in OAR 629-035-0030, using management practices that:

(a) Pursue compatibility of forest uses over time;

(b) Integrate and achieve a variety of forest resource management goals;

(c) Achieve, over time, site-specific goals for forest resources, using the process as set forth in OAR 629-035-0030 through 629-035-0070;

(d) Consider landscape context;

(e) Are based on the best science available; and

(f) Incorporate an adaptive management approach that applies new management practices and techniques as new scientific information and results of monitoring become available.

(6) Based on existing Board principles and policies and current scientific and silvicultural information, the Board finds that forest lands that are actively managed as provided in subsection (5) of this section can produce economic value over the long term and promote healthy, sustainable forest ecosystems that:

(a) Produce timber and revenues for the state, counties, and local taxing districts;

(b) Result in a high probability of maintaining and restoring properly functioning aquatic habitats for salmonids, and other native fish and aquatic life;

(c) Protect, maintain, and enhance native wildlife habitats;

(d) Protect soil, air, and water; and

(e) Provide outdoor recreational opportunities.

(7) Based on subsections (5) and (6) of this section, the Board finds that actively managing forest lands for the purposes described in subsections (3)(a) and (b) of this section is in the best interest of the state.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.010 - ORS 530.050
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98

629-035-0020

Greatest Permanent Value

(1) As provided in ORS 530.050, "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. These benefits include, but are not limited to:

(a) Sustainable and predictable production of forest products that generate revenues for the benefit of the state, counties, and local taxing districts;

(b) Properly functioning aquatic habitats for salmonids, and other native fish and aquatic life;

(c) Habitats for native wildlife;

(d) Productive soil, and clean air and water;

(e) Protection against floods and erosion; and

(f) Recreation.

(2) 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:

(a) Results in a high probability of maintaining and restoring properly functioning aquatic habitats for salmonids, and other native fish and aquatic life;

(b) Protects, maintains, and enhances native wildlife habitats;

(c) Protects soil, air, and water; and

(d) Provides outdoor recreation opportunities.

(3) Management practices must:

(a) Pursue compatibility of forest uses over time;

(b) Integrate and achieve a variety of forest resource management goals;

(c) Achieve, over time, site-specific goals for forest resources, using the process as set forth in OAR 629-035-0030 through 629-035-0070;

(d) Consider the landscape context;

(e) Be based on the best science available; and

(f) Incorporate an adaptive management approach that applies new management practices and techniques as new scientific information and results of monitoring become available.

(4) The State Forester shall manage forest lands as provided in this section by developing and implementing management plans for a given planning area as provided in OAR 629-035-0030 to 629-035-0100.

(5) The Board shall review 629-035-0020(2) (management focus) no less than every ten years in light of current social, economic, scientific, and silvicultural considerations.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.010 - ORS 530.050
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98

629-035-0030

Forest Management Planning

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

develop implementation and operations plans for forest management plans that describe smaller-scale, more specific management activities within the planning area.

(2) Forest Management Plans must contain the following elements:

(a) Guiding principles, that include legal mandates and Board of Forestry policies. Taken together, these principles shall guide development of the management plan.

(b) Description and assessment of the resources on state forest lands within the planning area and consideration of the surrounding ownership in order to provide a landscape context. The description and assessment includes general statements of the current conditions of each of the resources, and the laws, policies, and programs that affect the resources and their management.

(c) Forest resource management goals, which are statements of what the State Forester intends to achieve for each forest resource within the planning area consistent with OAR 629-035-0020.

(d) Management strategies, which describe how the State Forester will manage the forest resources in the planning area to achieve the goals articulated in the plan. The strategies shall identify management techniques the State Forester may use to achieve the goals of the plan during the implementation phase of the plan.

(e) General guidelines for asset management, which provide overall direction on investments, marketing, and expenses.

(f) General guidelines for implementation, monitoring, research, and adaptive management. The guidelines shall describe:

(A) The process for implementing Forest Management Plans;

(B) The approach for determining whether the strategies are meeting the goals of the Forest Management Plans; and

(C) The process for determining the validity of the assumptions used in developing the strategies.

(3) The State Forester shall be guided by the following stewardship principles in developing and implementing Forest Management Plans:

(a) The plans shall include strategies that provide for actively managing forest land in the planning area.

(b) The plans shall include strategies that:

(A) Contribute to biological diversity of forest stand types and structures at the landscape level and over time:

(i) through application of silvicultural techniques that provide a variety of forest conditions and resources; and

(ii) through conserving and maintaining genetic diversity of forest tree species.

