Volume I

Draft Environmental Impact Statement

for the Proposed Issuance of an Incidental Take Permit for the Elliott State Forest Habitat Conservation Plan

August 2008

Contents

Volume I

Page

Executive Summary ES-1

Chapter 1 Purpose and Need 1-1
1.1 Introduction 1-1
1.2 Purpose and Need for Action 1-3
1.2.1 Purpose for Action 1-3
1.2.2 Need for Action 1-3
1.2.3 Context 1-6
1.3 Environmental Review Process 1-12
1.3.1 Process Steps 1-12
1.3.2 Scoping 1-13
1.4 Relationship to Other Plans, Regulations, and Laws 1-13
1.4.1 Federal Permits and Consultation Requirements 1-15
1.4.2 State Permits and Consultation Requirements 1-16
1.5 Organization of This Environmental Impact Statement 1-17

Chapter 2 Alternatives 2-1
2.1 Alternatives Considered 2-1
2.2 Covered Activities Common to All Alternatives 2-1
2.2.1 Action Area, Management Activities, and Duration 2-1
2.3 Alternatives Analyzed in Detail 2-7
2.3.1 Alternative 1 - Current Management (No-Action) 2-7
2.3.2 Alternative 2 - Proposed Action 2-18
2.3.3 Alternative 3 – Increased Stream Buffers and Intensive Forestry 2-44
2.4 Alternatives Considered But Not Analyzed in Detail 2-58
2.4.1 Combined Reserves and Intensive Forestry 2-58
2.4.2 Northwest Forest Plan Riparian Reserve Area Stream Buffer Widths 2-58
2.4.3 Wood Emphasis 2-59
2.4.4 Conservation Emphasis 2-60

Chapter 3 Affected Environment 3-1

Section 3.0 Action Area and Study Area 3.0-1

Section 3.1 Forest Conditions 3.1-1
3.1.1 Sources of Information 3.1-1
3.1.2 Affected Environment 3.1-1
3.1.2.1 Forest Condition 3.1-1
3.1.2.2 Forest Health 3.1-5
3.1.2.3 Fuel Conditions and Fire Regime 3.1-5
3.1.2.4 Timber Harvest 3.1-6
3.1.2.5 Non-Timber Forest Products 3.1-8
3.1.2.6 Forest Chemicals 3.1-9

Section 3.2 Soils and Slope Stability 3.2-1
3.2.1 Sources of Information 3.2-1
3.2.2 Affected Environment 3.2-1
3.2.2.1 Topographic Conditions 3.2-1
3.2.2.2 Climatic Conditions 3.2-2
3.2.2.3 Geologic Conditions 3.2-2
3.2.2.4 Soil Characteristics 3.2-3
3.2.2.5 Slope Stability 3.2-7
3.2.2.6 Road System in the Action Area 3.2-9
3.2.2.7 Activities in the Action Area Affecting Soil and Slope Stability 3.2-10

Section 3.3 Streams, Water Quality, and Water Quantity 3.3-1
3.3.1 Sources of Information 3.3-1
3.3.2 Affected Environment 3.3-2
3.3.2.1 Study Area 3.3-2
3.3.2.2 Streams 3.3-9
3.3.2.3 Classification by Gradient and Confinement 3.3-13
3.3.2.4 Water Quality 3.3-18
3.3.2.5 Water Quantity 3.3-27

Section 3.4 Vegetation 3.4-1
3.4.1 Sources of Information 3.4-1
3.4.2 Affected Environment 3.4-1
3.4.2.1 Ecoregions in the Study Area 3.4-1
3.4.2.2 Vegetation Types in the Study Area 3.4-2
3.4.2.3 Rare Plant Occurrences 3.4-11

Section 3.5 Fish and Their Habitat 3.5-1
3.5.1 Sources of Information 3.5-1
3.5.2 Affected Environment for the Fish Species of Interest 3.5-1
3.5.2.1 Coho Salmon 3.5-3
3.5.2.2 Chinook Salmon 3.5-24
3.5.2.3 Chum Salmon 3.5-29
3.5.2.4 Steelhead 3.5-30
3.5.2.5 Coastal Cutthroat Trout 3.5-33

3.5.2.6 Pacific Lamprey 3.5-36
3.5.2.7 River Lamprey.....3.5-38
3.5.2.8 Western Brook Lamprey 3.5-40
3.5.3 Affected Environment of Aquatic Habitats in the Study Area.....3.5-41
3.5.3.1 Watershed Condition 3.5-41
3.5.3.2 Riparian Functions and Current Riparian Condition 3.5-49
3.5.3.3 Aquatic Habitats.....3.5-64

Section 3.6 Wildlife and Their Habitat.....3.6-1
3.6.1 Sources of Information.....3.6-2
3.6.2 Affected Environment.....3.6-2
3.6.2.1 Northern Spotted Owl 3.6-3
3.6.2.2 Marbled Murrelet.....3.6-12
3.6.2.3 Bald Eagle.....3.6-20
3.6.2.4 Northern Goshawk 3.6-23
3.6.2.5 Olive-Sided Flycatcher.....3.6-25
3.6.2.6 Western Bluebird 3.6-27
3.6.2.7 Fisher 3.6-28
3.6.2.8 Northern Red-Legged Frog.....3.6-30
3.6.2.9 Coastal Tailed Frog.....3.6-32
3.6.2.10 Southern Torrent Salamander 3.6-33
3.6.2.11 Game Species 3.6-34
3.6.2.12 Other Species 3.6-36

Section 3.7 Socioeconomics 3.7-1
3.7.1 Sources of Information.....3.7-1
3.7.2 Affected Environment.....3.7-1
3.7.2.1 Population 3.7-2
3.7.2.2 Employment Trends.....3.7-4
3.7.2.3 Timber Industry 3.7-6
3.7.2.4 Dependence on Elliott State Forest Timber Harvests.....3.7-8
3.7.2.5 Special Forest Products.....3.7-9
3.7.2.6 Wood Products Sustainability 3.7-9
3.7.2.7 Scenic Resources and Recreational Uses.....3.7-10
3.7.2.8 Funds Generated from County Property Taxation 3.7-10

Section 3.8 Cultural Resources.....3.8-1
3.8.1 Sources of Information.....3.8-1
3.8.2 Legal and Policy Requirements 3.8-1
3.8.2.1 Federal Regulations.....3.8-1
3.8.2.2 State of Oregon and Oregon Department of Forestry.....3.8-2
3.8.3 Affected Environment.....3.8-3
3.8.3.1 Prehistoric Setting.....3.8-4
3.8.3.2 Ethnography of Siuslaw and Coosan Peoples.....3.8-4
3.8.3.3 Historical Setting 3.8-5
3.8.3.4 History of the Elliott State Forest.....3.8-6
3.8.3.5 Known or Potential Prehistoric Sites in the Study Area 3.8-7
3.8.3.6 Known or Potential Historic Resources in the Study Area 3.8-8

Section 3.9 Recreation 3.9-1
3.9.1 Sources of Information 3.9-1
3.9.2 Affected Environment 3.9-1
3.9.2.1 Current Recreational Use in the Study Area 3.9-1
3.9.2.2 Current Approach to Recreation Management in the Study Area 3.9-3
3.9.2.3 State and Regional Recreation Trends 3.9-4
3.9.2.4 National Recreation Trends 3.9-5

Section 3.10 Air Quality 3.10-1
3.10.1 Sources of Information 3.10-1
3.10.2 Affected Environment 3.10-1
3.10.2.1 Climate 3.10-1
3.10.2.2 Air Quality Regulatory Constraints 3.10-2
3.10.2.3 Air Quality Trends 3.10-4

Section 3.11 Visual Resources 3.11-1
3.11.1 Sources of Information 3.11-1
3.11.2 Elliott State Forest Land Management Classifications 3.11-1
3.11.2.1 Special Stewardship-Visual 3.11-5
3.11.2.2 Focused Stewardship-Visual 3.11-5
3.11.3 Affected Environment 3.11-5
3.11.3.1 Visual Character of Elliott State Forest 3.11-6

Section 3.12 Land Use 3.12-1
3.12.1 Sources of Information 3.12-1
3.12.2 Affected Environment 3.12-1
3.12.2.1 Elliott State Forest Land Ownership and Use 3.12-1
3.12.2.2 Adjacent Land Ownership and Uses 3.12-2
3.12.2.1 Management Requirements for State-Owned Lands 3.12-5
3.12.2.2 Management Requirements for Adjacent Private Lands 3.12-7
3.12.2.3 Management Requirements for Adjacent Federal Lands 3.12-8
3.12.2.4 Use of Elliott State Forest Roads for Adjacent Land Management 3.12-9

Volume II

Page

Chapter 4 Environmental Consequences 4-1

Section 4.0 Relevant Information for Assessing Project Effects 4.0-1
4.0.1 Action Area and Study Area 4.0-1
4.0.2 Duration and Management Activities 4.0-2
4.0.3 Alternatives Evaluated 4.0-2
4.0.3.1 Alternative 1 – Current Management (No-Action) 4.0-2
4.0.3.2 Alternative 2 – Proposed Action 4.0-4
4.0.3.3 Alternative 3 – Increased Stream Buffers and Intensive Forestry 4.0-5

Section 4.1 Forest Conditions 4.1-1
4.1.1 Approach and Methodology 4.1-1
4.1.2 Environmental Consequences 4.1-1
4.1.2.1 Consequences Common to All Alternatives 4.1-1
4.1.2.2 Alternative 1 – Current Management (No Action) 4.1-3
4.1.2.3 Alternative 2 - Proposed Action 4.1-18
4.1.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.1-20

Section 4.2 Soils and Slope Stability 4.2-1
4.2.1 Approach and Methodology 4.2-1
4.2.2 Environmental Consequences 4.2-2
4.2.2.1 Consequences Common to All Alternatives 4.2-2
4.2.2.2 Alternative 1 - Current Management (No-Action) 4.2-7
4.2.2.3 Alternative 2 - Proposed Action 4.2-11
4.2.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.2-14

Section 4.3 Streams, Water Quality, and Water Quantity 4.3-1
4.3.1 Approach and Methodology 4.3-1
4.3.1.1 Consequences Common to All Alternatives 4.3-1
4.3.2 Environmental Consequences 4.3-4
4.3.2.1 Alternative 1 - Current Management (No-Action) 4.3-4
4.3.2.2 Alternative 2 - Proposed Action 4.3-16
4.3.2.3 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.3-22

Section 4.4 Vegetation 4.4-1
4.4.1 Approach and Methodology 4.4-1
4.4.2 Environmental Consequences 4.4-1
4.4.2.1 Consequences Common to All Alternatives 4.4-1
4.4.2.2 Alternative 1 - Current Management (No-Action) 4.4-2
4.4.2.3 Alternative 2 - Proposed Action 4.4-3

4.4.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.4-3

Section 4.5 Fish and Their Habitat 4.5-1
4.5.1 Approach and Methodology 4.5-1
4.5.1.1 Fish Species and Species Guilds 4.5-1
4.5.1.2 Fish Habitat 4.5-4
4.5.2 Environmental Consequences 4.5-6
4.5.2.1 Aquatic Ecosystem 4.5-7
4.5.2.2 Fish Species - Biological Effects 4.5-99

Section 4.6 Wildlife and Their Habitat 4.6-1
4.6.1 Approach and Methodology 4.6-1
4.6.1.1 Northern Spotted Owl 4.6-1
4.6.1.2 Marbled Murrelet 4.6-6
4.6.1.3 Other Wildlife 4.6-8
4.6.2 Environmental Consequences 4.6-9
4.6.2.1 Northern Spotted Owl 4.6-9
4.6.2.2 Marbled Murrelet 4.6-66
4.6.2.3 Bald Eagle 4.6-88
4.6.2.4 Northern Goshawk 4.6-103
4.6.2.5 Olive-Sided Flycatcher 4.6-120
4.6.2.6 Western Bluebird 4.6-138
4.6.2.7 Fisher 4.6-143
4.6.2.8 Northern Red-Legged Frog 4.6-161
4.6.2.9 Coastal Tailed Frog 4.6-180
4.6.2.10 Southern Torrent Salamander 4.6-196
4.6.2.11 Game Species 4.6-203
4.6.2.12 Other Species 4.6-206

Section 4.7 Socioeconomics 4.7-1
4.7.1 Approach and Methodology 4.7-1
4.7.2 Environmental Consequences 4.7-1
4.7.2.1 Consequences Common to All Alternatives 4.7-2
4.7.2.2 Alternative 1 – Current Management (No-Action) 4.7-4
4.7.2.3 Alternative 2 - Proposed Action 4.7-6
4.7.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.7-7

Section 4.8 Cultural Resources 4.8-1
4.8.1 Approach and Methodology 4.8-1
4.8.2 Environmental Consequences 4.8-1
4.8.2.1 Consequences Common to All Alternatives 4.8-2
4.8.2.2 Alternative 1 – Current Management (No-Action) 4.8-2
4.8.2.3 Alternative 2 - Proposed Action 4.8-2
4.8.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.8-2

Section 4.9 Recreation 4.9-1
4.9.1 Approach and Methodology 4.9-1

4.9.2 Environmental Consequences 4.9-1
4.9.2.1 Consequences Common to All Alternatives 4.9-2
4.9.2.2 Alternative 1 – Current Management (No-Action) 4.9-3
4.9.2.3 Alternative 2 (Proposed Action) 4.9-4
4.9.2.4 Alternative 3 Increased Stream Buffers and Intensive Forestry 4.9-5

Section 4.10 Air Quality 4.10-1
4.10.1 Approach and Methodology 4.10-1
4.10.2 Environmental Consequences 4.10-1
4.10.2.1 Consequences Common to All Alternatives 4.10-2
4.10.2.2 Alternative 1 – Current Management (No-Action) 4.10-2
4.10.2.3 Alternative 2 - Proposed Action 4.10-5
4.10.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.10-6

Section 4.11 Visual Resources 4.11-1
4.11.1 Approach and Methodology 4.11-1
4.11.1.1 Concepts and Terminology 4.11-2
4.11.2 Environmental Consequences 4.11-3
4.11.2.1 Consequences Common to All Alternatives 4.11-7
4.11.2.2 Alternative 1 – Current Management (No-Action) 4.11-8
4.11.2.3 Alternative 2 - Proposed Action 4.11-10
4.11.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.11-11

Section 4.12 Land Use 4.12-1
4.12.1 Approach and Methodology 4.12-1
4.12.2 Environmental Consequences 4.12-1
4.12.2.1 Consequences Common to All Alternatives 4.12-1
4.12.2.2 Alternative 1 - Current Management (No-Action) 4.12-2
4.12.2.3 Alternative 2 – Proposed Action 4.12-3
4.12.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.12-4

Chapter 5 Cumulative Effects 5-1
5.1 Introduction 5-1
5.2 Approach and Methodology 5-1
5.2.1 Context for the Analysis 5-5
5.3 Land Use Plans Considered in the Cumulative Effects Analysis 5-8
5.4 Analysis of Cumulative Effects by Resource Topic 5-22
5.4.1 Forest Conditions 5-22
5.4.2 Soils and Slope Stability 5-23
5.4.3 Streams, Water Quality, and Water Quantity 5-24
5.4.4 Vegetation 5-25
5.4.5 Fish and Their Habitat 5-26
5.4.6 Wildlife and Their Habitat 5-27
5.4.7 Socioeconomics 5-36
5.4.8 Cultural Resources 5-37

5.4.9 Recreation 5-39
5.4.10 Air Quality 5-40
5.4.11 Visual Resources 5-41
5.4.12 Land Use 5-41

Chapter 6 References 6-1
6.1 Printed References 6-1
6.2 Personal Communications 6-37

Chapter 7 Distribution List 7-1

Chapter 8 List of Preparers 8-1

Acronyms and Abbreviations

Appendix A Riparian and Stream Channel Network Supporting Data

Tables

Volume I

Page

1-1 Species Proposed for Coverage in the Elliott State Forest Habitat Conservation Plan 1-2

1-2 Permits, Approvals, and Environmental Review and Consultation Requirements that May Be Required for the Proposed Alternatives 1-14

2-1 Key Terms Associated with Alternative 1 2-7

2-2 Federally Listed, Candidate, Proposed, and Protected Species Present or Potentially Present in the Action Area and Vicinity 2-9

2-3 Alternative 1—Management Basin Strategies 2-13

2-4 Alternative 1—Aquatic Riparian Strategy 2-16

2-5 Key Terms Associated with Alternative 2 2-19

2-6 Species Proposed for Coverage under Alternative 2 2-22

2-7 Alternative 2—Target Percentage of Advanced Structure Stands 2-24

2-8 Alternative 2—Management Standards for Fish-Bearing (Type F) Stream Riparian Management Areas 2-30

2-9 Alternative 2—Management Standards for Large and Medium Non-Fish-Bearing (Type N) Stream Riparian Management Areas 2-32

2-10 Alternative 2—Management Standards for Small Non-Fish-Bearing (Type N) Stream Riparian Management Areas 2-34

2-11 Alternative 2 – Management Prescriptions for Lakes, Ponds, and Wetlands....2-36

2-12 Alternative 2 – Management Prescriptions for Bogs, Seeps, and Springs....2-37

2-13 Key Terms Associated with Alternative 3....2-45

2-14 Summary of Forest Management Strategies, Aquatic Riparian Strategies, Wildlife Conservation Strategies, and Research and Monitoring Activities for Alternatives Evaluated in Detail....2-51

3.1-1 Summary of Existing Stand Structure Condition in the Study Area....3.1-4

3.1-2 Average Annual Timber Volume Sold and Acreage in the Past Decade in the Study Area (1997-2006)....3.1-8

3.2-1 Road Mileages by Landscape Position for Each Watershed in the Action Area....3.2-9

3.2-2 Road Mileages by Side Slope Class for Each Watershed in the Action Area....3.2-9

3.3-1 Extent of Management Basins in the Action Area....3.3-3

3.3-2 Length of Stream and Stream Density by Size Class for Each Major Watershed in the Action Area....3.3-9

3.3-3 Length of Fish-Bearing Streams by Watershed, Management Basin, Stream Class....3.3-14

3.3-4 Waterbodies Downstream of the Study Area on the 303(d) List or Having TMDLs....3.3-20

3.3-5 Mean Percent Shade for Active Channel Width Categories by Watershed....3.3-22

3.3-6 Predicted Temperature Ranges and Mean Temperature by Channel Width and Elevation....3.3-23

3.3-7 Anticipated Water Temperature for Streams More Than 10 Miles from Topographic Divide....3.3-24

3.3-8 Peak Flow Recurrence Intervals for the West Fork Millicoma River....3.3-29

3.3-9 Water Rights in the Study Area....3.3-31

3.3-10 Instream Water Rights for Streams Partially or Completely in the Action Area 3.3-32

3.4-1 Proportions of OR-GAP Vegetation Cover Types in the Study Area 3.4-5

3.4-2 Rare Plants Potentially Occurring in the Study Area 3.4-12

3.5-1. Fishes Located in Streams and Rivers in the Study Area 3.5-2

3.5-2 Adult Winter Steelhead Trout Escapement Estimates and Population Trends (1996) 3.5-32

3.5-3 Coastal Cutthroat Trout Abundance Estimates and Population Trends (1999) 3.5-36

3.5-4 Miles of Streams and Percent of Total by Watershed and Gradient Class 3.5-48

3.5-5 Stream Length (Miles) of Various Channel Sizes and Fish Uses in Action Area Watersheds 3.5-49

3.5-6 Oregon Minimum Diameter Requirements for Large Wood Placement Projects 3.5-52

3.5-7 Existing Stand Structure and Age Class Data from Riparian Areas by Watershed in the Study Area 3.5-61

3.5-8 Status of Culverts in Fish-Bearing Streams in the Action Area as of 2003 ..... 3.5-68

3.5-9 Average Gravel Percentages in Riffles for Inventoried Stream Reaches 3.5-72

3.5-10 Sediment Data in the Action Area Compared to ODFW Reference Streams 3.5-74

3.5-11 Large Wood Volume and Density in Action Area Streams and in Oregon Coastal Reference Streams 3.5-75

3.5-12 Key Piece Density in Action Area and Reference Streams by Stream Size 3.5-76

3.5-13 Average Pool Characteristics for Inventoried Stream Reaches of Less Than 4 Percent Gradient in the Action Area 3.5-78

3.5-14 Miles of Small and Medium Stream Reaches with Limited Pools and In-Channel Wood Loading Levels by Watershed in the Study Area 3.5-79

3.5-15 Miles of Large Stream Reaches with Limited Pools and In-Channel Wood Loading Levels by Watershed in the Study Area 3.5-79

3.5-16 Miles of Stream Reaches with Likely High Quality Summer Rearing Habitat Potential based on High Levels of In-Channel Wood Loading Levels and Adjacent Wood Recruitment Potential 3.5-80

3.5-17 Percent Pool Data in the Action Area Compared to ODFW Reference Streams 3.5-81

3.5-18 Stream Width-to-Depth Ratios in the Action Area Compared to ODFW Reference Streams (Active Channel Width/Active Channel Height) 3.5-90

3.5-19 Percent Stream Bank Erosion in the Action Area Compared to ODFW Reference Streams 3.5-91

3.6-1 Summary of Northern Spotted Owl Habitat in the Study Area 3.6-8

3.6-2 Number of Spotted Owls, Owl Activity Centers and the Crude Densities of Spotted Owl Activity Centers in the Study Area, 1993–1998 and 2003 ..... 3.6-9

3.6-3. Spotted Owl Activity Centers Reported In or Adjacent To the Study Area as of 2003 ..... 3.6-10

3.6-4 Estimates of Marbled Murrelet Population Size in 2000 through 2003 in Oregon 3.6-14

3.6-5. Mapped Marbled Murrelet Habitat in the Study Area 3.6-18

3.7-1 Population by County (Year 2006) 3.7-2

3.7-2 Population Sizes and Trends 3.7-2

3.7-3 Population Composition by Race and Hispanic Origin 3.7-3

3.7-4 Median Household Income and Population in Poverty in 2003 ..... 3.7-4

3.7-5 Non-Farm Employment by Industry (Annual Average 2005) 3.7-5

3.7-6 Unemployment Trends 3.7-6

3.7-7 Extent of State-Managed Forestland 3.7-6

3.7-8 Ownership of Forestland in the Study Area 3.7-7

Volume II

Page

4.1-1 Timber Harvest Levels for Each Watershed under the Alternatives 4.1-5

4.1-2 Extents of Structural Classes and Stands at Least 100 Years Old at Year 50 (2057) 4.1-6

4.1-3 Standing Forest Tree Volume on Harvestable Ground over 150-Year Period 4.1-16

4.1-4 Estimated Relative Extent of Herbicide Use 4.1-17

4.2-1 Changes in the Road System in the Action Area 4.2-4

4.2-2 Relative Risk of Landslide Initiation among the Alternatives 4.2-9

4.2-3 Extent of Protected Riparian Areas by Harvesting Restrictions 4.2-11

4.2-4 Extent of No-Harvest and Potential Partial Harvest (Mature Forest Condition Management) of Protected Riparian Areas by Stream Type 4.2-11

4.3-1 Surface Water Temperature Predictions: Distance-from-Divide Model for Mainstem Channel Sizes using Shade from 100-Year Site-Potential Tree Height for Red Alder 4.3-7

4.3-2 Surface Water Temperature Predictions: Distance-from-Divide Model for Mainstem Channel Sizes using Shade from 100-Year Site-Potential Tree Height for Douglas-Fir 4.3-7

4.3-3 Surface Water Temperature Predictions with View-To-Sky Model for Quartile Distributions of Shade and Active Channel Widths at Various Elevations along Large Channels at ODFW AIP Reference Sites 4.3-9

4.3-4 Extent of Clearcutting among the Alternatives 4.3-11

4.3-5 Early Structure Forest over Time in the Action Area 4.3-15

4.3-6 Likely Differences in Stream Temperature between Alternatives 4.3-19

4.5-1 Fish Species and Guilds of Species in the Study Area 4.5-3

4.5-2 Stream Length (Miles) of Various Channel Sizes and Fish Uses in Action Area Watersheds 4.5-7

4.5-3 Riparian Management Area Acres and Vegetation Stand Structure along All Stream Channels in Action Area under Alternative 1 ..... 4.5-20

4.5-4 Percentage of Early Structure Forest in Riparian Management Areas along Stream Channels in the Action Area over Time under All Alternatives 4.5-21

4.5-5 Percentage of Advanced Structure Forest in Riparian Management Areas along Type F Streams in the Action Area over Time under All Alternatives 4.5-23

4.5-6 Percentage of Advanced Structure Forest in Riparian Management Areas along All Stream Channels in the Action Area over Time under All Alternatives 4.5-24

4.5-7a Frequency of Advanced Structure Forest in RMAs along Fish-Bearing Streams in the Action Area over Time 4.5-25

4.5-7b. Frequency of Advanced Structure Forest in RMAs along All Channel Types in the Action Area over Time 4.5-25

4.5-8 Riparian Management Area Acres and Vegetation Stand Structure along All Stream Channels in the Action Area under Alternative 2 ..... 4.5-30

4.5-9 Riparian Management Area Acres and Vegetation Stand Structure along all Stream Channels in the Action Area under Alternative 3 ..... 4.5-36

4.5-10 Minimum Functional Log Sizes for Various Channel Widths 4.5-41

4.5-11 Desired Future Conditions for Riparian Stand Characteristics Based on ODFW AIP Reference Site Conditions 4.5-47

4.5-12 Likely Availability of Standing Wood Pieces from Various Alternative Riparian Management Strategies along Type F Streams in the Action Area 4.5-49

4.5-13 Likely Availability of Standing Wood Pieces from Various Alternative Riparian Management Strategies along Large and Medium Perennial Type N Streams in the Action Area 4.5-49

4.5-14 Likely Availability of Standing Wood Pieces from Various Alternative Riparian Management Strategies along Small Seasonal Type N Streams in the Action Area 4.5-51

4.5-15 Stand Conditions under Various Alternative Riparian Management Strategies using Interquartile Distributions of Reference Stand Characteristics 4.5-55

4.5-16 Current and Projected Instream Large Wood Volume in Action Area Streams by Management Basin 4.5-59

4.5-17 Potential Long-Term Effects on Fish Habitat under Alternative 1 by Species Guild 4.5-102

4.5-18 Potential Long-Term Effects on Fish Habitat under Alternative 2 by Species Guild 4.5-104

4.5-19 Potential Long-Term Effects on Fish Habitat under Alternative 3 by Species Guild 4.5-107

4.6-1 Summary of Projected Trends in Spotted Owl Habitat in the Study Area over the 50-Year Analysis Period 4.6-12

4.6-2 Habitat Conditions and Persistence Potentials for Spotted Owl Activity Centers In and Near the Study Area 4.6-47

4.6-3 Fate of Mapped Marbled Murrelet Habitat in the Study Area over 50 Years 4.6-67

4.6-4 Current and Projected Acres of Potentially Suitable Marbled Murrelet Habitat in the Study Area 4.6-69

4.6-5 Location of Potentially Suitable Marbled Murrelet Habitat in the Study Area at Year 50 ..... 4.6-73

4.6-6 Projected Harvest of Potentially Suitable Marbled Murrelet Habitat in the Study Area over 50 Years 4.6-74

4.6-7 Activities Restricted in the Vicinity of Known Occupied Marbled Murrelet Habitat under Alternative 1 ..... 4.6-75

4.6-8 Levels of Intermediate Structure and Advanced Structure Forest Combined in the Study Area 4.6-77

4.6-9 Mapped Marbled Murrelet Habitat Available for Harvest under Alternative 2 ..... 4.6-78

4.6-10 Forest Structural Conditions Associated with Occupied and Mapped Marbled Murrelet Habitat in the Study Area 4.6-78

5-1 Forest Product Volume in Thousand Board Feet by Land Ownership for Coos and Douglas Counties (1997 to 2003) 5-7

5-2 Proposed Land Use Allocations under the Western Oregon Plan Revisions for the Coos Bay District Resource Management Plan.....5-12

7-1 Agencies and Organizations Receiving the Draft EIS 7-1

8-1 List of Preparers – Elliott State Forest Environmental Impact Statement.....8-1

Figures

Volume I

Page

1-1 Elliott State Forest Vicinity Map 1-9

2-1 Alternative 1 (No-Action Alternative) Management Basins and Habitat Conservancy Areas 2-11

2-2 Alternative 2 (Proposed Action) Management Basins and Conservation Areas 2-27

2-3 Alternative 3 (Increased Stream Buffers and Intensive Forestry) Management Basins and Conservation Areas 2-49

3.1-1 Historical Timber Harvest Volume in the Study Area 3.1-8

3.2-1 Soil Resources in the Study Area 3.2-5

3.3-1 Watersheds Comprising the Study Area 3.3-5

3.3-2 Management Basins in the Action Area 3.3-7

3.3-3 Streams and Lakes in the Action Area 3.3-11

3.3-4 Stream Classifications for the Action Area 3.3-15

3.3-5 Average Monthly Flows for the West Fork Millicoma River 3.3-29

3.4-1 Level IV Ecoregions 3.4-3

3.4-2 OR-GAP Vegetation Cover Types 3.4-7

3.5-1 Coho Salmon Distributions in the Study Area 3.5-5

3.5-2 Coho Spawning and Rearing Habitat Distribution in the Study Area 3.5-7

3.5-3 Oregon Coast Coho Salmon Evolutionarily Significant Unit 3.5-11

3.5-4 Estimated Total Run Size, Including the Amount of Harvest and Spawning Escapement of Natural-Origin Spawners in the Oregon Coast Coho Evolutionarily Significant Unit 3.5-13

3.5-5 Independent Populations and Geographic Strata of the Oregon Coast Coho Evolutionarily Significant Unit 3.5-17

3.5-6 Estimated Spawning Escapement of Natural Origin Spawners in Action Area Streams 3.5-19

3.5-7 Twenty-Year Trend in Coho Salmon Spawner Abundance in Streams Originating in the Action Area and Streams in Other Portions of the Oregon Coast Range.....3.5-21

3.5-8 Oregon Coast Chinook Salmon Evolutionary Significant Unit.....3.5-27

3.5-9 Percent Riparian Stand Type by Size of Fish-Bearing Streams in the Action Area 3.5-57

3.5-10 Percent Riparian Stand Age by Size of Fish-Bearing Streams in the Action Area 3.5-59

3.5-11 Streamnet Barriers Identified by Record ID in the Action Area 3.5-65

3.5-12 High Intrinsic Potential for Coho Salmon in the Action Area and Study Area 3.5-83

3.5-13 Quality of Winter Rearing Habitat for Coho Salmon in the Study Area 3.5-85

3.5-14 Quality of Summer Rearing Habitat for Coho Salmon in the Study Area 3.5-87

3.11-1 Visual Resources in the Action Area 3.11-3

3.12-1 Land Ownership in Vicinity of the Action Area.....3.12-3

Volume II

Page

4.1-1 Umpqua Watershed – Early Structure over 50-Year Period.....4.1-7

4.1-2 Umpqua Watershed – Intermediate Structure over 50-Year Period 4.1-7

4.1-3 Umpqua Watershed – Advanced Structure over 50-Year Period 4.1-7

4.1-4 Umpqua Watershed – Stands over 100 Years Old.....4.1-7

4.1-5 Tenmile Watershed – Early Structure over 50-Year Period.....4.1-9

4.1-6 Tenmile Watershed – Intermediate Structure over 50-Year Period 4.1-9

4.1-7 Tenmile Watershed – Advanced Structure over 50-Year Period 4.1-9

4.1-8 Tenmile Watershed – Stands over 100 Years Old 4.1-9

4.1-9 Coos Watershed – Early Structure over 50-Year Period.....4.1-11

4.1-10 Coos Watershed – Intermediate Structure over 50-Year Period 4.1-11

4.1-11 Coos Watershed – Advanced Structure over 50-Year Period 4.1-11

4.1-12 Coos Watershed – Stands over 100 Years Old.....4.1-11

4.1-13 Forest-Wide – Early Structure over 50-Year Period 4.1-13

4.1-14 Forest-Wide – Intermediate Structure over 50-Year Period 4.1-13

4.1-15 Forest-Wide – Advanced Structure over 50-Year Period 4.1-13

4.1-16 Forest-Wide – Stands over 100 Years Old.....4.1-13

4.5-1 Comparison of Forest Trends in Stand Structural Components between Alternatives within a Standard Riparian Evaluation Width over 50 Years.....4.5-31

4.5-2 Large Wood Recruitment Potential from Streamside Tree Stands as a Function of Riparian Buffer Width.....4.5-42

4.5-3 Modeled Net Volume of Large Wood in Streams and Recruitment Distance Class 4.5-46

4.5-4 Example of Predicted Trends in Relative Density and Stocking (Trees/Acre) for an Unmanaged Douglas-Fir Stand Planted at 250 Trees per Acre on Site Index 120, as Modeled by ORGANON SMC 4.5-54

4.5-5 Trends in Early Stand Structure across the Action Area for the Alternatives over 50 Years 4.5-85

4.6-1 Trends in Spotted Owl Habitat in the Action Area under the Three EIS Alternatives 4.6-13

4.6-2 Trends in Spotted Owl Habitat in Basin 1 under the Three EIS Alternatives 4.6-15

4.6-3 Trends in Spotted Owl Habitat in Basin 2 under the Three EIS Alternatives 4.6-17

4.6-4 Trends in Spotted Owl Habitat in Basin 3 under the Three EIS Alternatives 4.6-19

4.6-5 Trends in Spotted Owl Habitat in Basin 4 under the Three EIS Alternatives 4.6-21

4.6-6 Trends in Spotted Owl Habitat in Basin 5 under the Three EIS Alternatives 4.6-23

4.6-7 Trends in Spotted Owl Habitat in Basin 6 under the Three EIS Alternatives 4.6-25

4.6-8 Trends in Spotted Owl Habitat in Basin 7 under the Three EIS Alternatives 4.6-27

4.6-9 Trends in Spotted Owl Habitat in Basin 8 under the Three EIS Alternatives 4.6-29

4.6-10 Trends in Spotted Owl Habitat in Basin 9 under the Three EIS Alternatives 4.6-31

4.6-11 Trends in Spotted Owl Habitat in Sub-Basin 10-A under the Three EIS Alternatives 4.6-33

4.6-12 Trends in Spotted Owl Habitat in Sub-Basin 10-B under the Three EIS Alternatives 4.6-35

4.6-13 Trends in Spotted Owl Habitat in Sub-Basin 10-C under the Three EIS Alternatives 4.6-37

4.6-14 Trends in Spotted Owl Habitat in Basin 11 under the Three EIS Alternatives 4.6-39

4.6-15 Trends in Spotted Owl Habitat in Basin 12 under the Three EIS Alternatives 4.6-41

4.6-16 Trends in Spotted Owl Habitat in Basin 13 under the Three EIS Alternatives 4.6-43

4.6-17 Trends in Advanced Structure Forest in the Study Area under the Three Alternatives 4.6-61

4.6-18 Projected Trends in Potentially Suitable Marbled Murrelet Habitat (Advanced Structure Forest with at least Eight Trees per Acre 32 Inches DBH or Larger) 4.6-71

4.6-19 Forest-Wide Trends in Bald Eagle Habitat over 50-Year Period 4.6-91

4.6-20 Basin 1 Trends in Bald Eagle Habitat over 50-Year Period 4.6-95

4.6-21 Basin 2 Trends in Bald Eagle Habitat over 50-Year Period 4.6-95

4.6-22 Basin 3 Trends in Bald Eagle Habitat over 50-Year Period 4.6-95

4.6-23 Basin 6 Trends in Bald Eagle Habitat over 50-Year Period 4.6-95

4.6-24 Basin 7 Trends in Bald Eagle Habitat over 50-Year Period 4.6-97

4.6-25 Basin 8 Trends in Bald Eagle Habitat over 50-Year Period 4.6-97

4.6-26 Basin 9 Trends in Bald Eagle Habitat over 50-Year Period 4.6-97

4.6-27 Basin 10 Trends in Bald Eagle Habitat over 50-Year Period 4.6-97

4.6-28 Basin 11 Trends in Bald Eagle Habitat over 50-Year Period 4.6-99

4.6-29 Basin 12 Trends in Bald Eagle Habitat over 50-Year Period 4.6-99

4.6-30 Basin 13 Trends in Bald Eagle Habitat over 50-Year Period 4.6-99

4.6-31 Forest-Wide Trends in Northern Goshawk Habitat over 50-Year Period 4.6-107

4.6-32 Basin 1 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-109

4.6-33 Basin 2 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-109

4.6-34 Basin 3 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-109

4.6-35 Basin 4 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-109

4.6-36 Basin 5 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-111

4.6-37 Basin 6 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-111

4.6-38 Basin 7 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-111

4.6-39 Basin 8 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-111

4.6-40 Basin 9 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-113

4.6-41 Sub-Basin 10-A Trends in Northern Goshawk Habitat over 50-Year Period 4.6-113

4.6-42 Sub-Basin 10-B Trends in Northern Goshawk Habitat over 50-Year Period 4.6-113

4.6-43 Sub-Basin 10-C Trends in Northern Goshawk Habitat over 50-Year Period 4.6-113

4.6-44 Basin 11 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-115

4.6-45 Basin 12 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-115

4.6-46 Basin 13 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-115

4.6-47 Forest-Wide Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-123

4.6-48 Basin 1 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-125

4.6-49 Basin 2 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-125

4.6-50 Basin 3 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-125

4.6-51 Basin 4 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-125

4.6-52 Basin 5 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-127

4.6-53 Basin 6 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-127

4.6-54 Basin 7 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-127

4.6-55 Basin 8 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-127

4.6-56 Basin 9 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-129

4.6-57 Sub-Basin 10-A Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-129

4.6-58 Sub-Basin 10-B Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-129

4.6-59 Sub-Basin 10-C Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-129

4.6-60 Basin 11 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-131

4.6-61 Basin 12 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-131

4.6-62 Basin 13 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-131

4.6-63 Forest-Wide Trends in Fisher Habitat over 50-Year Period 4.6-147

4.6-64 Basin 1 Trends in Fisher Habitat over 50-Year Period 4.6-149

4.6-65 Basin 2 Trends in Fisher Habitat over 50-Year Period 4.6-149

4.6-66 Basin 3 Trends in Fisher Habitat over 50-Year Period 4.6-149

4.6-67 Basin 4 Trends in Fisher Habitat over 50-Year Period 4.6-149

4.6-68 Basin 5 Trends in Fisher Habitat over 50-Year Period 4.6-151

4.6-69 Basin 6 Trends in Fisher Habitat over 50-Year Period 4.6-151

4.6-70 Basin 7 Trends in Fisher Habitat over 50-Year Period 4.6-151

4.6-71 Basin 8 Trends in Fisher Habitat over 50-Year Period 4.6-151

4.6-72 Basin 9 Trends in Fisher Habitat over 50-Year Period 4.6-153

4.6-73 Sub-Basin 10-A Trends in Fisher Habitat over 50-Year Period 4.6-153

4.6-74 Sub-Basin 10-B Trends in Fisher Habitat over 50-Year Period 4.6-153

4.6-75 Sub-Basin 10-C Trends in Fisher Habitat over 50-Year Period 4.6-153

4.6-76 Basin 11 Trends in Fisher Habitat over 50-Year Period 4.6-155

4.6-77 Basin 12 Trends in Fisher Habitat over 50-Year Period 4.6-155

4.6-78 Basin 13 Trends in Fisher Habitat over 50-Year Period 4.6-155

4.6-79 Forest-Wide Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-165

4.6-80 Basin 1 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-167

4.6-81 Basin 2 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-167

4.6-82 Basin 3 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-167

4.6-83 Basin 4 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-167

4.6-84 Basin 5 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-169

4.6-85 Basin 6 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-169

4.6-86 Basin 7 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-169

4.6-87 Basin 8 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-169

4.6-88 Basin 9 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-171

4.6-89 Basin 10 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-171

4.6-90 Basin 11 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-171

4.6-91 Basin 12 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-171

4.6-92 Basin 13 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-173

4.6-93 Forest-Wide Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-183

4.6-94 Basin 1 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-185

4.6-95 Basin 2 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-185

4.6-96 Basin 3 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-185

4.6-97 Basin 4 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-185

4.6-98 Basin 5 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-187

4.6-99 Basin 6 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-187

4.6-100 Basin 7 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-187

4.6-101 Basin 8 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-187

4.6-102 Basin 9 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-189

4.6-103 Basin 10 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-189

4.6-104 Basin 11 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-189

4.6-105 Basin 12 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-189

4.6-106 Basin 13 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-191

4.11-1 Representative Viewsheds of Forest Management from Roads Adjacent to the Action Area 4.11-5

5-1 Cumulative Effects Analysis Area 5-3

Executive Summary

Introduction

The Oregon Department of Forestry (ODF) has submitted an application to the U.S. Fish and Wildlife Service (FWS) to amend an existing incidental take permit (ITP) in accordance with section 10(a)(1)(B) of the Federal Endangered Species Act (ESA), as amended. and to the National Marine Fisheries Service (NMFS) for consideration of a new ITP The ODF is seeking this authorization so that activities associated with implementation of the revised *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a) comply with the ESA, while providing protection for three species listed under the ESA, and an additional 15 species currently not listed under the ESA. These species and their statuses appear in Table ES-1 below.

The Elliott State Forest (ESF) encompasses approximately 93,000 acres of State-owned forestlands in Coos and Douglas Counties. Managed out of ODF's Coos District Office (located in Coos Bay), the ESF lies on a contiguous block of land approximately 18 miles long from north to south, and about 16 miles wide from west to east.

Of the ESF lands, 91 percent are Common School Forest Lands, which are owned by the State Land Board. Oregon's constitution states that these lands must be managed for the greatest benefit for the people of the State of Oregon (State), consistent with the conservation of the resource under sound techniques of land management. Oregon's attorney general has concluded that the "greatest benefit for the people" is to use the land for schools and the production of income for the Common School Fund. The remaining lands are Board of Forestry Lands, which must be managed to secure the greatest permanent value to the citizens of Oregon.

The ESF is currently managed in accordance with the 1994 *Elliott State Forest Management Plan* (Oregon Department of Forestry 1994) and the 1995 *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 1995). The ODF holds an ITP for potential take of northern spotted owls on the ESF through 2055, but is seeking to extend their ITP coverage to marbled murrelet and coho salmon (both federally listed as threatened), and potentially 15 other unlisted species if those species are listed in the future (Table ES-1).

As part of its ITP applications to the FWS and NMFS (collectively the Services), ODF must submit an HCP that documents compliance with Section 10 of the ESA. As a result, ODF prepared the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008).

The proposed amendment of an ITP by FWS and issuance of an ITP by NMFS are Federal actions that may affect the human environment; and therefore, are subject to review under the National Environmental Policy Act (NEPA). As part of the NEPA and ESA processes, a Draft Environmental Impact Statement (DEIS) and supporting HCP are required to be circulated for public review and comment. Following a public comment period on the DEIS, the Services will review and respond to comments in writing and/or by the incorporation of changes to the proposed HCP and DEIS. The resulting Final Environmental Impact Statement (FEIS) will be made available to the public and those who commented on the DEIS. After a 30-day public comment period, FWS will prepare a ROD that will formally document its selected alternative, and will make its permit issuance decision.

Table ES-1 Species Proposed for Coverage in the Elliott State Forest Habitat Conservation Plan

	Listing Status		Federal Overseeing Agency
Species Name	**Federal**	**State**	
Birds			
Northern spotted owl	Threatened	Threatened	FWS
Strix occidentalis caurina			
Marbled murrelet	Threatened	Threatened	FWS
Brachyramphus marmoratus			
Bald eagle	Not Listed	Threatened	FWS
Haliaeetus leucocephalus			
Northern goshawk	Not Listed	State Sensitive/Critical	FWS
Accipiter gentilis			
Olive-sided flycatcher	Not Listed	State Sensitive/ Vulnerable	FWS
Contopus borealis			
Western bluebird	Not Listed	State Sensitive/ Vulnerable	FWS
Sialia mexicana			
Fish			
Coho salmon	Threatened	Sensitive / Critical	NMFS
Oncorhynchus kisutch			
Chinook salmon	Not Listed	Not Listed	NMFS
Oncorhynchus tshawytscha			
Chum salmon	Not Listed	Sensitive / Critical	NMFS

Species Name	Listing Status		Federal Overseeing Agency
	Federal	State	
Oncorhynchus keta			
Steelhead trout	Species of Concern	Sensitive / Vulnerable	NMFS
Oncorhynchus mykiss			
Coastal cutthroat trout	Species of Concern	Sensitive / Vulnerable	FWS
Oncorhynchus clarki clarki			
Pacific lamprey	Species of concern	Sensitive / Vulnerable	FWS
Lampetra tridentatus			
River lamprey	Species of concern	Not Listed	FWS
Lampetra ayresi			
Western brook lamprey	Not Listed	Not Listed	FWS
Lampetra richardsoni			
Mammals			
Fisher	Candidate	State Sensitive/Critical	FWS
Martes pennanti			
Amphibians			
Red-legged frog	Not Listed	State Sensitive/ Undetermined Status	FWS
Rana aurora			
Southern torrent salamander (HAS)	Not Listed	State Sensitive/ Vulnerable	FWS
Rhyacotriton variegatus			
Coastal tailed frog (HAS)	Not Listed	State Sensitive / Vulnerable	FWS
Ascaphus truei			

Source: Oregon Department of Forestry 2008
FWS = U.S. Fish and Wildlife Service
HAS = headwater amphibian species
NMFS = National Marine Fisheries Service

Duration and Management Activities

Analysis of the resources covered in this EIS is based on management of the ESF for the next 50-years. All alternatives would be implemented in accordance with the Oregon Constitution, policies of the State Land Board and Board of Forestry, and other applicable laws, including the State and Federal ESA and the Oregon Forest Practices Act (FPA).

The effects of forestland management activities have been evaluated for each resource area described in this EIS. A more detailed description of these

activities is provided in Section 2.2, Covered Activities Common to All Alternatives. The activities include:

- mechanized timber harvest (i.e., felling, bucking, yarding and loading);
- forest product transport;
- road and landing construction, use, maintenance, and abandonment;
- site preparation and tree planting;
- site fertilization;
- silvicultural practices;
- fire suppression;
- aquatic habitat restoration;
- rock pit activities development;
- other management activities, including vertebrate control and harvesting of minor forest products; and
- research and monitoring.

Purpose and Need

The purpose for this action is to allow for the Services to respond to ODF's application for ITPs, and for ODF to continue its forest management activities while complying with the ESA. If granted, the ITPs would authorize the incidental take of the listed species identified in Table ES-1. Additionally, provisions for coverage of unlisted species (Table ES-1) would be made by the Services so incidental take coverage could be provided if these species were listed in the future.

The need for this action is to provide protection and conservation for listed, proposed, and unlisted species, while providing for long-term management of State lands subject to the *Elliott State Forest Management Plan*. Technical discussions between the applicant and the Services during development of the HCP have considered specific criteria that must be satisfied before a decision can be reached on permit issuance. The determination of whether the ITP proposals have met these criteria will be made after the public has had an opportunity to comment on the DEIS and HCP. The decision on whether to amend the existing ITP (FWS) or issue a new ITP (NMFS) will be based on the Services' NEPA and ESA compliance determinations, and will be documented in an ESA Section 10 findings document, ESA Section 7 BO, and a NEPA decision document, which will be developed by both FWS and NMFS at the conclusion of the NEPA and ESA processes.

Alternatives

Three management strategies have been identified for detailed analysis in this EIS. In addition to the No-Action Alternative (Alternative 1), two action alternatives have been analyzed: Alternative 2 – Proposed HCP, and Alternative-3 – Increased Stream Buffers and Intensive Forestry.

Alternative 1 – Current Management (No-Action)

Under Alternative 1, the No-Action Alternative, ODF would manage the ESF in accordance with the 1994 *Elliott State Forest Management Plan* (Oregon Department of Forestry 1994) and the 1995 *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 1995). Lands would be managed as either reserve areas or timber production lands. Reserve areas would include lands with a primary purpose other than timber production, such as providing habitat for threatened or endangered species, or protecting streams and riparian areas (Oregon Department of Forestry 1995). All lands outside of reserve areas would be managed for timber production using a target harvest age to control timber harvest rates in each of 17 management basins.

Incidental take coverage would be provided for potential take of northern spotted owl within the ESF, in accordance with the FWS ITP and the associated 1995 HCP. ODF would continue to protect federally listed species not covered by an ITP (i.e., marbled murrelet and coho salmon) on a case-by-case basis to avoid incidental take.

Under Alternative 1, the ESF would be managed to achieve four primary objectives.

- Produce a sustainable, even-flow harvest of timber. Harvest volumes would average 26.00 million board feet (MMBF) annually in the first decade, and would increase to 28.48 MMBF annually by the fifth decade.
- Maintain 12 to 66 percent nesting-roosting-foraging (NRF) habitat for northern spotted owls in each of the 17 management basins (refer to Table 2-1 for a definition of key terms). For the management basins with target harvest ages of 135 years and older, NRF habitat would not be harvested until NRF habitat in the management basin reached the levels shown in Table 2-3. The ESF would be managed to maintain approximately 39,781 acres (43 percent of the ESF) in NRF habitat.
- Manage each management basin for northern spotted owl dispersal habitat, such that 50 percent of the basin acreage consists of stands of trees averaging 11 inches in diameter-at-breast-height (dbh) or larger, and with a canopy closure of 40 percent or greater.
- Manage 18,060 acres (19.5 percent) of the ESF as reserve areas for non-commodity values.

Alternative 1 is the baseline against which the effects of all other alternatives are compared in this EIS.

Alternative 2 – Proposed Action

Under Alternative 2 – Proposed Action, ODF would manage the ESF according to stand structure condition, as described in the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008). All lands outside of "conservation areas" would be managed for timber production based on stand structure conditions in each of 13 management basins. Similar to the reserve areas identified for Alternative 1, conservation areas would include lands with a primary purpose other than timber production, such as lands that provide habitat for a threatened or endangered species, protect streams and riparian areas, or provide other scenic, unique, or visual (SUV) resources.

The ODF would request ITP coverage for three federally listed species: northern spotted owl, marbled murrelet, and coho salmon. A total of 15 other unlisted species (Table ES-1) would also be covered under the ITP, if those species were federally listed within the term of the ITP. Under Alternative 2, the ESF would be managed to achieve four primary objectives.

- Maintain a sustainable, even-flow harvest of timber. Harvest volumes would average 39.68 MMBF annually in the first decade, and would remain at approximately that level throughout the term of the HCP.
- Maintain 40 to 60 percent of the ESF in advanced structure stands; 25 to 55 percent in intermediate structure stands; and 5 to 15 percent in early structure stands (refer to Table 2-5 for a definition of terms). Advanced structure stand targets would be set for each of the 13 management basins to be consistent with an overall range of 40 to 60 percent across the ESF (Table 2-7).
- Maintain approximately 24 percent, or 22,598 acres, of the ESF in conservation areas with little or no active management.
- Manage 50 percent of the advanced structure forest in the ESF to have at least 8 trees per acre at 32 inches dbh or larger.

Alternative 3 – Increased Stream Buffers and Intensive Forestry

Under Alternative 3, ODF would manage approximately 50 percent of the ESF in upland conservation areas and riparian management areas (RMA). Upland conservation areas would be established to provide habitat for wildlife species found in late successional habitat. The RMAs would be established around all streams on ESF and would be managed to maintain and restore riparian structure and function, enhance habitat conservation for wildlife species dependent on the transition zone between upslope and riparian areas, and to allow additional

connectivity between other conservation areas. Riparian management area widths under Alternative 3 would be larger than the stream buffer widths associated with Alternative 1. Some thinning could occur in RMAs to benefit species and attain mature forest conditions. In large part, this would contribute toward conserving 50 percent of the ESF in a reserve status. The remainder of the ESF would be managed intensively for timber on a short rotation (40 to 50 years).

Similar to Alternative 2, ODF would request ITP coverage for northern spotted owl, marbled murrelet, and coho salmon, as well as the 15 other unlisted species (Table ES-1).

Under Alternative 3, the ESF would be managed to achieve two primary objectives.

- Produce a sustainable, even-flow harvest of timber. Harvest volumes would average 33.46 MMBF annually in the first decade, and would remain at approximately that level over the next 50 years.
- Maintain approximately 50 percent (46,641 acres) of the ESF in upland conservation areas and RMAs.

Potential Effects of Alternatives

The potential environmental effects associated with these alternatives are summarized in Table ES-2 and described in detail in Chapter 4, Environmental Consequences.

Table ES-2 Summary of Potential Resource Effects Under Each Alternative

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Forest Conditions			
Potential Effects on Forest Health	Intensive forest management would likely maintain a healthy forest, with minimal infestation by pests or disease.	Same as Alternative 1	Same as Alternative 1
Potential Increases in Fire Rates	The increased extent of clearcut harvest over current levels would increase ladder fuels in pre-thinned plantations. These increases would not likely materially increase losses from fire in the action area because frequencies of ignition are expected to remain small.	Same as Alternative 1	Same as Alternative 1
Changes in the Extent of Timber Harvest	The average clearcut acreage would increase to 561 acres per year (104 acres or a 23 percent increase relative to current conditions) over the next 50 years, and the average thinning acreage would increase to 767 acres per year (411 acres or a 115 percent increase relative to historic average). Average clearcut and thinning acreages would generally increase in all watersheds.	Clearcut harvest acreage would be 670 acres per year (109 acres or 20 percent increase relative to Alternative 1), and the average thinning acreage would be 1,132 acres per year (356 acres or a 50 percent increase relative to Alternative 1). Clearcut harvest acreages in the Umpqua and Tenmile Watersheds would be greater than Alternative 1, but less in the Coos Watershed. Thinning acreage would increase in all watersheds relative to Alternative 1.	Clearcut harvest acreage would be about 618 acres per year (57 acres or 10 percent increase relative to Alternative 1). Thinning acreage would average 619 acres per year (148 acres or 19 percent less than Alternative 1). Clearcut harvest acreages in the Umpqua and Tenmile Watersheds would be greater than Alternative 1, but less in the Coos Watershed. Thinning acreages would decrease in the Umpqua and Coos Watersheds, and slightly increase in the Tenmile Watershed, relative to Alternative 1.
Changes in the Extent of Harvest Volume	Harvest volumes would average 27.82 MMBF over the next 50 years (1.71 MMBF or a 7 percent increase over current conditions). Timber harvested from the Coos Watershed would be less than what was historically harvested, but timber harvested from the Tenmile and Umpqua Watersheds would be greater.	Harvest volumes would average 39.79 MMBF over the next 50 years (11.97 MMBF or 43 percent increase relative to Alternative 1). Increases in harvest volumes would be realized in all three watersheds.	Harvest volumes would average 33.45 MMBF over the next 50 years (5.53 MMBF or 20 percent increase relative to Alternative 1). Increases in harvest volumes would be realized in the Tenmile and Umpqua Watersheds; harvest volumes would decrease in the Coos Watershed relative to Alternative 1.
Changes in Forest Structure			
Early structure forest	The extent of early structure forest would increase about 6,500 acres (93 percent) from the current extent over the next 50 years. Increases in early structure forest would be realized in all watersheds.	The extent of early structure forest would increase by 854 acres (6 percent) relative to Alternative 1 over the next 50 years. These increases would only be realized in the Umpqua and Tenmile Watersheds; the extent of early structure would decrease relative to Alternative 1 in the Coos Watershed.	The extent of early structure forest would decrease by 1,246 acres (9 percent) relative to Alternative 1 over the next 50 years. This decrease would only be realized in the Coos Watershed; the extent of early structure would increase in the Umpqua and Tenmile Watersheds relative to Alternative 1.
Intermediate structure forest	The extent of intermediate structure forest would diminish about 16,800 acres (37 percent) from the current extent over the next 50 years. Decreases would be realized in all watersheds.	The extent of intermediate forest structure would increase about 3,638 acres (13 percent) relative to Alternative 1 over the next 50 years. These increases would be realized in all of the watersheds.	The extent of intermediate forest structure would increase about 3,061 acres (11 percent) relative to Alternative 1 over the next 50 years. These increases would be realized in the Tenmile and Umpqua Watersheds; the extent of intermediate forest structure would decrease in the Coos Watershed relative to Alternative 1.
Advanced structure forest	The extent of advanced structure forest would increase about 10,300 acres (26 percent) from the current extent over the next 50 years. Increases would be realized in all watersheds.	The extent of advanced structure forest would decrease by about 4,503 acres (9 percent) relative to Alternative 1 over the next 50 years. These decreases would be realized in the Umpqua and Tenmile Watersheds; the extent of advanced structure would increase relative to Alternative 1 in the Coos Watershed.	The extent of advanced structure forest would decrease by about 1,808 acres (4 percent) relative to Alternative 1 over the next 50 years. These decreases would be realized in the Umpqua and Tenmile Watersheds; the extent of advanced structure would increase relative to Alternative 1 in the Coos Watershed.
Forests Over 100 years Old	The extent of forests over 100 years old would decrease about 3,000 acres (7 percent) from the current extent over the next 50 years. Decreases would be realized in all watersheds.	The extent of forests over 100 years old would decrease by about 8,680 acres (22 percent) relative to Alternative 1 over the next 50 years. These decreases would be realized in all watersheds.	The extent of forests over 100 years old would decrease by about 9,204 acres (23 percent) relative to Alternative 1 over the next 50 years. These decreases would be realized in all watersheds.
Sustainability of Timber Yield	Standing wood volume on lands considered harvestable would increase over the next 50 years, and at least through a 150-year planning horizon. Lands considered harvestable under Alternative 1 would produce a sustained yield of timber over the next 50 years.	Standing wood volume on lands considered harvestable would increase over the next 50 years, and at least through a 150-year planning horizon. Lands considered harvestable under Alternative 2 would produce a sustained yield of timber over the next 50 years.	Standing wood volume on lands considered harvestable would decrease over the next 50 years, and through the 150-year planning horizon, such that, at Year 150, stand wood volume would decline to 92 percent of current levels. Lands considered harvestable under Alternative 3 would produce a sustained yield of timber over the next 50 years, but would not be sustainable over a longer planning horizon.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Soils and Slope Stability			
Increases in Landslide Frequency, Rates of Runoff, and Sediment Yield Resulting From New Road Construction	New road construction has the potential to increase landslide frequency, rates of runoff, and sediment yield to action area streams. Most new road construction would be on generally stable ridgetops. The drainage design of new roads and their topographic position high in the watershed would reduce the potential for a direct hydrologic connection. Increases in road mileage would result in localized, small magnitude increases in runoff and sediment supply where new roads cross streams. These increases are unlikely to be detectable on spatial scales larger than a stream reach.	Same as Alternative 1, except that localized impacts would be greater than Alternative 1 due to additional road construction under Alternative 2.	Same as Alternative 1, except that localized impacts would be greater than Alternative 1 due to additional road construction under Alternative 3.
Increases in Soil Compaction and Resulting Rates of Runoff and Sediment Yield	Soils beyond roadways may be compacted when heavy equipment is driven or logs are dragged over them. Compaction can reduce infiltration and increase soil erosion. Cable yarding would be predominantly used to reduce soil compaction and potential erosion effects.	Same as Alternative 1	Same as Alternative 1.
Increases in Soil Hydrophobicity and Resulting Rates of Runoff and Sediment Yield	Burning to eliminate slash after timber harvest could reduce the infiltration capacity of soils and increase rates of runoff and sediment yield. Pile burning would occur on landings, where soil is already compacted, so no further reduction in infiltration capacity would occur. Broadcast burning would be timed to occur when soil moisture conditions are high enough to reduce increases in soil hydrophobicity. When performed using these methods, slash burning would likely case minimal increases in rates of runoff and sediment yield.	Same as Alternative 1.	Same as Alternative 1.
Increases in Landslide Frequency, Sediment Yield, and Stream Sedimentation from Clearcutting	Increases in clearcut harvest levels from current conditions could increase the potential for landslides in the action area, most notably in the Umpqua and Tenmile Watersheds. It is estimated that this increase would be minor (less than 1 percent) and not apparent among the natural temporal variation in landslide initiation. To reduce these potential effects, ODF would continue to evaluate field conditions during timber harvest planning to identify areas that indicate a high risk of slope instability.	Increases in clearcut harvest levels relative to Alternative 1could increase the potential for landslides in the action area, most notably in the Umpqua and Tenmile Watersheds. The landslide initiation risk factor for Alternative 2 is estimated to be less than 1 percent greater than for Alternative 1. Measures to reduce these effects would be the same as those described for Alternative 1, with the exception that trees would be left adjacent to debris-flow tracks and high energy seasonal channels to contribute to aquatic habitat quality.	Increases in clearcut harvest levels relative to Alternative 1could increase the potential for landslides in the action area, most notably in the Umpqua and Tenmile Watersheds. The landslide initiation risk factor for Alternative 3 is estimated to be less than 1 percent greater than for Alternative 1. Measures to reduce these effects would be the same as Alternative 1.
Soil Disturbance in Riparian Areas	Soil disturbance in riparian areas would be similar to current conditions. Measures to reduce soil erosion and sedimentation to streams would include no harvest and equipment limitation areas on perennial Type N and Type F streams. About 8, 257 acres would be protected in no harvest RMAs; soil disturbance in these areas would likely be minimal.	Alternative 2 would likely result in increased levels of soil disturbance, relative to Alternative 1, in the early to mid portions of the next 50 years due to management in the riparian zone for MFC. Soil erosion levels would likely be similar to Alternative 1 by the end of 50 years. The riparian prescriptions under Alternative 2 would protect about 3,321 acres in no harvest RMAs, and about 15,345 acres as areas that would be managed for MFC. Although the acreage of no harvest RMA would decrease 4,936 acres (60 percent) relative to Alternative 1, if management of the inner RMA zone results in relatively little soils disturbance (as anticipated), such that impacts to this zone would not be materially different from impacts in the no harvest zone, then the acreage of little or no disturbance would be 18,666 acres under Alternative 2.	Alternative 3 would likely result in decreased levels of soil disturbance, relative to Alternative 1 given the wide RMAs that would be provided on all streams. The riparian prescriptions under Alternative 3 would protect about 21, 400 acres as RMAs. Management for MFC, if approved by the Services and ODFW, outside of a 25-foot no harvest zone, could reduce this benefit.
Streams, Water Quality, and Water Quantity			
Increases in Runoff and Sediment Delivery to Streams Because of Additional Roads	Increases in road mileage would be unlikely to result in detectable increases in rates of runoff or sedimentation to streams at spatial scales greater than a stream reach. Increases in road mileage would result in localized, small magnitude increases in runoff and sediment supply where new roads cross streams (see Soils and Slope Stability above).	Same as Alternative 1, with the exception that localized impacts would be greater than Alternative 1 due to increased road construction under Alternative 2.	Same as Alternative 1, with the exception that localized impacts would be greater than Alternative 1 due to increased road construction under Alternative 3.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Application and Fate of Fertilizers and Forest Chemicals	Rain could mobilize fertilizer applied to targeted areas and carry it into action area streams. It is unlikely that fertilizer application would cause a substantial loading of surface waters given that fertilizer is not applied during wet weather. Herbicide use would increase relative to current conditions because herbicides are primarily used on clearcuts, and the acreage of clearcut harvest would increase over time under Alternative 1. Restrictions on herbicide application would vary with the location and method of application, but would generally reduce the potential for herbicide delivery to streams. Any introduction of herbicides to streams would likely be minimal and below detectable levels.	Similar to Alternative 1, with the exception that herbicide use could be slightly higher due to increased levels of clearcut harvest and road construction.	Similar to Alternative 1, with the exception that herbicide use could be slightly higher due to increased levels of clearcut harvest and road construction.
Effects on Water Rights Allocations, Watershed Use Zones, and Domestic Water Supplies	Allocations of surface waters under existing water rights and uses of water for community and individual supplies would not be affected.	Same as Alternative 1.	Same as Alternative 1.
Fire Suppression Activities	The withdrawal of water from streams for purposes of fire control would be infrequent, small, and similar to current uses.	Same as Alternative 1	Same as Alternative 1.
Coliform Bacteria in Scholfield Creek and Larson Slough	Contributions of coliform bacteria in Scholfield Creek and Larson Slough are attributed primarily to livestock use and would not be affected by activities within the action area.	Same as Alternative 1.	Same as Alternative 1.
Potential Effects on Water Temperature	RMA widths and silvicultural management options would reduce surface water temperatures on Type F and perennial Type N streams when compared to current conditions. Management for habitat enhancement within 100 feet of Type F streams could temporarily increase water temperature (due to decreased shade levels), but would likely result in long-term decreases in temperature. Small, seasonal Type N streams would not be flowing during the critical low flow summer season when surface water temperatures typically peak. Therefore, timber harvest impacts to these streams would not affect water temperature.	RMA widths on Type F and medium and large Type N streams would produce shade levels sufficient to maintain cool water temperatures in the long-term. Management for MFC in the riparian buffers of these streams would temporarily (a couple of decades) reduce shade levels relative to Alternative 1, but would also likely result in longer term decreases in stream temperature. Narrower no harvest buffers on small perennial Type N streams (25 feet) would be less protective than those under Alternative 1 (50 feet), and could result in local increases in peak stream temperature. On perennial, Type N streams, retention of 15 to 25 trees per acre in the inner RMA zone and retention of 80 percent shade within 500 feet of Type F streams would moderate potential increases in peak temperature. Small, seasonal Type N streams would not be flowing during the critical low flow summer season when surface water temperatures typically peak. Therefore, timber harvest impacts to these streams would not affect water temperature.	RMA widths on all streams under Alternative 3 would reduce surface water temperatures similar to Alternative 1. Thinning outside of 25-foot no harvest RMA to promote MFC could be allowed at the discretion of ODFW and the Services, it is unlikely that such thinning would affect stream temperatures. Small, seasonal Type N streams would not be flowing during the critical low flow summer season when surface water temperatures typically peak. Therefore, timber harvest impacts to these streams would not affect water temperature.
Potential Effects on Temperature in the Umpqua River	RMAs in the Umpqua Watershed would be managed for advanced structure forest, which would likely reduce thermal loading in the Umpqua River.	Similar to Alternative 1, with the exception that management for MFC in RMAs would likely be more extensive, and could temporarily reduce shade levels and increase surface water temperatures.	Similar to Alternative 1, with the exception that management for MFC in RMAs, if approved by ODFW and the Services, could temporarily reduce shade levels and increase surface water temperatures.
Potential Effects on Temperature in Larson Slough	RMAs would be managed for advanced structure, which would likely reduce thermal loading in Larson Slough.	Management for MFC in RMAs would be more extensive than Alternative 1, and would temporarily reduce shade levels and increase surface water temperatures.	Management for MFC in RMAs, if approved by ODFW and the Services, could temporarily reduce shade levels and increase surface water temperatures.
Increases in Landslides Related to Forest Practices	Increases in clearcut acreage relative to current conditions would increase the number and/or extent of landslides in the action area, which could increase turbidity and temperature in action area streams, and alter stream channel form. See Soils and Slope Stability above.	Increases in clearcut acreage under Alternative 2 would increase the number and/or extent of landslide in the action area relative to Alternative 1, which could increase turbidity and temperature in action area streams, and alternate stream channel form. See Soils and Slope Stability above.	Increases in clearcut acreage under Alternative 3 would increase the number and/or extent of landslide in the action area relative to Alternative 1, which could increase turbidity and temperature in action area streams, and alter stream channel form. See Soils and Slope Stability above.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Sediment Yield Affecting Tenmile Lakes	Forestry-related sediment yield would be similar to current conditions in the Tenmile Lakes area. The extent to which landslides would contribute inorganic phosphorus is unknown, but the effect of Alternative 1 would likely be minimal. Fertilizers used for forest management are not a source of phosphorous and would not contribute to the eutrophication of Tenmile Lakes.	The potential effects of landslide-related sediment on inorganic phosphorous to the Tenmile Lakes area relative to Alternative 1 is unknown, but would likely be minimal. Fertilizers used for forest management are not a source of phosphorous and would not contribute to the eutrophication of Tenmile Lakes	The potential effect of landslide-related sediment on inorganic phosphorous levels in the Tenmile Lakes area relative to Alternative 1 is unknown but would likely be minimal. Fertilizers used for forest management are not a source of phosphorous and would not contribute to the eutrophication of Tenmile Lakes
Riparian Area Disturbance Associated with Forest Practices	Increases in clearcut harvest relative to current conditions could increase the extent of riparian area soil disturbance and delivery of exposed soil materials to streams in the action area. This impact would be minimal due BMPs intended to reduce riparian area disturbance and soil erosion, and would be substantially smaller than erosion effects expected from landslides and form road-related effects. See Soils and Slope Stability above.	Similar to Alternative 1, although increases in clearcut harvest and management for MFC in riparian areas could increase this potential effect relative to Alternative 1. See Soils and Slope Stability above.	Increases in clearcut harvest under Alternative 3 relative to Alternative 1 could increase soil erosion; however, large RMAs would reduce the potential for delivery of exposed soil materials to streams. As such, the potential for sediment delivery to streams under Alternative 3 would be less than Alternative 1. See Soils and Slope Stability above.
Peak Flow Changes Due to Roads and Harvest	Forest management could affect peak flows on action area streams. The effect would occur because of both increased road mileage and increased clearcutting. Early structure forest would exceed 30 percent in five management basins during at least one 5-year period, which could result in measurable increases in peak flow at a management basin spatial scale during those periods. However, the planned amount of early structure forest would not likely be sufficient to cause any detectable change in peak flows with a greater than one year return interval, and thus would be unlikely to result in any detectable changes in sediment transport or channel form in stream channels on a spatial scale larger than a stream reach. Localized, small magnitude increases in peak flow would occur where timber harvest and road construction were concentrated in small drainages. .	Forest management could affect peak flows similar to Alternative 1. Early structure forest would exceed 30 percent in one management basin during at least one 5-year period, which could result in measurable increases in peak flow at a management basin scale during those periods. However, the planned amount of early structure forest would not likely be sufficient to cause any detectable change in peak flows with a greater than one year return interval, and thus would be unlikely to result in any detectable changes in sediment transport or channel form in stream channels on a spatial scale larger than a stream reach.. The overall potential effect on peak flow would be reduced compared to Alternative 1, where early structure forest would exceed 30 percent in three management basins. However, a greater number of localized, small magnitude increases could occur where timber harvest and road construction were concentrated in small drainage due to greater clearcut harvest under Alternative 2.	Forest management could affect peak flows similar to Alternative 1. Early structure forest would not exceed 30 percent in any of the management basins over the next 50 years under Alternative 3. As a result, detectable peak flow increases would be unlikely, and flow, water quality and habitat impairments would not expected to occur at a spatial scale larger than a stream reach. The overall potential effect on peak flows under Alternative 3 would be reduced compared to the effects anticipated under Alternative 1.However, a greater number of localized, small magnitude increases could occur where timber harvest and road construction were concentrated in small drainages due to greater clearcut harvest under Alternative 3.
Vegetation			
Potential Effects to Special-Status Plant Species	Ground disturbance associated with forest management activities have the potential to affect special-status plant species in the action area. Monitoring efforts during project planning would minimize potential effects to special status plant species. Riparian buffers around streams and other wet areas would further minimize potential effects to the two special-status plant species associated with wet areas.	Same as Alternative 1.	Same as Alternative 1.
Diversity of Vegetation Communities	Forest communities outside of reserve areas would generally be managed for timber production. Although levels of clearcut and thinning would increase relative to current conditions, conifer forest would continue to be the primary vegetation type in the action area and the current mix and relative extent of vegetation types would be maintained. The total amount of hardwood forest could decrease over time due to forest management, natural plant succession, and/or riparian enhancement that converts hardwood vegetative communities to other vegetation communities to enhance riparian function.	Forest communities outside of conservation areas would generally be managed for timber production, similar to Alternative 1. Although levels of clearcut and thinning would increase relative to Alternative 1, the current mix and relative extent of vegetation types would be maintained overall. The area of hardwood forest that would be converted to conifer would be slightly more under Alternative 2 because the total area of upland reserve would be less than Alternative 1, and because riparian enhancement projects in RMAs would occur more frequently under Alternative 2. As such, potential effects on the diversity of vegetation communities in the action area would be minor; however, effects to hardwood communities would be greater under Alternative 2than Alternative 1.	Forest communities outside of conservation areas would generally be managed for timber production, similar to Alternative 1. The level of clearcut harvest would increase relative to Alternative 1, and the level of thinning would decrease. However, the current mix and relative extent of vegetation types would be maintained overall. Conversions of hardwood forest would occur similar to Alternative 1, although conversion of riparian hardwood forest would be unlikely because RMAs would be wider and would be generally no harvest. As such, potential effects on the diversity of vegetation communities in the action area would be minor and less than Alternative 1.
Fish and Their Habitat			
Aquatic Ecosystem – Watershed Conditions			

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Changes in Natural and Human-Caused Disturbance	Fires would continue to be suppressed in the action area, which would reduce sediment runoff to streams attributable to fire over the next 50 years. Short term pulses of large wood to stream channels might increase over the next 50 years as a result of wind throw along the upland edge of RMAs. Landsliding along debris flow-prone channels would continue because Alternative 1 would not include provisions for leaving trees around such channels. Human-caused disturbances would continue to be managed by maintaining a network of RMAs on the landscape; placing limits on the rate of timber harvest; continuing ongoing efforts to repair or replace stream crossing culverts and disconnecting road drainage systems from the channel network, and by ensuring all road practices meet the requirements of the 1994 FMP and *Forest Roads Manual*. However both timber harvest and road construction would increase under Alternative 1 compared to current conditions, which could affect human-caused disturbances.	Similar to Alternative 1, fires would be suppressed in the action area under Alternative 2, which would limit sediment runoff to streams attributable to fire. The feathering approach of successive RMA zones under Alternative 2 and the protection of leave trees around debris flow-prone tracks, would likely represent a small, beneficial influence of added wood, more sediment retention, and reduced debris flow scour across the action area relative to Alternative 1. Human-caused disturbances would be managed by maintaining a network of RMAs on the landscape; placing limits on the rate of timber harvest; continuing ongoing efforts to repair or replace stream crossing culverts and disconnecting road drainage systems from the channel network, and by ensuring all road practices meet the requirements of the 2008 HCP and Forest Roads Manual. However, increased road construction and timber harvest would increase human-caused disturbance relative to Alternative 1.	Similar to Alternative 1, fires would be suppressed in the action area under Alternative 3, which would limit sediment runoff to streams attributable to fire. Wider RMAs under Alternative 3 would protect riparian areas from wind throw and would limit windthrow similar to Alternative 1. The protection of leave trees around debris flow-prone tracks would likely represent a small, beneficial influence of added wood, more sediment retention, and reduced debris flow scour across the action area relative to Alternative 1. Increased road construction and timber harvest would increase human-caused disturbance relative to Alternative 1.
Changes in Road Density and Location	Increases in road mileage over the next 50 years could increase the potential for roads to yield sediment to streams. Although additional roads would not be constructed parallel to or within 100 feet of stream channels, where possible, and very few road miles would be constructed on steep slopes, new roads would result in additional culverts and drainage ditches hydrologically connected to the stream network. All new roads would be constructed in accordance with the 1995 FMP and Forest Roads Manual to reduce the potential effects associated with road construction. It is anticipated that, at spatial scales larger than a stream reach, in-channel effects of increased sediment or water yield runoff as a result of road construction would be negligible and not substantially different than current conditions. Increases in road mileage would, however, result in localized, small magnitude increases in runoff and sediment supply where new roads cross streams.	Similar to Alternative 1, although the potential for new roads to yield sediments to streams would be somewhat increased due to additional road construction (31 miles or 5 percent more than Alternative 1) proposed under Alternative 2. All new roads would be constructed in accordance with the 2008 HCP and Forest Roads Manual to reduce the potential effects associated with road construction. It is anticipated that, at spatial scales larger than a stream reach, in-channel effects of increased sediment or water yield runoff as a result of road construction would be negligible and not substantially different than Alternative 1. Increases in new road construction compared to Alternative 1 would, however, result in localized, small magnitude increases in runoff and sediment supply where new roads cross streams.	Similar to Alternative 1, although the potential for new roads to yield sediments to streams would be somewhat increased due to additional road construction (15 miles or 2 percent more than Alternative 1) proposed under Alternative 3. All new roads would be constructed in accordance with the FPA and Forest Roads Manual to reduce the potential effects associated with road construction. It is anticipated that, at spatial scales larger than a stream reach, in-channel effects of increased sediment or water yield runoff as a result of road construction would be negligible and not substantially different than Alternative 1. Increases in new road construction compared to Alternative 1 would, however, result in localized, small magnitude increases in runoff and sediment supply where new roads cross streams.
Riparian Management Areas and Stand Structure Diversity	About 8,257 acres would be protected in RMAs around Type F and perennial Type N streams. Early structure forest in RMAs would increase 6 percent over the next 50 years, and advanced structure forest would increase 18 percent. Six of the management basins in the action area would exceed 15 percent early structure forest in RMAs over the next 50 years. Six management basins would exceed 15 percent early structure forest in RMAs over the next 50 years, and two would have more than 15 percent early structure forest in RMAs at the end of 50 years. All but two management basins would support at least 45 percent advanced structure forest in RMAs after 50 years.	About 25,371 acres would be protected in RMA around Type F and perennial Type N streams under Alternative 2 (17,114 acres more than Alternative 1). Although the no harvest zone would decrease by 4,936 acres under Alternative 2 compared to Alternative 1, the combined area of the no harvest streambank zone and inner RMA zone (where management for MFC would be allowed) would exceed the acreage in no harvest under Alternative 1 by 10,409 acres. Early structure forest in RMAs would increase about 4 percent (2 percent less than Alternative 1) after 50 years, and advanced structure forest in RMAs would increase 16 percent (2 percent less than Alternative 1). Two management basins (versus six under Alternative 1) would exceed 15 percent early structure forest in RMA over the next 50 years; none would exceed that threshold at the end of 50 years (versus 2 management basins under Alternative 1). All management basins would support at least 45 percent advanced structure forest in RMAs within the next 45 years, which would be an improvement compared to Alternative 1, where two management basins would not meet this target at the end of the 50 year period.	About 21, 400 acres would be protected in RMA around Type F and Type N streams under Alternative 3 (13,143 acres more than Alternative 1). Early structure forest in RMA would decrease 7 percent over the next 50 years (a decrease of 13 percent compared to Alternative 1), and advanced structure forest in RMA would increase 40 percent (22 percent more than Alternative 1. None of the management basins would have more than 15 percent early structure forest in RMA over the next 50 years (versus six management basins under Alternative 1). All of the management basins would support at least 45 percent advanced structure within the next 35 years, which would be an improvement compared to Alternative 1, where two management basins would not meet this target at the end of the 50 year period. In addition, the average time to reach the minimum advanced structure target would be 10 years shorter than Alternative 1.
Aquatic Ecosystem – Riparian Functions			