(B) Manage forest conditions to result in a high probability of maintaining and restoring properly functioning aquatic habitats for salmonids, and other native fish and aquatic life, and protecting, maintaining, and enhancing native wildlife habitats, recognizing that forests are dynamic and that the quantity and quality of habitats for species will change geographically and over time.

(C) Provide for healthy forests by:

(i) managing forest insects and diseases through an integrated pest management approach; and

(ii) utilizing appropriate genetic sources of forest tree seed and tree species in regeneration programs.

(D) Maintain or enhance long-term forest soil productivity.

(E) Comply with all applicable provisions of ORS 496.171 to 496.192 and 16 USC § 1531 to 1543 (1982 & supp 1997) concerning state and federally listed threatened and endangered species.

(c) The plans shall include strategies that maintain and enhance forest productivity by:

(A) Producing sustainable levels of timber consistent with protecting, maintaining, and enhancing other forest resources.

(B) Applying management practices to enhance timber yield and value, while contributing to the development of a diversity of habitats for maintaining salmonids and other native fish and wildlife species.

(d) The plans shall include strategies that utilize the best scientific information available to guide forest resource management actions and decisions by:

(A) Using monitoring and research to generate and utilize new information as it becomes available.

(B) Employing an adaptive management approach to ensure that the best available knowledge is acquired and used efficiently and effectively in forest resource management programs.

(4) The Board shall review and may revise the forest management plan developed by the State Forester to ensure that it is consistent with OAR 629-035-0020.

(5) The Board's approval of the plan represents its determination that activities carried out or allowed by the State Forester under subsection (6) of this section meet the obligation to secure the greatest permanent value to the state as defined in OAR 629-035-0020.

(6) Once the management plan is approved by the Board as provided in subsection (5) of this section:

(a) The Board shall adopt the plan as an administrative rule.

(b) The State Forester shall implement the plan through more specific, small scale or time limited plans that are consistent with the Forest Management Plan.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.010 - ORS 530.050
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98

629-035-0040

Forest Land Base Designation

(1) Following the process described in subsection (2) of this section, all forest land shall be designated either as:

(a) Silviculturally capable of growing forest tree species, as defined by the Forest Practices Reforestation Suitability Standards as established by the Oregon Forest Practices Act (Silviculturally Capable); or

(b) Not capable of such growth (Non-Silviculturally Capable).

(2) Each district with forest land management responsibility shall identify Silviculturally Capable and Non-Silviculturally Capable lands in the district and display the designations on a map. The district shall forward the designations and map to the State Forester for approval. If approved by the State Forester, the State Forester shall forward the recommended designations to the Board for approval or modification. The Board shall adopt forest land base designations as an administrative rule.

(3) Designations of forest land under this section shall be reviewed by the appropriate district and, if necessary, updated prior to the completion of management plans for any planning area.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.010 - ORS 530.050
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98

629-035-0045

Forest Land Base Designation Maps

The forest land designation maps required by OAR 629-035-0040 are a set of maps entitled "Land Base Designation Map (OAR 629-035-0040)" consisting of nine consecutively numbered sheets and bearing the date of adoption by the Board. The maps are maintained by the State Forester at the Oregon Department of Forestry's headquarters in Salem, Oregon.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.050
Hist.: DOF 1-1999, f. & cert. ef. 5-13-99

629-035-0050

Forest Land Management Classifications

(1) For purposes of implementing the plan's forest resource management strategies, the State Forester shall classify all forest lands within the planning area. The classifications must describe:

(a) The types of management that the Department will apply to particular areas of the land base;

(b) The appropriate range of management activities for these areas; and

(c) The forest resource or resources the classification is intended to address.

(2) The District Forester shall recommend to the State Forester land management classifications determined under subsection (1) of this section for each district. The recommended classifications shall be shown on maps.

(3) In classifying lands under this section:

(a) The State Forester may harvest forest tree species at some level on any Silviculturally Capable lands, regardless of classification, unless a legal or contractual obligation on the land prevents such management or unless the district determines under subsection (4) of this section that other management is more consistent with the direction of OAR 629-035-0020.

(b) No land designated as Silviculturally Capable land shall be managed for a single use unless required by law or contract or the District Forester determines under subsection (4) of this section that a single use for a particular parcel or parcels of Silviculturally Capable land is more consistent with the direction of OAR 629-035-0020.

(4) In determining whether to restrict or prohibit timber harvest on Silviculturally Capable lands or to allow a single use on Silviculturally Capable lands, the District Forester shall consider:

(a) Effects on other forest resources. In making this determination, the district shall consider, but is not limited to, the following:

(A) Risk to other forest resources;

(B) Sensitivity of forest resources;

(C) Duration and intensity of impact;

(D) Ability of forest resources to recover;

(E) Contribution to meeting planning goals;

(F) Intensity of the management practice;

(G) Type of forest resources involved.

(b) Public safety or other potential liability to the state;

(c) Specific desired uses;

(d) Legal constraints.

(5) Before sending the recommended classifications to the State Forester, the District Forester shall offer a 90-day public comment period on the recommendations. All public comments shall be forwarded to the State Forester, along with the District Forester's classification recommendations.

(6) The State Forester shall approve, modify, or deny the District Forester's recommendations. If the State Forester modifies the recommendations, the State Forester or District Forester shall prepare a new

map showing the modified land management classifications for the district. If the State Forester denies the recommendations, the District Forester shall prepare new recommendations according to the provisions of subsections (1) to (5) of this section.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.010 - ORS 530.050
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98

629-035-0055

Forest Land Management Classification System

(1) The State Forester's classification of forest lands, required by OAR 629-035-0050, shall be accomplished pursuant to this section.

(2) Land Classifications. All forest lands subject to this rule shall be classified into one of the following three classifications: General Stewardship, Focused Stewardship, or Special Stewardship. These classifications apply to lands designated as Silviculturally Capable and Non-Silviculturally Capable.

(3) Distinguishing Characteristics. All forest lands will be classified according to the following distinguishing characteristics. In addition, forest lands will be further classified into subclasses when they are classified as Focused Stewardship or Special Stewardship.

(a) General Stewardship lands include all those whose forest resources are managed using integrated management practices in a manner which is intended to accomplish forest management planning goals, and are compatible over time and across the landscape when actively managed.

(b) Focused Stewardship lands include all those whose forest resources are managed using integrated management practices in a manner which is intended to accomplish forest management planning goals, and are compatible over time and across the landscape when actively managed, but for which a forest management plan, habitat conservation plan, or other legal requirement identifies a requirement for one or more of the following for a specific resource: supplemental planning, before conducting management practices, that helps to achieve identified goals for the specific resource; modified management practices that help achieve the identified goals for the specific resource; or, compliance with legal or contractual requirements above those required on lands classified as General Stewardship.

(A) In addition, other lands may be classified as Focused Stewardship where more specific, small scale, or time-limited plans developed by the State Forester to implement forest management plans call for supplemental planning and/or modified management practices to help achieve the identified goals for a specific resource.

(B) These lands will be further classified into one of the following subclasses:

(i) Agriculture, Grazing or Wildlife Forage -- lands where agricultural crops, domestic livestock grazing values, or wildlife forage values exist and are the focus of the supplemental planning, modified management practices, or legal requirements described above.

(ii) Aquatic and Riparian Habitat -- lands where aquatic and riparian habitat exists and where the habitat is the focus of the supplemental planning, modified management practices, or legal requirements described above.

(iii) Cultural Resources -- lands where cultural resources exist and where those resources are the focus of the supplemental planning, modified management practices, or legal requirements described above.

(iv) Deeds -- lands where deed requirements are a focus of the integrated management of a variety of forest resources.

(v) Domestic Water Use -- lands where individuals or communities have water rights, where surface water is being used for domestic water use and where the State Forester determines water quality and/or quantity is a focus of the integrated management of a variety of forest resources. For the purposes of this section, "domestic water use" means the use of water for human consumption and other household human use.

(vi) Easements -- lands where contractual obligations are a focus of the integrated management of a variety of forest resources.

(vii) Energy and Minerals -- lands where commercial quantities of energy or minerals exist, commercial extraction is occurring or likely to occur, and where those resources are the focus of the supplemental planning, modified management practices, or legal requirements described above.

(viii) Plants -- lands where a specific plant species or a community of plants exist and where those resources are the focus of the supplemental planning, modified management practices, or legal requirements described above.

(ix) Recreation -- lands that receive moderate or high levels of dispersed recreational use and where recreation management is the focus of the supplemental planning, modified management practices, or legal requirements described above.

(x) Research/Monitoring -- lands that are part of a research or monitoring project and where the design of the project requires supplemental planning or modified management practices.

(xi) Transmission -- lands used for the transmission of energy, materials, data, video, and/or voice and where the transmission is a focus of the integrated management of a variety of forest resources.