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Large Wood Recruitment Potential	Long-term growth of riparian vegetation within 100 feet of the RMA along Type F streams would likely provide more in-channel wood pieces and volumes over the next 50 years than what currently exists. Riparian protection measures within 50 feet of perennial Type N streams would add a source of large wood recruitment that would benefit downstream Type F streams by stabilizing channels, reducing streambank erosion, and helping decrease the downstream transport of coarse and fine sediments.	Riparian management provisions for streams greater than 50 feet in width would likely provide larger in-channel wood pieces and volume, at a faster rate than Alternative 1. Thinning in riparian areas would decrease available standing wood of functional sizes on small, medium and some large streams, compared to Alternative 1. Additional protections around debris flow channels and intermittent Type N streams not protected under Alternative 1 would benefit large wood recruitment potential.	Riparian management provisions for Type F streams would likely provide increasing wood recruitment and key piece sizes compared to Alternative 1. Additional protections around debris flow channels and intermittent Type N streams not protected under Alternative 1 would also increase large wood recruitment. Voluntary thinning would result in similar impacts as those described under Alternative 2.
Potential Effects on Bank Stability and Erosion	Stream bank integrity would be protected by no harvest buffers on all streams, with the exception of seasonal Type N streams. These prescriptions would likely maintain functioning channel bank conditions in the action area under Alternative 1.	No harvest RMAs and equipment limitation zones would protect streambank integrity along all streams in the action area. Additional riparian management prescriptions along high energy and debris flow reaches would reduce stream bank erosion compared to Alternative 1.	No harvest RMAs and equipment limitation zones would protect streambank integrity along all streams in the action area. Additional riparian management prescriptions along high energy and debris flow reaches would reduce stream bank erosion compared to Alternative 1.
Potential Increases in Nutrient Production	The concentration of nutrients in streams in the action area under would not be expected to change as a result of forest management activities, except that nutrient levels could be reduced as a result of hardwood conversions in RMAs.	Same as Alternative 1.	Same as Alternative 1.
Aquatic Ecosystem – Aquatic Habitats			
Effects on Fish Passage	Increases in road mileage would increase the potential for additional stream crossings in the action area. Such crossings would be constructed in accordance with the 1994 FMP and Forest Roads Manual and would not be expected to increase passage risk for fish. Nonetheless, the existence of a road system with culverts would retain a small level of risk to fish migration.	Similar to Alternative 1, with the exception that the potential for additional stream crossing would increase slightly due to additional road construction proposed under Alternative 2.	Similar to Alternative 1, with the exception that the potential for additional stream crossing would increase slightly due to additional road construction proposed under Alternative 3.
Changes in Sediment / Spawning Habitat	RMAs would increase gravel retention in Type F streams and increase fish spawning substrate relative to current conditions. Reduction of fine sediment input would reduce the potential for embeddedness of spawning sites compared to current conditions.	More rapid increases in potential large wood recruitment would result in improved gravel retention over time in Type F streams greater than 50 feet in width relative to Alternative 1. Fine sediment delivery would be reduced by leave trees around debris flow-prone channels.	More rapid increases in potential large wood recruitment would result in improved gravel retention over time in Type F streams greater than 50 feet in width relative to Alternative 1. Fine sediment delivery would be reduced by leave trees around debris flow-prone channels.
Changes in Surface Water Temperature	Effective shade would increase and the corresponding water temperature would decrease over the next 50 years, which would improve summer rearing habitat conditions for coldwater fish species.	Same as Alternative 1.	Same as Alternative 1.
Changes in Suspended Sediment	Increases in road mileage and timber harvest would increase the potential for sediment to be delivered to streams compared to current conditions. The lack of RMAs around debris flow-prone channels could result in sporadic and localized increased in suspended sediments, although such affects would be similar to current conditions. RMAs around Type F and perennial Type N streams would be effective at sediment removal and erosion control, although the lack of RMAs around small seasonal stream channels could increase sedimentation rates. It is unlikely that implementation of Alternative 1 would markedly increase suspended sediment, and subsequently influence fish habitat, at spatial scales larger than a stream reach over the next 50 years, when compared to current conditions. However, increases in road mileage and timber harvest would result in localized, small magnitude increases in sediment supply where new roads cross streams or timber harvest occurs adjacent to a stream.	Increases in road mileage and timber harvest would increase the potential for sediment to be delivered to streams relative to Alternative 1. Potential sediment delivery by debris flow-prone channels and seasonal Type N streams would be expected to decrease under Alternative 2 because of RMAs and leave tree requirements. RMAs around Type F and perennial Type N streams would be less effective at sediment removal and erosion control than Alternative 1 given that forest management for MFC would be allowed between 25 and 100 feet. Increased levels of road construction and timber harvest would result in additional localized, small magnitude increases in sediment supply where new roads cross streams or timber harvest occurs adjacent to a stream.	Increases in road mileage and timber harvest would increase the potential for sediment to be delivered to streams relative to Alternative 1. Potential sediment delivery by debris flow-prone channels and seasonal Type N streams would be expected to decrease under Alternative 3 because of RMAs and leave tree requirements. RMAs around Type F and perennial Type N streams would be less effective at sediment removal and erosion control than Alternative 1 given that forest management for MFC would be allowed between 25 and 100 feet. Increased levels of road construction and timber harvest would result in additional localized, small magnitude increases in sediment supply where new roads cross streams or timber harvest occurs adjacent to a stream.
Dissolved Oxygen	Reduced sediment input over time as a function of the surface erosion management controls, road management, and increases in large wood recruitment to channels would maintain dissolved oxygen levels similar to current conditions.	Same as Alternative 1.	Same as Alternative 1.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Forest Chemicals	The use of forest chemicals to control competing vegetation, kill noxious weeds, and maintain roads would occur in proportion to the rate of clearcut harvest and road construction. All herbicide applications would be done in accordance with EPA herbicide label requirements and FPR requirements to protect human health and the environment. The effects of forest chemical applications on fish and their habitat would not be anticipated to different than those experienced under current conditions.	Although forest chemicals would be used on a greater area due to increased clearcut harvest under Alternative 2, the potential effects of their use would be the same as Alternative 1.	Although forest chemicals would be used on a greater area due to increased clearcut harvest under Alternative 3, the potential effects of their use would be the same as Alternative 1.
Increases in Peak Flow and Potential Effects on Fish Habitat	Early structure forest would increase across the action area over time, although the overall small extent of such stands would be unlikely to result in measurable effects on peak stream flow at spatial scales larger than a stream reach. Early structure forest in five management basins exceeding 15 percent at various times over the next 50 years could result in potential increases in small peak flows, subsequent increases in coarse and fine sediment transport, and changes in scour depth and channel morphology.	Similar to Alternative 1, the extent of early structure forest would be less than 30 percent over the next 50 years in all but one management basin, making it unlikely that measurable effects of peak stream flow on channel conditions or fish habitat would occur at a spatial scale larger than a stream reach. The shifts in early structure forest under Alternative 2 would be of a lower magnitude and frequency than Alternative 1, and would affect fewer management basins.	The extent of early structure forest would be less than 30 percent over the next 50 years in all management basins, which would preclude measurable effects of peak stream flow on channel conditions or fish habitat at spatial scales larger than a stream reach under Alternative 3. The shifts in early structure forest under Alternative 3 would be of a lower magnitude and frequency than Alternative 1.
Changes in the Drainage Network	No new roads would be constructed parallel to or within 100 feet of streams, where possible, and all roads would be constructed in accordance with the 1994 FMP and Forest Roads Manual. These prescriptions would reduce the potential for hydrologic connectivity of roads to streams, and would likely improve current road drainage conditions over time. Nonetheless, the existence of a road network would maintain some degree of hydrologic connectivity to streams, with effects comparable to those experienced under current conditions, or slightly greater.	Similar to Alternative 1, with the exception that an additional increase in road mileage would increase the potential for hydrologic connectivity of roads and the stream network relative to Alternative 1.	Similar to Alternative 1, with the exception that an additional increase in road mileage would increase the potential for hydrologic connectivity of roads and the stream network relative to Alternative 1.
Changes in Floodplain Connectivity	Anticipated increases in in-channel wood loading would enhance floodplain connectivity compared to current conditions along most Type F streams.	Similar to Alternative 1, with the exception that forecasted increases in in-channel wood loading could enhance floodplain connectivity at a quicker rate due to MFC in the inner RMA zone.	Similar to Alternative 1, with the exception that increases in in-channel wood from stands in excess of 100 years could enhance floodplain connectivity compared to Alternative 1. In addition, if thinning outside of a 25-foot no harvest RMA were approved by the Services and ODFW, increases in in-channel wood loading could enhance floodplain connectivity at a quicker rate.
Changes in Pools and Off-Channel Habitat / Refugia	Wood loading levels, gravel retention, and pool frequencies would increase over the next 50 years under Alternative 1, which would improve habitat complexity and areas of off-channel habitat and refugia, Alternative 1 would maintain current watershed processes, and maintain or improve the quality of habitat that potentially functions as watershed-scale refugia for fish populations.	Increases in potential large wood and gravel recruitment over time would improve habitat complexity and areas of off-channel habitat and refugia, including pools relative to Alternative 1. Pool frequencies would be maintained or reduced along small, medium, and large streams less than 50 feet in width due to silvicultural thinning in the inner RMA zone. Improvements in the quality of habitat that potentially functions as watershed-scale refugia for fish populations would be similar to or greater than Alternative 1.	Increases in potential large wood and gravel recruitment over time would improve habitat complexity and areas of off-channel habitat and refugia, including pools, relative to Alternative 1. Pools frequencies would be increased along Type N streams because of the increased large wood recruitment potential. Pool frequencies would be maintained or reduced along small, medium, and larger streams less than 50 feet in width due to voluntary thinning in the RMA. Improvements in the quality of habitat that potentially functions as watershed-scale refugia for fish populations would be similar to or greater than Alternative 1.
Changes in Channel Cross Sections	In-channel width-to-depth ratios would improve (decrease) in Type F streams with increases in instream wood levels and overall complexity of streams compared to current conditions. Fish habitat complexity and productivity would subsequently increase.	Similar to Alternative 1, with the exception that improvements in width-to-depth ratios would occur more quickly and also in Type N streams.	Similar to Alternative 1, with the exception that improvements in width-to-depth ratios would occur more quickly and also in Type N streams.
Effects on Aquatic Guilds			
Salmonid Fish Guild	Increases in riparian stand structure; reductions in water temperature; increases in large wood recruitment potential; improvements in pool frequency and quality; increases in development of refugia; and enhanced channel conditions would improve habitat conditions for fish in the salmonid fish guild . These improvements would also benefit the lamprey species in this guild.	Habitat conditions for water quality, habitat access, habitat elements, channel condition, and watershed condition would be the same as Alternative 1, and would result in increased riparian stand structure; large wood recruitment potential; pool frequency and quality; and refugia. These improvements would also benefit the lamprey species in this guild.	Habitat conditions for water quality, habitat access, habitat elements, channel condition, and watershed condition would be the same as Alternative 1, and would result in increased riparian stand structure and large wood recruitment potential along Type N and Type F streams after 100 years. These improvements would also benefit the lamprey species in this guild.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Warm Water / Low Elevation (Lotic) Fish Guild	Species of this guild would benefit from enhanced development of off channel habitats. Cooling surface water temperatures would restrict the distribution of the species of this guild to the lowermost portions of the watersheds.	Increases in key piece-sized large wood loading, and further increases in side channel habitat frequency, complexity, and diversity, relative to Alternative 1 would benefit the species in this guild. Cooling surface water temperatures would restrict the distribution of the species of this guild to the lowermost portions of the watersheds.	Increases in key piece-sized large wood loading, and further increases in side channel habitat frequency, complexity, and diversity, relative to Alternative 1 would benefit the species in this guild. Cooling surface water temperatures would restrict the distribution of the species of this guild to the lowermost portions of the watershed
Slack Water (Lentic) Fish Guild	Species of this guild would benefit from enhanced development of off channel habitats. Increases in large wood recruitment would result in improved habitat complexity.	Increases in key piece-sized large wood loading, and further increases in side channel habitat frequency, complexity, and diversity, relative to Alternative 1, would benefit the species in this guild.	Increases in key piece-sized large wood loading, and further increases in side channel habitat frequency, complexity, and diversity, relative to Alternative 1, would benefit the species in this guild.
Wildlife and Their Habitat			
Northern Spotted Owl			
Habitat at the Landscape Level	The amount of suitable spotted owl habitat in the action area would increase by about 9,229 acres over the next 50 year under Alternative 1. Trends within individual management basins or subbasins would be variable. The potential for owls to persist in the action area overall and in nine out of 13 basins would be high; the potential for owls to persist in the remaining four basins would be moderate to low. At least 64 percent of the suitable habitat would be NRF habitat in all years.	The amount of suitable spotted owl habitat in the action area would increase by about 3,071 acres over the next 50 year under Alternative 2. Trends within individual management basins and subbasins would be variable. All management basins would retain the potential to support viable populations of spotted owls over the entire 50 year period, but the risk of having insufficient habitat in some management basins would be greater than under Alternative 1. NRF habitat would make up at least 62 percent of the total suitable habitat at all times. Compared to Alternative 1, Alternative 2 would result in 1,450 fewer acres of suitable spotted owl habitat in the action area at the lowest point (36,572 acres vs. 35,122 acres), 6,149 fewer acres of habitat in the action area at Year 50 (47,864 acres vs. 41,720 acres), more years in which the action area would be below 40 percent suitable habitat (5 years versus. 25 years), and a smaller percentage of suitable habitat consisting of NRF at Year 50 (68 percent versus. 61 percent).	The amount of suitable spotted owl habitat in the action area would show a net decrease of 5,593 acres over the next 50 years under Alternative 3. The size of the net decrease would be partly due to not counting any advanced structure forest in RMAs as potentially suitable spotted owl habitat if it is not bordered by forest at least 70 years old outside the RMA, some of this habitat may still be used by spotted owls. Trends within individual management basins and subbasins would be variable, but most management basins would show net decreases relative to the current condition. Compared to Alternative 1, Alternative 3 would result in less suitable habitat in the action area at the lowest point (36,572 acres versus. 27,553 acres), considerably less habitat in the action area at Year 50 (47, 864 acres versus. 33,056 acres), more years in which the action area would be below 40 percent suitable habitat (5 years versus. 50 years), and a smaller percentage of suitable habitat consisting of NRF at Year 50 (68 percent versus 58 percent).
Habitat for Individual Activity Centers	Three of the 17 known spotted owl activity centers would have sufficient suitable habitat under Alternative 1 to give resident owls a high potential for persistence. An additional two activity centers would have sufficient habitat to give resident spotted owls a moderate potential for persistence; three activity centers would have a low to moderate potential for persistence; and the remaining nine would have low potential for persistence under Alternative 1.	Compared to Alternative 1, Alternative 2 would increase the potential for persistence of known resident spotted owls in the action area. Four of the 17 known spotted owl activity centers would have high potential for persistence and another four would have a moderate to high potential for persistence under Alternative 2. Only seven activity centers would have low potential for persistence under Alternative 2, compared to nine under Alternative 1. The potential for persistence would go up for six activity centers under Alternative 2, the potential would go down for two, and the potential would stay the same for nine.	Alternative 3 would decrease the potential for persistence of some resident spotted owls when compared to Alternative 1, and increase it for others. One of the 17 known spotted owl activity centers would have high potential for persistence and another eight would have a moderate potential for persistence under Alternative 3. Eight activity centers would have low potential for persistence, compared to nine under Alternative 1. The potential for persistence would go up for five activity centers under Alternative 3, the potential would go down for three, and the potential would stay the same for nine.
Felling of Unknown Nests	There would be no requirement to monitor known owls or survey for unknown nest prior to timber harvest under Alternative 1. Unknown nest trees could be unintentionally felled during timber harvest, which could destroy eggs or lead to the death of young owls unable to flee the nest. The number of nests that would be impacted cannot be predicted, however, harvest of NRF habitat during March through May would have an associated risk of felling an active spotted owl nest tree. Up to 5,848 acres of NRF would be available for harvest under Alternative 1 over the next 50 years.	Up to 12,488 acres of NRF would be available for harvest under Alternative 2 over the next 50 years (about 6,640 acres more than Alternative 1). All suitable spotted owl habitat in the action area would be surveyed for spotted owls at intervals of approximately eight years, and nests discovered during these surveys would be protected as known nests. These surveys could offset the loss of some unknown nests. Given that these surveys are not required under Alternative 1, it is likely that the effects to unknown nests would be less under Alternative 2.	Similar to Alternative 1, there would be no requirement to monitor known owls or survey for unknown nest prior to timber harvest under Alternative 3. Up to 13,046 acres of NRF habitat would be available for harvest over the next 50 years under Alternative 3. Spotted owls nesting outside of conservation areas would be at greater risk of being impacted by covered activities involving tree felling due to the increased rate of harvest.
Collisions with Vehicles	Spotted owls could be directly impacted by collisions with vehicles. This effect would be unlikely due to road conditions and low vehicle speed in the action area.	Same as Alternative 1.	Same as Alternative 1.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Indirect Effect of Disturbance Related to Timber Harvest and Road Construction	Timber harvest and road construction can cause noise disturbance and alter forest cover, both of which can impact nesting owls. Neither of these activities would be restricted in the vicinity of active spotted owl nests under Alternative 1.	The potential for direct impacts to known spotted owl nest sites from timber harvest and road construction would be lower under Alternative 2 than Alternative 1 because of specific guidance on restricted activities and buffer distances (e.g., restrictions on harvest of advanced structure, chainsaw operation, and heavy equipment operation within noted distances of an active nest).	Same as Alternative 1.
Effects on the Regional Population	Alternative 1 would contribute to the conservation of the local spotted owl population by providing habitat capable of supporting multiple breeding pairs of spotted owl.	The overall contribution to the regional population under Alternative 2 would be similar to, or slightly less than under Alternative 1. In the short term, more known spotted owl activity centers would have a high potential for persistence under Alternative 2, but over the long term, the total amount of suitable habitat present in the action area would be slightly less than Alternative 1. This lower overall amount of suitable habitat could reduce the number of owls the action area can sustain.	The overall contribution to the regional population under Alternative 3 would be less than under Alternative 1. Fewer known spotted owl activity centers would have a high potential for persistence under Alternative 3, and the total amount of suitable habitat present in the action area would be less.
Marbled Murrelet			
Effects on Mapped (Current Suitable) Habitat	An estimated 2,260 acres of mapped marbled murrelet habitat would be harvested under Alternative 1 over the next 50 years. All mapped habitat would be surveyed for nesting murrelets prior to harvest, and habitat found to be occupied would not be harvested. Consequently, the actual amount of harvest could be more or less than 2,260 acres, but the potential for occupied habitat to be harvested would be low due to the requirement for surveys. MMMA, HCA, and RMAs would protect at least 7,229 acres of mapped habitat from harvest. Another 7,191 acres of mapped habitat outside reserve areas would likely remain at the end of 50 years due to restrictions on the location and timing of timber harvest unrelated to marbled murrelets.	Between 4,000 and 6,800 acres of mapped marbled murrelet habitat would be harvested under Alternative 2 over the next 50 years. Harvest would be limited to 4,000 acres if no replacement marbled murrelet nesting habitat developed in the action area over time. Additional harvest of up to 2,800 acres could occur if replacement habitat developed. The harvest would be spread over the 50 years. Conservation areas (T&E core areas, SUV areas, and RMA) would protect 6,491 acres of mapped habitat from regeneration harvest under Alternative 2. Another 3,389 to 6,189 acres of mapped habitat outside conservation areas would likely remain at the end of 50 years due to restrictions on the location and timing of timber harvest unrelated to marbled murrelets. The minimum harvest of mapped habitat under Alternative 2 (4,000 acres) would be approximately 77 percent higher than would occur under Alternative 1. The maximum (6,800 acres) would be about double the amount that would be harvested under Alternative 1	An estimated 5,770 acres of mapped marbled murrelet habitat would be harvested under Alternative 3 over the next 50 years. This would be roughly 2.5 times the amount harvested under Alternative 1. The area of mapped habitat in formal protection would also be higher under Alternative 3, however. Conservation areas would protect 10,652 acres of mapped habitat from regeneration harvest under Alternative 3. This would be about 47 percent more than under Alternative 1. With more habitat in conservation areas and more intensive harvest outside conservation areas, only 258 acres of mapped habitat would likely remain outside conservation area at the end of 50 years under Alternative 3.
Effects on Known Occupied Habitat	Forest in the action area that has been surveyed and designated as occupied marbled murrelet habitat would be protected under Alternative 1 to avoid incidental take. The 85 occupied sites and two other sites that are possibly occupied would be protected within 39 MMMA, which would protect an estimated 10,388 acres of murrelet habitat / surrounding buffers. All MMMAs would be protected indefinitely under Alternative 1.	Of the 85 sites in the action area occupied by marbled murrelets, 76 would be included within the boundaries of a conservation area, which would protect an estimated 9,325 acres of murrelet habitat / surrounding buffers. . .The remaining nine known occupied sites and the two possibly occupied sites would be available for harvest. Four of the nine sites and both possibly occupied sites could be harvested within the first ten years after issuance of the ITP. The other five sites could only be harvested after ten years. Overall, Alternative 2 would result in the harvest of 72 acres (nine sites) of known occupied marbled murrelet habitat that would not be harvested under Alternative 1. If the possibly occupied sites were found to be occupied, they would also be protected under Alternative 1 but not under Alternative 2.	Of the 85 sites in the action area occupied by murrelets, 83 would be included within the boundaries of a conservation are or RMA, which would protect an estimated 10,328 acres of habitat / surrounding buffers. The remaining two known occupied sites and the two possibly occupied sites would be available for harvest. Overall, Alternative 3 would protect at least 2 fewer acres of known occupied marbled murrelet habitat at two fewer sites than Alternative 1. The total area of harvest of occupied habitat could increase if the two occupied sites available for harvest were found to contain more suitable habitat. If the possibly occupied sites were found to be occupied, they would also be protected under Alternative 1 but not under Alternative 3.
Effects on Potentially Suitable Habitat	The total area of potentially suitable marbled murrelet nesting habitat (advanced structure forest with at least eight trees per acre at least 32 inches dbh) in the action area would increase from 25,775 acres to 33,993 acres over the next 50 years. An estimated 5,848 acres of potentially suitable habitat (including some mapped habitat) would be harvested over the same period.	The total area of potentially suitable marbled murrelet nesting habitat in the action area would increase from 25,775 acres to 27,450 acres over the next 50 years; 6,543 fewer acres than would develop under Alternative 1. An estimated 12,488 acres of potentially suitable habitat (including some mapped habitat) would be harvested over the same period.	The total area of potentially suitable marbled murrelet nesting habitat in the action area would increase from 25,775 acres to 26,193 acres over the next 50 years; 7,800 fewer acres than would develop under Alternative 1. An estimated 13,046 acres of potentially suitable habitat (including some mapped habitat) would be harvested over the same period.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Injury of Individual Marbled Murrelets	Forest management activities could result in the injury of death of nestling murrelets through the felling of trees. The potential for direct impacts would be low under Alternative 1 because suitable habitat would be surveyed prior to timber harvest.	Prohibitions on the felling of trees in occupied or unsurveyed mapped habitat from May 1 through September 15 would minimize the potential for direct impacts to nest trees. However, direct impacts could occur during the harvest of potential murrelet habitat that has not been mapped as suitable. The potential for direct impacts would be higher under Alternative 2 than it would be under Alternative 1.	There would be no prohibition on felling trees under Alternative 3. The potential for direct impacts would be higher under Alternative 3 than it would be under Alternative 1.
Disturbance of Nesting Marbled Murrelets	Noise generating activities, such as aircraft overflight, timber harvest, blasting, or heavy equipment, would be restricted in the vicinity of occupied habitat and unsurveyed mapped habitat during the nesting season under Alternative 1 to minimize potential effects on marbled murrelets.	Alternative 2 would include measures to minimize disturbance of all known occupied habitat during the nesting season, but would allow activity near unsurveyed mapped habitat that is not known to be occupied. Consequently, Alternative 2 could result in more disturbance than Alternative 1.	There would be no provisions to minimize disturbance to nesting marbled murrelets under Alternative 3. Alternative 3 would likely result in more disturbance of nesting marbled murrelets than to Alternative 1.
Nest Predation	Over the 50 year permit term, a slight increase in predation of murrelet nests could occur as a result of increased forest management under Alternative 1. Buffers associated with MMMA would minimize the predation effects of forest edge.	Known occupied marbled murrelet habitat would be protected and buffered in T&E cores areas similar to Alternative 1. However, there would be more potentially suitable habitat in RMAs outside T&E core areas in the future under Alternative 2, with an associated increase in the potential for nest predation in these high edge habitats.	Known occupied marbled murrelet habitat would be protected and buffered in upland conservation areas similar to Alternative 1 However, Alternative 3 would have considerably more potentially suitable habitat in RMAs in the future, so the potential for nest predation in these high edge habitats would be higher than under Alternative 1.
Effects on the Regional Population	By protecting all occupied habitat, Alternative 1 would maintain the murrelet population of the action area at or near its current level. If managed in this way, the action area would continue to contribute to the overall conservation of the species in the Oregon Coast Range.	In the first decade up to 1,200 acres of occupied or mapped habitat would be harvested. Over the long term, another 2,800 to 5,600 acres of occupied or mapped habitat could be harvested without prior surveys, and some of this would be occupied nesting habitat. The growth of new suitable habitat would offset some of this reduction. The action area would continue to contribute to the conservation of the Oregon Coast Range marbled murrelet population under Alternative 2, but the contribution would be less than under Alternative 1.	A reduction of up to 5,770 acres of known occupied and mapped habitat under Alternative 3 would likely result in a corresponding decrease in the number of nesting murrelets in the action area. The growth of new suitable habitat would offset some of this reduction. The action area would continue to contribute to the conservation of the Oregon Coast Range marbled murrelet population under Alternative 3, but the contribution would be less than under Alternative 1.
Bald Eagle			
Habitat at the Landscape Level	Suitable bald eagle nesting habitat would increase by 2,553 acres (24 percent) over the next 50 years. These increases would be realized in six of the 11management basins or subbasins where bald eagle nesting habitat is currently found; habitat would decline in an additional three management basins and remain about the same in the remaining two management basins. Substantial increases (hundreds of acres) in bald eagle habitat would be expected in four management basins under Alternative 1, while sustained declines would only be expected in one.	Alternative 2 would result in 192 more acres of suitable bald eagle habitat in 50 years than Alternative 1. Compared to Alternative 1, the amount of suitable bald eagle habitat would be greater in five of the 11 management basins or subbasins, less in three of the management basins, and similar in the remaining three management basins. Substantial increases (hundreds of acres) in bald eagle habitat would be expected in two management basins under Alternative 2, while a sustained decline would be expected in one basin.	Alternative 3 would result in 3,100 more acres of suitable bald eagle habitat in 50 years than Alternative 1. Compared to Alternative 1, the amount of suitable habitat under Alternative 3 would be greater in six of the 11 management basins or subbasins and less in the remaining five management basins. Substantial increases (hundreds of acres) in bald eagle habitat would be expected in seven management basins under Alternative 2, while sustained declines would be expected in three basins.
Effects on Individual Bald Eagles	Forest management activities could remove or modify bald eagle nesting habitat, or disturb nesting populations of bald eagle. Potential effects to known bald eagle would be avoided under Alternative 1 by protecting key components of active nesting and roosting sites in riparian buffers, and by implementing seasonal restrictions on forest management during the nesting season and critical roosting period.	Under Alternative 2, potential disturbance and habitat modification impacts to nesting bald eagle would be minimized through development of site management plans for all existing and newly established nesting territories and winter roost sites. Site plans would protect key components of bald eagle nesting territories, and seasonally prohibit actions that could disturb active nests, perch, and roost sites.	Same as Alternative 1.
Effects on the Regional Population	Alternative 1 would contribute to the conservation of the local bald eagle population by providing habitat capable of supporting multiple breeding pairs of bald eagles	Same as Alternative 1.	The overall contribution to the regional bald eagle population under Alternative 3 is expected to exceed that of Alternative 1.
Northern Goshawk			

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Habitat at a Landscape Level	Under Alternative 1, suitable northern goshawk nesting habitat would increase 10, 235 acres (26 percent) over the next 50 years. Nesting habitat would generally increase in all but three of the 13 management basins or subbasins; declines in these basins would be relatively minor. About 41 percent of the suitable habitat at Year 50 would be contained in reserve areas; the remaining habitat would be located in timber production lands and available for harvest.	The amount of suitable northern goshawk habitat in the action area would increase over the next 50 years under Alternative 2, but the end result would be 4,503 acres (9 percent) less than under Alternative 1. Compared to Alternative 1, the amount of suitable habitat under Alternative 2 would be greater in five of the management basins or subbasins, less in five of the basins, and similar in the remaining basins. Substantial increases in northern goshawk habitat would be expected in four basins under Alternative 2, while sustained declines would only be expected in two. About 31 percent of the suitable habitat available in Year 50 would be contained in upland conservation areas, 10 percent less than Alternative 1.	The amount of suitable northern goshawk habitat would increase over the next 50 years under Alternative 3, but the end result would be 1,808 acres (3.6 percent) less than under Alternative 1. Compared to Alternative 1, the amount of suitable habitat under Alternative 3 would be greater in seven of the management basins or subbasins, less in seven of the basins, and similar in the one remaining basin. The majority of the suitable habitat at Year 50 would be contained in riparian and upland conservation areas under Alternative 3. Advanced structure in forest in RMAs would be less likely to provide suitable nesting habitat unless it is contiguous with larger blocks of similar forest outside the RMA. Similar to Alternative 1, about 41 percent of the suitable goshawk habitat present under Alternative 3 at Year 50 would be within upland conservation areas.
Effects on Individual Northern Goshawks	Forest management activities could result in the injury or death of young northern goshawks or eggs through the felling of nest trees. An estimated 28,030 acres of forest would be clearcut and 38,365 acres would be commercially thinned in the action area over 50 years, all with the potential to alter goshawk habitat and disturb goshawk nesting. The potential for impacts would be very low, however, because goshawks are not currently known to exist in the action area.	The potential for impacts to goshawks from felling of unknown nest trees would be greater under Alternative 2 than Alternative 1 because of increased timber harvest. An estimated 33,500 acres of clearcut harvest and 56,620 acres of commercial thinning would occur under Alternative 2. The overall potential for impacts would remain quite low, however, because the species is not known to occur in the action area. Monitoring for goshawk presence, development of up to four site management plans, and implementation of seasonal timber management restrictions around active nest trees would further minimize the potential for impacts.	Potential impacts on young goshawks and eggs from felling of unknown nest trees would be slightly less under Alternative 3 than Alternative 1 because an overall decrease in timber harvest. An estimated 30,920 acres of clearcut harvest and 30,970 acres of commercial thinning would occur under Alternative 2. The overall potential for impacts would remain quite low because the species is not known to occur in the action area.
Effects on the Regional Population	The effects of Alternative 1 on the regional population of northern goshawk are unknown because the species is regionally rare in the Oregon Coast Range and their presence in the action area is uncertain. Increases in suitable habitat under Alternative 1 could, however, provide support to a regional northern goshawk population, should the species attempt to nest in the action area in the future.	Similar to Alternative 1, the effects of Alternative 2 on the regional population of northern goshawk is unknown because the species is regionally rare in the Oregon Coast Range and their presence in the action area is uncertain. The overall potential contribution to the regional northern goshawk populations under Alternative 2, however, would likely be less than that of Alternative 1 because it would contribute less suitable habitat over the next 50 years.	Similar to Alternative 1, the effects of Alternative 3 on the regional population of northern goshawk is unknown because the species is regionally rare in the Oregon Coast Range and their presence in the action area is uncertain. The overall potential contribution to the regional northern goshawk populations under Alternative 3, however, would be slightly less than that of Alternative 1 because of reduced levels of suitable nesting habitat.
Olive-sided Flycatcher			
Habitat at the Landscape Level	Under Alternative 1, suitable olive-sided flycatcher habitat would increase 6,481 acres (93 percent) over the next 50 years. Nesting habitat would generally increase in all but two of the 15 management basins and subbasins; however there would be extended time periods in six basins when little to no suitable nesting habitat would be present.	The amount of suitable olive-sided flycatcher habitat in the action area would increase 854 acres (6 percent) more over the next 50 years under Alternative 2 than it would under Alternative 1. Compared to Alternative 1, the amount of suitable habitat under Alternative 2 would be greater after 50 years in all but five of the management basins or subbasins due to increased timber harvest. Only two basins would experience brief periods when little to no suitable habitat would be present. This would likely result in a more widely distributed population than Alternative 1.	The amount of suitable olive-sided flycatcher habitat in the action area would increase over the next 50 years under Alternative 3, but the end result would be 1,246 acres (9 percent) less than under Alternative 1. In addition, the quality of the habitat would be lower under Alternative 3 because the number of snags and live trees retained would be less than half that required under Alternative 1. Compared to Alternative 1, the amount of suitable habitat under Alternative 3 would be greater after 50 years in all but six of the management basins or subbasins due to increased timber harvest. Only two subbasins would experience brief periods when little or no suitable habitat would be present.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Effects on Individual Olive-Sided Flycatcher	Forest management activities in or near early structure forest could disrupt olive-sided flycatcher nesting behavior and result in harm to adults and young if conducted during the nesting season (June to August). Slash burning and herbicide spraying could temporarily disturb olive-sided flycatchers. Neither activity would involve felling of nest trees, but the presence of helicopters during application could result in localized disturbance for up to a few hours. This short-term disturbance would not likely lead to nest abandonment or harm to nestlings. These activities would occur in proportion to the amount of clearcut harvesting in the study area. .	Similar to Alternative 1, with the exception that affects would occur in proportion to the amount of clearcut harvesting in the study area, so the frequency of these activities, and the associated potential for impacts to nesting olive-sided flycatchers, would be greater under Alternative 2 than Alternative 1.	Similar to Alternative 1, with the exception that affects would occur in proportion to the amount of clearcut harvesting in the study area, so the frequency of these activities, and the associated potential for impacts to nesting olive-sided flycatchers, would be greater under Alternative 3 than Alternative 1.
Effects on the Regional Population	Alternative 1 would contribute to the conservation of the local olive-sided flycatcher population by providing habitat capable of supporting numerous breeding pairs over the next 50 years.	The overall contribution to the regional olive-sided flycatcher population under Alternative 2 would be slightly more than Alternative 1 due to an increased amount of suitable habitat.	The overall contribution to the regional olive-sided flycatcher population under Alternative 3 would be slightly less than Alternative 1 due to a decreased amount of suitable habitat and decreased habitat quality due to fewer snags and residual trees.
Western bluebird			
Habitat at the Landscape Level	Under Alternative 1, suitable western bluebird habitat would increase 6,481 acres (93 percent) over the next 50 years. Nesting habitat would generally increase in all but two of the 13 management basins or subbasins; however there would be extended time periods in six basins when little to no suitable nesting habitat would be present.	The amount of suitable western bluebird habitat in the action area would increase an additional 854 acres (6 percent) over the next 50 years under Alternative 2 than it would under Alternative 1. Compared to Alternative 1, the amount of suitable habitat under Alternative 2 would be greater after 50 years in all but five of the management basins or subbasins due to increased timber harvest. Only two basins would experience brief periods when little to no suitable habitat would be present. This would likely result in a more widely distributed population than Alternative 1.	The amount of suitable western bluebird habitat in the action area would increase over the next 50 years under Alternative 3, but the end result would be 1,246 acres (9 percent) less than under Alternative 1. In addition, the quality of the habitat would be lower than Alternative 1 because the number of snags retained would be less than half that required under Alternative 1. Compared to Alternative 1, the amount of suitable habitat under Alternative 3 would be greater after 50 years in six of the management basins or subbasins due to increased timber harvest. Only two subbasins would experience brief periods when little or no suitable habitat would be present. This would likely result in a more widely distributed population than Alternative 1.
Effects on Individual Western Bluebird	Slash burning and herbicide application in recent clearcuts could result in the injury or death of young western bluebirds or eggs, but the potential for this would be low because these site preparation activities typically take place before nesting bluebirds become established in early structure forest.	Same as Alternative 1. Additional snag retention and creation requirements under Alternative 2 would indirectly help offset these impacts by creating suitable breeding habitat in early structure forest.	Same as Alternative 1. Alternative 3 might support a lower breeding density of western bluebirds than Alternative 1 due to lower snag retention and creation requirements.
Effects on the Regional Population	Alternative 1 would contribute to the conservation of the local western bluebird population by providing habitat capable of supporting numerous breeding pairs over the next 50 years.	The overall contribution to the regional western bluebird population under Alternative 2 would be slightly more than Alternative 1 due to an increased amount and higher quality of habitat.	The overall contribution to the regional western bluebird population under Alternative 3 would be slightly less than Alternative 1 due to a decreased amount and lower quality habitat.
Fisher			
Habitat at the Landscape Level	Under Alternative 1, suitable fisher habitat would increase 8,218 acres (32 percent) over the next 50 years. Suitable habitat would generally increase in all of the 13 management basins and subbasins; however four basins would experience sustained declines in suitable habitat over the next 50 years.	The amount of suitable fisher habitat in the action area would increase slightly over the next 50 years under Alternative 2, but the end result would be 6,543 acres (19 percent) less than under Alternative 1. Compared to Alternative 1, the amount of suitable habitat under Alternative 2 would be less in all but four of the management basins or subbasins due to increased timber harvest. Seven basins would experience sustained declines in suitable fisher habitat over the next 50 years.	The amount of suitable fisher habitat in the action area would increase slightly over the next 50 years under Alternative 3, but the end result would be 7,798 acres (23 percent) less than under Alternative 1. Compared to Alternative 1, the amount of suitable habitat under Alternative 3 would be less in eight of the management basins or subbasins due to increased timber harvest.
Effects on Individual Fishers	Forest management activities could result in the injury of death of young kits if a maternal den in a snag or log were removed during timber harvest. The potential for impacts would be very low, however, because the fisher is not currently known to exist in the action area.	Same as Alternative 1, with the exception that the potential for removal of maternal dens would be greater under Alternative 2 due to increased timber harvest. Monitoring for fisher and development of site management plans to protect the integrity of up to four areas of concentrated use by fisher would provide additional den protection and reduce any increased potential for effect.	Same as Alternative 1, with the exception that the potential for removal of maternal dens would be greater under Alternative 3 due to increased timber harvest.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Effects on the Regional Population	Increases in suitable habitat for fisher under Alternative 1 could provide support to a regional fisher population, should the species become established in the action area.	Similar to Alternative 1, increases in suitable habitat for fisher under Alternative 2 could provide support to a regional fisher population, should the species become established in the action area. The overall potential contribution to the regional fisher population would likely be less than that of Alternative 1, however, because Alternative 2 would contribute less suitable habitat over the next 50 years.	Similar to Alternative 1, increases in suitable habitat for fisher under Alternative 3 could provide support to a regional fisher population, should the species become established in the action area. The overall potential contribution to the regional fisher population under Alternative 3 would likely be less than that of Alternative 1 because there would be less suitable habitat in the action area over the next 50 years.
Red-legged Frog			
Removal of Water for Fire Suppression	Under Alternative 1, ODF could use red-legged frog breeding ponds as water sources for fire suppression activities. The potential impact would be minor because fires are infrequent in the action area and, in most years, water removal for fire suppressions would occur after tadpole metamorphosis is complete.	Same as Alternative 1.	Same as Alternative 1.
Habitat at the Landscape Level	Under Alternative 1, suitable red-legged frog habitat would be maintained and enhanced in upland reserve areas and RMAs. About 8,257 acres of RMA along Type F and perennial Type N streams would protect water quality and provide upland habitat and connectivity corridors for red-legged frogs. Habitat quality, as indicated by the proportion of advanced structure forest within 160 feet of Type F and large and medium Type N streams, and within 100 feet of small Type N streams, would generally improve in all management basins over the next 50 years.	Alternative 2 would provide 5,072 more acres of RMA along Type F and perennial Type N streams than Alternative 1, thereby improving the quality of aquatic habitat and increasing the quantity of upland habitat for red-legged frogs. The proportion of advanced structure forest along streams at the end of 50 years would be only 2 percent lower than Alternative 1, with a negligible difference in overall habitat quality for red-legged frogs. The potential for the removal of additional hardwoods under Alternative 2 would reduce nutrient levels and potentially decrease food supply.	Under Alternative 3, suitable red-legged frog habitat would be maintained and developed in conservation areas that represent about 50 percent of the action area. About 16,194 acres in riparian reserve areas (7,128 acres more than Alternative 1) would provide habitat connectivity and corridors for red-legged frog movements and dispersal by limiting forest management activities in the vicinity of Type F (160 feet) and perennial Type N (100 feet) streams. Under Alternative 3, impact to red-legged frogs from timber harvest would be expected to be similar to Alternative 1.
Effects on Individual Red-legged Frogs	Timber harvest outside RMAs could remove upland habitat important to adult red-legged frogs and result in direct injury or death of individuals. An estimated 66,395 acres of clearcut harvest and commercial thinning would occur in the action area over the next 50 years. The construction of 72.6 miles of new roads and the use and maintenance of the current road system could also result in the injury or death of a small portion of the red-legged frog population in the action area.	Timber harvest outside RMAs could remove more upland habitat than Alternative 1 and result in greater potential for direct injury or death of individuals. An estimated 90,120 acres of clearcut harvest and commercial thinning would occur in the action area over the next 50 years. The construction of 103.9 miles of new roads and the use and maintenance of the current road system could also result in the injury or death of a small portion of the red-legged frog population in the action area.	Timber harvest outside RMAs would remove less upland habitat than Alternative 1 and result in lower potential for direct injury or death of individuals. An estimated 61,890 acres of clearcut harvest and commercial thinning would occur in the action area over the next 50 years. The construction of 87.1 miles of new roads and the use and maintenance of the current road system could result in higher potential for injury or death of red-legged frogs than Alternative 1.
Effects on Regional Population	Alternative 1 would contribute to the conservation of the local red-legged frog population by providing aquatic and adjacent riparian habitat used by red-legged frogs within protected reserve areas capable of supporting the species over the next 50 years. Suitable red-legged habitat in the action area and within the individual management basins would slowly increase, which would benefit the larger regional population of red-legged frogs.	Contributions to the regional red-legged frog population under Alternative 2 would be the same or slightly less than Alternative 1 due to increased timber harvest and road construction.	Contributions to the regional red-legged frog population under Alternative 3 would be greater than under Alternative 1 due to the increased quality of red-legged frog habitat in RMAs and the lower rate of timber harvest in uplands.
Coastal Tailed Frog and Southern Torrent Salamander			
Habitat at the Landscape Level	Under Alternative 1, suitable coastal tailed frog and southern torrent salamander habitat would be maintained and enhanced in RMAs. An estimated 3,927 acres of RMA along perennial Type N streams would protect water quality and aquatic habitat for these species. Habitat quality, as indicated by the proportion of advanced structure forest within 160 feet of large and medium Type N streams and 100 feet of small Type N streams, would generally improve in all management basins over the next 50 years.	Alternative 2 would provide 8,771 more acres of RMA along perennial Type N streams than Alternative 1, thereby improving the quality of aquatic habitat for these species. The proportion of advanced structure forest along streams at the end of 50 years would be only 2 percent lower than Alternative 1, with a negligible difference in overall habitat quality for coastal tailed frogs and southern torrent salamanders. Additional aquatic and riparian strategies under Alternative 2 for Type N streams would concentrate the tree retention from the 25 to 160 foot zone to within 50 feet of the stream. Unless there were operational or safety constraints, tree retention under Alternative 2 would result in a 50-foot no harvest RMA on most streams. Thus, although RMAs around Type N streams would be wider under Alternative 2, resulting buffers would provide an effective no - harvest buffer of similar width to Alternative 1.	Alternative 3 would provide 4,800 more acres of RMA along perennial Type N streams than Alternative 1, improving the quality of aquatic habitat for these species. The proportion of advanced structure forest along streams at the end of 50 years would be 25 percent higher than Alternative 1, potentially providing a substantial improvement in overall habitat quality for coastal tailed frogs and southern torrent salamanders.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Effects on Individual Animals	Negative impacts to aquatic life forms of these species would be unlikely. Timber harvest outside RMAs could degrade riparian and upland habitat in some situations, and indirectly harm individual coastal tailed frogs. An estimated 66,395 acres of clearcut harvest and commercial thinning would occur in the action area over the next 50 years. The construction of 72.6 miles of new roads and the use and maintenance of existing roads could also result in the injury or death of a small portion of the coastal tailed frog population in the action area.	Timber harvest outside RMAs could remove more upland habitat than Alternative 1 and result in greater potential for direct injury or death of individual coastal tailed frogs. An estimated 90,120 acres of clearcut harvest and commercial thinning would occur in the action area over the next 50 years. The construction of 103.9 miles of new roads and the use and maintenance of existing roads could also result in the injury or death of a small portion of the coastal tailed frog population in the action area.	Timber harvest outside RMAs would remove less upland habitat than Alternative 1 and result in lower potential for direct injury or death of individual coastal tailed frogs. An estimated 61,890 acres of clearcut harvest and commercial thinning would occur in the action area over the next 50 years. The construction of 87.1 miles of new roads and the use and maintenance of existing roads could result in higher potential for injury or death of coastal tailed frogs than Alternative 1.
Effects on Regional Population	Alternative 1 would contribute to the conservation of the local coastal tailed frog and southern torrent salamander populations by providing aquatic and adjacent riparian habitat within protected reserves capable of supporting these species over the next 50 years. Suitable habitat in the action area and within the individual management basins would slowly increase, which would benefit the larger regional populations of both species.	Contributions to the regional coastal tailed frog and southern torrent salamander populations under Alternative 2 would be the same or slightly less than Alternative 1 due to increased timber harvest and road construction.	Contributions to the regional coastal tailed frog and southern torrent salamander populations under Alternative 3 would be greater than under Alternative 1 due to the increased quality of habitat in RMAs and the lower rate of timber harvesting in uplands under Alternative 3.
Game Species and Other Species			
Changes in Habitat Structure	Forest management would affect game and other wildlife species by changing the amount and distribution of suitable habitat over time. Species that use early seral forest would increase moderately as early structure forest increased over the next 50 years. Species that use mature forest would increase slowly as advanced structure forest increased over time. Multicover users would benefit from the juxtaposition of forest reserve areas and timber production lands, and aquatic and riparian species would benefit from the long-term protection of habitat provided by RMAs and other reserve areas. No existing habitats would be eliminated or substantially reduced in the action area under Alternative 1.	Similar to Alternative 1, forest management would affect game and other wildlife species by changing the amount and distribution of suitable habitat over time. Compared to Alternative 1, species that use early seral forest would benefit more from Alternative 2 due to increased early structure forest. Increased timber harvest under Alternative 2 would also produce more mature forest / clearcut edge, which would benefit edge and multicover users. Mature forest game populations would increase more slowly under Alternative 2 due to a decrease in the availability of advanced structure forest compared to Alternative 1. Aquatic and riparian species would benefit from wider and more extensive RMAs, although the management of these areas could have varying effects on species. No existing habitats would be eliminated or substantially reduced in the action area under Alternative 2.	Forest management activities would also affect game and other wildlife species by changing the amount and distribution of suitable habitat over time. Compared to Alternative 1, species that use early seral forest and edge habitat would have less habitat after 50 years under Alternative 3, and species that use mature forest would have more habitat. Aquatic and riparian species would benefit from larger RMAs under Alternative 3. No existing habitats would be eliminated or substantially reduced in the action area under Alternative 3.
Socioeconomics			
Collection of Special Forest Products	Authorization to remove special forest products (i.e., sword fern, salal, red huckleberry, and firewood) from the action area would continue at a rate similar to what is currently allowed (25 brush leases and 500 free-use woodcutting permits). It is unlikely that management activities would affect the availability of these products, or the public's ability to derive revenue from them.	Same as Alternative 1.	Same as Alternative 1.
Potential Effects Population Trends	The volume of timber removed from the action area would increase relative to current conditions, which could increase employment opportunities. However, it is unlikely that these increased employment opportunities would be substantial enough to affect population trends in the study area.	Same as Alternative 1.	Same as Alternative 1.
Potential Effects on Environmental Justice Populations	None of the potential effects associated with Alternative 1 would be realized exclusively by a minority or low income population, or in a way that would result in a disproportionate effect on a minority community, There are also no data to suggest that minority or low income populations in the study area are more or less dependent on the forest products industry than other populations, indicating that any potential effects on employment opportunities would be similar for all populations affected. Alternative 1 would not result in a disproportionate effect on minority or low income populations in the study area. Alternative 1 would have no effect on poverty levels in the study area or State.	Same as Alternative 1.	Same as Alternative 1.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Non-Use and Ecosystem Service Values	Changes in the intensity of forest management activities could affect the overall health of the ecosystem and could have an effect on how individuals perceive the inherent value of the ESF. The degree to which non-use and ecosystem service values would be affected would be difficult to quantify.	The potential effects on non-use and ecosystem service values could be greater than under Alternative 1, although such effects would be difficult to quantify.	The potential effects on non-use and ecosystem service values could be less than under Alternative 1, although such effects would difficult to quantify.
Potential Impacts to Employment Opportunities	Harvest volumes are expected to increase relative to the current conditions, but only by a small amount (see Forest Conditions above). The number of jobs may slightly increase over the next 50 years as increases in timber harvest are realized. Given that standing wood volume would increase over the next 50 years, increases in jobs realized under Alternative 1 would be sustainable indefinitely.	Timber harvest volumes would increase relative to Alternative 1 (see Forest Conditions above). Increases in timber harvest would likely increase the number of available jobs in the timber industry relative to Alternative 1. Similar to Alternative 1, continued increases in standing wood volume over the next 50 years indicates that increases in job opportunities in the timber industry would be sustainable.	Timber harvest volumes would increase relative to Alternative 1 (see Forest Conditions above). Increases in timber harvest would likely increase the number of available jobs in the timber industry relative to Alternative 1. However, standing wood volume would decrease over the next 50 years and would not likely be sustainable over a longer planning horizon, indicating that increases in job opportunities in the timber industry may not be sustainable over the longer term. This effect would be greater than Alternative 1.
State Revenues from Timber Harvest	Timber harvested from the action area would result in average annual revenue of between $9.6 million and $11.3 million over the next 50 years. The net change in annual revenue would range from a decrease of $1.8 million to an increase of $0.9 million compared to current conditions.	Timber harvested from the action areas would result in average annual net revenues of about $15.7 million over the next 50 years. This would result in a net increase of between $4.44 million and $6.2 million, relative to Alternative 1.	Timber harvested from the action area would result in average annual net revenues of about $13.4 million over the next 50 years. This would result in a net increase of between $2.1 million and $3.8 million, relative to Alternative 1.
Cultural Resources			
Inadvertent Damage to Unknown Cultural Resources	There are no known prehistoric or historic sites in the study area. If cultural resource are inadvertently discovered during management activities, such activities in the immediate area would be stopped so that a qualified archaeologist could accurately assess the context and integrity of the find. If human skeletal remains are encountered, the nearest office of the Oregon State Police, the SHPO, the Commission on Indian Services, and ODF would immediately be contacted. ODF would continue to protect any real property of historic significance and other important cultural resources found within the study area	Same as Alternative 1. Potential prehistoric sites would most likely be associated with river corridors, therefore additional aquatic habitat restoration activities associated with Alternative 2 may result in a higher potential of encountering unknown cultural resources compared to Alternative 1.	Same as Alternative 1. Potential prehistoric sites would most likely be associated with river corridors, therefore additional aquatic habitat restoration activities associated with Alternative 3 may result in a higher potential of encountering unknown cultural resources compared to Alternative 1.
Recreation			
Potential Effects on Recreation Use and Access to Recreational Opportunities in the Study Area	Current recreation use in the study area would not be affected, with the exception of hunting opportunities which could be affected by changes in game species habitat (see below). Access to recreational opportunities would not be affected by implementation of Alternative 1, with the exception of potential increases in OHV and/or hunter access attributable to new road construction (see below).	Same as Alternative 1.	Same as Alternative 1.
Potential Effects on Regional and Statewide Recreation Trends	Alternative 1 would have no effect on where and to what extent an increase in Statewide or regional recreational use would occur. Implementation of this alternative would not prohibit a portion of any anticipated regional or statewide increase in recreational use from being accommodated in the study area, although it is unlikely that such increases would be notable due to the characteristically steep terrain, distance from major metropolitan areas, and limited accessibility of the study area.	Same as Alternative 1.	Same as Alternative 1

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Changes in Off-Highway Vehicle Use	It is expected that OHV activities would continue in the study area under Alternative 1, and that use would continue to be limited to maintained roads on ESF. An increase in road miles over the next 50 years could lead to an increase in OHV use and access, although the extent to which OHV riders would use these roads in unknown. Increased OHV use on roads in the study area could lead to conflicts with other recreational users. Although it is unlikely that OHV use would increase substantially over the next 50 years, if increases in OHV use lead to conflicts with other recreational uses, ODF may consider managing OHV use in the future.	Same as Alternative 1, with the exception that the total mileage of roads in the study area would increase an additional 32 miles over the next 50 years compared to Alternative 1.	Same as Alternative 1, with the exception that the total mileage of roads in the study area would increase an additional 15 miles over the next 50 years compared to Alternative 1.
Potential Effects on Hunting Opportunities	Populations of game species in the study area would likely fluctuate with the availability of their preferred habitat. Species that use early structure forest and edge habitats, mature forests, and multiple covers would increase as these types of habitat increase over the next 50 years, although to varying degrees. Aquatic and riparian associated species would benefit from the long-term protection to aquatic resources provided by riparian and other reserve areas, and the associated improvements in aquatic habitats. Periodic timber harvest in timber production areas might disrupt behavior of game species that occupy harvest and adjacent areas, which could affect hunting opportunities in the study area, although it is unknown to what degree. Construction of up to 73 miles of new roads under Alternative 1 could also increase access to hunting opportunities in the study area, although it is unknown how many of these additional road miles would be used by hunters.	Game species that use early structure forest, edge habitats, and multiple covers would increase more quickly under Alternative 2 than Alternative 1 due to increased harvest levels on timber protection lands. Mature forest game populations would increase at a slightly lower rate than Alternative 1, due to a decline in availability of advanced structure. Aquatic and riparian-associated game species would benefit from the expanded area of riparian habitat protected in RMA, although the management prescriptions within these areas could affect the degree that these benefits would be realized. Potential impacts to game species from timber harvest, and resulting effects on hunting opportunities, would be higher than Alternative 1 because of the increased harvest on timber production lands. Construction of new roads could increase access to hunting opportunities in the study area to a greater degree than Alternative 1 because 32 additional road miles would be constructed.	Game species that use early structure forest would initially increase more quickly under Alternative 3 than Alternative 1 due to increased harvest on timber production lands. However, less early structure forest would be present in the action area after 50 years, which could affect the extent of game species that use this habitat. Increased timber harvest compared to Alternative 1 would produce more forest edge adjacent to clearcuts, benefiting both edge and multicover users. Mature forest game populations would increase at a slightly lower rate than Alternative 1 due to a decline in availability of advanced structure. Aquatic and riparian-associated game species would benefit from the expanded area of riparian habitat protected in RMAs compared to Alternative 1. Potential impacts to game species from timber harvest, and resulting effects on hunting opportunities, would be slightly higher than Alternative 1 because of the increased harvest on timber production lands. Construction of new roads could increase access to hunting opportunities in the study area to a greater degree than Alternative 1 because an additional 15 miles of road would be constructed.
Air Quality			
Compliance with State Implementation Plan and National Ambient Air Quality Standards	Potential effects on air quality would be temporary and localized, would be consistent with Oregon's State Implementation Plan, and are not expected to contribute air pollutants that would result in an exceedance of an established NAAQS.	Same as Alternative 1.	Same as Alternative 1.
Roadway Construction and Maintenance	Construction and maintenance of access roads in the action area could result in temporary and localized air pollutant emissions that affect air quality. The amount of the pollutants would be directly related to the amount of road construction and maintenance proposed. Although it is estimated that the total mileage of roads on the action area would increase about 73 miles relative to current conditions, considering the temporary and limited extent of the air pollutant emissions from roadway construction and maintenance, and regulations designed to reduce future tailpipe emissions, it is unlikely that air quality effects would be substantial, or that such activities would result in an exceedances of the NAAQS.	It is estimated that the total mileage of roads would increase about 32 miles relative to Alternative 1. Considering the temporary and limited extent of the air pollutant emissions from roadway construction and maintenance, and regulations designed to reduce future tailpipe emissions, it is unlikely that air quality effects would be substantial, or that such activities would result in an exceedances of the NAAQS. However, the effect would be greater than those experienced under Alternative 1 due to increases in road construction and maintenance proposed under Alternative 2.	It is estimated that the total mileage of road would increase about 15 miles relative to Alternative 1. Considering the temporary and limited extent of the air pollutant emissions from roadway construction and maintenance, and regulations designed to reduce future tailpipe emissions, it is unlikely that air quality effects would be substantial, or that such activities would result in an exceedances of the NAAQS. However, the effect would be greater than those experienced under Alternative 1 due to increases in road construction and maintenance proposed under Alternative 3.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Timber Harvesting	Timber harvesting generates pollutants of fugitive dust and tailpipe emissions from diesel-powered logging equipment. The amount of pollutants would be directly related to the volume of timber removed under each alternative. Under Alternative 1, harvest volumes within the action area would increase over the next 40 years relative to current conditions (see Forest Conditions above). Considering the temporary and limited extent of the air pollutant emissions from timber harvest activities, and regulations designed to reduce future tailpipe emissions, it is unlikely that air quality effects would be substantial, or would result in an exceedances of the NAAQS. Air quality effects would be similar to those experienced under current conditions in the first decade of implementation, but may be slightly higher by the fifth decade of implementation.	Timber harvest volumes would increase over the next 50 years relative to Alternative 1 (see Forest Conditions above). Considering the temporary and limited extent of the air pollutant emissions from timber harvest activities, and regulations designed to reduce future tailpipe emissions, it is unlikely that air quality effects would be substantial, or would result in an exceedances of the NAAQS. However, the effect would be greater than those experienced under Alternative 1 due to increased timber volumes projected under Alternative 2 over the next 50 years.	Timber harvest volumes would increase over the next 50 years relative to Alternative 1 (see Forest Conditions above). Considering the temporary and limited extent of the air pollutant emissions from timber harvest activities, and regulations designed to reduce future tailpipe emissions, it is unlikely that air quality effects would be substantial, or would result in an exceedances of the NAAQS. However, the effect would be greater than those experienced under Alternative 1 due to increased timber volumes projected under Alternative 3 over the 50 year period.
Logging Trucks on Access Roads in the Action Area	Logging truck traffic on access roads in the action area may generate air pollutants that could affect air quality in the immediate vicinity of the access roads. The extent of these emissions would be dependent upon the volume of timber removed the action area. Harvest volumes would increase over the next 50 years relative to current conditions (see Forest Conditions above). It is anticipated that the number of logging trucks on access roads in the action area would be similar or slightly higher than that currently experienced. Considering the temporary and limited extent of these effects, and regulations designed to reduce future tailpipe emissions, it is unlikely that air quality effects would be substantial, or that they would result in an exceedances of the NAAQS.	Timber harvest volumes would increase over the next 50 years relative to Alternative 1, and would likely require the use of more logging trucks each year. Considering the temporary and limited extent of these effects, and regulations designed to reduce future tailpipe emissions, it is unlikely that air quality effects would be substantial, or would result in an exceedances of the NAAQS. However, the effect would be greater than those experienced under Alternative 1 due to increased number of trucks on access roads over the next 50 years.	Under Alternative 3, timber harvest volumes would increase over the next 50 years relative to Alternative 1, and would likely require the use of more logging trucks each year. Considering the temporary and limited extent of these effects, and regulations designed to reduce future tailpipe emissions, it is unlikely that air quality effects would be substantial, or would result in an exceedances of the NAAQS. However, the effect would be greater than those experienced under Alternative 1 due to increased number of trucks on access roads over the next 50 years.
Prescribed Burning	It is estimated that up to 10 percent of the acreage of land clearcut in a given year within the action area is burned. Harvest volumes would increase over the next 50 years relative to current conditions, indicating that air quality effects resulting from prescribed burning would be similar or slightly higher than that experienced under current conditions. However, continued compliance with the required prescribed burning regulations would ensure smoke emissions would not substantially increase ambient pollutant concentrations, or impair visibility beyond the action area boundary.	Timber harvest volumes would increase over the next 50 years relative to Alternative 1. This increase in timber harvest would likely require more prescribed burning. Air quality effects resulting from prescribed burning would be greater relative to Alternative 1, due to increased timber harvest volumes and the likely number of prescribed burns. However, continued compliance with the required prescribed burning regulations would ensure smoke emissions would not substantially increase ambient pollutant concentrations, or impair visibility beyond the action area boundary.	Timber harvest volumes would increase over the next 50 years relative to Alternative 1. This increase in timber harvest would likely require more prescribed burning. Air quality effects resulting from prescribed burning would be greater relative to Alternative 1, due to increased timber harvest volumes and the likely number of prescribed burns. However, continued compliance with the required prescribed burning regulations would ensure smoke emissions would not substantially increase ambient pollutant concentrations, or impair visibility beyond the action area boundary.
Visual Resources			
Oregon Highway 38	Current rules protecting the visually sensitive corridors along Oregon Highway 38 from forest management activities would continue to be implemented. These protections would ensure that the visual quality of resources along Highway 38 would not be affected by timber harvest.	Same as Alternative 1.	Same as Alternative 1.
Oregon Myrtlewood Stand and Bottomland Hardwoods	The Oregon Myrtlewood stand in the Big Creek basin and the bottomland hardwoods in the Ash Valley basin would not be available for harvest. The visual resource protections provided to these stands would ensure that the visual integrity and coherence of these areas are maintained over the next 50 years. These protections, combined with the fact that these areas are not readily accessible or observed by many viewers, indicate that the visual quality of these resources would not be affected.	Same as Alternative 1.	Same as Alternative 1.
Forest Stands over 175 Years Old	The majority of forest stands and individual trees over 175 years old would be protected from timber harvest. It is possible that an individual tree or stand could be located adjacent to a stand eligible for harvest, which could affect the visual integrity and cohesion of that stand. However, due to the limited access that viewers have to these stands, it is unlikely that there would be a substantial visual impact for most viewers resulting from adjacent forest management activities.	Same as Alternative 1.	Same as Alternative 1.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Loon Lake Recreation Area	Forestlands within the action area surrounding the Loon Lake Recreation Area would not be available for timber harvest that detracts from scenic quality. This would ensure that the visual integrity and coherence of the area would be maintained over the next 50 years.	Same as Alternative 1.	Same as Alternative 1.
Big Creek	A 100-foot-wide no harvest RMA would be maintained around Big Creek. An HCA, which similarly limits forest management activities, would also be located adjacent to a portion of Big Creek, and stands in the surrounding management basin would be managed for a rotation age of 200 years. These constraints would result in a high level of visual resource protection over the next 50 years.	A 25-foot-wide no harvest RMA would be established around Big Creek, as would a 75-foot-wide limited forest management area. A T&E core area, which would similarly limit forest management activities, would also be located adjacent to a portion of Big Creek. Forest on slopes above Big Creek could be converted to early forest structure through increased timber harvest under Alternative 2. Although these forest management activities could somewhat reduce the current scenic values of the creek corridor, it is likely that timber harvest constraints would result in a high level of visual resource protection over the next 50 years, similar to Alternative 1.	A 160-foot-wide no harvest RMA would be maintained around Big Creek. These constraints would result in a high level of visual resource protection over the next 50 years. The larger riparian corridor along Big Creek would likely provide better protection of scenic resources than the protection provided under Alternative 1.
Charlotte Creek	A 100-foot-wide no harvest RMA would be maintained around Charlotte Creek. Three HCAs would also be located adjacent to a portion of Charlotte Creek, and stands in the surrounding management basin would be managed for a rotation age of 240 years. These constraints would result in a high level of visual resource protection over the next 50 years.	A 25-foot-wide no harvest RMA would be established around Charlotte Creek, as would a 75-foot-wide limited forest management area. A T&E core area would also be located adjacent to a portion of Charlotte Creek. Forest on slopes above Charlotte Creek could be converted to early forest structure through increased timber harvest. Although these forest management activities could somewhat reduce the current scenic values of the creek corridor, it is likely that timber harvest constraints would result in a high level of visual resource protection over the next 50 years, similar to Alternative 1.	A 160-foot-wide no harvest RMA would be maintained around Charlotte Creek. A T&E core area would also be located adjacent to a portion of Charlotte Creek. Forest on slopes above Charlotte Creek could be converted to early forest structure through increased timber harvest, however, it is likely that the larger riparian corridor along Charlotte Creek would provide better protection of scenic resources than the protection provided under Alternative 1.
West Fork Millicoma River	A 100-foot-wide no harvest RMA would be maintained along West Fork Millicoma River 1. Six HCAs would also be located adjacent to a several portions of the stream. Although forests in the watershed of the West Fork Millicoma River are otherwise managed for short-rotation timber protection, these constraints would result in a high level of visual resource protection over the next 50 years.	A 25-foot-wide no harvest RMA would be established around West Fork Millicoma River, as would a 75-foot-wide limited forest management area. A T&E core area and SUV area would also be located adjacent to a portion of West Fork Millicoma River. Forest on slopes above West Fork Millicoma River could be converted to early forest structure through increased timber harvest under Alternative 2. Although these forest management activities could somewhat reduce the current scenic values of the creek corridor, it is likely that timber harvest constraints would result in a high level of visual resource protection over the next 50 years, similar to Alternative 1.	A 160-foot-wide no harvest RMA would be maintained around West Fork Millicoma River. These constraints would result in a high level of visual resource protection over the next 50 years. The larger riparian corridor along West Fork Millicoma River would likely provide better protection of scenic resources than the protection provided under Alternative 1.
Elk Creek	A 100-foot-wide no harvest RMA would be maintained along Elk Creek. Portions of the stream corridor would also be managed as HCAs and SUV areas, and stands in the surrounding management basin would be managed for a rotation age of 240 years. These constraints would result in a high level of visual resource protection over the next 50 years.	A 25-foot-wide no harvest RMA would be established around Elk Creek, as would a 75-foot-wide limited forest management area. Timber on lands boarding the RMA could be managed for short-rotation forestry. Although these forest management activities could somewhat reduce the current scenic values of the creek corridor, it is likely that timber harvest constraints would result in a high level of visual resource protection over the next 50 years, similar to Alternative 1.	A 160-foot-wide no harvest RMA would be maintained around Elk Creek. These constraints would result in a high level of visual resource protection over the next 50 years. The larger riparian corridor along Elk Creek would likely provide better protection of scenic resources than the protection provided under Alternative 1.
Tenmile Lakes	Viewshed forests of the action area from Tenmile Lakes would continue to be managed as HCAs, or as forests with rotation ages between 200 and 240 years. These constraints would result in a high level of visual resource protection over the next 50 years.	Viewsheds forests of the action area from Tenmile Lakes would generally be maintained as T&E core areas. Forestlands outside T&E core areas, however, could be managed for short-rotation forestry under Alternative 2. Due to the distance between Tenmile Lakes and the action area, however, these changes would probably not be perceived by users of the lakes as degrading visual quality. These effects would be similar to those described for Alternative 1.	Viewsheds forests of the action area from Tenmile Lakes would generally be maintained as T&E core areas. Forestlands outside T&E core areas, however, could be managed for short-rotation forestry under Alternative 3. Due to the distance between Tenmile Lakes and the action area, however, these changes would probably not be perceived by users of the lakes as degrading visual quality. These effects would be similar to those described for Alternative 1.

Potential Effects	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Land Use			
Consistency with Land Use Plans and Regulations	With the exception of the 2006 FMP, Alternative 1 would be consistent with all land use plans and regulations specific to management of State-owned lands and would not conflict with plans specific to other, adjacent land uses. If selected, ODF would have to manage ESF in accordance with the 1994 FMP, rather than the 2006 FMP.	Alternative 2 would be consistent with all land use plans and regulations specific to management of State-owned lands and would not conflict with plans specific to other adjacent land uses.	With the exception of the 2006 FMP, Alternative 3 would be consistent with all land use plans and regulations specific to management of State-owned lands and would not conflict with plans specific to other, adjacent land uses. If selected, ODF would have to manage ESF in accordance with a revised FMP specific Alternative 3.
Potential Effects of Management for Threatened and Endangered Species on Adjacent Forestlands	Management strategies for T&E species would not be contingent on actions by adjacent landowners and would not dictate how other adjacent landowners manage their lands.	Same as Alternative 1.	Same as Alternative 1.
Potential Effects on Late Successional Reserves	Alternative 1 would not affect the designation of LSRs on adjacent Federal lands.	Same as Alternative 1.	Same as Alternative 1.
Hauling Restrictions on Roads	On roads not commonly used, seasonal restrictions on road use would be implemented between April 1 and September 15 to protect nesting populations of marbled murrelets. Access to roads could also be limited between October 1 and April 30 (wet season) to prevent road damage and sediment yield to adjacent stream systems. Seasonal hauling restrictions for northern spotted owl would not be implemented under Alternative 1. Murrelet disturbance policies would not be applied to adjacent or nearby landowners hauling on roads if those landowners hold permanent easements for those roads.	The operation of heavy equipment would not be allowed within 100 feet of an active northern spotted owl nest tree between March 1 and July 7. Seasonal use restrictions to minimize disturbance to nesting marbled murrelets would be implemented, however, hauling logs, rock, or heavy equipment on commonly used roads would not be prohibited, provided such equipment used unmuffled compression brakes. Similar to Alternative 1, access to roads could also be limited between October 1 and April 30 to prevent road damage and sediment yield to adjacent stream systems. The restrictions would likely have less of an effect on haul traffic than Alternative 1 because of the exceptions provided for activities in the vicinity of murrelet nests. Similar to Alternative 1, murrelet disturbance policies would not be applied to adjacent or nearby landowners hauling on roads if those landowners hold permanent easements for those roads.	Hauling restrictions under Alternative 3 would be limited to those associated with wet weather conditions, as described for Alternative 1. No specific haul restrictions would be implemented in the vicinity of known northern spotted owl nests or during the marbled murrelet nesting season. These restrictions would have less of an effect on hauling traffic in the study area than Alternative 1 because they would be allow for haul traffic under a broader set of circumstances.

dbh = diameter-at-breast-height; ESF = Elliott State Forest; FMP = forest management plan; FPA = Oregon Forest Practices Act; HCA = Habitat Conservancy Area; ITP = incidental take permit; LSR = late successional reserve; MFC = mature forest condition; MMBF = million board feet; MMMA = Marbled Murrelet Management Area; NAAQS = National Ambient Air Quality Standards; ODF = Oregon Department of Forestry; ODFW = Oregon Department of Fish and Wildlife; OHV = off-highway vehicle; RMA = riparian management area; SHPO = State Historic Preservation Office; SUV = scenic, unique, and visual; T&E = threatened and endangered; Type F = fish-bearing stream; Type N = non-fish-bearing stream

Contents

Volume I

Page

Executive Summary ES-1

Chapter 1 Purpose and Need 1-1
1.1 Introduction 1-1
1.2 Purpose and Need for Action 1-3
1.2.1 Purpose for Action 1-3
1.2.2 Need for Action 1-3
1.2.3 Context 1-6
1.3 Environmental Review Process 1-12
1.3.1 Process Steps 1-12
1.3.2 Scoping 1-13
1.4 Relationship to Other Plans, Regulations, and Laws 1-13
1.4.1 Federal Permits and Consultation Requirements 1-15
1.4.2 State Permits and Consultation Requirements 1-16
1.5 Organization of This Environmental Impact Statement 1-17

Chapter 2 Alternatives 2-1
2.1 Alternatives Considered 2-1
2.2 Covered Activities Common to All Alternatives 2-1
2.2.1 Action Area, Management Activities, and Duration 2-1
2.3 Alternatives Analyzed in Detail 2-7
2.3.1 Alternative 1 - Current Management (No-Action) 2-7
2.3.2 Alternative 2 - Proposed Action 2-18
2.3.3 Alternative 3 – Increased Stream Buffers and Intensive Forestry 2-44
2.4 Alternatives Considered But Not Analyzed in Detail 2-58
2.4.1 Combined Reserves and Intensive Forestry 2-58
2.4.2 Northwest Forest Plan Riparian Reserve Area Stream Buffer Widths 2-58
2.4.3 Wood Emphasis 2-59
2.4.4 Conservation Emphasis 2-60

Chapter 3 Affected Environment 3-1

Section 3.0 Action Area and Study Area 3.0-1

Section 3.1 Forest Conditions 3.1-1
3.1.1 Sources of Information 3.1-1
3.1.2 Affected Environment 3.1-1
3.1.2.1 Forest Condition 3.1-1
3.1.2.2 Forest Health 3.1-5
3.1.2.3 Fuel Conditions and Fire Regime 3.1-5
3.1.2.4 Timber Harvest 3.1-6
3.1.2.5 Non-Timber Forest Products 3.1-8
3.1.2.6 Forest Chemicals 3.1-9

Section 3.2 Soils and Slope Stability 3.2-1
3.2.1 Sources of Information 3.2-1
3.2.2 Affected Environment 3.2-1
3.2.2.1 Topographic Conditions 3.2-1
3.2.2.2 Climatic Conditions 3.2-2
3.2.2.3 Geologic Conditions 3.2-2
3.2.2.4 Soil Characteristics 3.2-3
3.2.2.5 Slope Stability 3.2-7
3.2.2.6 Road System in the Action Area 3.2-9
3.2.2.7 Activities in the Action Area Affecting Soil and Slope Stability 3.2-10

Section 3.3 Streams, Water Quality, and Water Quantity 3.3-1
3.3.1 Sources of Information 3.3-1
3.3.2 Affected Environment 3.3-2
3.3.2.1 Study Area 3.3-2
3.3.2.2 Streams 3.3-9
3.3.2.3 Classification by Gradient and Confinement 3.3-13
3.3.2.4 Water Quality 3.3-18
3.3.2.5 Water Quantity 3.3-27

Section 3.4 Vegetation 3.4-1
3.4.1 Sources of Information 3.4-1
3.4.2 Affected Environment 3.4-1
3.4.2.1 Ecoregions in the Study Area 3.4-1
3.4.2.2 Vegetation Types in the Study Area 3.4-2
3.4.2.3 Rare Plant Occurrences 3.4-11

Section 3.5 Fish and Their Habitat 3.5-1
3.5.1 Sources of Information 3.5-1
3.5.2 Affected Environment for the Fish Species of Interest 3.5-1
3.5.2.1 Coho Salmon 3.5-3
3.5.2.2 Chinook Salmon 3.5-24
3.5.2.3 Chum Salmon 3.5-29
3.5.2.4 Steelhead 3.5-30
3.5.2.5 Coastal Cutthroat Trout 3.5-33

3.5.2.6 Pacific Lamprey 3.5-36
3.5.2.7 River Lamprey.....3.5-38
3.5.2.8 Western Brook Lamprey 3.5-40
3.5.3 Affected Environment of Aquatic Habitats in the Study Area.....3.5-41
3.5.3.1 Watershed Condition 3.5-41
3.5.3.2 Riparian Functions and Current Riparian Condition 3.5-49
3.5.3.3 Aquatic Habitats.....3.5-64

Section 3.6 Wildlife and Their Habitat.....3.6-1
3.6.1 Sources of Information.....3.6-2
3.6.2 Affected Environment.....3.6-2
3.6.2.1 Northern Spotted Owl 3.6-3
3.6.2.2 Marbled Murrelet.....3.6-12
3.6.2.3 Bald Eagle.....3.6-20
3.6.2.4 Northern Goshawk 3.6-23
3.6.2.5 Olive-Sided Flycatcher.....3.6-25
3.6.2.6 Western Bluebird 3.6-27
3.6.2.7 Fisher 3.6-28
3.6.2.8 Northern Red-Legged Frog.....3.6-30
3.6.2.9 Coastal Tailed Frog.....3.6-32
3.6.2.10 Southern Torrent Salamander 3.6-33
3.6.2.11 Game Species 3.6-34
3.6.2.12 Other Species 3.6-36

Section 3.7 Socioeconomics 3.7-1
3.7.1 Sources of Information.....3.7-1
3.7.2 Affected Environment.....3.7-1
3.7.2.1 Population 3.7-2
3.7.2.2 Employment Trends.....3.7-4
3.7.2.3 Timber Industry 3.7-6
3.7.2.4 Dependence on Elliott State Forest Timber Harvests.....3.7-8
3.7.2.5 Special Forest Products.....3.7-9
3.7.2.6 Wood Products Sustainability 3.7-9
3.7.2.7 Scenic Resources and Recreational Uses.....3.7-10
3.7.2.8 Funds Generated from County Property Taxation 3.7-10

Section 3.8 Cultural Resources.....3.8-1
3.8.1 Sources of Information.....3.8-1
3.8.2 Legal and Policy Requirements 3.8-1
3.8.2.1 Federal Regulations.....3.8-1
3.8.2.2 State of Oregon and Oregon Department of Forestry.....3.8-2
3.8.3 Affected Environment.....3.8-3
3.8.3.1 Prehistoric Setting.....3.8-4
3.8.3.2 Ethnography of Siuslaw and Coosan Peoples.....3.8-4
3.8.3.3 Historical Setting 3.8-5
3.8.3.4 History of the Elliott State Forest.....3.8-6
3.8.3.5 Known or Potential Prehistoric Sites in the Study Area 3.8-7
3.8.3.6 Known or Potential Historic Resources in the Study Area 3.8-8

Section 3.9 Recreation 3.9-1
3.9.1 Sources of Information 3.9-1
3.9.2 Affected Environment 3.9-1
3.9.2.1 Current Recreational Use in the Study Area 3.9-1
3.9.2.2 Current Approach to Recreation Management in the Study Area 3.9-3
3.9.2.3 State and Regional Recreation Trends 3.9-4
3.9.2.4 National Recreation Trends 3.9-5

Section 3.10 Air Quality 3.10-1
3.10.1 Sources of Information 3.10-1
3.10.2 Affected Environment 3.10-1
3.10.2.1 Climate 3.10-1
3.10.2.2 Air Quality Regulatory Constraints 3.10-2
3.10.2.3 Air Quality Trends 3.10-4

Section 3.11 Visual Resources 3.11-1
3.11.1 Sources of Information 3.11-1
3.11.2 Elliott State Forest Land Management Classifications 3.11-1
3.11.2.1 Special Stewardship-Visual 3.11-5
3.11.2.2 Focused Stewardship-Visual 3.11-5
3.11.3 Affected Environment 3.11-5
3.11.3.1 Visual Character of Elliott State Forest 3.11-6

Section 3.12 Land Use 3.12-1
3.12.1 Sources of Information 3.12-1
3.12.2 Affected Environment 3.12-1
3.12.2.1 Elliott State Forest Land Ownership and Use 3.12-1
3.12.2.2 Adjacent Land Ownership and Uses 3.12-2
3.12.2.1 Management Requirements for State-Owned Lands 3.12-5
3.12.2.2 Management Requirements for Adjacent Private Lands 3.12-7
3.12.2.3 Management Requirements for Adjacent Federal Lands 3.12-8
3.12.2.4 Use of Elliott State Forest Roads for Adjacent Land Management 3.12-9

Volume II

Page

Chapter 4 Environmental Consequences 4-1

Section 4.0 Relevant Information for Assessing Project Effects 4.0-1
4.0.1 Action Area and Study Area 4.0-1
4.0.2 Duration and Management Activities 4.0-2
4.0.3 Alternatives Evaluated 4.0-2
4.0.3.1 Alternative 1 – Current Management (No-Action) 4.0-2
4.0.3.2 Alternative 2 – Proposed Action 4.0-4
4.0.3.3 Alternative 3 – Increased Stream Buffers and Intensive Forestry 4.0-5

Section 4.1 Forest Conditions 4.1-1
4.1.1 Approach and Methodology 4.1-1
4.1.2 Environmental Consequences 4.1-1
4.1.2.1 Consequences Common to All Alternatives 4.1-1
4.1.2.2 Alternative 1 – Current Management (No Action) 4.1-3
4.1.2.3 Alternative 2 - Proposed Action 4.1-18
4.1.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.1-20

Section 4.2 Soils and Slope Stability 4.2-1
4.2.1 Approach and Methodology 4.2-1
4.2.2 Environmental Consequences 4.2-2
4.2.2.1 Consequences Common to All Alternatives 4.2-2
4.2.2.2 Alternative 1 - Current Management (No-Action) 4.2-7
4.2.2.3 Alternative 2 - Proposed Action 4.2-11
4.2.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.2-14

Section 4.3 Streams, Water Quality, and Water Quantity 4.3-1
4.3.1 Approach and Methodology 4.3-1
4.3.1.1 Consequences Common to All Alternatives 4.3-1
4.3.2 Environmental Consequences 4.3-4
4.3.2.1 Alternative 1 - Current Management (No-Action) 4.3-4
4.3.2.2 Alternative 2 - Proposed Action 4.3-16
4.3.2.3 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.3-22

Section 4.4 Vegetation 4.4-1
4.4.1 Approach and Methodology 4.4-1
4.4.2 Environmental Consequences 4.4-1
4.4.2.1 Consequences Common to All Alternatives 4.4-1
4.4.2.2 Alternative 1 - Current Management (No-Action) 4.4-2
4.4.2.3 Alternative 2 - Proposed Action 4.4-3

4.4.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.4-3

Section 4.5 Fish and Their Habitat 4.5-1
4.5.1 Approach and Methodology 4.5-1
4.5.1.1 Fish Species and Species Guilds 4.5-1
4.5.1.2 Fish Habitat 4.5-4
4.5.2 Environmental Consequences 4.5-6
4.5.2.1 Aquatic Ecosystem 4.5-7
4.5.2.2 Fish Species - Biological Effects 4.5-99

Section 4.6 Wildlife and Their Habitat 4.6-1
4.6.1 Approach and Methodology 4.6-1
4.6.1.1 Northern Spotted Owl 4.6-1
4.6.1.2 Marbled Murrelet 4.6-6
4.6.1.3 Other Wildlife 4.6-8
4.6.2 Environmental Consequences 4.6-9
4.6.2.1 Northern Spotted Owl 4.6-9
4.6.2.2 Marbled Murrelet 4.6-66
4.6.2.3 Bald Eagle 4.6-88
4.6.2.4 Northern Goshawk 4.6-103
4.6.2.5 Olive-Sided Flycatcher 4.6-120
4.6.2.6 Western Bluebird 4.6-138
4.6.2.7 Fisher 4.6-143
4.6.2.8 Northern Red-Legged Frog 4.6-161
4.6.2.9 Coastal Tailed Frog 4.6-180
4.6.2.10 Southern Torrent Salamander 4.6-196
4.6.2.11 Game Species 4.6-203
4.6.2.12 Other Species 4.6-206

Section 4.7 Socioeconomics 4.7-1
4.7.1 Approach and Methodology 4.7-1
4.7.2 Environmental Consequences 4.7-1
4.7.2.1 Consequences Common to All Alternatives 4.7-2
4.7.2.2 Alternative 1 – Current Management (No-Action) 4.7-4
4.7.2.3 Alternative 2 - Proposed Action 4.7-6
4.7.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.7-7

Section 4.8 Cultural Resources 4.8-1
4.8.1 Approach and Methodology 4.8-1
4.8.2 Environmental Consequences 4.8-1
4.8.2.1 Consequences Common to All Alternatives 4.8-2
4.8.2.2 Alternative 1 – Current Management (No-Action) 4.8-2
4.8.2.3 Alternative 2 - Proposed Action 4.8-2
4.8.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.8-2

Section 4.9 Recreation 4.9-1
4.9.1 Approach and Methodology 4.9-1

4.9.2 Environmental Consequences 4.9-1
4.9.2.1 Consequences Common to All Alternatives 4.9-2
4.9.2.2 Alternative 1 – Current Management (No-Action) 4.9-3
4.9.2.3 Alternative 2 (Proposed Action) 4.9-4
4.9.2.4 Alternative 3 Increased Stream Buffers and Intensive Forestry 4.9-5

Section 4.10 Air Quality 4.10-1
4.10.1 Approach and Methodology 4.10-1
4.10.2 Environmental Consequences 4.10-1
4.10.2.1 Consequences Common to All Alternatives 4.10-2
4.10.2.2 Alternative 1 – Current Management (No-Action) 4.10-2
4.10.2.3 Alternative 2 - Proposed Action 4.10-5
4.10.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.10-6

Section 4.11 Visual Resources 4.11-1
4.11.1 Approach and Methodology 4.11-1
4.11.1.1 Concepts and Terminology 4.11-2
4.11.2 Environmental Consequences 4.11-3
4.11.2.1 Consequences Common to All Alternatives 4.11-7
4.11.2.2 Alternative 1 – Current Management (No-Action) 4.11-8
4.11.2.3 Alternative 2 - Proposed Action 4.11-10
4.11.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.11-11

Section 4.12 Land Use 4.12-1
4.12.1 Approach and Methodology 4.12-1
4.12.2 Environmental Consequences 4.12-1
4.12.2.1 Consequences Common to All Alternatives 4.12-1
4.12.2.2 Alternative 1 - Current Management (No-Action) 4.12-2
4.12.2.3 Alternative 2 – Proposed Action 4.12-3
4.12.2.4 Alternative 3 - Increased Stream Buffers and Intensive Forestry 4.12-4

Chapter 5 Cumulative Effects 5-1
5.1 Introduction 5-1
5.2 Approach and Methodology 5-1
5.2.1 Context for the Analysis 5-5
5.3 Land Use Plans Considered in the Cumulative Effects Analysis 5-8
5.4 Analysis of Cumulative Effects by Resource Topic 5-22
5.4.1 Forest Conditions 5-22
5.4.2 Soils and Slope Stability 5-23
5.4.3 Streams, Water Quality, and Water Quantity 5-24
5.4.4 Vegetation 5-25
5.4.5 Fish and Their Habitat 5-26
5.4.6 Wildlife and Their Habitat 5-27
5.4.7 Socioeconomics 5-36
5.4.8 Cultural Resources 5-37

5.4.9 Recreation 5-39
5.4.10 Air Quality 5-40
5.4.11 Visual Resources 5-41
5.4.12 Land Use 5-41

Chapter 6 References 6-1
6.1 Printed References 6-1
6.2 Personal Communications 6-37

Chapter 7 Distribution List 7-1

Chapter 8 List of Preparers 8-1

Acronyms and Abbreviations

Appendix A Riparian and Stream Channel Network Supporting Data

Tables

Volume I

Page

1-1 Species Proposed for Coverage in the Elliott State Forest Habitat Conservation Plan 1-2

1-2 Permits, Approvals, and Environmental Review and Consultation Requirements that May Be Required for the Proposed Alternatives 1-14

2-1 Key Terms Associated with Alternative 1 2-7

2-2 Federally Listed, Candidate, Proposed, and Protected Species Present or Potentially Present in the Action Area and Vicinity 2-9

2-3 Alternative 1—Management Basin Strategies 2-13

2-4 Alternative 1—Aquatic Riparian Strategy 2-16

2-5 Key Terms Associated with Alternative 2 2-19

2-6 Species Proposed for Coverage under Alternative 2 2-22

2-7 Alternative 2—Target Percentage of Advanced Structure Stands 2-24

2-8 Alternative 2—Management Standards for Fish-Bearing (Type F) Stream Riparian Management Areas 2-30

2-9 Alternative 2—Management Standards for Large and Medium Non-Fish-Bearing (Type N) Stream Riparian Management Areas 2-32

2-10 Alternative 2—Management Standards for Small Non-Fish-Bearing (Type N) Stream Riparian Management Areas 2-34

2-11 Alternative 2 – Management Prescriptions for Lakes, Ponds, and Wetlands....2-36

2-12 Alternative 2 – Management Prescriptions for Bogs, Seeps, and Springs....2-37

2-13 Key Terms Associated with Alternative 3....2-45

2-14 Summary of Forest Management Strategies, Aquatic Riparian Strategies, Wildlife Conservation Strategies, and Research and Monitoring Activities for Alternatives Evaluated in Detail....2-51

3.1-1 Summary of Existing Stand Structure Condition in the Study Area....3.1-4

3.1-2 Average Annual Timber Volume Sold and Acreage in the Past Decade in the Study Area (1997-2006)....3.1-8

3.2-1 Road Mileages by Landscape Position for Each Watershed in the Action Area....3.2-9

3.2-2 Road Mileages by Side Slope Class for Each Watershed in the Action Area....3.2-9

3.3-1 Extent of Management Basins in the Action Area....3.3-3

3.3-2 Length of Stream and Stream Density by Size Class for Each Major Watershed in the Action Area....3.3-9

3.3-3 Length of Fish-Bearing Streams by Watershed, Management Basin, Stream Class....3.3-14

3.3-4 Waterbodies Downstream of the Study Area on the 303(d) List or Having TMDLs....3.3-20

3.3-5 Mean Percent Shade for Active Channel Width Categories by Watershed....3.3-22

3.3-6 Predicted Temperature Ranges and Mean Temperature by Channel Width and Elevation....3.3-23

3.3-7 Anticipated Water Temperature for Streams More Than 10 Miles from Topographic Divide....3.3-24

3.3-8 Peak Flow Recurrence Intervals for the West Fork Millicoma River....3.3-29

3.3-9 Water Rights in the Study Area....3.3-31

3.3-10 Instream Water Rights for Streams Partially or Completely in the Action Area 3.3-32

3.4-1 Proportions of OR-GAP Vegetation Cover Types in the Study Area 3.4-5

3.4-2 Rare Plants Potentially Occurring in the Study Area 3.4-12

3.5-1. Fishes Located in Streams and Rivers in the Study Area 3.5-2

3.5-2 Adult Winter Steelhead Trout Escapement Estimates and Population Trends (1996) 3.5-32

3.5-3 Coastal Cutthroat Trout Abundance Estimates and Population Trends (1999) 3.5-36

3.5-4 Miles of Streams and Percent of Total by Watershed and Gradient Class 3.5-48

3.5-5 Stream Length (Miles) of Various Channel Sizes and Fish Uses in Action Area Watersheds 3.5-49

3.5-6 Oregon Minimum Diameter Requirements for Large Wood Placement Projects 3.5-52

3.5-7 Existing Stand Structure and Age Class Data from Riparian Areas by Watershed in the Study Area 3.5-61

3.5-8 Status of Culverts in Fish-Bearing Streams in the Action Area as of 2003 ..... 3.5-68

3.5-9 Average Gravel Percentages in Riffles for Inventoried Stream Reaches 3.5-72

3.5-10 Sediment Data in the Action Area Compared to ODFW Reference Streams 3.5-74

3.5-11 Large Wood Volume and Density in Action Area Streams and in Oregon Coastal Reference Streams 3.5-75

3.5-12 Key Piece Density in Action Area and Reference Streams by Stream Size 3.5-76

3.5-13 Average Pool Characteristics for Inventoried Stream Reaches of Less Than 4 Percent Gradient in the Action Area 3.5-78

3.5-14 Miles of Small and Medium Stream Reaches with Limited Pools and In-Channel Wood Loading Levels by Watershed in the Study Area 3.5-79

3.5-15 Miles of Large Stream Reaches with Limited Pools and In-Channel Wood Loading Levels by Watershed in the Study Area 3.5-79

3.5-16 Miles of Stream Reaches with Likely High Quality Summer Rearing Habitat Potential based on High Levels of In-Channel Wood Loading Levels and Adjacent Wood Recruitment Potential 3.5-80

3.5-17 Percent Pool Data in the Action Area Compared to ODFW Reference Streams 3.5-81

3.5-18 Stream Width-to-Depth Ratios in the Action Area Compared to ODFW Reference Streams (Active Channel Width/Active Channel Height) 3.5-90