(xii) Visual -- lands which have been identified as having high or moderate visual sensitivity according to criteria in a forest management plan and where those visual resources are the focus of the supplemental planning, modified management practices, or legal requirements described above.

(xiii) Wildlife Habitat -- lands where wildlife habitat for a specific species or group of species exists and where that habitat is the focus of the supplemental planning, modified management practices, or legal requirements described above.

(c) Special Stewardship lands are those for which a forest management plan, habitat conservation plan, or other legal requirement identifies one or more of the following: a legal or contractual constraint dominates the management of the lands and precludes the integrated management of all forest resources; one or more forest resources are present which require a level of protection that precludes the integrated management of all forest resources; lands are committed to a specific use and management activities are limited to those that are compatible with the specific use.

(A) In addition, other lands may be classified as Special Stewardship, where more specific, small-scale, or time-limited plans developed by the State Forester to implement forest management plans call for a level of protection or a specific use that precludes the integrated management of all forest resources.

(B) These lands will be further classified into the following subclasses:

(i) Administrative Sites -- lands where administrative requirements restrict the integrated management of forest resources. These lands include but are not limited to building sites, rock stockpile sites, log storage/sorting sites, and demonstration areas.

(ii) Agriculture, Grazing, or Wildlife Forage -- lands where agricultural crops, domestic stock grazing, or wildlife forage values exist in a quantity or quality that restricts the integrated management of forest resources.

(iii) Aquatic and Riparian Habitat -- lands where aquatic or riparian habitat exists and where a legal requirement or the need to protect the habitat restricts the integrated management of forest resources.

(iv) County or Local Comprehensive Plans -- lands identified in county or local comprehensive plans where the integrated management of forest resources is restricted. Counties or local governments must take an exception to statewide land use planning Goal 4 for these lands.

(v) Cultural Resources -- lands where cultural resources exist in a quantity or quality that restricts the integrated management of forest resources.

(vi) Deeds -- lands where deed requirements restrict the integrated management of forest resources.

(vii) Domestic Water Use -- lands where individuals or communities have water rights, where surface water is being used for domestic water use and where the State Forester determines the need to protect water quality or quantity dominates the management of the land and the integrated management of forest resources is not possible. For the purposes of this section, "domestic water use" means the use of water for human consumption and other household human use.

(viii) Easements -- lands where contractual obligations restrict the integrated management of forest resources.

(ix) Energy and Minerals -- lands where commercial quantities of energy or minerals exist, extraction is occurring or likely to occur, and where the extraction restricts the integrated management of forest resources.

(x) Operationally Limited -- lands where current technology or engineering techniques are considered by the State Forester to be inadequate to reasonably ensure that integrated management practices would not cause significant long-term adverse effects. The State Forester may limit, restrict, or prohibit management activities in these areas as needed to protect forest resources or to accomplish the management goals for surrounding areas.

(xi) Plants -- lands where a specific plant species or a community of plants exist and where the need to protect the plant(s) restricts the integrated management of forest resources.

(xii) Recreation -- lands devoted to concentrated, formal recreation, or public education and where integrated management of forest resources is restricted. These lands include but are not limited to campgrounds, forest parks, waysides, rest areas, and interpretive centers.

(xiii) Research/Monitoring -- lands that are part of a research or monitoring project and the design of the project restricts the integrated management of forest resources.

(xiv) Transmission -- lands dedicated to the transmission of energy, materials, data, video and/or voice and where integrated management of forest resources is restricted. These lands include but are not limited to power lines, pipelines, and communication sites.

(xv) Visual -- lands subject to laws or regulations related to visual qualities or lands where the management practices needed to meet visual management objectives dominate over the integrated management of forest resources.

(xvi) Wildlife Habitat -- lands where a legal requirement or the need to maintain, protect, or enhance a wildlife habitat restricts the integrated management of forest resources.

(4) Types of Management.

(a) General Stewardship lands shall be actively managed, in compliance with OAR 629-035-0020, to provide 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. Lands within this classification which are designated as Silviculturally Capable will be actively managed to meet the requirements of OAR 629-035-0020(2). Lands within this classification which are designated as Non-Silviculturally Capable are not managed for sustainable timber harvest and revenues, but are managed to be consistent with the remaining management direction provided by OAR 629-035-0020(2). All management practices shall be consistent with the direction provided by OAR 629-035-0020(3).