3.5-19 Percent Stream Bank Erosion in the Action Area Compared to ODFW Reference Streams 3.5-91

3.6-1 Summary of Northern Spotted Owl Habitat in the Study Area 3.6-8

3.6-2 Number of Spotted Owls, Owl Activity Centers and the Crude Densities of Spotted Owl Activity Centers in the Study Area, 1993–1998 and 2003 ..... 3.6-9

3.6-3. Spotted Owl Activity Centers Reported In or Adjacent To the Study Area as of 2003 ..... 3.6-10

3.6-4 Estimates of Marbled Murrelet Population Size in 2000 through 2003 in Oregon 3.6-14

3.6-5. Mapped Marbled Murrelet Habitat in the Study Area 3.6-18

3.7-1 Population by County (Year 2006) 3.7-2

3.7-2 Population Sizes and Trends 3.7-2

3.7-3 Population Composition by Race and Hispanic Origin 3.7-3

3.7-4 Median Household Income and Population in Poverty in 2003 ..... 3.7-4

3.7-5 Non-Farm Employment by Industry (Annual Average 2005) 3.7-5

3.7-6 Unemployment Trends 3.7-6

3.7-7 Extent of State-Managed Forestland 3.7-6

3.7-8 Ownership of Forestland in the Study Area 3.7-7

Volume II

Page

4.1-1 Timber Harvest Levels for Each Watershed under the Alternatives 4.1-5

4.1-2 Extents of Structural Classes and Stands at least 100 Year Old at Year 50 (2057) 4.1-6

4.1-3 Standing Forest Tree Volume on Harvestable Ground over 150-Year Period 4.1-16

4.1-4 Estimated Relative Extent of Herbicide Use 4.1-17

4.2-1 Changes in the Road System in the Action Area 4.2-4

4.2-2 Relative Risk of Landslide Initiation among the Alternatives 4.2-9

4.2-3 Extent of Protected Riparian Areas by Harvesting Restrictions 4.2-11

4.2-4 Extent of No-Harvest and Potential Partial Harvest (Mature Forest Condition Management) of Protected Riparian Areas by Stream Type 4.2-11

4.3-1 Surface Water Temperature Predictions: Distance-from-Divide Model for Mainstem Channel Sizes using Shade from 100-Year Site-Potential Tree Height for Red Alder 4.3-7

4.3-2 Surface Water Temperature Predictions: Distance-from-Divide Model for Mainstem Channel Sizes using Shade from 100-Year Site-Potential Tree Height for Douglas-Fir 4.3-7

4.3-3 Surface Water Temperature Predictions with View-To-Sky Model for Quartile Distributions of Shade and Active Channel Widths at Various Elevations along Large Channels at ODFW AIP Reference Sites 4.3-9

4.3-4 Extent of Clearcutting among the Alternatives 4.3-11

4.3-5 Early Structure Forest over Time in the Action Area 4.3-15

4.3-6 Likely Differences in Stream Temperature between Alternatives 4.3-19

4.5-1 Fish Species and Guilds of Species in the Study Area 4.5-3

4.5-2 Stream Length (Miles) of Various Channel Sizes and Fish Uses in Action Area Watersheds 4.5-7

4.5-3 Riparian Management Area Acres and Vegetation Stand Structure along All Stream Channels in Action Area under Alternative 1 ..... 4.5-20

4.5-4 Percentage of Early Structure Forest in Riparian Management Areas along Stream Channels in the Action Area over Time under All Alternatives 4.5-21

4.5-5 Percentage of Advanced Structure Forest in Riparian Management Areas along Type F Streams in the Action Area over Time under All Alternatives 4.5-23

4.5-6 Percentage of Advanced Structure Forest in Riparian Management Areas along All Stream Channels in the Action Area over Time under All Alternatives 4.5-24

4.5-7a Frequency of Advanced Structure Forest in RMAs along Fish-Bearing Streams in the Action Area over Time 4.5-25

4.5-7b. Frequency of Advanced Structure Forest in RMAs along All Channel Types in the Action Area over Time 4.5-25

4.5-8 Riparian Management Area Acres and Vegetation Stand Structure along All Stream Channels in the Action Area under Alternative 2 ..... 4.5-30

4.5-9 Riparian Management Area Acres and Vegetation Stand Structure along all Stream Channels in the Action Area under Alternative 3 ..... 4.5-36

4.5-10 Minimum Functional Log Sizes for Various Channel Widths 4.5-41

4.5-11 Desired Future Conditions for Riparian Stand Characteristics Based on ODFW AIP Reference Site Conditions 4.5-47

4.5-12 Likely Availability of Standing Wood Pieces from Various Alternative Riparian Management Strategies along Type F Streams in the Action Area 4.5-49

4.5-13 Likely Availability of Standing Wood Pieces from Various Alternative Riparian Management Strategies along Large and Medium Perennial Type N Streams in the Action Area 4.5-49

4.5-14 Likely Availability of Standing Wood Pieces from Various Alternative Riparian Management Strategies along Small Seasonal Type N Streams in the Action Area 4.5-51

4.5-15 Stand Conditions under Various Alternative Riparian Management Strategies using Interquartile Distributions of Reference Stand Characteristics 4.5-55

4.5-16 Current and Projected Instream Large Wood Volume in Action Area Streams by Management Basin 4.5-59

4.5-17 Potential Long-Term Effects on Fish Habitat under Alternative 1 by Species Guild 4.5-102

4.5-18 Potential Long-Term Effects on Fish Habitat under Alternative 2 by Species Guild 4.5-104

4.5-19 Potential Long-Term Effects on Fish Habitat under Alternative 3 by Species Guild 4.5-107

4.6-1 Summary of Projected Trends in Spotted Owl Habitat in the Study Area over the 50-Year Analysis Period 4.6-12

4.6-2 Habitat Conditions and Persistence Potentials for Spotted Owl Activity Centers In and Near the Study Area 4.6-47

4.6-3 Fate of Mapped Marbled Murrelet Habitat in the Study Area over 50 Years 4.6-67

4.6-4 Current and Projected Acres of Potentially Suitable Marbled Murrelet Habitat in the Study Area 4.6-69

4.6-5 Location of Potentially Suitable Marbled Murrelet Habitat in the Study Area at Year 50 ..... 4.6-73

4.6-6 Projected Harvest of Potentially Suitable Marbled Murrelet Habitat in the Study Area over 50 Years 4.6-74

4.6-7 Activities Restricted in the Vicinity of Known Occupied Marbled Murrelet Habitat under Alternative 1 ..... 4.6-75

4.6-8 Levels of Intermediate Structure and Advanced Structure Forest Combined in the Study Area 4.6-77

4.6-9 Mapped Marbled Murrelet Habitat Available for Harvest under Alternative 2 ..... 4.6-78

4.6-10 Forest Structural Conditions Associated with Occupied and Mapped Marbled Murrelet Habitat in the Study Area 4.6-78

5-1 Forest Product Volume in Thousand Board Feet by Land Ownership for Coos and Douglas Counties (1997 to 2003) 5-7

5-2 Proposed Land Use Allocations under the Western Oregon Plan Revisions for the Coos Bay District Resource Management Plan.....5-12

7-1 Agencies and Organizations Receiving the Draft EIS 7-1

8-1 List of Preparers – Elliott State Forest Environmental Impact Statement.....8-1

Figures

Volume I

Page

1-1 Elliott State Forest Vicinity Map 1-9

2-1 Alternative 1 (No-Action Alternative) Management Basins and Habitat Conservancy Areas 2-11

2-2 Alternative 2 (Proposed Action) Management Basins and Conservation Areas 2-27

2-3 Alternative 3 (Increased Stream Buffers and Intensive Forestry) Management Basins and Conservation Areas 2-49

3.1-1 Historical Timber Harvest Volume in the Study Area 3.1-8

3.2-1 Soil Resources in the Study Area 3.2-5

3.3-1 Watersheds Comprising the Study Area 3.3-5

3.3-2 Management Basins in the Action Area 3.3-7

3.3-3 Streams and Lakes in the Action Area 3.3-11

3.3-4 Stream Classifications for the Action Area 3.3-15

3.3-5 Average Monthly Flows for the West Fork Millicoma River 3.3-29

3.4-1 Level IV Ecoregions 3.4-3

3.4-2 OR-GAP Vegetation Cover Types 3.4-7

3.5-1 Coho Salmon Distributions in the Study Area 3.5-5

3.5-2 Coho Spawning and Rearing Habitat Distribution in the Study Area 3.5-7

3.5-3 Oregon Coast Coho Salmon Evolutionarily Significant Unit 3.5-11

3.5-4 Estimated Total Run Size, Including the Amount of Harvest and Spawning Escapement of Natural-Origin Spawners in the Oregon Coast Coho Evolutionarily Significant Unit 3.5-13

3.5-5 Independent Populations and Geographic Strata of the Oregon Coast Coho Evolutionarily Significant Unit 3.5-17

3.5-6 Estimated Spawning Escapement of Natural Origin Spawners in Action Area Streams 3.5-19

3.5-7 Twenty-Year Trend in Coho Salmon Spawner Abundance in Streams Originating in the Action Area and Streams in Other Portions of the Oregon Coast Range.....3.5-21

3.5-8 Oregon Coast Chinook Salmon Evolutionary Significant Unit.....3.5-27

3.5-9 Percent Riparian Stand Type by Size of Fish-Bearing Streams in the Action Area 3.5-57

3.5-10 Percent Riparian Stand Age by Size of Fish-Bearing Streams in the Action Area 3.5-59

3.5-11 Streamnet Barriers Identified by Record ID in the Action Area 3.5-65

3.5-12 High Intrinsic Potential for Coho Salmon in the Action Area and Study Area 3.5-83

3.5-13 Quality of Winter Rearing Habitat for Coho Salmon in the Study Area 3.5-85

3.5-14 Quality of Summer Rearing Habitat for Coho Salmon in the Study Area 3.5-87

3.11-1 Visual Resources in the Action Area 3.11-3

3.12-1 Land Ownership in Vicinity of the Action Area.....3.12-3

Volume II

Page

4.1-1 Umpqua Watershed – Early Structure over 50-Year Period.....4.1-7

4.1-2 Umpqua Watershed – Intermediate Structure over 50-Year Period 4.1-7

4.1-3 Umpqua Watershed – Advanced Structure over 50-Year Period 4.1-7

4.1-4 Umpqua Watershed – Stands over 100 Years Old.....4.1-7

4.1-5 Tenmile Watershed – Early Structure over 50-Year Period.....4.1-9

4.1-6 Tenmile Watershed – Intermediate Structure over 50-Year Period 4.1-9

4.1-7 Tenmile Watershed – Advanced Structure over 50-Year Period 4.1-9

4.1-8 Tenmile Watershed – Stands over 100 Years Old 4.1-9

4.1-9 Coos Watershed – Early Structure over 50-Year Period.....4.1-11

4.1-10 Coos Watershed – Intermediate Structure over 50-Year Period 4.1-11

4.1-11 Coos Watershed – Advanced Structure over 50-Year Period 4.1-11

4.1-12 Coos Watershed – Stands over 100 Years Old.....4.1-11

4.1-13 Forest-Wide – Early Structure over 50-Year Period 4.1-13

4.1-14 Forest-Wide – Intermediate Structure over 50-Year Period 4.1-13

4.1-15 Forest-Wide – Advanced Structure over 50-Year Period 4.1-13

4.1-16 Forest-Wide – Stands over 100 Years Old.....4.1-13

4.5-1 Comparison of Forest Trends in Stand Structural Components between Alternatives within a Standard Riparian Evaluation Width over 50 Years.....4.5-31

4.5-2 Large Wood Recruitment Potential from Streamside Tree Stands as a Function of Riparian Buffer Width.....4.5-42

4.5-3 Modeled Net Volume of Large Wood in Streams and Recruitment Distance Class 4.5-46

4.5-4 Example of Predicted Trends in Relative Density and Stocking (Trees/Acre) for an Unmanaged Douglas-Fir Stand Planted at 250 Trees per Acre on Site Index 120, as Modeled by ORGANON SMC 4.5-54

4.5-5 Trends in Early Stand Structure across the Action Area for the Alternatives over 50 Years 4.5-85

4.6-1 Trends in Spotted Owl Habitat in the Action Area under the Three EIS Alternatives 4.6-13

4.6-2 Trends in Spotted Owl Habitat in Basin 1 under the Three EIS Alternatives 4.6-15

4.6-3 Trends in Spotted Owl Habitat in Basin 2 under the Three EIS Alternatives 4.6-17

4.6-4 Trends in Spotted Owl Habitat in Basin 3 under the Three EIS Alternatives 4.6-19

4.6-5 Trends in Spotted Owl Habitat in Basin 4 under the Three EIS Alternatives 4.6-21

4.6-6 Trends in Spotted Owl Habitat in Basin 5 under the Three EIS Alternatives 4.6-23

4.6-7 Trends in Spotted Owl Habitat in Basin 6 under the Three EIS Alternatives 4.6-25

4.6-8 Trends in Spotted Owl Habitat in Basin 7 under the Three EIS Alternatives 4.6-27

4.6-9 Trends in Spotted Owl Habitat in Basin 8 under the Three EIS Alternatives 4.6-29

4.6-10 Trends in Spotted Owl Habitat in Basin 9 under the Three EIS Alternatives 4.6-31

4.6-11 Trends in Spotted Owl Habitat in Sub-Basin 10-A under the Three EIS Alternatives 4.6-33

4.6-12 Trends in Spotted Owl Habitat in Sub-Basin 10-B under the Three EIS Alternatives 4.6-35

4.6-13 Trends in Spotted Owl Habitat in Sub-Basin 10-C under the Three EIS Alternatives 4.6-37

4.6-14 Trends in Spotted Owl Habitat in Basin 11 under the Three EIS Alternatives 4.6-39

4.6-15 Trends in Spotted Owl Habitat in Basin 12 under the Three EIS Alternatives 4.6-41

4.6-16 Trends in Spotted Owl Habitat in Basin 13 under the Three EIS Alternatives 4.6-43

4.6-17 Trends in Advanced Structure Forest in the Study Area under the Three Alternatives 4.6-61

4.6-18 Projected Trends in Potentially Suitable Marbled Murrelet Habitat (Advanced Structure Forest with at least Eight Trees per Acre 32 Inches DBH or Larger) 4.6-71

4.6-19 Forest-Wide Trends in Bald Eagle Habitat over 50-Year Period 4.6-91

4.6-20 Basin 1 Trends in Bald Eagle Habitat over 50-Year Period 4.6-95

4.6-21 Basin 2 Trends in Bald Eagle Habitat over 50-Year Period 4.6-95

4.6-22 Basin 3 Trends in Bald Eagle Habitat over 50-Year Period 4.6-95

4.6-23 Basin 6 Trends in Bald Eagle Habitat over 50-Year Period 4.6-95

4.6-24 Basin 7 Trends in Bald Eagle Habitat over 50-Year Period 4.6-97

4.6-25 Basin 8 Trends in Bald Eagle Habitat over 50-Year Period 4.6-97

4.6-26 Basin 9 Trends in Bald Eagle Habitat over 50-Year Period 4.6-97

4.6-27 Basin 10 Trends in Bald Eagle Habitat over 50-Year Period 4.6-97

4.6-28 Basin 11 Trends in Bald Eagle Habitat over 50-Year Period 4.6-99

4.6-29 Basin 12 Trends in Bald Eagle Habitat over 50-Year Period 4.6-99

4.6-30 Basin 13 Trends in Bald Eagle Habitat over 50-Year Period 4.6-99

4.6-31 Forest-Wide Trends in Northern Goshawk Habitat over 50-Year Period 4.6-107

4.6-32 Basin 1 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-109

4.6-33 Basin 2 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-109

4.6-34 Basin 3 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-109

4.6-35 Basin 4 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-109

4.6-36 Basin 5 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-111

4.6-37 Basin 6 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-111

4.6-38 Basin 7 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-111

4.6-39 Basin 8 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-111

4.6-40 Basin 9 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-113

4.6-41 Sub-Basin 10-A Trends in Northern Goshawk Habitat over 50-Year Period 4.6-113

4.6-42 Sub-Basin 10-B Trends in Northern Goshawk Habitat over 50-Year Period 4.6-113

4.6-43 Sub-Basin 10-C Trends in Northern Goshawk Habitat over 50-Year Period 4.6-113

4.6-44 Basin 11 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-115

4.6-45 Basin 12 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-115

4.6-46 Basin 13 Trends in Northern Goshawk Habitat over 50-Year Period 4.6-115

4.6-47 Forest-Wide Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-123

4.6-48 Basin 1 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-125

4.6-49 Basin 2 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-125

4.6-50 Basin 3 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-125

4.6-51 Basin 4 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-125

4.6-52 Basin 5 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-127

4.6-53 Basin 6 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-127

4.6-54 Basin 7 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-127

4.6-55 Basin 8 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-127

4.6-56 Basin 9 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-129

4.6-57 Sub-Basin 10-A Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-129

4.6-58 Sub-Basin 10-B Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-129

4.6-59 Sub-Basin 10-C Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-129

4.6-60 Basin 11 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-131

4.6-61 Basin 12 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-131

4.6-62 Basin 13 Trends in Olive-Sided Flycatcher and Western Bluebird Habitat over 50-Year Period 4.6-131

4.6-63 Forest-Wide Trends in Fisher Habitat over 50-Year Period 4.6-147

4.6-64 Basin 1 Trends in Fisher Habitat over 50-Year Period 4.6-149

4.6-65 Basin 2 Trends in Fisher Habitat over 50-Year Period 4.6-149

4.6-66 Basin 3 Trends in Fisher Habitat over 50-Year Period 4.6-149

4.6-67 Basin 4 Trends in Fisher Habitat over 50-Year Period 4.6-149

4.6-68 Basin 5 Trends in Fisher Habitat over 50-Year Period 4.6-151

4.6-69 Basin 6 Trends in Fisher Habitat over 50-Year Period 4.6-151

4.6-70 Basin 7 Trends in Fisher Habitat over 50-Year Period 4.6-151

4.6-71 Basin 8 Trends in Fisher Habitat over 50-Year Period 4.6-151

4.6-72 Basin 9 Trends in Fisher Habitat over 50-Year Period 4.6-153

4.6-73 Sub-Basin 10-A Trends in Fisher Habitat over 50-Year Period 4.6-153

4.6-74 Sub-Basin 10-B Trends in Fisher Habitat over 50-Year Period 4.6-153

4.6-75 Sub-Basin 10-C Trends in Fisher Habitat over 50-Year Period 4.6-153

4.6-76 Basin 11 Trends in Fisher Habitat over 50-Year Period 4.6-155

4.6-77 Basin 12 Trends in Fisher Habitat over 50-Year Period 4.6-155

4.6-78 Basin 13 Trends in Fisher Habitat over 50-Year Period 4.6-155

4.6-79 Forest-Wide Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-165

4.6-80 Basin 1 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-167

4.6-81 Basin 2 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-167

4.6-82 Basin 3 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-167

4.6-83 Basin 4 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-167

4.6-84 Basin 5 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-169

4.6-85 Basin 6 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-169

4.6-86 Basin 7 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-169

4.6-87 Basin 8 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-169

4.6-88 Basin 9 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-171

4.6-89 Basin 10 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-171

4.6-90 Basin 11 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-171

4.6-91 Basin 12 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-171

4.6-92 Basin 13 Trends in Red-Legged Frog Habitat over 50-Year Period 4.6-173

4.6-93 Forest-Wide Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-183

4.6-94 Basin 1 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-185

4.6-95 Basin 2 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-185

4.6-96 Basin 3 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-185

4.6-97 Basin 4 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-185

4.6-98 Basin 5 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-187

4.6-99 Basin 6 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-187

4.6-100 Basin 7 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-187

4.6-101 Basin 8 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-187

4.6-102 Basin 9 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-189

4.6-103 Basin 10 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-189

4.6-104 Basin 11 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-189

4.6-105 Basin 12 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-189

4.6-106 Basin 13 Trends in Coastal Tailed Frog and Southern Torrent Salamander Habitat over 50-Year Period 4.6-191

4.11-1 Representative Viewsheds of Forest Management from Roads Adjacent to the Action Area 4.11-5

5-1 Cumulative Effects Analysis Area 5-3

Chapter 1

Purpose and Need

1.1 Introduction

The Oregon Department of Forestry (ODF) has submitted an application to the U.S. Fish and Wildlife Service (FWS) for an Incidental Take Permit (ITP) in accordance with Section 10(a)(1)(B) of the Federal Endangered Species Act (ESA), as amended, and to the National Marine Fisheries Service (NMFS) for consideration of a new ITP. The ODF is seeking this authorization so that activities associated with implementation of the revised *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a) comply with the ESA, while providing protection for three species listed under the ESA, and an additional 15 species currently not listed under the ESA. These species and their statuses appear in Table 1-1 below.

The issuance of an ITP from the FWS and NMFS (collectively the Services) would provide ODF with the long-term regulatory assurance that implementation of the *Elliott State Forest Management Plan* complies with the provisions of the ESA. In order for an ITP to be issued, a habitat conservation plan (HCP) that documents compliance with Section 10 of the ESA must be submitted by the project applicant (See Section 1.2.2.1, Endangered Species Act Section 10, for a list of the required components of an HCP). To this end, ODF has prepared the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008).

Since the proposed amendment of an ITP from the FWS and issuance of an ITP from NMFS would be a Federal action that may affect the human environment, they are subject to review under the National Environmental Policy Act (NEPA). As part of that process, this EIS and supporting HCP are required to be circulated for public review and comment.

This EIS analyzes alternatives to ODF's request for ITP coverage of the species listed in Table 1-1 below. Following a 60-day public comment period on the Draft Environmental Impact Statement (DEIS), the Services will review and respond to comments in writing and/or by the incorporation of changes to the proposed HCP and DEIS. The resulting Final Environmental Impact Statement (FEIS) will be circulated to the public and those who commented on the DEIS. After a 30-day public comment period, the FWS will prepare a ROD that will

formally document its selected alternative, and the FWS will make its permit issuance decision.

Table 1-1 Species Proposed for Coverage in the Elliott State Forest Habitat Conservation Plan

Species Name	Listing Status		Federal Overseeing Agency
	Federal	State	
Birds			
Northern spotted owl	Threatened	Threatened	FWS
Strix occidentalis caurina			
Marbled murrelet	Threatened	Threatened	FWS
Brachyramphus marmoratus			
Bald eagle	Not Listed	Threatened	FWS
Haliaeetus leucocephalus			
Northern goshawk	Not Listed	State Sensitive/Critical	FWS
Accipiter gentilis			
Olive-sided flycatcher	Not Listed	State Sensitive/ Vulnerable	FWS
Contopus borealis			
Western bluebird	Not Listed	State Sensitive/ Vulnerable	FWS
Sialia mexicana			
Fish			
Coho salmon	Threatened	Sensitive / Critical	NMFS
Oncorhynchus kisutch			
Chinook salmon	Not Listed	Not Listed	NMFS
Oncorhynchus tshawytscha			
Chum salmon	Not Listed	Sensitive / Critical	NMFS
Oncorhynchus keta			
Steelhead trout	Species of Concern	Sensitive / Vulnerable	NMFS
Oncorhynchus mykiss			
Coastal cutthroat trout	Species of Concern	Sensitive / Vulnerable	FWS
Oncorhynchus clarki clarki			
Pacific lamprey	Species of concern	Sensitive / Vulnerable	FWS
Lampetra tridentatus			
River lamprey	Species of concern	Not Listed	FWS
Lampetra ayresi			
Western brook lamprey	Not Listed	Not Listed	FWS
Lampetra richardsoni			

Species Name	Listing Status		Federal Overseeing Agency
	Federal	State	
Mammals			
Fisher *Martes pennanti*	Candidate	State Sensitive/Critical	FWS
Amphibians			
Red-legged frog *Rana aurora*	Not Listed	State Sensitive/ Undetermined Status	FWS
Southern torrent salamander (HAS) *Rhyacotriton variegatus*	Not Listed	State Sensitive/ Vulnerable	FWS
Tailed frog (HAS) *Ascaphus truei*	Not Listed	State Sensitive / Vulnerable	FWS

Source: Oregon Department of Forestry 2008
NA = Not applicable
HAS = Headwater Amphibian Species
FWS = U.S. Fish and Wildlife Service
NMFS = National Marine Fisheries Science

1.2 Purpose and Need for Action

1.2.1 Purpose for Action

The purpose for this action is for the Services to respond to ODF's application for ITPs, and for ODF to continue its forest management activities while complying with the ESA. If granted, the ITPs would authorize the incidental take of the listed species identified in Table 1-1. Additionally, provisions for coverage of unlisted species (Table 1-1) would be made by the Services so incidental take coverage could be provided if these species were listed in the future. Section 1.2.3, Context, describes ODF's proposed action and the activities proposed for incidental take coverage in the HCP.

1.2.2 Need for Action

The need for this action is to provide broader protection and conservation for listed, proposed, and unlisted species than is available under Section 9 of the ESA, while providing for long-term management of State lands subject to the revised *Elliott State Forest Management Plan*. Technical discussions between the applicant and the Services during development of the HCP have considered specific criteria that must be satisfied before a decision can be reached on permit

issuance. The determination of whether the ITP proposals to the Services has met these criteria will be made after the public has had an opportunity to comment on the DEIS and HCP. The decision on whether to amend (FWS) and/or issue (NMFS) the ITPs will be based on the Services' NEPA and ESA compliance determinations. These determinations will be documented in an ESA Section 10 findings document, an ESA Section 7 BO, and a NEPA decision document, which will be developed at the conclusion of the NEPA and ESA permit issuance processes.

The following section provides general information on requirements under the ESA and NEPA. Refer to Section 1.4.1, Federal Permits and Consultation Requirements, for a general discussion of these Federal regulations.

1.2.2.1 Endangered Species Act Section 10

The ESA is intended to provide a means for protecting and conserving species listed as either endangered or threatened, and for conserving the ecosystems upon which listed species depend. To be protected under the ESA, a species must be listed by the Services as endangered or threatened. A species is considered endangered if it is determined that the species is in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is found that the species is likely to become endangered in the foreseeable future.

Section 9 of the ESA prohibits the take of an endangered species, where take is defined in the ESA to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." Section 10 of the ESA allows the Services to issue an ITP to a non-Federal entity for incidental take of a federally listed species, where "incidental take" is defined as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity."

Permit issuance criteria prescribed in 50 Code of Federal Regulations (CFR) 17.22(b)(2), 50 CFR 17.32(b)(2), and Section 10(a)(2)(B) of the ESA state:

- the taking must be incidental;
- the applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking;
- the applicant will ensure that adequate funding for the conservation plan and procedures to deal with unforeseen circumstances will be provided;
- the taking will not appreciably reduce the likelihood of survival and recovery of the species in the wild; and
- the Services may require other measures necessary or appropriate for the purposes of the HCP.

A conservation plan submitted in support of a Section 10 permit application must specify:

- the impact that will likely result from the taking;
- steps the applicant will take to monitor, minimize, and mitigate such impacts, the funding available to implement such steps, and the procedures to be used to deal with unforeseen circumstances;
- alternative actions to such taking considered by the applicant, and the reasons why such alternatives are not proposed to be used; and
- other measures that the Services may require as necessary or appropriate for the purposes of the plan.

The evaluation of ODF's ESA Section 10(a)(1)(B) applications to the Services will be documented in Section 10 findings documents, which will be produced at the end of the NEPA and ESA permit issuance processes. The result of the assessments will determine whether or not an ITP will be amended (FWS) and/or issued (NMFS).

1.2.2.2 Endangered Species Act Section 7

Issuance of an ITP is also a Federal action subject to Section 7 of the ESA. Section 7(a)(2) requires all Federal agencies, in consultation with the Services, to ensure that any action "authorized, funded, or carried out by an agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification" of critical habitat. Although the provisions of Section 7 and Section 10 are similar, Section 7 and its regulations require several considerations in the HCP process, including an analysis of indirect effects, effects on federally listed plants, and effects on critical habitat.

The results of these consultations are typically documented in BOs developed by the Services for the species under their jurisdiction (Table 1-1). Biological opinions are produced near the end of the ESA permitting process and document conclusions regarding the likelihood of jeopardizing the continued existence of, or adversely modifying designated critical habitat for, any listed species.

1.2.2.3 National Environmental Policy Act

NEPA is one of the primary laws governing the environmental protection process. It is a decision-making requirement that applies to proposals for Federal actions. The Council on Environmental Quality (CEQ) regulations defines "major Federal action" as those actions with "effects that may be major and which are potentially subject to Federal control and responsibility," including "projects and programs entirely or partly financed, assisted, conducted, regulated, or approved by Federal agencies."

Under NEPA, any Federal agency undertaking a "major Federal action" likely to "significantly affect the human environment" must prepare an EIS. An EIS must provide a "detailed statement" of the environmental impacts of the action, possible alternatives, and measures to mitigate adverse effects of the proposed actions. While NEPA does not mandate any particular result, it requires the agency to follow particular procedures in its decision-making process. The purpose of these procedures is to ensure the agency has before it the best possible information to make an "intelligent, optimally beneficial decision" and to ensure the public is fully apprized of any environmental risks that may be associated with the preferred action.

Amendment or Issuance of an ITP under Section 10(a)(1)(B) is a Federal action subject to NEPA compliance. Although ESA and NEPA requirements overlap considerably, the scope of NEPA goes beyond that of the ESA by considering the impacts of a Federal action not only on fish and wildlife resources, but also on other resources, such as water quality, air quality, and cultural resources. The EIS process culminates in issuance of a ROD. The ROD documents the alternative selected for implementation, as well as any conditions that may be required, and summarizes the impacts expected to result from the action.

1.2.3 Context

The ODF is pursuing an amended ITP from the FWS and a new ITP from NMFS through the ESA Section 10 process to avail itself of a broad approach to ESA compliance within the Elliott State Forest (ESF). As outlined in the 2008 *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008), over the next 50 years (i.e., the permit term proposed in the HCP), ODF's proposed activities would involve a relatively large range of forest management actions that could affect federally listed species. Administration of ESA compliance activities for each of these actions on a project-by-project basis would likely be a less efficient process for both ODF and the Services. A project-by-project approach would also be less effective at addressing issues on a landscape or ecosystem level. The ODF is therefore utilizing the HCP and its regional perspective on species conservation as a mechanism for compliance with the ESA. This approach is intended to address the full range of forest management actions within the ESF.

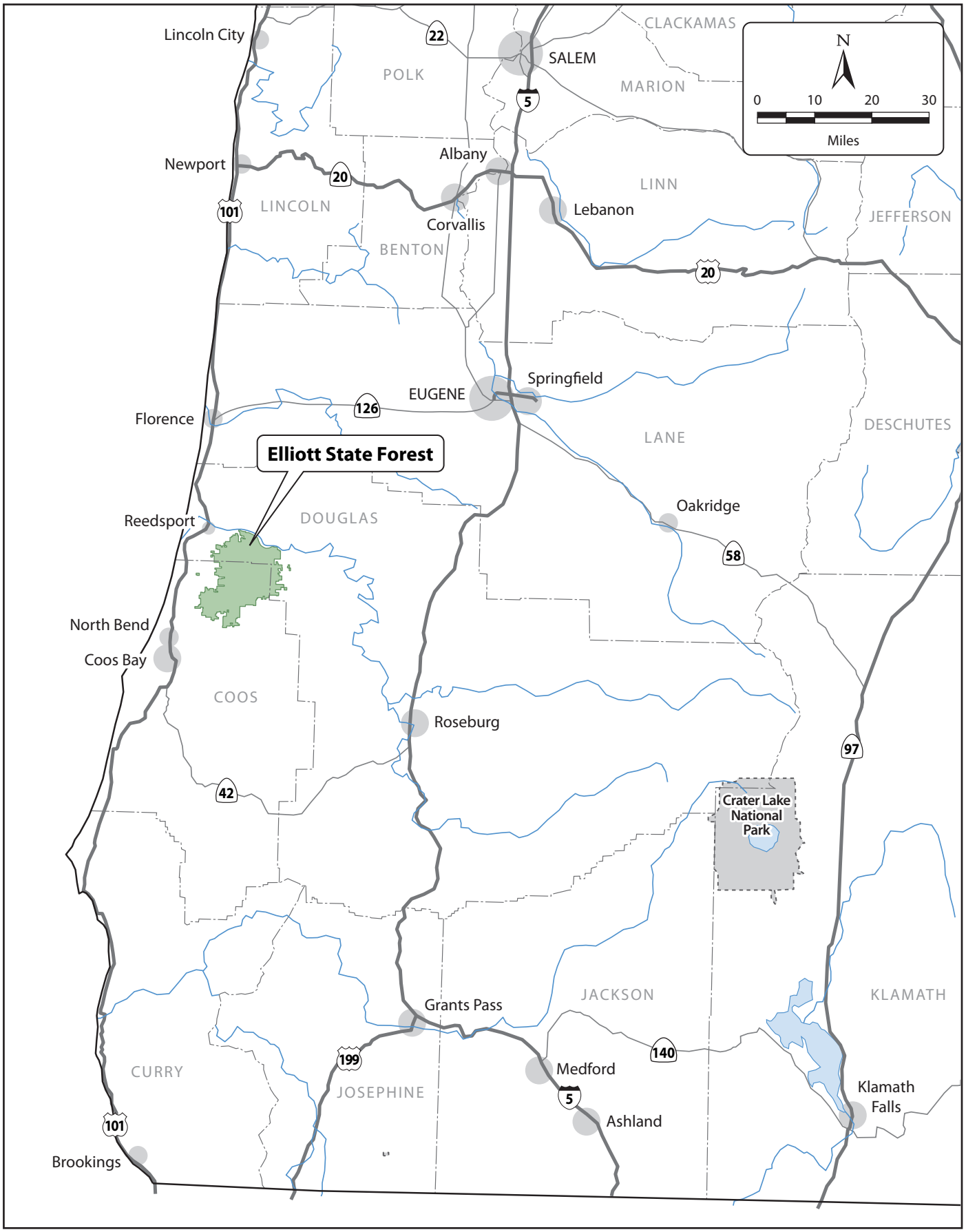
1.2.3.1 Background

The ESF, located in Oregon's Coast range, encompasses approximately 93,000 acres of State-owned forestlands in Coos and Douglas Counties (Figure 1-1). Managed out of ODF's Coos District Office, which is located in Coos Bay, the ESF lies on a contiguous block of land approximately 18 miles long from north to south, and about 16 miles wide from west to east.

Of the ESF lands, 91 percent are Common School Forest Lands, which are owned by the State Land Board. Oregon's constitution states that these lands

must be managed for the greatest benefit for the people of the State, consistent with the conservation of the resource under sound techniques of land management. Oregon's attorney general has concluded that the "greatest benefit for the people" is to use the land for schools and the production of income for the Common School Fund. The remaining lands are Board of Forestry Lands, which must be managed to secure the greatest permanent value to the citizens of Oregon.

Approximately half of the ESF is composed of timber that is 100 to 130 years old. The rest of the forest is primarily less than 60 years old. In total, the forest contains an estimated 3 billion board feet of mature timber currently valued at more than $1.2 billion. Although ODF has not developed recreational amenities within the forest (e.g., campgrounds, fire rings, picnic tables), the forest also provides dispersed recreation opportunities for camping, swimming, hunting, fishing, and hiking.



04718.04 EIS (11-06)

Jones & Stokes

Figure 1-1
Elliott State Forest Vicinity Map

As described in Chapter 2, Alternatives, the ESF is currently managed in accordance with the 1994 *Elliott State Forest Management Plan* (Oregon Department of Forestry 1994) and the 1995 *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 1995). The ODF currently holds an ITP for potential take of northern spotted owls in the ESF through 2055.

In January 2006, ODF released a revised *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a). Some of the proposed forest management activities outlined in the revised forest management plan may affect the northern spotted owl, as well as other species subject to protection under the ESA, including marbled murrelet and coho salmon. As a result, ODF has proposed a new, multi-species HCP with a proposed 50-year term, based on the revised forest management plan, which addresses the take of these three listed species, as well as 15 unlisted species (Table 1-1). The proposed revisions represent a major amendment to the 1995 HCP, and require that ODF minimize and mitigate the impacts of take on all covered species associated with the proposed activities, to the maximum extent practicable. In the process, ODF must also demonstrate that adequate funding for the HCP will be provided.

1.2.3.2 Oregon Department of Forestry Covered Activities Included in the Habitat Conservation Plan

The proposed covered activities for which ODF is seeking ITPs include the following forest management activities in the ESF:

- mechanized timber harvest;
- forest product transport;
- road and landing construction, use, maintenance, and abandonment;
- site preparation and tree planting (excluding use of herbicides);
- site fertilization;
- silvicultural practices;
- fire suppression;
- aquatic habitat restoration;
- rock pit development;
- other management activities, including vertebrate control and harvesting of minor forest products; and
- research and monitoring.

Many of these activities are ongoing, in accordance with the 1994 *Elliott State Forest Management Plan*. These activities are described in detail in Chapter 2, Alternatives.

1.2.3.3 Oregon Department of Forestry Conservation Strategy in the Habitat Conservation Plan

The ODF has proposed a conservation strategy in the HCP to minimize and mitigate impacts of take on federally listed species and other unlisted species that may become listed in the future. The conservation strategy would be implemented through the conservation measures described in Chapters 5 through 9 of the HCP, and includes the following:

- managing for a range of stand structures across the landscape;
- designating conservation areas to protect special resources, including sites used by northern spotted owls and marbled murrelets;
- landscape design to provide functional habitat for native species;
- maintaining structural habitat components throughout the forest;
- using watershed analysis as a tool to inform management decisions;
- applying management standards for aquatic and riparian areas, including establishment of riparian management areas adjacent to all streams;
- applying alternative vegetation treatments (e.g., hardwood conversions) to achieve habitat objectives in riparian areas;
- applying specific strategies to other aquatic habitats, such as wetland areas;
- managing the forest to minimize risk in high and moderate landslide hazard locations;
- managing forest roads to protect forest resources;
- implementing a monitoring and research program; and,
- implementing adaptive management measures.

1.3 Environmental Review Process

1.3.1 Process Steps

The environmental review process began with internal, interagency, and tribal scoping to address key components of alternatives descriptions, to develop the level of detail for impact and cumulative analysis, and to prepare the DEIS framework and schedule. Public input on the development of the DEIS was solicited during a 45-day public scoping period that included three public meetings. The current public review period provides the public an additional opportunity to comment on the DEIS, Implementation Agreement (IA), and the draft HCP.

Following the public review period, an FEIS will be prepared. The FEIS will be an edited version of the DEIS based primarily on input received during the public comment period. The FEIS will also include a summary of the public process and all comment letters and responses. Upon its completion, the FEIS will be available to the public and those who commented on the DEIS and will be available to the general public for 30-days. This period will be announced through the same venues used for the DEIS.

The Services will conduct a review of the FEIS after completion of the FEIS 30-day comment period to evaluate alternatives and to make a permit decision on the proposed action. The final decision-making process will involve analysis and notice in ESA Section 10 Findings documents, ESA Section 7 BOs, and a NEPA ROD.

1.3.2 Scoping

On May 9, 2005, a 45-day public scoping period was announced in the *Federal Register* (FR) (88 FR 24450-24452, May 9, 2005). Three public scoping workshops were held on May 24, 25, and 26, 2005, to introduce the proposed HCP and the NEPA review process. Each workshop began with a 1-hour open house to accommodate informal discussion and questions, followed by a 1-hour presentation to provide structured input on the proposed action. Public and agency comments were received, both orally at the meeting and in writing in subsequent letters. A scoping report documenting comments received during the public scoping period was prepared in September 2005 and is available upon request from the Services. The Services also conducted internal scoping activities to address key components of alternative descriptions, to develop the level of detail for impact and cumulative impact analyses, and to prepare the DEIS framework and schedule. The DEIS was prepared in consideration of issues raised during the public and internal scoping process.

1.4 Relationship to Other Plans, Regulations, and Laws

Many Federal, State, and local statues, regulations, and policies govern the activities proposed for ITP coverage under the draft HCP (Table 1-2). Key Federal and State permits and regulatory consultation requirements that are likely to govern development or implementation of the draft HCP are summarized in the following text. It should be noted that ODF's requirements for permits and environmental review and consultation might change during the EIS review process as discussions with involved agencies proceed.

Table 1-2 Permits, Approvals, and Environmental Review and Consultation Requirements that May Be Required for the Proposed Alternatives

Permit / Consultation	Oversight Agency	Activities that Trigger Permit/ Consultation Requirements
Federal Requirements		
Section 404, Clean Water Act Permit (33 USC 1344)	Corps	Discharge of dredged or fill-material into waters of the United States, including wetlands. Permits are issued following public interest review and analyses according to the EPA's Section 404(b)(1) guidelines.
Section 10, Rivers and Harbors Act of 1899 Permit (33 USC 403)	Corps	Applies to activities that could affect navigable waters of the United States.
Section 401, Clean Water Act Permit (33 USC 1341)	EPA, delegated to DEQ	Discharges requiring a Federal license or permit to comply with State water quality standards.
Section 402, Clean Water Act Permit (33 USC 1342)	EPA, delegated to DEQ	Discharge of any pollutant or pollutants directly into surface waters of the United States from any point source.
Section 10, ESA, ITP (16 USC 1536)	FWS and NMFS	Potential incidental take of federally listed threatened and endangered species. Potentially issued if requested by a non-Federal applicant when proposed activities have the potential to harm listed species.
Section 7, ESA Consultation (16 USC 1536)	FWS and NMFS	Consultation triggered by proposed issuance of a Section 10 ITP by FWS and/or NMFS.
Magnuson-Stevens Fishery Conservation and Management Act Consultation	NMFS	Applies to activities that will adversely affect essential fish habitat.
Fish and Wildlife Coordination Act Consultation (16 USC 661-666)	FWS, NMFS, and ODFW	Applies to water resource activities affecting general fish and wildlife resources.
Coastal Zone Management Act Permit (16 USC 1451)	NMFS, through the Oregon Land Conservation and Development Commission	Applies to development activities within the coastal zone.
Section 106, National Historic Preservation Act Consultation (16 USC 470)	FWS and NMFS, through the SHPO and ACHP	Activities affecting cultural resources that are determined eligible for listing on the NRHP. Also requires consultation and coordination with Native American tribes.

Permit / Consultation	Oversight Agency	Activities that Trigger Permit/ Consultation Requirements
NEPA	FWS and NMFS	Major Federal actions significantly affecting the quality of the human environment. Issuing Federal permits, such as an ITP, triggers the NEPA process as a major Federal action.
State Requirements		
Oregon Removal-Fill Permit (ORS 196.795-900)	DSL	Activities that could result in the removal or fill of material into waters of the State.
Oregon Endangered Species Act Consultation (ORS 496.002 – 496.192)	ODFW, DSL, Oregon Department of Agriculture	Consultation triggered by activities taken by State agencies on State lands that would affect State-listed threatened or endangered species. Consultation typically completed in conjunction with Federal consultation under Section 7 of the ESA.
Oregon Forest Practices Act (FPA)	ODF	Governs forest management in the State.

USC = U.S. Code
Corps = U.S. Army Corps of Engineers
EPA = Environmental Protection Agency
DEQ = Oregon Department of Environmental Quality
ESA = Endangered Species Act
ITP = Incidental Take Permits
FWS = U.S. Fish and Wildlife Service
NMFS = National Marine Fisheries Service
ODFW = Oregon Department of Fish and Wildlife
SHPO = State Historic Preservation Officer
ACHP = Advisory Council on Historic Preservation
NRHP = National Register of Historic Places
ORS = Oregon Revised Statutes
DSL = Oregon Department of State Lands
FPA = Oregon Forest Practices Act

1.4.1 Federal Permits and Consultation Requirements

Development of the *Elliott State Forest Habitat Conservation Plan* and related EIS are regulated primarily by the ESA and NEPA, as described in Section 1.2.2, Need for Action. Other Federal permits and consultations that may be required over the term of the ITP are summarized in Table 1-2 above.

1.4.2 State Permits and Consultation Requirements

Two key State regulations, the Oregon State Endangered Species Act (Oregon ESA), and the Oregon Forest Practices Act (FPA), are likely to govern development and implementation of the HCP, as described below.

1.4.2.1 Oregon Endangered Species Act

The Oregon ESA offers protection to species listed as threatened or endangered by the State (Oregon Revised Statutes [ORS] 496.002 through 496.192). However, unlike the Federal ESA, the Oregon ESA applies only to State agencies taking actions on State-owned or leased lands. Oregon's ESA is administered by Oregon Department of Fish and Wildlife (ODFW), Oregon Department of State Lands (DSL), and Oregon Department of Agriculture (ODA).

Several State-listed species occur within the ESF (Table 1-1). Since the ESF resides on State-owned land, ODF will be required to consult with ODFW for impacts on State-listed species. In practice, compliance with the Oregon ESA is typically achieved during consultations with the Federal agencies pursuant to the Federal ESA.

1.4.2.2 Oregon Forest Practices Act

The FPA was voted into law by the legislature in 1971 and encourages economically efficient forest management in Oregon, as well as the continuous growing and harvesting of trees and maintenance of forestland consistent with the protection of forest resources through the sound management of soil, air, water, fish, and wildlife resources. It also helps preserve scenic resources along visually sensitive corridors and reduces the risk of serious bodily injury or death caused by shallow, rapidly moving landslides directly related to forest practices. The FPA, and the Forest Practices Rules (FPR) that implement the FPA, have been upgraded many times in response to new scientific knowledge and public concerns.

As outline in Oregon Administrative Rules (OAR) Chapter 629, the FPR specify requirements specific to clearcut harvest, road design and construction, leave trees, the use of chemicals, and protections of habitats for certain fish and wildlife species, among other things. The FPR apply to all State-owned lands and private lands in the State, whether owned by individuals or large corporations.

1.5 Organization of This Environmental Impact Statement

The EIS is organized in the following sections.

Volume I:

- Cover Sheet
- Executive Summary
- Table of Contents
- List of Figures
- List of Tables
- Chapter 1, Purpose and Need
- Chapter 2, Alternatives
- Chapter 3, Affected Environment

Volume II:

- Chapter 4, Environmental Consequences
- Chapter 5, Cumulative Effects
- Chapter 6, References
- Chapter 7, Distribution List
- Chapter 8, List of Preparers
- List of Acronyms and Abbreviations
- Appendices

Chapter 2

Alternatives

2.1 Alternatives Considered

Three alternative management strategies have been identified for detailed analysis in this Environmental Impact Statement (EIS), including the Proposed Action alternative (Alternative 2). These three alternatives are described in Section 2.3, Alternatives Analyzed in Detail, and are compared and summarized in Table 2-14 at the end of this chapter.

Alternative 1, the No Action Alternative, involves the continued implementation of the 1994 *Elliott State Forest Management Plan* (Oregon Department of Forestry 1994) and the 1995 *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 1995). This alternative is the baseline against which the effects of all other alternatives are compared, as described in Chapter 4, Environmental Consequences. Management strategies and issues raised during the scoping process that were not analyzed as alternatives are described in Section 2.4, Alternatives Not Analyzed in Detail.

The alternatives described in this chapter were developed by the U.S. Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) (collectively referred to as, the Services), and with substantial input from resource specialists with the Oregon Department of Forestry (ODF) and Oregon Department of Fish and Wildlife (ODFW). Public input provided during the public scoping period also contributed to the development of alternatives. Section 1.3.2, Scoping, describes the process for gathering the information used in developing this EIS.

2.2 Covered Activities Common to All Alternatives

2.2.1 Action Area, Management Activities, and Duration

The alternatives would be implemented on the Elliott State Forest (ESF), 93,282 acres of State-owned forestlands located in Coos and Douglas Counties. The

ESF is a nearly contiguous block of land approximately 18 miles long from north to south, and about 16 miles wide from west to east. The ESF is referred to as the "action area" in this EIS (Figure 1-1).

Management of the action area, for the purposes of the analysis in this EIS, would occur over a 50 year period. All alternatives would be implemented in accordance with the Oregon Constitution, policies of the State Land Board and Board of Forestry, , and other applicable laws, including the State and Federal Endangered Species Acts (ESAs). Each alternative evaluated in detail in this EIS was developed to reflect different forest management objectives and wildlife and aquatic / riparian conservation strategies, with the intent of providing the public with a range of alternatives for consideration. The effects of the following forestland management activities under each alternative are addressed in this EIS:

- mechanized timber harvest (i.e., felling, bucking, yarding and loading);
- forest product transport;
- road and landing construction, use, maintenance, and abandonment;
- site preparation and tree planting;
- site fertilization;
- silvicultural practices;
- fire suppression,
- aquatic habitat restoration;
- rock pit development;
- other management activities, including vertebrate control and harvesting of minor forest products; and
- research and monitoring.

The components of these activities that are common to each of the proposed alternatives are described below in Sections 2.2.1.1 through 2.2.1.11.

2.2.1.1 Mechanized Timber Harvest

Under all of the alternatives, mechanized timber harvest would include the felling, bucking, yarding, loading, and salvage of timber. Felling activities would include cutting down trees. Bucking activities would include cutting felled trees into logs. Yarding activities would include moving the logs from the area they are felled to the landing area, and loading activities would include loading logs from the landing area to a truck. Salvage activities would include the removal of snags, down logs, windthrow, or dead and dying material.

2.2.1.2 Forest Product Transport

Under all of the alternatives, timber would be removed from the action area on established road systems by logging trucks.

2.2.1.3 Road and Landing Construction, Use, Maintenance, and Abandonment

Under all of the alternatives, ODF would construct roads and landings, maintain existing road surfaces, install and maintain culverts, and install and maintain bridges. These activities would be conducted as needed to provide access for the sale of timber and other forest products, timber management activities, protection from fire, and public access.

Forest roads and landings would be designed, constructed, and maintained to meet or exceed rules prescribed in ODF's *Forest Roads Manual* (Oregon Department Forestry 2000). As such, each alternative would include provisions to avoid road construction in sensitive locations (e.g., within 100 feet of streams and parallel to roads); reduce erosion on bare soils (grass and seed mulch); install adequate drainage relief structures to remove water from road surfaces and ditches; prevent delivery of ditch water to streams; provide fish passage on all fish-bearing streams; and permanently close roads to motor vehicle access where possible.

2.2.1.4 Site Preparation and Tree Planting

Under all of the alternatives, site preparation and tree planting would be completed to meet or exceed the requirements of the FPA and *Oregon Smoke Management Plan* (Oregon Department of Forestry 1992). Within 12 months following timber harvest, harvest units would be prepared for planting, as needed, to achieve reforestation of the site to a desired stocking level. Herbicide application would occur under certain circumstances and application would be in accordance with the label and FPA. As described in Section 2.2.1.6, Silvicultural Practices, although herbicides could be used under all alternatives, an incidental take permit (ITP) issued for any of the alternatives would not cover such use.

A limited amount of site preparation would occur through prescribed burning activities. Prescribed burning in the action area would be limited to areas where slash loads or competing vegetation are barriers to establishing a new stand after harvest, present an unacceptable risk of wildfire, or where there are barriers to forage vegetation for ungulates. Prescribed burning would also be limited in areas with a risk of debris flow initiation. All prescribed burning activities would be completed in accordance with the *Oregon Smoke Management Plan*.

Tree planting would be completed within 24 months after harvest. By the end of the sixth full calendar year after harvest, a minimum of 200 free-to-grow trees[1] per acre would be established in the re-planted area. To address these requirements, initial restocking efforts would consist of planting 400 or more conifer seedlings per acre. To promote biodiversity, approximately 15 percent of these seedlings would be conifer species other than Douglas-fir (*Pseudotsuga menziesii*). These other conifer species (e.g., western hemlock [*Tsuga heterophylla*], western redcedar [*Thuja plicata*]) would be planted at locations conducive to their establishment and survival.

2.2.1.5 Site Fertilization

Although a forest-wide fertilization program would not be implemented to promote stand growth in the action area, fertilizer may be applied to targeted stands with nutrient deficient soils, as needed, over the course of the ITP. It is estimated that up to 1,000 acres within the action area would be treated with urea over a 10-year fertilization cycle. Urea would be applied as pellets and aerially broadcast onto the identified stands.

2.2.1.6 Silvicultural Practices

Silvicultural practices include activities designed to control the establishment, composition, growth, health, and quality of stands to achieve forest management and habitat objectives. Silvicultural activities could include commercial and pre-commercial thinning, vegetation control, seed tree management, and active snag development using blasting, cutting, girdling, or inoculating methods. Pre-commercial thinning could occur in stands typically younger than 15 years old, and one or more commercial thinning could occur prior to clearcut harvest. Within the action area, forestlands would be managed for commercial timber production using practices that meet or exceed the FPA.

Silvicultural chemicals (e.g., herbicides, insecticides, and soil fumigants) could be used under all alternatives, which could require water drafting from local streams or ponds to facilitate chemical mixing. However, an ITP issued for any of the alternatives evaluated in this EIS would not cover such use.

2.2.1.7 Fire Suppression

The ODF would engage in wildfire prevention and suppression as needed to protect timberland and to prevent spread of wildfire to surrounding lands. This may include helicopter water drops, handline and possibly bulldozer line construction, application of water by engines or stationary pumps, snag felling,

[1] "Free-to-grow" is defined in the FPA as a tree or a stand of well distributed trees, of acceptable species and good form that have a high probability of remaining or becoming vigorous, healthy, and dominant over undesired competing vegetation (FPA–Section 629-600-0100).

and manual digging for fire mop-up. As needed, bulldozer and hand dug lines would be water-barred and mulched after the fire is controlled. In addition, water drafting in local streams or ponds could occur to support fire suppression activities, as necessary.

Aerial fire retardant[2] could also be used under all alternatives to suppress wildfires. However, an ITP issued for any of the alternatives evaluated in this EIS would not cover such use.

2.2.1.8 Aquatic Habitat Restoration

Aquatic habitat enhancement projects would be considered on a site-specific basis as part of the ESF annual operation planning process. Specific projects on identified streams would be developed collaboratively with local watershed associations, ODF, ODFW biologists, and the Services. ODFW and the watershed associations would provide input on the actual design and location of enhancement work; ODF would verify plan feasibility and provide appropriate funding and necessary materials. Watershed associations might also provide project funding and management. All enhancement projects would have to be approved by the Services.

Under all of the alternatives, stream enhancement projects within the action area could include placement of logs or whole trees in streams to create pools and to retain spawning gravels; replacement of stream crossing structures (i.e., culverts) that block fish passage; relocation or redesign of improperly located roads; stabilization of sediment sources (i.e., cut banks); improvement of road drainage systems; road closure; and/or road abandonment. The *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003) would be used as a guide to establish project priorities, in collaboration with Services, ODFW, and the local watershed associations.

2.2.1.9 Rock Pit Development

Under all alternatives, ODF would develop rock quarries to provide crushed rock for roads in the action area. Portable rock processing plants would be located at strategic locations within the action area to facilitate extraction from small, localized quarries (i.e., approximately 200 feet long, 200 feet wide and 20 feet deep). Quarries would be maintained and active for several years, with crushing activities occurring intermittently. It is estimated that each quarry would produce

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

approximately 30,000 cubic yards of material, all of which would be produced as needed and stored on site as necessary.

Although the total number and specific location of quarry sites is undetermined at this time, quarries would not be located in conservation or reserve areas (Section 2.3, Alternatives Analyzed in Detail). Quarries and placement of surfacing materials would be operated to avoid delivery of sediment to streams in the action area.

2.2.1.10 Other Management Activities

Vertebrate Control

The ODF would trap and remove mountain beavers (*Aplodontia rufa*), as needed, to prevent damage to seedlings in newly planted areas. Plastic tubing sleeves and big game repellent may be used to prevent damage to young seedlings from browsing deer and elk.

Harvesting of Special or Minor Forest Products

Special or minor forest products within the action area include a variety of plant products other than timber, which are collected or harvested for personal or commercial purposes. Under all of the alternatives, ODF would sell or issue permits (called brush leases) for the collection of special or minor forest products, including but not limited to the following: swordfern (*Polystichum munitum*), salal (*Gaultheria shallon*), red huckleberry (*Vaccinium parvifolium*), and firewood remaining on landscape after harvest operations.

It is estimated that approximately 25 brush leases, each covering approximately 320 acres, would be issued each year. Approximately 500 free-use woodcutting permits would be given to the public each year.

2.2.1.11 Research and Monitoring

Under all of the alternatives, ODF would implement a research and monitoring program to evaluate the effectiveness of forest management and conservation strategies, and to provide information for the adaptive management process. Specific commitments to research and monitoring under each of the proposed alternatives are described in Sections 2.3.1 through 2.3.3.

2.3 Alternatives Analyzed in Detail

2.3.1 Alternative 1 - Current Management (No-Action)

Under Alternative 1, ODF would manage the action area in accordance with the 1994 *Elliott State Forest Management Plan* and the 1995 *Elliott State Forest Habitat Conservation Plan.* The FWS would not amend the existing ITP and the revised HCP (Oregon Department of Forestry 2008) would not be implemented. All lands outside of reserve areas would be managed with timber production as the primary use, but with varying rotation ages depending on location. Table 2-1 provides definitions of key terms associated with Alternative 1.

Alternative 1 is used as the baseline against which other alternatives are compared and described in Chapter 4, Environmental Consequences. The differences demonstrated in that comparison are the potential environmental consequences of implementing the alternatives. For the purposes of this EIS, the term "environmental consequences" is synonymous with effects and impacts.

It is important to note that Alternative 1 represents management of the action area over time and is, therefore different than the "current condition" described in Chapter 3, Affected Environment. The current condition represents the condition of a given resource area at a set point in time, which in this EIS, is typically the year 2005. Refer to Section 4.0, Environmental Consequences, for a more detailed discussion of how the alternatives were compared and how the current condition in the action area is considered in the analysis.

Table 2-1 Key Terms Associated with Alternative 1

Key Terms	
Late-successional forest	A mature and/or old-growth forest stand. Under Alternative 1, late-successional forest stands are defined as stands that are 156 years or older (160-year age class and up).
Nesting-roosting-foraging (NRF) habitat	Habitat with the forest structure, sufficient area, and adequate prey to meet the need of a nesting pair of spotted owls. Under Alternative 1, NRF habitat is defined as conifer stands 80-year age class and older.
Marbled murrelet habitat	Under Alternative 1, marbled murrelet habitat is defined as coniferous forest stands that are either within or adjacent to the action area and that are: (1) at least 60 years old with at least five trees within a 330-foot radius containing platforms suitable for nesting murrelets; (2) dominated by western hemlock and Sitka spruce that are at least 80 years old; (3) dominated by Douglas-fir that are at least 100 years old.
Marbled Murrelet Management Area (MMMA)	An area subject to special management considerations for the purposes of maintaining suitable nesting habitat for marbled murrelets. Marbled Murrelet Management Areas are identified and designated using an established procedure, and are similar to reserve areas.

Key Terms	
Reserve areas	Blocks of forestlands managed for non-commodity values. Under Alternative 1, reserve areas include Habitat Conservancy Areas (HCAs), riparian management areas (RMAs), and other special interest reserve areas. Forest management activities are limited in reserve areas.
Habitat Conservancy Area (HCA)	Reserves established to protect sensitive wildlife habitat areas, such as threatened or endangered species sites or fisheries areas. Under Alternative 1, HCAs would be located in all of the management basins in permanent, fixed locations.
Riparian management areas (RMA)	An area bordering a stream where the primary purpose is to protect the stream and its riparian area.
Other special interest reserve areas	Other special interest reserve areas include late-successional habitat in the action area that is managed for non-timber production goals, outside of HCAs and RMAs. Examples are scenic conservancy, protective conservancy, and noncommercial forest areas.
Matrix lands	Forestlands managed for timber production.
Fish-bearing stream	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 the Federal or State ESA.
Non-fish-bearing streams	Waters other than those meeting the definition of fish-bearing.
Perennial streams	Streams that are expected to have summer surface flow after July 15.

Source: Oregon Department of Forestry 1995

2.3.1.1 Species covered

Under Alternative 1, ITP coverage would continue to be provided through October 3, 2055, for potential take of northern spotted owls within the action area, in accordance with the FWS ITP, and associated 1995 *Elliott State Forest Habitat Conservation Plan*. ODF would continue to protect federally listed species not covered by an ITP (i.e., marbled murrelet and coho salmon) on a case-by-case basis to avoid incidental take.

Table 2-2 identifies species in the action area that are currently listed, proposed for listing, candidates for listing, or otherwise protected.

Table 2-2 Federally Listed, Candidate, Proposed, and Protected Species Present or Potentially Present in the Action Area and Vicinity

Species Name	Listing Status		Federal Management Agency
	Federal	State	
Birds			
Northern spotted owl *Strix occidentalis caurina*	Threatened	Threatened	FWS
Marbled murrelet *Brachyramphus marmoratus*	Threatened	Threatened	FWS
Bald eagle *Haliaeetus leucocephalus*	Not listed	Threatened	FWS
Fish			
Coho salmon, coastal *Oncorhynchus kisutch*	Threatened	Sensitive/Critical	NMFS
Mammals			
Fisher *Martes pennanti*	Candidate	Sensitive/Critical	FWS

FWS = Fish & Wildlife Service

2.3.1.2 Management

Forest Strategies

Under Alternative 1, the action area would be managed to achieve four primary objectives.

- To produce a sustainable, even-flow harvest of timber. Harvest volumes would average 26.00 million board feet (MMBF) annually in the first decade, and would increase to 28.48 MMBF annually by the fifth decade.[3]
- To maintain 12 to 66 percent nesting-roosting-foraging (NRF) habitat for northern spotted owls in each of 17 management basins (see Table 2-1 for a definition of key terms). For the management basins with target harvest ages of 135 years and older, NRF habitat would not be harvested until NRF

[3] Harvest volumes presented in this EIS (i.e., timber volume associated with regeneration and thinning operations) are based on the most recent forest inventory data (Stand Level Inventory) and associated growth and yield tables for each of the alternatives. Refer to Appendix I in the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008) for a description of the model assumptions for each alternative. In addition, the projected harvest volumes for Alternative 1 are different than those presented in the 1995 *Elliott State Forest Habitat Conservation Plan*. As described in Section 4.7, Socioeconomics, this is attributable to the fact that ODF must avoid take of marbled murrelet during forest management activities. Given that ODF murrelet surveys identify new sites on about 25 percent of new timber sale areas (an average of 55 acres per timber sale area), the acreage of land available for timber harvest decreases each year.

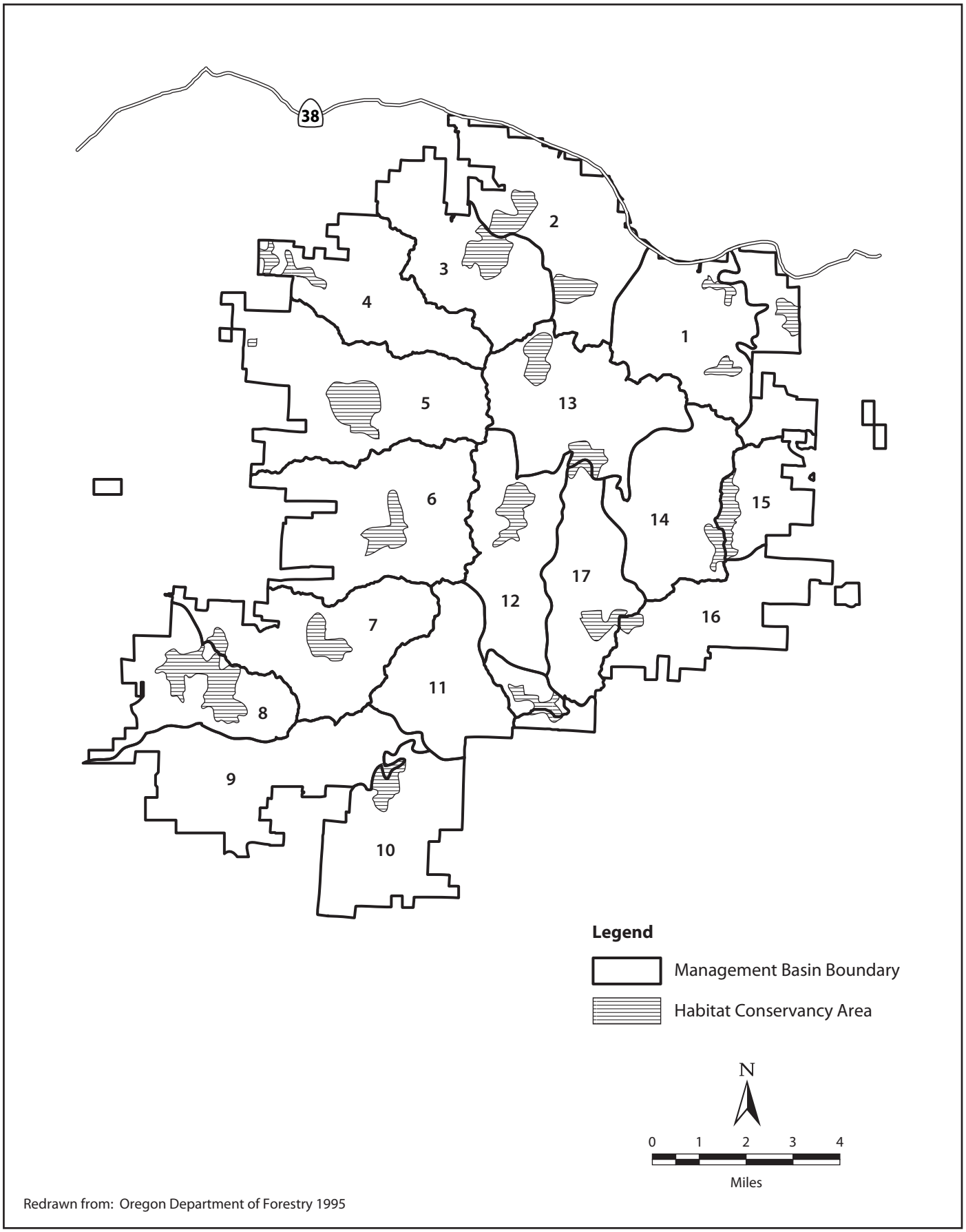
habitat in the basin reaches the level shown in Table 2-3. The action area would be managed to maintain approximately 39,781 acres (43 percent of the action area) in NRF habitat.

- To manage each management basin for northern spotted owl dispersal habitat, such that 50 percent of the basin acreage consists of stands of trees averaging 11 inches in diameter at breast height (dbh) or larger, and with a canopy closure of 40 percent or greater.
- To manage at least 18,060 acres (19.5 percent) of the action area as reserve areas for non-commodity values.

Management Basins

Under Alternative 1, the action area would continue to be managed according to 17 management basins (Figure 2-1). The basin boundaries have been aligned with watershed boundaries, where practical, and allocate an average of 5,500 acres to each management basin (Table 2-3). These management basins would continue to serve as the basis for implementing and monitoring management activities, and for regulating the intensity of timber harvest.

Lands within the management basins in the action area would continue to be managed either as reserve areas or matrix (timber production) lands. Reserve areas, which include habitat conservancy areas (HCAs), riparian management areas (RMAs), and areas with scenic value, or public safety restrictions because of steepness, would be managed for non-commodity values, as described in detail under the Aquatic and Riparian Strategies and Wildlife Conservation sections below. Matrix lands would include all lands not in the reserve areas, and would represent approximately 74,794 acres or 81percent of the action area. These lands would be managed for timber production within the parameters specified above, by using target harvest age to control timber harvest rates in each management basin. Of the 17 management basins, three would be managed on a 240-year rotation; three would be managed on a 200-year rotation; three would be managed on a 160-year rotation; one would be managed on a 135-year rotation; and seven would be managed on an 80-year rotation (Table 2-3). Management basins with longer rotation lengths (160 to 240 years) would emphasize late-successional forest development, while management basins with rotation lengths between 80 and 135 years would emphasize a mix of early to mid successional stages. Table 2-3 illustrates the management basin strategies for each of the 17 management basins.



04718.04 EIS (11-06)

Jones & Stokes

Figure 2-1
Alternative 1 (No-Action Alternative)
Management Basins and Habitat Conservancy Areas

Table 2-3 Alternative 1—Management Basin Strategies[1]

Basin	Total Basin Acres	HCA Acres	Other Reserves Acres	RMA Acres	Total Reserve Acres	Total Harvest Age	Current Average Stand Age in HCAs	Current Acres in 80+ age	Current Percentage in 80+ age	Long Term Percentage in 80+ age
1	5153	267	626	311	1204	160	150	2795	54	50
2	6179	643	1191	317	2151	240	138	4128	67	66
3	5352	464	41	354	859	200	98	2654	50	60
4	5034	221	74	346	641	160	161	2074	41	50
5	7779	618	57	519	1194	200	109	4303	55	60
6	7352	387	31	506	924	240	93	4670	64	66
7	5870	346	143	393	882	200	116	3429	58	60
8	4176	983	144	223	1350	160	103	2061	49	50
9	6212	211	516	400	1127	80	90	2599	42	18
10	4929	267	255	322	844	80	110	793	16	17
11	2445	315	277	354	946	80	91	3459	45	17
12	4968	443	165	318	926	80	117	2746	55	19
13	5965	555	37	392	984	80	105	3342	56	16
14	5078	212	84	349	645	135	87	3019	59	40
15	4655	530	1330	204	2064	80	122	2773	60	44
16	4444	115	132	306	553	80	95	783	18	12
17	4263	384	107	275	766	240	114	2381	56	66
Total (Average)	92,854	6,961	5,210	5,889	18,060	151 (Average)	112 (Average)	47,009	51 (Average)	43 (Average)

Source: Oregon Department of Forestry 1995

[1] The acreage of land allocated to reserve and harvest areas in this table has changed since this data was generated. This is attributable to the fact that ODF must avoid take of marbled murrelet during forest management activities, and that new murrelet sites are identified on about 25 percent of new timber sale areas (an average of 55 acres per timber sale area) each year. As such, the acreage of land available for timber harvest decreases each year and the acreage in reserve increases.

HCA = Habitat Conservancy Area; RMA = Riparian Management Area

Legacy Structural Components

Retained live trees, snags, and downed wood, collectively termed "legacy structural components," would provide opportunities for development of stand diversity in the action area after timber harvest. Under Alternative 1, the following legacy structural components would be implemented.

Live Tree Retention. Live trees would be left standing within or adjacent to timber sale units in order to provide habitat for a variety of species, and to aid in the development of multi-story canopy stands that could be used by northern spotted owls and other cavity-nesting birds. Under Alternative 1, in all timber sales, three or more trees per acre harvested would be left standing.

Snag Creation and Retention. Snags provide habitat for a variety of cavity nesting bird species and are associated with optimal spotted owl habitat. Under Alternative 1, snags would be created within most sale units from retained live trees over 20 inches dbh by removing tops after harvesting operations are finished. In timber sales, one-half to three snags per acre would be created or retained.

Downed Wood Retention and Creation. Downed wood retention and creation would include leaving logs on the ground that might otherwise have commercial value and be removed during timber harvest. Under Alternative 1, in timber sales, three to six downed logs per acre would be left scattered in a unit. The minimum size of retained logs would be 12 inches in diameter on the large end and 16 feet in length.

Aquatic and Riparian Strategies

Under Alternative 1, RMAs would be established to provide streamside protection, contribute to the protection of aquatic species, and link areas of older forest structure between and within management basins and HCAs. Approximately 5,889 acres, or 7.3 percent of the action area, would be located in no-harvest RMAs (outside of HCAs described under Wildlife Conservation Strategies below).

Riparian buffer areas would range in size from small brush areas adjoining seasonal, non-fish-bearing streams to 100-foot no-harvest areas on fish-bearing streams. Buffer size and management would depend on whether the stream is perennial or intermittent, and whether or not it is fish-bearing (see Table 2-1 for a definition of key terms). Table 2-4 describes the riparian strategy for Alternative 1 in detail, including additional management requirements for roads, yarding and line corridors, yarding suspension over stream banks, protection of wetlands next to streams, high landslide hazard areas, and rehabilitation of stream structure. Of note, the RMA described in Table 2-4 would be measured from the edge of the active channel.

Table 2-4 Alternative 1—Aquatic Riparian Strategy

	Fish-bearing perennial streams	Non-fish-bearing perennial streams	Fish-bearing intermittent streams	Non-fish-bearing intermittent streams
Riparian Management Area[1]	100 feet	50 feet	75 feet	Shrub and forb retention
Harvest	No harvest except for specific habitat enhancement[2]	No harvest except for specific habitat enhancement[2]	No harvest except for specific habitat enhancement[2]	No constraints
Adjacent riparian management area constraints[3]	No constraints	No constraints	No constraints	No constraints
Roads	No road construction in riparian management areas when possible, except crossings	No road construction in riparian management areas when possible, except crossings	No road construction in riparian management areas when possible, except crossings	No road construction in riparian management area when possible, except crossings
Yarding and line corridors	Yes	Yes	Yes	Yes
Yarding suspension over riparian management areas	Full	Full when possible, otherwise one-end suspension[4]	Full	One-end suspension
Protection of wetlands adjacent to stream	Yes	Yes	Yes	Yes
High landslide hazard areas	Site-specific strategy[5]	Site-specific strategy[5]	Site-specific strategy[5]	Site-specific strategy[5]
Rehabilitation	Stream structure and large wood placement[6]	No proposed strategy.	Stream structure and large wood placement[6]	No proposed strategy.

Source: Oregon Department of Forestry 1995

[1] Measured slope distance from the edge of the active channel. Includes all portions of the stream channel carrying water at normal high flows, not just the current wetted channel, and all side channels and backwaters, which may not carry water during summer low flow.

[2] Riparian habitat enhancement projects, such as an alder conversion or similar activity, would require a written plan developed in consultation with ODFW and approved by the Services.

[3] Necessary green tree retention is often placed adjacent to riparian management areas, further increasing the effective width of the original riparian management area.

[4] Partial suspension on stable areas, full suspension on unstable areas.

[5] Slope hazard analysis is conducted prior to harvest by a geotechnical specialist—unstable areas require tailored protection.

[6] Rehabilitation projects would require a written plan based upon results of the limited factors analysis from the stream survey work.

Wildlife Conservation Strategies

Under Alternative 1, the action area would be managed to provide a range of habitat types and structural conditions at both the forest landscape and the stand level. Landscape structure objectives (which would be accomplished through the manipulation of stand age, management unit rotation length, species composition, and development of stand heterogeneity through legacy structure components), would focus on development of the following to promote wildlife conservation.

- Three successional forest types, including late, mid-, and early successional forests.
- Corridors linking the three forest types.
- Matrix conditions across the forest, ensuring a minimum mix of stand ages and habitat.
- Late-successional reserves to protect and enhance biodiversity and threatened and endangered (T&E) species habitat.

To achieve these landscape structure objectives, specific areas of habitat that currently provide high value for northern spotted owls, marbled murrelets, and fish, or areas that could become high value areas, would be protected as HCAs (Table 2-1). HCAs would continue to be located in permanent and fixed locations in all of the management basins. They would represent between 3 and 25 percent of the land cover within a given management basin, for a total acreage of approximately 6,961 acres. Activities in HCAs would be restricted to vehicle traffic on forest roads, wildfire suppression and control, reforestation, precommercial thinning, slash burning, road construction and maintenance, sales of minor forest products, forage seeding, pruning, placement of harvest unit guy lines or tailholds, stream rehabilitation work, stream survey work, and animal survey work. No clearcut harvesting would be allowed in HCAs.

In addition to management activities in HCAs, nine of the 17 management basins would be managed as long-rotation basins (i.e., 160 to 240 year old stands) to provide varying levels of NRF and dispersal habitat for northern spotted owls, and habitat for other late seral species. Nesting, roosting, foraging habitat objectives for the action area and the individual management basins, as described under Forest Strategies above, would be accomplished in part through management of these long rotation basins over the term of the ITP.

Several other targeted wildlife management strategies would be implemented to protect marbled murrelets and bald eagles. These management strategies would also benefit other late seral species utilizing similar stand structures. Specifically, in accordance with the provisions of the ESA, occupied marbled murrelet stands identified during marbled murrelet surveys would be protected from harvest indefinitely and, in effect, would become reserve areas, or marbled murrelet management areas (MMMAs). Operations that would result in detrimental habitat modification would not be allowed in an identified MMMA, and actions within 0.25 mile that are likely to disrupt nesting sites during the breeding season would be prohibited. In addition, in accordance with the FMP

and FPA, forest management activities would not be conducted within 0.25 mile of an active bald eagle nest or perch tree between January 1 and August 31, or within 0.25 mile of an active roost site between November 15 and March 15. All operations would be designed and conducted to minimize disturbance to foraging eagles in the action area.

Research and Monitoring

Research and monitoring projects would continue to be implemented within the action area to better understand the effects of forest management activities on forest resources, and to provide information for the adaptive management process outlined in the 1995 *Elliott State Forest Habitat Conservation Plan*. Most of the research commitments identified in that document have already been completed, including the demographic studies of owls in northwest Oregon and on ESF, the radio telemetry monitoring of NRF habitats used by owls, and the five-year research program on biological requirements for marbled murrelets. The following ongoing commitments to monitoring would continue to be implemented by ODF under Alternative 1.

- Monitoring to determine amounts and percentages of dispersal habitat and NRF habitat by management basin for northern spotted owl populations.
- Monitoring to assess the amounts and types of northern spotted owl and marbled murrelet enhancement activities by management basin.
- Preparing an annual monitoring report (e.g., specifying acres and location of owl or murrelet habitat harvested, estimates of level of possible murrelet and owl deaths).

2.3.2 Alternative 2 - Proposed Action

Under Alternative 2, the action area would be managed in accordance with the *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a), *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008) and ITPs from the FWS and NMFS. The ODF would manage the action area according to stand structure condition, with the objective of creating and sustaining patches of different habitat types that contribute to the larger regional landscape. High quality habitat areas used by northern spotted owls and marbled murrelets would be maintained for the length of the permit period. Outside of these areas, stand structure conditions associated with specific types of habitat (e.g., advanced structure stands) would change locations on the landscape as certain habitat objectives are met. Table 2-5 provides definitions for key terms associated with Alternative 2.

Table 2-5 Key Terms Associated with Alternative 2

Key Terms	
Early structure	Early structure stand conditions exist after the landscape has been disturbed and/or regeneration harvest has occurred. Early structure stands exist when: • average tree diameter of the largest 40 trees per acres is less than or equal to 6 inches dbh; and • trees are seedlings or saplings usually less than 15 years old. Herbaceous vegetation and shrubs represent 20 to 80 percent of the ground cover.
Intermediate structure	Intermediate structure stand conditions exist as the stand continues to develop and the understory begins to reinitiate. Intermediate structure stands exist when: • average tree diameter of dominant and co-dominant trees is generally between 6 and 18 inches dbh, but may be larger. Tree heights generally range from 40 to 100 feet; and • trees dominate the site and form a single, main canopy layer. There may be little or no understory development or the development may include understory trees. Generally, herbs, shrubs, and grasses may cover up to 40 percent or more of the forest floor. The stand does not have significant vertical layering of tree crowns.
Advanced structure	Advanced structure stands are commonly associated with older forests. For Alternative 2, advanced structure stands have: • twenty or more trees per acre of 18 inches or larger dbh and 100 feet or more in height, of which at least 10 overstory trees per acre are at least 24 inches dbh. The quadratic mean diameter must be 15 inches or more; • understory trees that average 30 feet in height; and • a basal area of at least 150 square feet/acre, and no more than 325 square feet/acre. In addition, stands would be managed to develop the following characteristics:· • eight or more live trees per acre at least 32 inches dbh; • at least six snags per acre, two of which must be at least 24 inches dbh. The remaining four must be at least 12 inches dbh; • a total of 3,000 to 4,500 cubic feet of down logs in all decay classes 1 to 5; or 600 to 900 cubic feet per acre of sound down logs in decay classes 1 or 2; and • multiple tree species, including shade-tolerant species; some trees with defects or decadence, and diverse understory vegetation.
Mapped marbled murrelet habitat	Suitable marbled murrelet nesting habitat identified through aerial photo interpretation and field verification.
Occupied marbled murrelet habitat	Forest that is considered to be used for marbled murrelet nesting, based on detections of marbled murrelets during the nesting season.

Key Terms	
Conservation areas	Conservation areas include all T&E Core Areas, SUV areas, and RMAs.
Threatened & endangered species (T&E) Core Areas	T&E Core Areas would be designed to protect specific wildlife habitat. They would be based upon current advanced structure conditions and known use by northern spotted owl, marbled murrelet, and bald eagle. T&E Core Areas would be designated throughout the action area and would be distributed so that there is at least one in each management basin.
Scenic, unique, and visual (SUV) areas	SUV areas include: • areas that have little to no commercial value for timber production because they are rocky, swampy, or inundated by water; • areas associated with steep, slopes that are restricted from harvest due to public safety concerns; • areas where scenic values are the primary value to be maintained, such as areas buffering recreational areas and highway corridors; • stands dominated by conifer trees over 175 years of age as of 2004; and • two specific unique forest types: a stand of Oregon myrtle (*Umbellularia californica*) in the Big Creek Basin, and a stand of bottomland hardwoods in the Ash Valley Basin.
Riparian management areas (RMA)	Protected riparian corridors that extend on either side of streams within the action area. Refer to the Aquatic and Riparian Strategy discussion in this section for the width and application of RMAs to different categories of streams.
Fish-bearing (Type F) streams	Waters that are inhabited at any time of the year by anadromous or game fish species, fish species that are listed as threatened or endangered under either the Federal or State ESA, or by fish species (including lamprey) covered for incidental take under the HCP. Referred to as Type F streams in aquatic riparian strategy for Alternative 2.
Non-fish-bearing (Type N) streams	Waters other than those meeting the definition of fish-bearing. Referred to as Type N streams in aquatic riparian strategy for Alternative 2.
Perennial streams	Streams that are expected to have summer surface flow after July 15.
Seasonal streams	Streams that only flow during portions of the year; these streams are not expected to have summer surface flow after July 15.
Small streams	Streams with an average annual flow of 2 cfs or less.
Medium streams	Streams with an average annual flow greater than 2 cfs, but less than 10 cfs.
Large streams	Streams with an average annual flow of 10 cfs or greater.
Seasonal high-energy streams	Seasonal, Type N streams, with physical conditions that favor the periodic transport of coarse sediments and wood during high-flow events. Under Alternative 2, and in the absence of specific geomorphologic identification, stream reaches with an average gradient exceeding 15 percent and an active channel width of 5 feet or more are defined as seasonal high-energy streams.

Key Terms	
Potential debris flow track reaches	Seasonal, Type N streams that have a high likelihood to deliver wood to a Type F stream. The criteria used to assess this likelihood are described in detail in the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008).
Aquatic zone	The area that includes the stream channel and associated aquatic habitat feature. This zone includes beaver ponds, stream-associated wetlands, side channels, and channel migration zones.
Streambank zone	The area within 25 feet of the outer edge of the aquatic zone for all streams, including the stream bank. Most riparian functions are supported to some extent by vegetation in this zone, which provides aquatic shade, delivers downed wood and organic inputs to the stream and riparian area, stabilizes the stream bank, contributes to floodplain functions, and influences sediment routing processes.
Inner RMA zone	The area that extends between 25 and 100 feet on both sides of all streams. Vegetation in this zone contributes substantially to desired riparian functions, including shade, potential contribution of large wood, and organic input.
Outer RMA zone	The area that extends between 100 and 160 feet on both sides of all streams. Vegetation in this zone contributes to certain riparian functions, including potential contribution of large wood and protection of microclimates.

Source: Oregon Department of Forestry 2008

dbh = diameter at breast height

cfs = cubic feet per second

2.3.2.1 Species Covered

Under Alternative 2, ODF would request ITP coverage for three federally listed species: northern spotted owl. marbled murrelet, and coho salmon (Table 2-6). A total of 15 other unlisted species would also be covered under the ITP if those species were federally listed within the term of the ITP. In accordance with Section 10(a)(1)(b) of the ESA, all of the unlisted species considered in the HCP would be treated as if they are listed. That is, conservation measures in the proposed HCP would provide benefits to these species as if they are currently listed for protection under the ESA.

Table 2-6 Species Proposed for Coverage under Alternative 2

Species Name	Listing Status		Federal Management Agency
	Federal	State	
Birds			
Northern spotted owl *Strix occidentalis caurina*	Threatened	Threatened	FWS
Marbled murrelet *Brachyramphus marmoratus*	Threatened	Threatened	FWS
Bald eagle *Haliaeetus leucocephalus*	Not listed	Threatened	FWS
Northern goshawk *Accipiter gentiles*	Not listed	Sensitive/Critical	FWS
Olive-sided flycatcher *Contopus borealis*	Not listed	Sensitive/Vulnerable	FWS
Western bluebird *Sialia mexicana*	Not listed	Sensitive/Vulnerable	FWS
Fish			
Coho salmon, coastal *Oncorhynchus kisutch*	Threatened	Sensitive/Critical	NMFS
Chinook salmon *Oncorhynchus tshawytscha*	Not listed	Not listed	NMFS
Chum salmon *Oncorhynchus keta*	Not listed	Sensitive/Critical	NMFS
Steelhead trout *Oncorhynchus mykiss*	Species of Concern	Sensitive/Vulnerable	NMFS
Coastal cutthroat trout *Oncorhynchus clarki clarki*	Species of Concern	Sensitive/Vulnerable	FWS
Pacific lamprey *Lampetra tridentatus*	Species of Concern	Sensitive/Vulnerable	FWS
River lamprey *Lampetra ayresi*	Species of Concern	Not listed	FWS
Western brook lamprey *Lampetra richardsoni*	Not listed	Not listed	FWS
Mammals			
Fisher *Martes pennanti*	Candidate	Sensitive/Critical	FWS
Amphibians			
Red-legged frog *Rana aurora*	Not listed	Sensitive/Undetermined Status	FWS
Southern torrent salamander	Not listed	Sensitive/Vulnerable	FWS

Species Name	Listing Status		Federal Management Agency
	Federal	State	
Rhyacotriton variegatus			
Coastal tailed frog	Not listed	Sensitive/Vulnerable	FWS
Ascaphus truei			

FWS =U.S. Fish and Wildlife Service
NMFS = National Marine Fisheries Service

2.3.2.2 Management

Forest Strategies

Under Alternative 2, the action area would be managed to achieve four primary objectives.