(b) Focused Stewardship lands shall be managed in the manner provided for General Stewardship lands in the preceding subparagraph. However, because one or more specific forest resources on these lands require a heightened or focused awareness, supplemental planning and/or modified management practices may be required to achieve the goals of forest management plans, habitat conservation plans or legal requirements. Management practices may be modified to emphasize the protection and management of identified forest resources, but the practices will be consistent with the direction provided by OAR 629-035-0020(3) and will avoid long-term adverse impacts to the specified resources.

(c) Special Stewardship lands shall be managed for a specific forest resource. Integrated management of all resources is not conducted on these lands. Other resources are managed to the extent possible without interfering with the management of the specific forest resource or with applicable legal requirements.

(5) Range of Management Activities.

(a) On lands classified for General Stewardship, all management activities that meet or exceed the requirements of applicable state and federal laws, habitat conservation plans and forest management plans are allowed.

(b) On lands classified for Focused Stewardship, all management activities that meet or exceed the requirements of applicable state and federal laws, habitat conservation plans and forest management plans are allowed. However, management activities may require supplemental planning and/or modified practices to achieve the goals identified in the forest management plans for the specific forest resources. Management of the specific forest resources may have minor effects on the management of other forest resources, but will not preclude the integrated management of forest resources.

(c) On lands classified for Special Stewardship, management activities that protect, maintain, or enhance the specific forest resources, or are necessary to comply with the legal requirements, are allowed. Management of other forest resources on these lands must have no significant long-term adverse effect on the specific forest resources which required the classification.

(6) Resources Addressed.

(a) The General Stewardship classification will provide for management of all resources included in Forest Management Plans. All resources may not be treated equally on every acre, but across the landscape the resources will be managed to meet the goals identified in the Forest Management Plans.

(b) The Focused Stewardship classification will provide for management of all resources included in Forest Management Plans. Lands having forest resources described in a subclass designation will be assigned to that subclass. The subclass designation will be used to identify the specific forest resources that, with supplemental planning and/or modified management practices, can be managed in an integrated approach with other forest resources. All resources may not be treated equally on every acre, but across the landscape the resources are managed to meet the goals identified in the Forest Management Plans.

(c) The Special Stewardship classification addresses all forest resources included in the Forest Management Plan that meet the distinguishing characteristics of this classification. Lands having forest resources described in a subclass designation will be assigned to that subclass. The subclass designation will be used to identify the specific forest resources that are the emphasis of the management of these lands.

(7) Forest Land Management Classification Considerations. The following considerations apply to Forest Land Management Classifications:

(a) Prescriptions are not part of Forest Land Management Classifications. Prescriptions will be based upon goals and strategies in a forest management plan, statutory, or contractual requirements, and site-specific conditions.

(b) The identification and mapping of streams, wetlands, and the associated Aquatic and Riparian Habitat subclasses will be based upon criteria in Forest Management Plans and habitat conservation plans and will be accomplished using existing information or map-based estimates. The information will be updated through watershed assessments, planning for site-specific management activities or site-specific field visits conducted over time. The updated information will be used to determine any changes that may be needed to the classification of aquatic and riparian habitat.

(c) Land management classifications will be applied to broad geographic areas. Normally, areas smaller than five acres will not be classified, but will be included as part of an adjacent classification. Areas smaller than five acres will only be classified where specific information exists and the classification will be meaningful for making decisions on management activities.

(d) The boundary lines shown on maps for forest land management classifications are approximate locations. Exact locations of boundary lines will be determined on the site and will depend upon the conditions that exist on the site. Management activities will be conducted based upon boundaries determined on site rather than boundaries shown on maps.

(e) More than one classification or subclass may be assigned to a parcel of land. Where this occurs, the resource requiring the highest level of protection will determine the management approach. For example, if a Focused Stewardship resource and a Special Stewardship resource exist on the same parcel, then the Special Stewardship resource will be given the emphasis in the management of the resources. If multiple resources exist on a parcel and they are all within the same classification i.e. Focused Stewardship or Special Stewardship, the management approach will seek to achieve the goals for all of the identified resources to the maximum extent practicable.

(f) For the purposes of protecting threatened and endangered species and certain specific sites used by threatened and endangered species, locations of specific sites, such as nest trees and roosting trees, will not be displayed on classification maps. Broader geographic areas within which the sites exist will be displayed. The appropriate size of the area to be displayed may vary with the specific site.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.050
Hist.: DOF 1-1999, f. & cert. ef. 5-13-99

629-035-0060

Changes to Forest Land Management Classifications

The State Forester may make changes to the district land management classification maps as follows:

(1) Minor changes. The District Forester may recommend minor changes to the Area Director for approval. The District Forester may offer a 30-day public comment period prior to making any recommendations and shall forward any public comments with the recommendations to the Area Director for approval.