- To maintain a sustainable, even-flow harvest of timber. Harvest volumes would average 39.68 MMBF annually in the first decade, and would remain at approximately that level over the 50 year permit term.
- To maintain 40 to 60 percent of action area in advanced structure stands; 25 to 55 percent of the action area in intermediate structure stands; and 5 to 15 percent of the action area in early structure stands (See Table 2-5 for a definition of terms). Advanced structure stand targets would be set for each of the 13 management basins to be consistent with an overall range of 40 to 60 percent across the action area (Table 2-7).[4]
- To maintain approximately 24 percent, or 22,598 acres, of the action area in conservation areas with little or no active management.
- To manage 50 percent of the advanced structure in the action area to have at least eight trees per acre at 32 dbh or larger.

Management Basins

Under Alternative 2, the action area would be managed according to 13 management basins (Figure 2-2). The basin boundaries would be aligned with 5th and 6th field hydrologic unit code watershed boundaries. These management basins would continue to serve as the basis for conducting watershed analysis, for implementing and monitoring management activities, and for regulating the intensity of timber harvest.

Lands within each management basin would be managed either as conservation areas or for timber production. Conservation areas, which would include T&E

[4] For administrative purposes, all forest stands in conservation areas would be considered advanced structure under Alternative 2, regardless of their silvicultural characteristics. This is due to the fact that conservation areas were identified based on their association with use by covered species or as sensitive areas. Only very limited management activities would be allowed in these areas, and only to promote beneficial fish or wildlife habitat conditions.

Core Areas, RMAs[5], and steep, unique, and visual (SUV) areas, would be managed primarily for non-commodity values, as described in detail under Aquatic and Riparian Strategies and Wildlife Conservation below. Lands outside of conservation areas would represent approximately 70,684 acres, or 76 percent of the action area. Most of these lands would be managed for timber production, within the parameters specified above, by using stand structure targets for individual management basins to control timber harvest rates. Between 3,389 and 6,189 acres outside designated conservation areas would not be subject to timber harvest because they would be protected as mapped marbled murrelet habitat. Table 2-7 illustrates advanced structure stand targets for each of the 13 management basins.

Table 2-7 Alternative 2—Target Percentage of Advanced Structure Stands[1]

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

Source: Oregon Department of Forestry 2008

[1] Target percentages of advanced structure stands to be maintained within individual management basins in the action area over the term of the HCP. See Table 2-5 for a definition of advanced structure stands. For administrative purposes, all forest stands in conservation areas would be considered advanced structure under Alternative 2, regardless of their silvicultural characteristics. This is due to the fact that conservation areas were identified based on their association with use by covered species or as sensitive areas. Only very limited management activities would be allowed in these areas, and only to promote beneficial fish or wildlife habitat conditions.

Advanced structure stands would only be harvested from basins above the target percentage of advanced structure (Table 2-7). For basins below the target percentage of advanced structure, advanced structure stands would not be

[5] All lands in RMA would count toward achievement of conservation area objectives (i.e., maintenance of approximately 24 percent, or 22,598 acres in the action area) with the exception of RMAs associated with small, seasonal, non-fish bearing (Type N) streams. The Services have determined that RMAs around small, seasonal Type N streams, when harvested on both sides, would not provide suitable habitat to contribute towards conservation and recovery of covered species needing large blocks of older forest structure.

harvested until the management basin has exceeded its advanced structure target. Once a basin has reached its advanced structure target, the advanced structure would only be harvested if stands could be maintained at or above the target percentage.

Legacy Structural Components

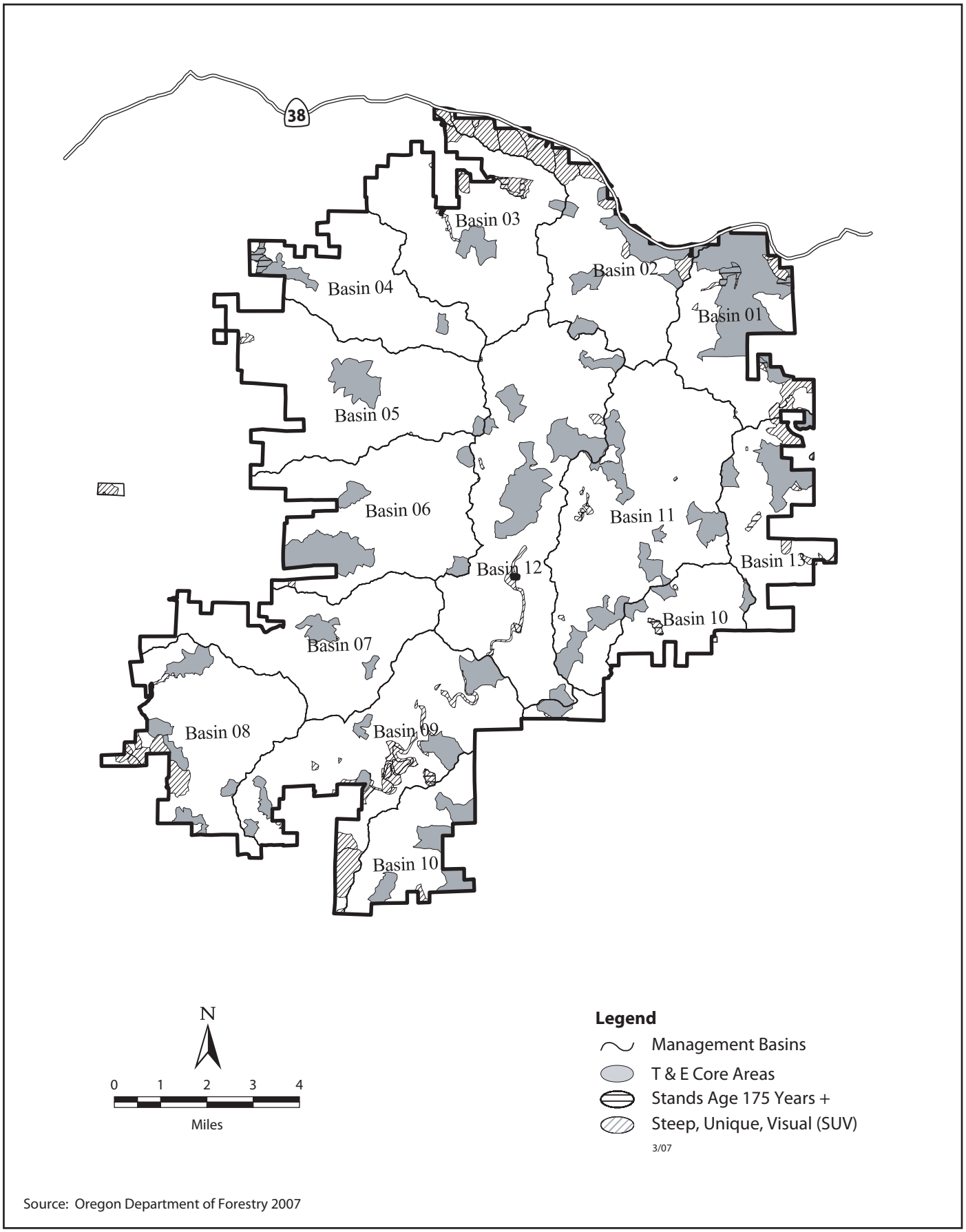
Legacy structural components would be maintained within the action area under Alternative 2, as described below.

Live Tree Retention. An average of three and no fewer than two, live trees per acre would be retained after each timber harvest. Retained live trees, in general, would be equal to or larger in diameter than the stand's average dbh.

Snag Creation and Retention. At least three hard snags over 15 inches dbh, of decay classes 1 or 2, and at least 20 feet tall, would be retained per acre harvested. If fewer than three snags per acre exist after harvest, one snag would be created from a live tree greater than 20 inches dbh for every two acres harvested. Created snags would be at least 20 feet tall, and would not be required if the harvest stand is composed predominately of trees less than 20 inches dbh. Existing snags of all decay classes would be retained during harvest activities where operationally feasible.

Downed Wood Retention and Creation. On average, 300 to 600 cubic feet of downed wood would be retained per acre after timber harvest. Fifty percent of this volume would be conifer logs, when available, and any individual piece would have a minimum volume of 20 cubic feet. At least two downed logs per acre would meet or exceed 26 inches in diameter on the large end. Existing down wood of all decay classes would be retained during harvest activities where operationally feasible.

When harvested stands are composed predominantly of trees less than 20 inches dbh, an average of three to six logs per acre (decay class 1 or 2) would be retained per acre of timber harvest. As noted above, 50 percent of the volume would be conifer logs, where available, and any individual piece of downed wood would have a minimum volume of 20 cubic feet.



Source: Oregon Department of Forestry 2007

04718.04 EIS (5-07)

Jones & Stokes

Figure 2-2
Alternative 2 (Proposed Action)
Management Basins and Conservation Areas

Aquatic and Riparian Strategies

Under Alternative 2, RMAs would be managed to protect streams and riparian areas from disturbance; filter sediment from uplands; and supply food, cover, shade, and large woody debris for aquatic habitat. Determination of the applicable management standards for RMAs would be based on a classification system that groups streams into two major categories (fish-bearing [Type F] and non-fish-bearing [Type N]), based on the primary beneficial uses of the stream. Streams would then be further classified according to size (small, medium, and large), based on average annual flow, and flow patterns (perennial and seasonal). Some seasonal Type N streams would also be classified as seasonal high-energy streams or potential debris flow track reaches. Refer to Table 2-5 for the definitions associated with these stream classification categories.

Riparian management areas established along each of the stream classification categories would, in general, contain four zones – the aquatic zone, stream bank zone, inner RMA zone, and outer RMA zone (definitions are in Table 2-5). The management standards for Type F and Type N streams in each of these zones are summarized in Tables 2-8 through 2-10. Of note, the RMA distances described in the Tables 2-8, 2-9, and 2-10 would be measured from the secondary channel, channel migration zone, or the average annual high water mark, whichever is greater.

In general, within the streambank zone (0 to 25 feet) of all streams, with the exception of small seasonal streams that do not qualify as high energy reaches or potential debris flow track reaches, no timber harvest would be allowed (Tables 2-8, 2-9 and 2-10). The inner RMA zone (25 to 100 feet) of Type F streams and large and medium Type N streams would also be managed for mature forest conditions; specific and varying retention requirements would be implemented within the inner RMA zone on all small perennial and seasonal Type N streams (Table 2-10). Conifer tree and snag retention requirements would also be required in the outer RMA zone (100 to 160 feet) for all Type F streams and large and medium Type N streams.

Table 2-8 Alternative 2—Management Standards for Fish-Bearing (Type F) Stream Riparian Management Areas

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

All Stream Sizes: Large, Medium, and Small

Source: Oregon Department of Forestry 2008.

[1] Desired mature forest condition consists of a stand dominated by large conifer trees, or where hardwood-dominated conditions are expected to be the natural plant community, a mature hardwood/shrub community. For conifer stands, this equates to a basal area of 220 square feet or more per acre, inclusive of all conifers over 11 inches dbh. At a mature age (80 to 100 years or greater), this equals 40 to 45 conifer trees 32 inches dbh per acre. As appropriate, ODF would determine if a hardwood-dominated stand is expected to be the natural plant community based on input from foresters, biologists, and other resource specialists.

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

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

RMA = riparian management area

dbh = diameter at breast height

Table 2-9 Alternative 2—Management Standards for Large and Medium Non-Fish-Bearing (Type N) Stream Riparian Management Areas

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

Large and Medium Type N Streams

Source: Oregon Department of Forestry 2008.

[1] Desired mature forest condition consists of a stand dominated by large conifer trees, or where hardwood-dominated conditions are expected to be the natural plant community, a mature hardwood/shrub community. For conifer stands, this equates to a basal area of 220 square feet or more per acre, inclusive of all conifers over 11 inches dbh. At a mature age (80 to 100 years or greater), this equals 40 to 45 conifer trees 32 inches in dbh per acre. As appropriate, ODF would determine if a hardwood-dominated stand is expected to be the natural plant community based on input from foresters, biologists, and other resource specialists.

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

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

RMA = riparian management area

dbh = diameter at breast height

Table 2-10 Alternative 2—Management Standards for Small Non-Fish-Bearing (Type N) Stream Riparian Management Areas

Small Perennial Type N Streams (Applied to at Least 75 percent of Stream Reach Contained within the Harvest Unit) [1]	
Stream bank zone (0–25 feet)	• No harvest. • No ground-based equipment operation.
Inner RMA zone (25–100 feet)	• Manage to retain at least 15 to 25 conifer trees and snags per acre (25 to 40 trees per 1,000 feet of RMA). Where possible, all tree retention in this zone would be provided 25 to 50 feet from the stream. In most stands, this would result in retention of all trees within 50 feet of the streams. [2, 3, 4] • Retain all other snags as safety permits. • Within 500 feet of a confluence with a Type F stream, retain all hardwoods, non-merchantable trees, and other conifers as necessary, to achieve 80 percent shade over aquatic zone. • Retain all dead and downed material that was present prior to the operation.
Outer RMA zone (100–160 feet)	• Manage to retain 0 to 10 conifer trees and snags per acre (0 to 15 trees per 1,000 feet of RMA). [2, 3] • Retain all snags as safety permits.
Small Seasonal Type N Streams: High Energy Reaches (Applied to at Least 75 percent of Stream Reach Contained within the Harvest Unit) [1]	
Stream bank zone (0–25 feet)	• No harvest. • No ground-based equipment operation.
Inner RMA zone (25–100 feet)	• Manage to retain at least 15 to 25 conifer trees and snags per acre (25 to 40 trees per 1,000 feet of RMA). [2, 3] • Retain all other snags as safety permits. • Retain all dead and downed material that was present prior to the operation.
Outer RMA zone (100–160 feet)	• Manage to retain 0 to 10 conifer trees and snags per acre (0 to 15 trees per 1,000 feet of RMA). [2, 3] • Retain all snags as safety permits.
Small Seasonal Type N Streams: Potential Debris Flow Track Reaches (Applied to at Least 75 percent of Reach) [1]	
Stream bank zone (0–25 feet)	• No harvest. • No ground-based equipment operation.

Inner RMA zone (25–100 feet)	• Manage to retain at least 10 conifer trees and snags per acre (15 trees per 1,000 feet of RMA) [2, 5]. • Retain all other snags as safety permits. • Retain all dead and down material that was present prior to the operation.
Outer RMA zone (100–160 feet)	• Retain trees and snags sufficient to meet landscape management targets.
Other Small Seasonal Type N Streams (Applied to at Least 75 percent of Reach)[1]	
Stream bank zone (0–25 feet)	• Maintain integrity of stream channel. • No ground-based equipment operation.
Inner RMA zone (25–100 feet)	• Manage to retain at least 10 conifer trees and snags per acre where operationally feasible (15 trees per 1,000 feet. of RMA) [2]. • Retain all other snags as safety permits. • Retain all dead and down material that was present prior to the operation.
Outer RMA zone (100–160 feet)	• Retain trees and snags sufficient to meet landscape management targets.

Source: Oregon Department of Forestry 2008.

[1] Prescription to be applied to at least 75 percent of perennial stream reach contained within the harvest unit, including the first 500 feet above the confluence with a Type F stream, and areas that meet the definition of a special emphasis area. The application of this prescription to 75 percent of the stream reach is designed to provide flexibility for operational constraints typically encountered around these small streams.

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

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

[4] Unless there are operational or safety constraints, trees and snag retention in the inner zone will be as close to the stream as possible to provide habitat for headwater amphibian species. In most stands, this would result in retention of all trees within 50 feet of these streams.

[5] To maximize the influence of retained trees on debris flow processes, preference would 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.

RMA = riparian management zone

dbh = diameter at breast height

Aquatic habitats other than streams, including wetlands, lakes, ponds, bogs, seeps, and springs, would be managed under Alternative 2 according to the prescriptions outlined in Tables 2-11 and 2-12.

Table 2-11 Alternative 2 – Management Prescriptions for Lakes, Ponds, and Wetlands

Greater than 1 Acre
• Establish a 25-foot no harvest zone, starting from the high-water line or wetland boundary (whichever is greater). • Establish an RMA of 100 feet from the high-water line or wetland boundary (whichever is greater). • Manage vegetation to achieve and maintain mature forest conditions. • The site-specific prescription will classify the wetland.
From 0.25 to 1 Acre
• Establish a 25-foot no harvest zone, starting from the high-water line or wetland boundary (whichever is greater). • Establish an RMA of 50 feet from the high-water line or wetland boundary (whichever is greater). • Within the RMA, harvest activities will retain at least 50 percent of the existing live tree basal area, or 110 square feet of basal area per acre (whichever is greater). Retained trees will generally be representative of the exiting diameter classes and species distribution, with a preference for retaining trees greater than 20 inches dbh. • If the waterway is inhabited by fish, or is identified as an important area for temperature-sensitive amphibian species, at least 80 percent shade will be maintained over the aquatic area. • The site-specific prescription will classify the wetland.
Less than 0.25 Acre
• Establish an RMA of 50 feet for Type F waters or 25 feet for Type N waters. These areas will be measured from the high-water line or wetland boundary (whichever is greater) • For Type F waters, harvest within the RMA will retain at least 50 percent of the existing live tree basal area, or 110 square feet of basal area per acre (whichever is greater). Retained trees will generally be representative of the exiting diameter classes and species distribution, with a preference for retaining trees greater than 20 inches dbh. • For Type N waters, hardwood trees and brush will be retained to protect the hydrologic functions and wildlife habitat values of the site. • If the waterway is inhabited by fish, or is identified as an important area for temperature-sensitive amphibian species, at least 80 percent shade will be maintained over the aquatic area.
Stream-Associated Wetlands
Stream associated wetlands are considered to be components of the aquatic habitat of streams and would be managed according to the objectives and prescriptions specified for the associated stream.

Source: Oregon Department of Forestry 2008

RMA = riparian management area

dbh = diameter at breast height

Type F = fish-bearing stream

Type N = non-fish-bearing stream

Table 2-12 Alternative 2 – Management Prescriptions for Bogs, Seeps, and Springs

Bogs
• Establish a 25-foot no harvest zone, starting from the high-water line or wetland boundary (whichever is greater). • Establish an RMA of 100 feet from the high-water line or wetland boundary (whichever is greater) • Manage vegetation to achieve and maintain mature forest conditions.
Seeps and Springs
Where possible, these aquatic areas should be incorporated into the RMAs of adjacent streams, and vegetation retention should be provided according to the stream prescription. In practice, this may simply require adjusting the boundary of a stream's RMA to fully encompass the spring or seep.

Source: Oregon Department of Forestry 2008

RMA = riparian management area

Wildlife Conservation Strategies

Under Alternative 2, the action area would be managed to provide a range of structural conditions across the landscape. To provide certain types of wildlife habitat, advanced structure stand targets would be set for each management basin, and conservation areas would be managed to enhance habitat features specific to T&E wildlife species. Landscape structure objectives would focus on development of the following to promote wildlife conservation:

- advanced structure stand targets for each management basin (Table 2-7);
- a landscape design that provides advanced structure stands to support T&E Core Areas;
- a variety of patch sizes in different shapes and distributions across the landscape;
- habitat connectivity outside of conservation areas; and
- forest management measures that maintain and enhance habitat features and minimize the likelihood of habitat degradation for species not currently listed under the ESA.

To achieve these landscape structure objectives, T&E Core Areas would be designated to protect habitat for northern spotted owl, marbled murrelet, bald eagle, and other late seral species. Factors considered when determining the location of the T&E Core Areas would include the following:

- location of northern spotted owl nest sites or activity centers
- location of areas receiving concentrated use by northern spotted owls, as measured by radio telemetry;
- location of stands with documented marbled murrelet occupancy behaviors and/or known nest trees;
- location of bald eagle nest trees; and

- location of late-successional habitat, including identified marbled murrelet habitat and older, advanced structure stands.

T&E Core Areas would be designated across the action area so that there would be at least one in each management basin. A total of 48 T&E Core Areas would be designated in permanent and fixed location in the action area. These areas would average approximately 150 acres in size and would range in size from less than 100 to over 1,000 acres (Figure 2-2).

Activities in all conservation areas, including T&E Core Areas, would be restricted to vehicle traffic on forest roads, wildfire suppression and control, road maintenance, minimal road construction, installation of harvest unit guy lines and tailholds for nearby harvests, stream rehabilitation work, stream survey work, and animal survey work. Removal of trees or snags for safety reasons may also occur in some circumstances, such as when a dead tree is leaning over a forest road. In addition, management activities that further the purpose of the conservation area might be allowed in some areas, such as management to attain mature forest conditions along streams.

To enhance habitat connectivity and the functional arrangement of T&E Core Areas on the landscape, within each management basin, one T&E Core Area, plus the area within 0.7 mile of the outer boundary of that Core Area, would be managed to contain at least 500 acres of advanced structure (HCP Conservation Measure 5.6). These 500 acres could be within 1 mile of the T&E Core Area boundary if the acreage was contiguous, and part or all of the 500 acres could reside in an adjacent basin (which could include another conservation area). Both advanced and intermediate structures within conservation areas would count toward the 500 acres.

Several other targeted wildlife management strategies and conservation measures would be implemented to provide further protections for covered species under Alternative 2, as described below.

Seasonal Restrictions on Disturbance of Active Northern Spotted Owl Trees (HCP Conservation Measure 6.1)

Outside of T&E Core Areas, seasonal restrictions would be applied to minimize disturbance to known active northern spotted owl nest trees. When management activities are planned, the following specific restrictions would be implemented, unless there is a fire emergency in the action area:

- Harvest of advanced structure within 0.25 mile of known active nest trees would not be allowed from March 1 to July 7.
- Harvest in a 70-acre core surrounding an active nest tree would not be allowed from March 1 to September 30, unless there is contiguous advanced structure to that Core Area that is not part of the harvest operation.
- Known nest trees would be retained as part of the live tree retention requirements in harvest units, unless prohibited by safety concerns or operational constraints.

- From March 1 to July 7, the use of explosives would be prohibited as follows: those associated with rock quarries in or within 1.0 mile of an active nest tree, and those associated with road construction in or within 0.25 mile of an active nest tree.
- Aircraft conducting work for the ODF (including Type I helicopters) would be prohibited from flying within 500 feet of an active nest tree from March 1 through July 7.
- The operation of chainsaws would not be allowed within 200 feet of an active nest tree from March 1 through July 7, except as described below.
- The operation of heavy equipment would not be allowed within 100 feet of an active nest tree from March 1 through July 7, except as described below.
- Burning would not be allowed within 0.25 mile of an active nest tree from March 1 through September 30.
- Ground application of chemicals and fertilizer, trapping, forage seeding, manual brush cutting without chainsaws, planting, surveying, pruning, roadside seeding, harvest of minor forest products, and snag creation by girdling or chemical injection are not considered *disturbance* under this conservation measure. In addition, the operation of chainsaws between July 7 and March 1, or farther than 200 feet from an active nest tree, would not be considered disturbance under this conservation measure.

Seasonal Restrictions on Disturbance to Known Occupied Marbled Murrelet Sites (HCP Conservation Measure 7.2)

To avoid disturbance to nesting marbled murrelet adults and chicks, ODF would apply management standards during the murrelet nesting season (April 1 to September 15) for conservation areas with murrelet-occupied sites, and for other occupied sites located on ODF forest lands or adjacent ownerships in the future. Site-specific topographic features would be considered when seasonal restrictions were applied. The following restrictions would apply between April 1 and September 15, unless there is a fire emergency in the action area:

- Aircraft conducting work for ODF (including Type I helicopters) would be prohibited from flying within 1,320 feet (0.25 mile) of nesting habitat. Small aircraft conducting work for ODF, including single-engine airplanes and Type II and III helicopters, would be prohibited from flying within 330 feet of the likely nesting habitat. Over flights would be required to be greater than 500 feet above the likely nesting habitat.
- The use of explosives associated with rock quarries in or within 1.0 mile, and the use of explosives associated with road construction in or within 0.25 mile of the likely nesting habitat, would be prohibited.
- Timber harvest activities—including the use of chainsaws, yarding, and loading, and the hauling of logs, rock, and heavy equipment—or the use of heavy equipment (includes vibratory rollers) on roads that are not commonly used would be prohibited within 330 feet of the likely nesting habitat from April 1 through August 5. These activities would be allowed from August 6 to September 15 only after consultation with the Services.

Hauling of logs, rock, or heavy equipment involving the use of unmuffled compression brakes on commonly used roads would not be considered a *disturbance* activity under this conservation measure. In addition, ground application of chemicals and fertilizer, trapping, forage seeding, manual brush cutting without chainsaws, planting, surveying, pruning, roadside seeding, harvest of minor forest products, and snag creation by girdling or chemical injection would not be considered disturbance under this conservation measure.

Seasonal Restrictions on Harvest of Mapped Marbled Murrelet Habitat (HCP Conservation Measure 7.3)

Under Alternative 2, ODF would implement one of the following options to limit the likelihood of disrupting murrelet nesting activities during critical nesting periods in mapped habitat. These options would be applied to felling and yarding activities in and around mapped murrelet habitat during the murrelet nesting season. Other harvest-related activities, including loading and hauling, would not be restricted.

ODF could choose to implement the option that effectively and efficiently reconciles the numerous timing and cost constraints to which operations are subject, such as restrictions for winter hauling and fire season restrictions. Various other constraints—such as, but not limited to, contract duration, numerous operations on a road system, and right-of-way limitations—could limit ODF's ability to apply the most conservative option (Option 1). Site-specific topographic features would be considered when seasonal restrictions were applied.

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

If the mapped habitat were felled prior to April 1, seasonal restrictions would not apply.

Limitations on Harvest of Unsurveyed Mapped Marbled Murrelet Habitat (HCP Conservation Measure 7.4)

Under Alternative 2, a minimum of 4,000 acres of mapped murrelet habitat outside of conservation areas would be subject to regeneration harvest activities over the next 50 years according to the following schedule:

- Decade 1 – 1,200 acres
- Decade 2 – 1,000 acres
- Decade 3 – 1,000 acres

- Decade 4 – 800 acres
- Decade 5 – 0 acres

An additional 2,800 acres (for a maximum of 6,800 acres) of mapped murrelet habitat may be harvested over the next 50 years, contingent upon ODF demonstrating ingrowth of marbled murrelet habitat in the action area. Additional acres of murrelet habitat may be harvested if ODF demonstrates that an equivalent amount of new marbled murrelet habitat has developed in the action area. During the first three decades, no more than 1,200 acres of marbled murrelet habitat would be harvested in any one decade. In the last two decades, no more than 1,600 acres of marbled murrelet habitat would be harvested in any one decade.

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

Deferred Harvest of Selected Marbled Murrelet Occupied Sites (HCP Conservation Measure 7.1)

Five occupied murrelet sites would be located outside of conservation areas under Alternative 2 and would be eligible for timber harvest. These areas would not be eligible for harvest activities until after the first 10 years of HCP implementation.

Site Management Plans

The ODF would develop site plans for known populations of bald eagle, northern goshawk, and fisher in the event that any nesting sites, breeding areas, or other significant habitat locations are discovered in the action area during the term of the permit. Site plans would specify any actions necessary to address potential threats to the species and protect the site from deleterious changes to key habitat characteristics. Site plans would be completed within one year of the discovery of important nesting, breeding, or other significant habitat locations, or at the time an operation is planned with the established distance from a site, whichever comes first. Site plans would be approved by the FWS and would be reviewed on an annual basis to determine if continuing implementation is warranted.

As summarized in Chapter 9 of the draft HCP, the following key considerations would be incorporated into site management plans for bald eagle, northern goshawk, and fisher:

- Bald Eagle. Site plans would focus on retaining historic nesting and perching trees; providing a forested buffer around known nest trees or roosting areas; maintaining territory or roost site integrity through buffers; prohibiting felling, yarding, road construction, or other habitat alteration within 0.25 mile of an active nest or perch tree, or within 0.5 mile if the eagles have line-of-site vision to the disturbance area during the nesting season (January 1 to August 31); and managing stands to maintain nesting habitat or to develop additional nesting habitat over time.

- Northern goshawk. Site plans for nesting territories would focus on retaining nesting trees; providing a forested buffer around the trees; maintaining territory integrity through establishment of buffers; and managing stands to maintain and develop additional nesting habitat over time.

  A maximum of four goshawk territories would be protected by site management plans at any given time over the term of the permit under Alternative 2. No more than two of these would be located outside of T&E Core Areas. However, felling, yarding, road construction, or other habitat alteration would be prohibited within 660 feet of any known active northern goshawk nest during the nesting season (February 15 through September 15). These seasonal restrictions would be lifted if the nest were to be abandoned.

- Fisher. Site plans would be developed for fisher if ODF and FWS determine that fishers are exhibiting concentrated use of forested habitats in the action area, and measures to avoid disturbing fishers during the breeding season are needed to minimize the potential for incidental take. Concentrated use could be based on repeated fisher detections in a localized area. Site plans would focus on seasonal restrictions on forest management activities within one-half mile of active areas of concentrated use, as well as using landscape strategies to maintain and enhance habitat on State forestlands adjacent to areas of concentrated use. A maximum of four fisher site plans would be implemented at any given time over the term of the ITP.

Headwater Amphibian Habitat Protections

As noted in Table 2-10, the aquatic riparian strategies under Alternative 2 require retention of at least 15 to 25 conifer trees and snags per acre at a distance of 25 to 100 feet from small, perennial Type N streams. Unless there were operational or safety constraints, tree and snag retention in this area would be as close to the stream as possible to provide habitat for headwater amphibians. In most stands, this would result in retention of all trees within 50 feet of these streams.

The HCP also includes specific prescriptions for reducing the effects of construction of both permanent and temporary crossings of small, Type N streams, including restrictions on the width and height of fill, erosion control measures, and requirements that stream flow be maintained.

Training and Capacity Building

To facilitate identification of wildlife species in the action area, ODF would develop information on how to recognize adults and young animals and their nesting structures. This information would be used for informal training of ODF field foresters and others involved in activities on the forest, including monitoring and timber sale activities. This information would also be shared with FWS, and would be available within 1 year of plan implementation.

Research and Monitoring

Similar to Alternative 1, research and monitoring projects would be implemented within the action area to better understand the effects of forest management activities on forest resources, and to provide information for the adaptive management process described in Chapter 11, Plan Implementation, of the HCP.

Three research priorities would be considered under Alternative 2:

- research that is a necessary part of a conservation strategy;
- research that is needed to assess or improve conservation strategies that are in place; or to increase management options and commodity production opportunities, including testing new technologies and experimental application of silvicultural techniques; and
- research that is needed to improve the general understanding of the wildlife, habitats, and ecosystems within the action area.

Priority research topics are summarized in Section 11.3.3.5 of the draft HCP. Examples of priority research topics identified in the draft HCP include research to evaluate riparian area management and instream large wood levels; research to determine how effectively managed stands provide habitat for covered species; and research to compare the active and passive forest management strategies relative to an accelerated development of functional habitat for wildlife species.

Monitoring efforts, as summarized in Section 11.3.3.6 of the draft HCP, would also be tailored to meet three primary objectives, as defined below:

- **Implementation Monitoring** - to determine whether the conservation strategies are implemented as written.
- **Effectiveness Monitoring** – to determine whether anticipated habitat conditions have resulted from implementation of the conservation strategies. The following summarizes some of the key effectiveness monitoring projects outlined in the draft HCP.
  - Stand Structure Development**.** ODF would establish a monitoring project in a sub-sample of stands to determine and track development of stand structure and habitat suitability for covered species at 10-year intervals over the term of the permit.
  - Northern Spotted Owl. Periodic density studies would be conducted to assess the population of northern spotted owls in the action area and where they are located. Studies would survey all suitable habitat and would occur at approximately 8-year intervals.
  - Marbled murrelet. Periodic surveys of marbled murrelet in T&E Core Areas would be conducted to determine the proportion that remains in occupied status. Surveys would be discontinued when marbled murrelet occupancy is confirmed, or after a period of 5 consecutive years of surveying. Surveys would use established protocols and would occur at 10-year intervals.
  - Bald Eagle. Annual monitoring of known nest sites and roosting areas would be completed to determine occupancy and productivity.
  - Northern goshawk. Approximately 11,600 acres of potential habitat would be surveyed for northern goshawks, beginning at year 10 of the HCP. A minimum of 20 percent of this acreage would be surveyed during any given year, so that surveys would be completed in 5 years. In addition, monitoring activities to determine occupancy and productivity

would be established as part of site management plans for northern goshawk.

- Fisher. If Federal monitoring efforts indicate that fisher populations are expanding and occurring within 30 miles of the action area, ODF would participate in regional research or survey efforts that include the action area, or would conduct its own fisher research or survey activities.
- Olive-sided flycatcher and western bluebird. A representative sample of early structure stands would be surveyed using established protocols to determine the presence of olive-sided flycatchers and western bluebird. Surveys would occur at approximately 10-year intervals.
- Red-legged frog. Periodic surveys of all suitable ponds would be conducted at approximately 6-year intervals to determine occupancy by red-legged frogs.
- Headwater Amphibian Species. Within five years of HCP implementation, ODF would conduct a study to determine the effectiveness of the aquatic and riparian strategies to protect the functions of small perennial Type N streams. Parameters to be measured would include shade, water quality, and presence of headwater amphibian species. The study would include surveys before and after management actions have been completed.

- **Validation Monitoring** – to evaluate cause-and-effect relationships between habitat conditions resulting from implementation of the conservation strategies and the wildlife populations that these strategies are intended to benefit.

2.3.3 Alternative 3 – Increased Stream Buffers and Intensive Forestry

Under Alternative 3, approximately 50 percent of the action area would be managed as upland conservation areas and RMAs. As described in Aquatic and Riparian Strategies below, buffer widths within the RMAs were based on a modified application of Forest Ecosystem Management Assessment Team (FEMAT) stream buffers, which were derived from the Northwest Forest Plan (NWFP) (U.S. Forest Service et al. 1994), and are larger than RMA widths associated with Alternative 1. Some thinning could occur in RMA's to benefit species and attain mature forest conditions. The remainder of the lands would be managed intensively for timber on a short rotation (40 to 50 years). Table 2-13 provides definitions for key terms associated with Alternative 3.

2.3.3.1 Species Covered

Under Alternative 3, ODF would request ITP coverage for three federally listed species: northern spotted owl, marbled murrelet, and coho salmon. Similar to Alternative 2, a total of 15 other unlisted species would also be covered under the ITPs if those species were federally listed in the future (Table 2-6).

2.3.3.2 Management

Forest Strategies

Under Alternative 3, the action area would be managed to achieve two primary objectives.

- To produce a sustainable, even-flow harvest of timber. Harvest volumes would average 33.46 MMBF annually in the first decade, and would remain at approximately that level over the next 50 years.
- To maintain approximately 50 percent (46,641 acres) of the action area in upland conservation areas and RMAs (Table 2-13 lists definitions of key terms).

Table 2-13 Key Terms Associated with Alternative 3

Key Terms	
Late-successional forest	A mature and/or old-growth forest stand. Under Alternative 3, late-successional forest stands are defined as stands that are 156-years or older (160-year age class and up).
Upland conservation areas	Under Alternative 3, upland conservation areas would be established around sensitive wildlife habitat areas to protect threatened and endangered species and fisheries resources. Upland conservation areas would also include SUV areas. Upland conservation areas would make up 50 percent of the landscape in the action area.
Scenic, unique, and visual (SUV) areas	SUV areas include: • areas that have little to no commercial value for timber production because they are rocky, swampy, or inundated by water; • areas associated with steep, slopes that are restricted from harvest due to public safety concerns; • areas where scenic values are the primary value to be maintained, such as areas buffering recreational areas and highway corridors; • stands dominated by conifer trees over 175 years of age as of 2004; and • two specific unique forest types: a stand of Oregon myrtle (*Umbellularia californica*) in the Big Creek Basin, and a stand of bottomland hardwoods in the Ash Valley Basin.

Key Terms	
Riparian management areas (RMA)	Protected riparian corridors that would extend on either side of streams within the action area. Refer to the Aquatic and Riparian Strategy discussion in this section for the width and application of RMAs to different categories of streams.
Mapped marbled murrelet habitat	Suitable marbled murrelet nesting habitat identified through aerial photo interpretation and field verification.
Occupied marbled murrelet habitat	Forest that is considered to be used for marbled murrelet nesting, based on detections of marbled murrelets during the nesting season.
Fish-bearing streams (Type F)	Waters that are inhabited at any time of the year by anadromous or game fish species, by fish species that are listed as threatened or endangered under either the Federal or State ESA, or by lamprey. Referred to as Type F streams in aquatic riparian strategy for Alternative 3.
Non-fish-bearing streams (Type N)	Waters other than those meeting the definition of Type F streams. Referred to as Type N streams in aquatic riparian strategy for Alternative 3.
Small streams	Streams with an average annual flow of 2 cfs or less.
Medium streams	Streams with an average annual flow greater than 2 cfs, but less than 10 cfs.
Large streams	Streams with an average annual flow of 10 cfs or greater.

cfs= cubic feet per second

Management Basins

Under Alternative 3, the action area would be managed according to the same 13 management basins described under Alternative 2 (Figure 2-2).

Legacy Structural Components

Under Alternative 3, legacy structural components on lands outside upland conservation areas would be managed according to the FPA, as described below.

Live Tree Retention. Under Alternative 3, in all timber sales, two trees or snags, at least 11 inches dbh and 30 feet tall, would be left standing for each acre harvested.

Snag Creation and Retention. Under Alternative 3, no snag creation or retention would be required outside of the tree retention requirements described above.

Downed Wood Retention and Creation. In all timber sales, two downed logs of at least 10 cubic feet (decay class 1 or 2) would be left scattered in a unit for each acre harvested.

Aquatic and Riparian Strategies

Under Alternative 3, RMAs would be managed to maintain and restore riparian structure and function in the action area, enhance habitat conservation for wildlife species dependent on the transition zone between upslope and riparian

areas, and to allow for additional connectivity between other upland conservation areas.

Similar to Alternative 2, streams in the action area would be grouped into two major categories (Type F and Type N streams), and then subdivided by size/average annual flow (small, medium, large) (Table 2-14). Riparian management areas would be established around all streams in the action area, dependent on their classification.

A 160-foot RMA would be established around all Type F streams, and a 100-foot RMA would be established around all Type N streams. The 160-foot RMA width was based on a distance equal to one site-potential tree height, which is the average height of dominant trees at 100 years in the action area. The use of site-potential trees to determine RMA widths was modeled after the Aquatic Conservation Strategy in the NWFP, with the exception that ODF defines site potential tree height at 100 years, and the NWFP does not restrict the definition by age. The NWFP defines site potential tree height in this area as 180 to 220 feet (Bureau of Land Management 1995). The NWFP applies a two-site potential tree RMA width to Type F streams, where the first site-potential tree width provides protection for riparian stream habitat and the second site potential tree width provides habitat protection for upland wildlife species. It was determined that the application of a two-site potential tree RMA width on streams in the action area would not allow ODF to meet its stated timber harvest objectives, as described in Section 2.4.2, Northwest Forest Plan Riparian Reserve Area Stream Buffer Widths.

Under Alternative 3, ODF, in collaboration with the Services and ODFW, may consider thinning in the RMA to benefit species and attain mature forest conditions along streams, outside of a 25-foot no-harvest zone. No other management activities would be allowed within these RMAs under Alternative 3, with the following exceptions: establishment of cable yarding corridors; maintenance activities on existing roads; minimal road construction; fire suppression and control; fish and wildlife enhancement projects; and fish and wildlife survey work.

Aquatic habitats other than streams, including wetlands, lakes, ponds, bogs, seeps, and springs, would be managed under Alternative 3 according to the prescriptions outlined in Tables 2-11 and 2-12.

Wildlife Conservation Strategies

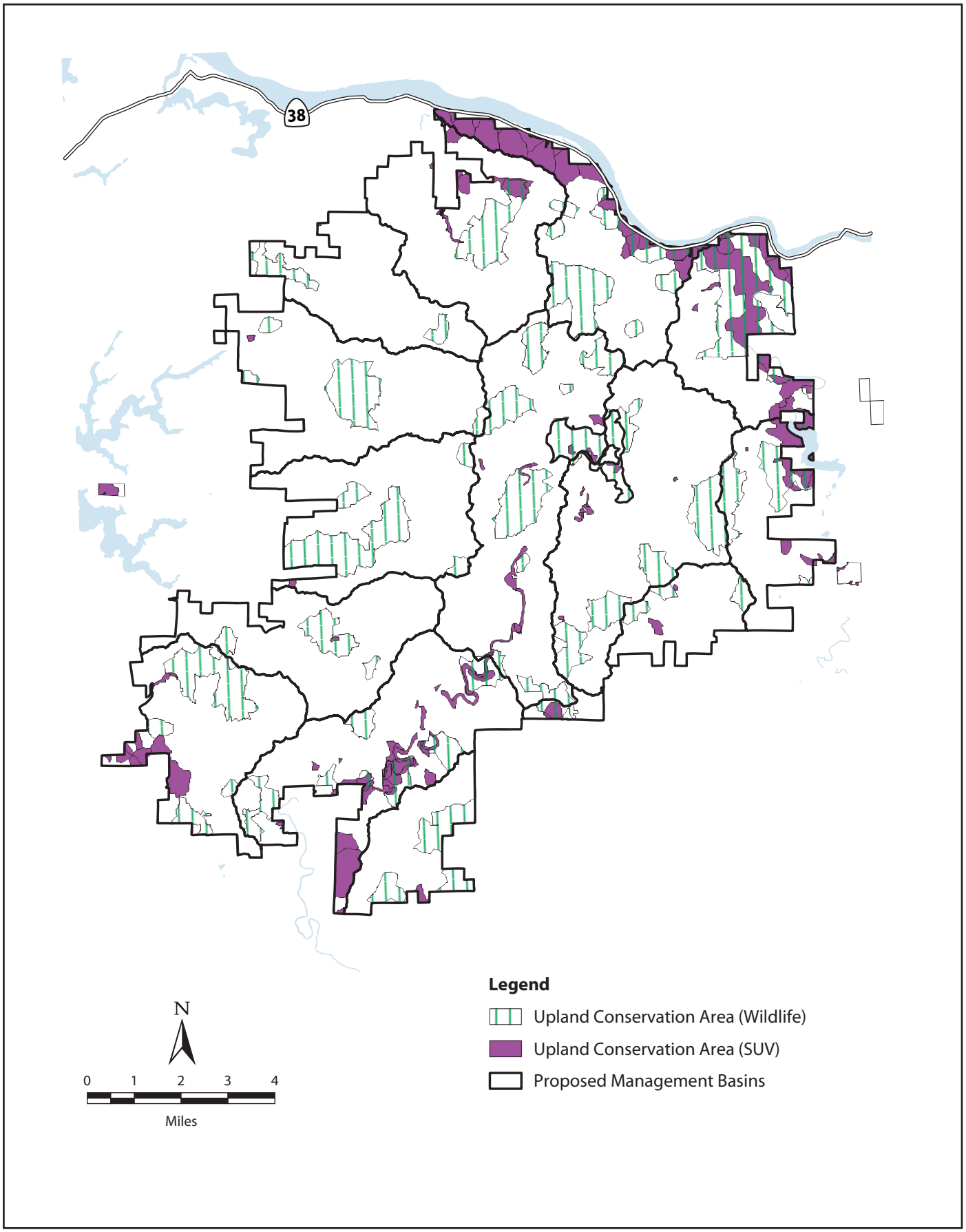
Under Alternative 3, upland conservation areas would be established to provide habitat for wildlife species in the action area, as illustrated in Figure 2-3. The location of the upland conservation areas would be based on use and/or potential use by northern spotted owl, marbled murrelet, and bald eagle, and the location of late-successional forest. SUV areas, as described under Alternative 2, would also be established on the landscape and would be managed as upland conservation areas. All habitat outside of upland conservation areas would be eligible for timber harvest.