(2) Major changes. The District Forester may recommend major changes to the Area Director for review and the State Forester for approval. Prior to seeking approval, the district shall offer a 30-day public comment period on the proposed changes. Any public comments received shall be submitted to the State Forester with the request for approval.

(3) As used in this section:

(a) "Minor change" means:

(A) Any change in Land Management Classification that affects 160 acres or less, and involves land classification within, but not across, the Land Base Designation classes of Silviculturally Capable or Non-Silviculturally Capable; or

(B) Any change that affects ten acres or less involving land classification changes across the Land Base Designation classes of Silviculturally Capable or Non-Silviculturally Capable, and the District Forester determines this change is not likely to substantially affect the management of forest resources.

(b) "Major change" means any change not defined as minor. Minor changes within a district that cumulatively exceed 500 acres within one year shall be deemed a major change.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.010 - ORS 530.050
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98

629-035-0070

Forest Land Exchanges and Acquisitions

(1) The District Forester shall recommend an amendment to the district land designations and management classifications of state-owned forest lands under OAR 629-035-0040 to 629-035-0050 when lands are added to or removed from the district land base.

(2) The District Forester shall provide a 30-day public comment period on the proposed amendments.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.010 - ORS 530.050
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98

629-035-0080

Public Involvement

(1) The goals for public involvement in forest land planning are:

(a) To seek insight, opinions, and data on planned management actions on state-owned forest lands.

(b) To build understanding, acceptance, and support for the forest resource management planning processes and decisions.

(c) To offer information to the public about forest systems and forest stewardship.

(d) To provide the public with meaningful opportunities to comment and affect planning decisions at a time when public involvement can contribute positively to the planning decisions under consideration.

(2) Opportunities for public involvement shall be appropriate to the planning decision under consideration and shall include one or more of the following: general public access to decisions, a public comment period, a Board meeting, public meeting, public hearing, or focused technical review.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.010 - ORS 530.050
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98

629-035-0090

Consultation with Forest Trust Land Advisory Committee

As provided in ORS 526.156(3), the Forest Trust Land Advisory Committee shall advise the Board and the State Forester on the management of lands subject to the provisions of ORS 530.010 to 530.170, and on other matters in which counties may have a responsibility pertaining to forest land. The Board and the State Forester shall consult with the committee with regard to such matters.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 526.156(3)
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98

629-035-0100

Existing Long Range Plans

(1) The Board considers long range plans approved by the Board prior to the effective date of these rules to be consistent with OAR 629-035-0010 to 629-035-0090 and directs the State Forester to manage the forest lands covered by the plans according to those plans until the plan is modified or a new plan is adopted. Any modification of existing plans or any new plan shall be adopted in accordance with the provisions of OAR 629-035-0010 to 629-035-0090.

(2) Initial forest land base designations and management classifications developed pursuant to OAR 629-035-0040 through 629-035-0055 must be submitted to the State Forester for approval within one year of the adoption of an amended or new Forest Management Plan.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.010 - ORS 530.050
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98; DOF 1-2001(Temp), f. & cert. ef. 1-12-01 thru 7-10-01; DOF 4-2001, f. 4-26-01, cert. ef. 7-11-01

629-035-0105

Adopted Forest Management Plan Documents

(1) The following forest management plan documents have been adopted and incorporated by reference into this division:

(a) Northwest Oregon State Forests Management Plan, Final Plan, January 2001;

(b) Southwest Oregon State Forest Management Plan, Final Plan, January 2001.

(2) The forest management plan documents which have been incorporated by reference into this division are maintained by the State Forester at the Oregon Department of Forestry's headquarters in Salem, Oregon.

Stat. Auth.: ORS 526.016(4) and ORS 526.041

Stats Implemented: ORS 530.050
Hist.: DOF 2-2001, f. & cert. ef. 1-19-01

629-035-0110

Management of Common School Fund Lands

Common School Fund Lands managed by the State Forester under an agreement with the State Land Board shall be managed consistent with OAR 629-035-0030 through 629-035-0100 if the Agreement or the State Land Board so directs.

Stat. Auth.: ORS 526.016(4)
Stats. Implemented: ORS 530.490 - ORS 530.500
Hist.: DOF 2-1998; f. 1-15-98, cert. ef. 3-1-98