Activities in upland conservation areas would be restricted to vehicle traffic on forest roads, wildfire suppression and control, road maintenance, minimal road construction, installation of harvest unit guy lines and tail holds for nearby harvests, stream rehabilitation work, stream survey work, and animal survey work. Removal of trees or snags for safety reasons may also occur in some circumstances, such as when a dead tree is leaning over a forest road. In addition, when large-scale disturbance events such as severe fire, wind or insect and disease outbreaks occur, upland conservation areas would be evaluated to determine if they can still function for their intended purpose. Active management, including salvage, might be applied if it would help restore the upland conservation area's function.

As described under Alternative 1, when management activities are planned, seasonal restrictions to protect nesting and foraging populations of bald eagle would be applied. No other species specific conservation strategies would be implemented under Alternative 3.

Research and Monitoring

Similar to Alternative 2, ODF would complete implementation monitoring under Alternative 3 to determine whether the conservation strategies had been implemented as written. Implementation monitoring would document the types, amounts, and locations of forest management activities carried out in the action area to indicate trends in landscape-level habitat conditions. Periodic density surveys for covered species would be conducted under Alternative 3. With the exception of stand structure development, key effectiveness monitoring projects would be similar to those described for Alternative 2.



04718.04 EIS (5-07)

Jones & Stokes

Figure 2-3
Alternative 3 (Increased Stream Buffers and Intensive Forestry) Management Basins and Conservation Areas

Table 2-14 Summary of Forest Management Strategies, Aquatic Riparian Strategies, Wildlife Conservation Strategies, and Research and Monitoring Activities for Alternatives Evaluated in Detail

	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Brief Description	ODF would manage the action area in accordance with the 1994 FMP and the 1995 HCP. All lands outside of reserve areas would be managed for timber production using target harvest age to control timber harvest rates in each of 17 management basins.	ODF would manage the action area according to stand structure condition. All lands outside of conservation areas would be managed for timber production based on stand structure conditions in each of 13 management basins.	ODF would manage approximately 50 percent of the action area as upland conservation areas and riparian management areas (RMA) created, in part, by increased RMA widths around streams. The remainder of the action area would be managed intensively for timber on a short rotation (40 to 50 years).
Species Covered	Northern spotted owl; avoid incidental take of other federally listed species (i.e., marbled murrelet and coho salmon)	Northern spotted owl, marbled murrelet, and coho salmon as well as 15 other unlisted species.	Northern spotted owl, marbled murrelet, and coho salmon, as well as 15 other unlisted species.
Term of Permit	1995 to 2055	50 years	50 years
Analysis Period Evaluated in EIS	50 years	50 years	50 years
Forest Management Strategy: Management Objectives			
Harvest Volumes	Average annual volume of 26.00 million board feet (MMBF) in the first decade, increasing to 28.48 MMBF by the fifth decade.	Average annual volume of 39.68 MMBF for the permit term.	Average annual volume of 33.46 MMBF for the permit term.
Habitat and Stand Structure Goals	Maintain 39,781 acres (43 percent of the action area) in nesting-roosting-foraging (NRF) habitat for northern spotted owls.	Maintain 40 to 60 percent of the action area in advanced structure stands; 25 to 55 percent of the action area in intermediate stands; and 5 to 15 percent of the action area in early stands. Maintain advanced structure stand targets for each of the 13 management basins (Table 2-7).	Maintain approximately 46,641 acres (50 percent) of the action area in upland conservation areas and RMAs.

	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
	Maintain 50 percent of the acreage in each management basin in stands where the trees average diameter at breast height (dbh) is 11-inches or larger, and canopy closure is 40 percent or greater.	Manage 50 percent of the advanced structure in the action area to have at least eight trees per acre at 32 dbh or larger.	
	Manage at least 18,060 acres (19.5 percent) of the action area as reserve areas for non-commodity values.	Maintain approximately 22,598 acres (24 percent) of the action area in conservation areas with little or no active management.	
Forest Management Strategy: Management Basins			
	Lands managed as reserve areas or matrix (timber production) lands within 17 management basins. Matrix lands managed using target harvest age. Nine of the 17 management basins managed as long rotation basins (i.e., 160- to 240-year-old stands).	Lands managed as conservation areas or timber production lands within 13 management basins. Timber production lands managed by using stand structure targets for the entire action area and for each management basin (Table 2-7).	Lands managed as upland conservation areas and RMAs within 13-management basins. Timber production lands managed using short rotation intensive management.
Forest Management Strategy: Legacy Structural Components			
Live Tree Retention	Three or more trees per acre retained for each acre harvested.	An average of three, and no fewer than two, trees retained for each acre harvested.	Two trees or snags, at least 11 inches dbh and 30 feet tall, retained for each acre harvested.
Snag Creation and Retention	One-half to three snags per acre created or retained in timber sales	At least three hard snags over 15 inches dbh and at least 20 feet tall retained for each acre harvested. If fewer than three snags per acre exist after harvest, one snag would be created from a live tree greater than 20 inches dbh for every 2 acres harvested, if available.	None, outside of live tree retention described above.
Downed Wood Retention and Creation	Three to six downed logs per acre scattered in a unit after timber sales. The minimum size of retained logs would be 12 inches in diameter on the large end and 16 feet in length.	On average, 300 to 600 cubic feet of downed wood retained per acre after timber harvest. At least two downed logs per acre must meet or exceed 26 inches on the large end.	Two downed logs of at least 10 cubic feet (decay class 1 or 2) would be left scattered in a unit after timber sales.

	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Aquatic and Riparian Strategy			
Buffer Areas	Riparian buffer size and management dependent on whether stream is perennial or intermittent, and whether or not it is fish-bearing. Buffer areas range in size from small brush areas adjacent to seasonal, non-fish-bearing streams, to 100-foot no-harvest areas on fish-bearing streams. Refer to Table 2-4 for a more detailed description of riparian buffer size and management under Alternative 1.	Riparian management area prescriptions based on stream classification system that reflects fish presence or absence (fish-bearing or non-fish-bearing); size (small, medium, large); and flow patterns (seasonal or perennial). Management prescriptions applied to four zones (aquatic zone, streambank zone, inner RMA zone, and outer RMA zone) that extend out to 160 feet from the stream channel. In general, a 25-foot no-harvest zone applied to all streams in action area, with limited management activities allowed within 100 feet of the stream channel on all fish-bearing and large and medium non-fish-bearing streams. Refer to Tables 2-8 through 2-10 for a more detailed description of riparian buffer size and management prescriptions for mature forest conditions under Alternative 2. Refer to Tables 2-11 and 2-12 for a detailed description of management prescriptions for lakes, ponds, wetlands, bogs, seeps, and springs.	Riparian management prescriptions based on fish presence or absence and size. No-harvest RMAs range in size from 160 feet on all fish-bearing to 100 feet on all non-fish-bearing streams. ODF, in collaboration with the Services and ODFW, may consider thinning in the RMA to benefit species and attain mature forest conditions along streams, outside of a 25-foot no-harvest zone. Refer to Tables 2-11 and 2-12 for a detailed description of management prescriptions for lakes, ponds, wetlands, bogs, seeps, and springs.
Wildlife Conservation Strategies			

	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Habitat Features	Manage Habitat Conservancy Areas (HCAs) in permanent and fixed locations in all management basins, and Marbled Murrelet Management Areas (MMMAs) as identified. HCAs would represent between 3 and 25 percent of the land cover within each management basin, for a total acreage in the action area of 6,961 acres. MMMAs currently make up 10,388 acres in the action area. The total area in MMMA could increase over the next 50 years if additional occupied habitat were discovered.	Manage a total of 48 threatened and endangered species core areas (T&E Core Areas) in permanent and fixed locations across the action area. At least one T&E Core Area, with an average size of 150 acres, would be maintained in each of the 13 management basins.	Upland conservation areas established to support known or potential threatened and endangered species population. At least one upland conservation area would be maintained in each of the 13 management basins.
Management Prescriptions	Manage 9 of 17 management basins as long-rotation basins (i.e., 160- to 240-year-old stands) to provide habitat for late seral species.	Manage one T&E Core Area in each management basin such that the T&E Core Area plus the area within 0.7 mile of the outer boundary of the Core Area, contains at least 500 acres of advanced structure.	
Species Specific Conservation Measures	Provide distance and seasonal restrictions to protect bald eagle nest and perch trees and roosting sites.	Provide distance and seasonal restrictions to protect marbled murrelet and northern spotted owl sites.	Provide distance and seasonal restrictions to protect bald eagle nest and perch trees and roosting sites.
	Protect all occupied marbled murrelet stands from harvest indefinitely.	Protect the majority (98 percent) of currently known occupied marbled murrelet habitat within conservation areas. Defer harvest for 10 years for five of nine known occupied sites located outside of conservation areas.	Protect the majority (99 percent) of currently known occupied marbled murrelet habitat within upland conservation areas and RMAs.
		Apply seasonal restrictions on harvest of mapped murrelet habitat outside of conservation areas.	
		Limit total harvest of unsurveyed, mapped murrelet habitat.	

Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
	Develop site management plans for known populations of bald eagle, northern goshawk, and fisher in the event that any nesting sites, breeding areas, or other significant habitat locations are discovered in the action area.	
	Concentrate tree retention requirements for small perennial Type N streams between 25 and 50 feet to provide habitat for headwater amphibians.	

	Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Research and Monitoring	Research and monitoring projects would be implemented within the action area to better understand the effects of forest management activities on forest resources, and to provide information for the adaptive management process outlined in the 1995 HCP. All of the research commitments in the 1995 HCP have been completed. Ongoing commitments to monitoring efforts would include monitoring to determine northern spotted owl dispersal and NRF habitat, and monitoring to assess the types and amounts of habitat enhancement activities each year.	Research and monitoring projects would be implemented within the action area to better understand the effects of forest management activities on forest resources, and to provide information for the adaptive management process described in the draft HCP. Priority research topics would include research to evaluate riparian area management and instream large wood levels; research to determine how effectively managed stands provide habitat for covered species; and research to compare the active and passive forest management strategies relative to an accelerated development of functional habitat for wildlife species. Implementation, effectiveness, and validation monitoring would also be implemented. Examples of effectiveness monitoring projects would include conducting periodic density studies to assess the population of northern spotted owls on the action area and monitoring water quality parameters in some small perennial non-fish-bearing streams before and after timber harvest.	Implementation monitoring would be completed, similar to Alternative 2. Periodic density surveys for covered species would also be conducted under Alternative 3.

Alternative 1 – Current Management (No Action)	Alternative 2 – Proposed Action	Alternative 3 – Increased Stream Buffers and Intensive Forestry
Notes:		
dbh = diameter-at-breast height		
FMP = Forest Management Plan		
HCA = Habitat Conservancy Area		
HCP = habitat conservation plan		
MMBF = million board feet		
MMMA = Marbled Murrelet Management Area		
NRF = nesting, roosting, and foraging habitat		
RMA = riparian management area		
T&E = threatened and endangered		

2.4 Alternatives Considered But Not Analyzed in Detail

2.4.1 Combined Reserves and Intensive Forestry

Under this alternative, approximately one-half of the action area would be managed intensively on a short rotation (40 to 50 years). The remainder of the lands (approximately 46,641 acres) would be in designated reserve areas, including certain portions of the RMAs described for Alternative 2, SUV areas, and known owl and murrelet habitat areas. Reserve areas, which would increase in late-successional forest habitat over the next 50 years, would be managed for non-timber production goals, as wildlife refuges, and as linkage corridors between management basins. Although similar to Alternative 3, the location of the reserve areas under this alternative would be more dispersed on the landscape, rather than concentrated near streams as RMAs.

This alternative was eliminated from detailed evaluation because it would provide comparable amounts of mature forest within the action area for timber harvest and wildlife habitat relative to Alternative 3, and would therefore result in similar environmental impacts to federally listed species. Although the physical location of the reserve and managed areas under this alternative would be different than Alternative 3, there would not be a substantive difference in how the landscape in the action area would be managed, or in the type or amount of habitat that would be made available for federally listed species. In addition, Alternative 3, and specifically the riparian management strategies in that Alternative, were considered more responsive to the public's request that wider riparian buffers be evaluated as a component of one of the alternatives in the EIS. Given these considerations and the detailed evaluation of Alternative 3 in the EIS, the Services determined that this alternative could be eliminated from further consideration.

2.4.2 Northwest Forest Plan Riparian Reserve Area Stream Buffer Widths

As described under Alternative 3, the NWFP generally bases the width of RMAs on the height of a site-potential tree in a given area. For fish-bearing streams, the width of a stream buffer area would typically be equivalent to the height of two site-potential trees, while the width of the stream buffer area for non-fish-bearing and intermittent streams would be one-site potential tree.

Application of the NWFP stream buffer widths to the action area, in combination with the other conservation areas described under Alternative 2, would require that approximately 75 percent of the action area be managed as a conservation area with little or no active forest management. These extensive limits on forest

management would not allow ODF to meet its stated purpose of producing a sustainable, even-flow harvest of timber, while balancing resource protection and species habitat requirements (Section 1.2.3, Context, in Chapter 1, Purpose and Need).

The Services determined that the stream buffer width reflected in Alternative 3 represented the increased stream buffer width that best met both the purpose and need and the applicant's stated objectives. As a result, this alternative was eliminated from detailed analysis in this EIS.

2.4.3 Wood Emphasis

This alternative would maximize timber production in the action area. Stands would be managed on short rotations (40 to 50 years). Riparian management areas and non-production areas, where timber harvest would not be permitted due to scenic values, resources protection needs, and public safety needs would grow into mature and advanced structure stands over the long term.

Under this alternative, it was assumed that Federal lands would provide sufficient habitat for survival and recovery of both northern spotted owls and marbled murrelets. In the short term, RMAs and non-production areas in the action area would provide limited habitat for owls and murrelets, with wildlife conservation efforts focused on known occupied sites. Surveys for northern spotted owls and marbled murrelets would continue in the action area, and occupied sites would be protected until they become vacant.

It is anticipated that northern spotted owl sites would decline over time under this alternative. Over the long term, the action area would provide some nesting and dispersal habitat for spotted owls, which they could use to move to federal lands where late-successional reserves would provide habitat. Marbled murrelets would be managed according to the *Marbled Murrelet Operational Policy for State Forest Lands* (Oregon Department of Forestry 2005), which would likely result in the loss of some murrelet sites in the first few decades but a net gain over the next 50 years. Aquatic and riparian resources would be managed in accordance with the FPA.

This alternative was eliminated from detailed analysis because it would provide minimal amounts of mature forest within the action area, and therefore, would contribute less to the survival of northern spotted owl and marbled murrelet than other alternatives. This management strategy would not meet the Federal purpose and need of providing for conservation of listed species (Chapter 1, Purpose and Need).

In addition, this alternative may not allow ODF to meet its stated purpose of producing a sustainable, even-flow harvest of timber due to the uncertainty associated with stand management in and around newly discovered sites occupied by marbled murrelet and northern spotted owls.

2.4.4 Conservation Emphasis

Under this alternative, ODF would manage the action area primarily as a habitat reserve for northern spotted owls and marbled murrelets with no timber harvest. Stands would mature and grow into advanced forest structures, and trees that die from natural tree mortality, windstorms, insects and disease, and forest fires would be left in the forest as snags and large woody debris. Some openings, usually small, would occur in the forest through tree mortality. Under this alternative, the action area would eventually provide large areas of northern spotted owl and marbled murrelet habitat with minimal habitat fragmentation.

This alternative was eliminated from detailed analysis in this EIS because it would not allow for timber harvest or forest management in the action area, which would not allow ODF to meet its stated purpose of producing a sustainable, even-flow harvest of timber, while balancing resource protection and species habitat requirements (Section 1.2.3, Context, in Chapter 1, Purpose and Need).

Chapter 3

Affected Environment

This chapter describes the environment that may be affected (affected environment) by adoption and implementation of a habitat conservation plan (HCP) for the Elliott State Forest (ESF). Each section in this chapter includes a summary of the sources of information used to describe the affected environment and a detailed description of resources within the study area, as defined below. This information forms the basis for the description of impacts in Chapter 4, Environmental Consequences.

3.0 Action Area and Study Area

The action area reflects the area where forest management activities associated with the proposed HCP would be implemented. As described in Chapter 1, Purpose and Need, the action area is represented by the ESF, which comprises a contiguous block of about 93,000 acres in Coos and Douglas Counties (Figure 1-1).

The study area, as the term is used in this chapter, varies by resource topic. In some cases, the study area is the same as the action area (the ESF). However, for most resources, the study area extends beyond the ESF boundaries to account for potential impacts on lands and resources affected by proposed actions, or lands affecting management of the ESF. For example, for fish resources, which are described in Section 3.5, Fish and Their Habitat, the study area encompasses the streams and rivers in the vicinity of the action area associated with the Coos, Tenmile, and Umpqua Watersheds. For resource topics that require evaluation of a study area that is different from the action area detailed above, a description of that study area is provided within that section.

Section 3.1

Forest Conditions

This section describes the species composition, age, structure, general health, and annual harvest of forests in the study area. For this section, the study area is the same as the action area described in Section 3.0, Action Area and Study Area.

3.1.1 Sources of Information

Information on the forest conditions and timber resources described in this section is based on 2004 Oregon Department of Forestry (ODF) forest inventory data. These survey data were derived from, and have been summarized in, the *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a). Additional information was obtained from a cost-benefit analysis of the Elliott State Forest (ESF) Common School Fund Lands (Ehlen and Lord 2005) commissioned by the Oregon Department of State Lands (DSL) and ODF.

In addition, data on the acreage of forest structural classifications was based on information provided by ODF. The data were derived from a spatially-explicit forest growth and harvest model for the study area, termed the Elliott State Forest Harvest Scheduling Model. The model utilized 2004 forest inventory data for the study area, and predicted harvest patterns based on the management constraints of the various alternatives. Appendix I of the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008) summarizes modeling metadata used in preparation of the HCP and this Environmental Impact Statement (EIS).

3.1.2 Affected Environment

3.1.2.1 Forest Condition

Species Composition

The study area encompasses about 93,000 contiguous acres of forest. This acreage is dominated by conifer forest types, with hardwoods making up only about 10 percent of the forested area (Oregon Department of Forestry 2008). The majority of the stands in the study area originated after the Coos Bay Fire of 1868. About 50 percent of the conifer stands are more than 85 years old, but very few are more than 145 years old (Oregon Department of Forestry 2006a).

Conifer stands. The ODF classifies stands as conifer if conifer species comprise 30 percent or more of the tree canopy. The majority of the study area is dominated by Douglas-fir (*Pseudotsuga menziesii*) with minor components of other conifer species including western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), Sitka spruce (*Picea sitchensis*), and grand fir (*Abies grandis*). Conifer stands may also contain hardwood trees, brush, grass, and ferns that contribute to a diverse forest ecosystem. These other vegetation types are either intermixed with the conifers, or are in homogenous clumps that are too small to map and inventory as separate stands.

Hardwood stands. The ODF estimates that approximately 10 percent of the forest in the study area is comprised of hardwood trees. However, many of the hardwood trees occur in small patches or riparian stringers within larger stands of conifer forest, so they do not appear as hardwood stands in forest inventory data. For the forest inventory, ODF defines hardwood stands as having at least 70 percent of the canopy composed of hardwood trees. The predominant hardwood species in the study area are by red alder (*Alnus rubra*) and bigleaf maple (*Acer macrophyllum*). Oregon myrtle (*Umbellularia californica*) is found in the western portion of the study area. Other hardwood species present include willow (*Salix*), golden chinquapin (*Chrysolepis chrysophylla*), Pacific madrone *(Arbutus menziesii)*, cascara (*Rhamnus purshiana)*, and Pacific dogwood (*Cornus nuttallii)*.

Non-conifer vegetation is classified by size instead of age. Of the total acreage of non-conifer vegetation in the study areas, most is dominated by hardwood trees in the 5- to 10-inch diameter-at-breast height (dbh) size class.

Site Class

Site Class is a measure of the capacity of a site to produce wood volume, as determined by the height of the tallest trees at a given age. It is based on the fact that height growth of dominant trees is almost entirely a function of soil fertility. Site class is measured separately for each tree species of interest, and reported on a scale of I to V. The most productive sites are Site Class I, and the least productive are Site Class V. Most of the study area is Site Class II or III for Douglas-fir, indicating a moderate to high productive capacity (Duncan and Steinbrenner 1973).

Structure

Forest stands in the study area are classified according to the structural complexity and stage of stand development. Stands are classified as having early, intermediate, or advanced stand structure. Additional areas of the land base are classified as not capable of silvicultural production, rock, or other. The total acreage of each structure category in the study area, as well as acreage of forest stands over 100 years of age, is shown in Table 3.1-1. The three structural classes are defined as follows:

- Early Structure – Early structure stand conditions exist after the landscape has been disturbed and/or regeneration harvest has occurred. Early structure exist when:
  - Average dbh of the largest 40 trees per acre is less than or equal to 6 inches.
  - Trees are seedlings or saplings usually less than 15 years old.
  - Herbaceous vegetation and shrubs represent 20 to 80 percent of the ground cover.
- Intermediate Structure – Intermediate structure stand conditions exist as the stand continues to develop and a single cohort of trees dominates the site. Intermediate structure exist when:
  - Average dbh of dominant and co-dominant trees is generally between 6 and 18 inches, but may be larger. Tree heights generally range from 40 to 100 feet.
  - Trees dominate the site and form a single, main canopy layer. There may be little or no understory development or the development may include understory trees. Generally, herbs, shrubs, and grasses may cover up to 40 percent or more of the forest floor. The stand does not have significant vertical layering of tree crowns.
- Advanced Structure – Advanced structure stands provide habitat for species commonly associated with older forests. Advanced structure stands have:
  - Twenty or more trees per acre of 18 inches dbh or larger and 100 feet or more in height, of which at least 10 overstory trees per acre are at least 24 inches dbh. The quadratic mean diameter must be 15 inches or more.
  - Understory trees that average 30 feet in height.
  - Basal area (the cross-sectional area of live trees) between 150 and 325 square feet per acre.

In addition, advanced structure stands in the study area are managed to develop the following characteristics:

- Eight or more live trees per acre at least 32 inches dbh.
- At least six snags per acre, two of which must be at least 24 inches dbh; the remaining four must be at least 12 inches dbh.
- A total of 3,000 to 4,500 cubic feet of down logs in all decay classes (1 through 5); or 600 to 900 cubic feet per acre of sound down logs (decay classes 1 or 2).
- Multiple tree species, including shade-tolerant species; some trees with defects or decadence; and diverse understory vegetation.

Most advanced structure stands in the study area are more than 95 years of age. However, stands 70 years and older can exhibit the full suite of advanced structural attributes if managed to promote these characteristics.

Table 3.1-1 Summary of Existing Stand Structure Condition in the Study Area

		Forest Structural Classification (acres)						
Management Basin	**Basin Area (acres)**	**Early Structure**	**Intermediate Structure**	**Advanced Structure**	**Advanced Structure Percent of Basin (percent)**	**Advanced Structure with ≥8 trees/acre ≥32 inches dbh[1]**	**Advanced Structure with ≥8 trees/acre ≥32 inches dbh and ≥4 trees/acre ≥38inches dbh[1]**	**Stands 100 Years and Older[2]**
1	5,356	61	3,275	1,921	36	786	357	2,493
2	6,422	250	1,923	4,240	66	2,096	308	4,668
3	7,296	24	3,661	3,571	49	1,827	321	3,941
4	4,990	101	3,214	1,660	33	1,209	707	2,098
5	7,823	176	3,679	3,899	50	2,693	1,982	4,781
6	7,417	322	2,846	4,249	57	2,658	1,457	4,458
7	6,322	225	2,751	3,281	52	2,248	442	3,326
8	6,541	445	3,342	2,717	42	2,101	570	2,763
9	8,284	1,015	4,806	2,431	29	1,186	457	2002
10	6,512	847	4,312	1,293	20	390	38	499
11	10,873	1,264	4,165	5,322	49	4,483	1,199	5,631
12	11,314	2,043	5,461	3,798	34	2,672	993	4,302
13	4,132	207	2,243	1,660	40	1,426	801	1,720
Umpqua (Basins 1,2,3,4,13)	28,196	643	14,316	13,052	46	7,344	2,494	14,920
Tenmile (Basins 5,6,7)	21,562	723	9,276	11,429	53	7,599	3,881	12,565
Coos (Basins 8,9,10,11,12)	43,524	5,614	22,086	15,561	36	10,832	3,257	15,197
Forest Total	93,282	6,980	45,678	40,042	43	25,775	9,632	42,682

Source: Oregon Department of Forestry 2006b
[1] Subset of Advanced Structure Classification
[2] Includes predominantly stands classified as advanced structure but also includes some classified as intermediate.
≥ = at least
dbh = diameter at breast height

As shown in Table 3.1-1, the total acreage of stands at least 100 years old is greater than the total acreage of advanced structure in most management basins. This occurs because some stands over 100 years old are classified as intermediate structure. In Basins 9 and 10, however, the opposite is true and there are more acres in advanced structure than there are at least 100 years old. Basins 9 and 10 are located in the southern portion of the study area, where stands have developed the structural complexity associated with advanced structure prior to reaching an age of 100 years.

3.1.2.2 Forest Health

Current forest health in the study area can be ascertained partially by examining long-term trends in damage from major disturbance agents. Aerial and ground surveys conducted during the past 50 years show little evidence of major pest outbreaks in the study area, aside from those described below. Substantial blowdown has occurred during periodic major winter storms.

Several diseases have reached noticeable levels of damage in recent decades. Swiss needle cast, the highly visible foliage disease of Douglas-fir, is causing growth decline over a large area along the west slope of the Coast Range. In northwest Oregon, growth reduction is severe enough on some sites that the future productivity of those stands is uncertain. Although Swiss needle cast affects some stands in the study area, it has not become severe enough to cause ODF to modify silvicultural activities, with the exception that certain silvicultural treatments (e.g., thinning to encourage non-host tree species, planting species mixtures) are applied to reduce the impact of Swiss needle cast in affected stands. The ODF also monitors disease distribution and severity annually through aerial and ground surveys (Oregon Department of Forestry 2006a). Laminated root rot, a native disease of conifers, has damaged Douglas-fir on some sites in the study area, but current management practices are expected to stabilize or reduce the unwanted effects of this disease. Black stain root disease has reached epidemic proportions in some locations in southwest Oregon, but is found infrequently in Douglas-fir within the study area.

Few insect problems occur in the mid- to late- successional Douglas-fir stands that are found in the study area. The most significant pest is the Douglas-fir beetle, whose outbreaks follow major windthrow events. The Sitka spruce weevil continues to limit Sitka spruce production. Other chronic diseases and insect pests that occur to a limited extent in the study area include armillaria root disease, hemlock dwarf mistletoe, annosus root disease, stem decay, and spruce aphid. Port Orford cedar root rot has been detected in one location, but sudden oak death syndrome has not been detected. Bears, mountain beavers, deer, elk, and porcupines also cause localized damage to stands in the study area.

3.1.2.3 Fuel Conditions and Fire Regime

Fire is a principal disturbance agent in the Hemlock Zone of the Oregon Coast. The fire return interval for the coastal zone ranges from 25 to more than 200 years (U.S. Geological Survey 2005) and the average is estimated to be 230

years. The study area experienced a major stand replacement fire around 140 years ago. Large fires also occurred along the eastern and northern edges of the study area in 1770 and 1840, respectively, but did not affect most of the study area. Since establishment of ESF in 1930, there have been few ignitions in the study area. Most fires have resulted from escaped slash burning or warming fires and have burned only a few acres. Occasional fires resulting from lightening strikes have occurred, but have generally burned less than 0.1 acre because they occurred outside of the late summer dry season and were accompanied by rain. Over the past 20 years (1987 to 2006), the following ignitions and resulting fires have occurred:

- 1992: 0.1-acre fire caused by an arsonist;
- 2003: 0.01-acre fire caused by an abandoned campfire;
- 2003: 0.01-acre fire caused by a lightning strike; and
- 2005: 44-acre fire caused by a logging accident.

Forest management activities have affected fuel conditions and fire return intervals in the study area. Forest floor fuel volumes are generally low in harvested and thinned stands because tree boles and slash have been removed and few standing dead trees have fallen to the ground since the initiation of snag retention practices. Dense, young stands that have not been thinned tend to be more flammable than older stands with more advanced structure, potentially increasing the risk of spreading fire into neighboring stands. Based on the recent fire history, however, it does not appear that intensive forestry has increased fire hazard in the study area.

Fire return intervals for the majority of the study area are within the historical range. Fire condition class is used as a general measure of ecosystem integrity with respect to historical fire cycles. The majority of stands in the study area are in Fire Condition Class 1, indicating that fire regimes are mostly within historical ranges, vegetation composition and structure are intact, and the risk of losing key components of the ecosystem from fire is low. Some stands, primarily in the southeastern portion of the study area, are in Fire Condition Class 2. Fire regimes in this condition class have been moderately altered from their historical range, and the risk of losing key components of the ecosystem from fire in these areas is moderate (U.S. Geological Survey 2005). Because there are few built structures in the study area, the fire risk to structures, if a fire occurred, would be very low (U.S. Geological Survey 2005).

3.1.2.4 Timber Harvest

Approximately 2.3 billion board feet of merchantable timber are now standing in the study area (Oregon Department of Forestry 2006b). The majority (approximately 89 percent) is Douglas-fir. The forest consists of a well-distributed mosaic of stand ages from recent clearcuts to timber stands that are over 160 years old. Many of the older stands have been commercially thinned over the years, increasing the growth rates of the remaining trees and resulting in fewer but larger and higher-quality trees than would have occurred without thinning.

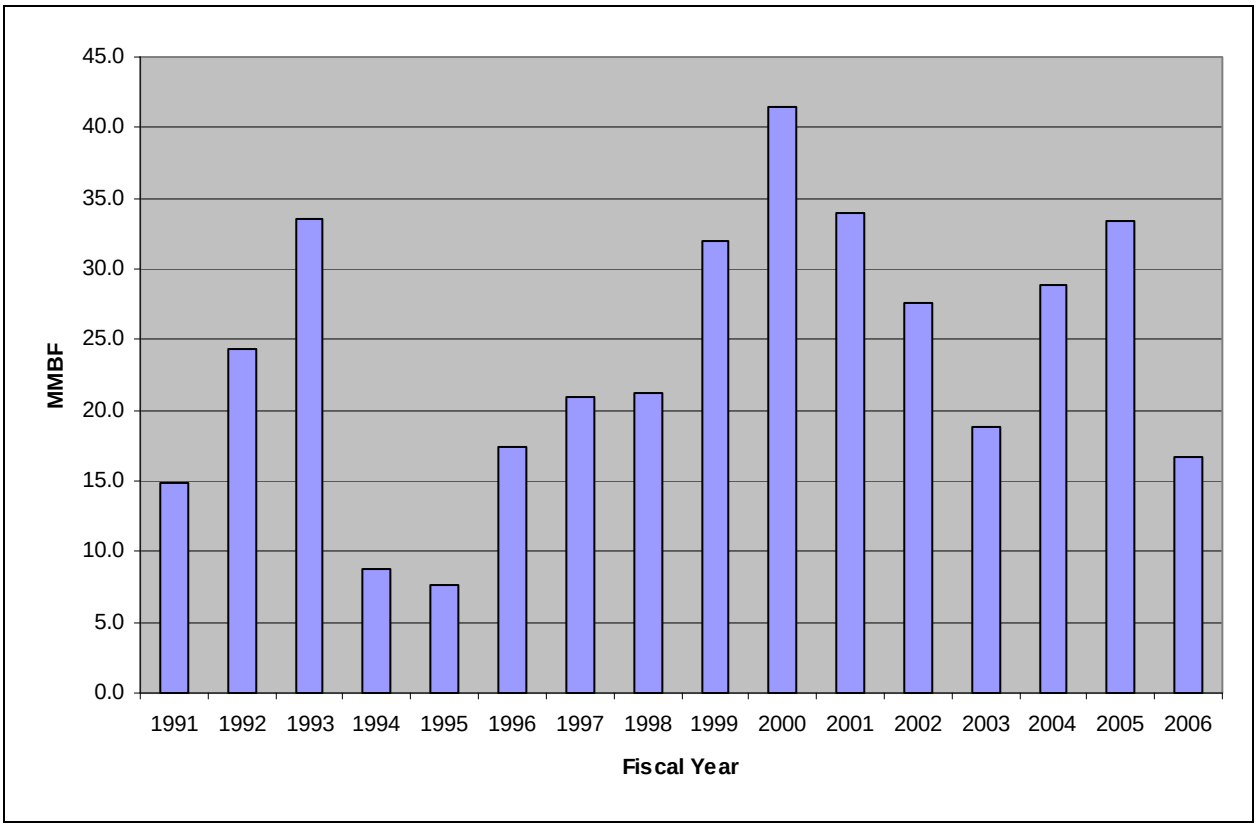
In forest management plans prior to 1995, the predominant land use in the study area was timber production, with 95 percent of the ODF Coos District forests in this classification. The remaining acreage was allocated to uses such as roads, stream buffers, inoperable terrain, watershed use, recreation 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 30 to 45 years for the first commercial thinning, with most clearcutting being done at 90 to 130 years.

Average annual harvest in the 1980s was approximately 41.00 million board feet (MMBF). Figure 3-1.1 shows average annual harvest from 1991 to the present (2006), during which annual harvest has ranged from 7.60 to 41.50 MMBF, and averaged 23.80 MMBF (Freedom Martinmass 2006).

During the 6-year period from 1991 through 1996, harvest volume in the study area was limited by the habitat restrictions associated with protection of the northern spotted owl (*Strix occidentalis caurina*) (federally listed as endangered in 1990) and marbled murrelet (*Brachyramphus marmoratus*) (federally listed as threatened in 1992) (Chapter 1, Purpose and Need). The average annual harvest volume during this period was 17.74 MMBF. The 1994 *Elliott State Forest Management Plan* (Oregon Department of Forestry 1994) and 1995 *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 1995) increased the estimated annual harvest to approximately 28.00 MMBF. From fiscal year 1997 through 2006, the average annual volume sold in the study area was 26.11 MMBF (ODF 2006c). For purposes of impact assessment in this EIS, this period (1997 through 2006) is assumed to represent the current condition. Table 3.1-2 shows the average annual timber volume sold, and acreages of clearcutting and thinning during that period in each watershed in the study area.

Management of the timber assets in the study area includes investment of time, dollars, and resources to realize the ability of the forest to generate sustainable timber harvest and revenue over the long term. Investments include direct expenses for stand establishment, and management activities such as site preparation, seeding and planting, seedling release, and pre-commercial thinning; and for forest infrastructure such as roads and bridges. Long-term management includes indirect expenses, such as forest inventory and geographic information systems (GIS), research projects, and monitoring projects.

Figure 3.1-1 Historical Timber Harvest Volume in the Study Area



Source: Freedom Martinmass 2006.

Table 3.1-2 Average Annual Timber Volume Sold and Acreage in the Past Decade in the Study Area (1997-2006)

Watershed	Timber Volume (MMBF)	Clearcut Acreage (acres)	Thinning Acreage (acres)
Umpqua	3.42	52	97
Tenmile	0.20	1	44
Coos	22.49	405	214
Forest-wide total	26.11	457	356

Source: Oregon Department of Forestry 2006c.
MMBF = million board feet

3.1.2.5 Non-Timber Forest Products

Non-timber forest products harvested from the study area under special use permits include swordfern (*Polystichum munitum*), salal (*Gaultheria shallon*), firewood, and huckleberry (*Vaccinium* spp.). As described in Section 2.2.1.10, Other Management Activities, ODF sells approximately 25 leases for brush

collecting each year, and approximately 500 free-use woodcutting permits are given to the public each year.

3.1.2.6 Forest Chemicals

Forest chemicals include pesticides (insecticides, fungicides, rodenticides, and herbicides) to control nuisance plants and animals, and fertilizer to increase the rate of commercially valuable trees. Insecticides, fungicides, and rodenticides are seldom employed in western Oregon because the target pests rarely reach levels that threaten the health or economic return of managed forests. There are no recent records of the use of insecticides, fungicides, or rodenticides in the study area.

Herbicides are used on an as-needed basis prior to stand establishment (the period of time after clearcut harvest) to increase the survival and growth of commercial tree seedlings by reducing competition from shrubs and non-commercial trees. Some sites may require a second application of herbicides during the first 10 to 15 years of stand establishment to remove competing vegetation, although many sites require no application at all. Herbicides are not needed once a stand is established and free of competition, so the average frequency of application at a particular site is less than once per harvest rotation (typically 40 years or longer). Because clearcut units are highly interspersed with stands of other ages, the resulting rate of herbicide application at the landscape level is also quite low when compared to agricultural or residential landscapes.

Herbicide applications to regenerating stands in the study area averaged 427 acres (less than 0.5 percent of the study area) annually from 2001 to 2005. In 2006, 650 acres (0.7 percent of the study area) were treated with herbicides. Most of the treated areas were recent clearcuts, although some release treatments were applied to regenerating stands (Young pers. comm. 2006). In general, about 85 percent of the acreage that is clearcut in the study area each year is treated with herbicides (Young pers. comm. 2006).

Herbicide formulations and application rates vary over time as the technology evolves. Current herbicide applications in the study area are as follows.

- Approximately 60 to 70 percent of the application acreage is treated with glyphosate (the generic name for Roundup™) at a rate of 3.0 pounds of active ingredient (ai) per acre and imazapyr at 0.1875 pounds ai per acre to control plant competition.
- Approximately 25 to 35 percent of the application acreage is treated with a combination of glyphosate at 2.0 pounds ai per acre, imazapyr at 0.125 pounds ai per acre, sulfometuron methyl at 0.07 pounds ai per acre, and metsulfuron methyl at 0.01875 pounds ai per acre, with the latter two herbicides added for control of Scotch broom (*Cytisus scoparius* [L.]).
- Approximately 4 to 6 percent of the application acreage is treated with triclopyr at 1.25 pounds ai per acre for control of Scotch broom (Johnson pers. comm. 2006).

- A small number of acres are also sprayed by backpack sprayer each year to control Scotch broom. This treatment is a direct basal application of either 10 percent Garlon-4 in 80 percent crop oil and 10 percent water, or a foliar application of 4 percent Garlon-4 in water, without a surfactant.

Surfactants are added to applications to facilitate absorption of herbicides into plant leaves. Surfactants typically used for clearcut applications in the study area include Wilbur Ellis R-11 Spreader Activator™ (16 ounces ai per acre) and Loveland Products Incorporated Phase Surfactant – Antifoaming Agent (5 ounces ai per acre) (Young pers. comm. 2006). The principal functioning agents by percent weight in Wilbur Ellis R-11 Spreader Activator are alkyphenola ethoxylate, butyl alcohol, dimethylpolysiloxane (90 percent) and other constituents ineffective as a spray adjuvant (10 percent). The application rate is 16 ounces per 10 gallon mix. The principal functioning agents for Loveland Products Incorporated Phase Surfactant – Antifoaming agent are methylated esters of fatty acids, alcohol ethoxylate, and polyether modified polysiloxane – 100 percent. The application rate is 5 ounces per acre in a 10-gallon mix.

Herbicides are also used to control the spread of invasive Scotch broom from roadside areas, and to control vegetation along roads to maintain safe visibility for vehicle traffic. Roadside herbicide applications have averaged 50 miles of road (both sides) per year since 2003 (Young pers. comm. 2006). Roadside herbicide applications typically include 2,4-D at 0.25 gallon per mile, Garlon-4™ at 0.25 gallon per mile, Escort™ at 1.0 ounce per mile, and a surfactant. Surfactants used for roadside applications include Oil Max and Herbimax (methylated seed oils) at an application rate of 1 quart per mile.

Herbicide applications to regenerating stands are largely by helicopter, with occasional spot applications by back-pack sprayer. Roadside applications are usually done with a truck-mounted power spray. Application methods in the study area include the following measures to minimize risk to humans and the environment (Biosystems et al. 2003).

- A half-boom technique is used when applying herbicides by helicopter near streamside buffers. The boom on one side is shut off and the wash of air from the helicopter blade forces the spray downward to minimize scatter to the side.
- No spraying is done over perennial streams, wetlands, seeps, or other wet areas. All perennial streams are buffered by retained trees.
- All spray mixing and handling is done away from stream channels.
- Spraying occurs only on calm, dry days to avoid drift of spray into adjacent areas or wash-off of spray by rain.
- Nearby landowners are contacted prior to herbicide application.

Fertilizers are used infrequently in the study area. When used, they are applied by helicopter in areas where low soil nitrogen is retarding tree growth. The ODF estimates fertilizer is applied to about 1,000 acres per 10-year period. The most recent fertilizer application in the study area was in 1997. It involved application

of urea at a rate of 200 pounds per acre on approximately 3,500 acres. As a general rule, the rate of fertilizer application in the study area is dependent on local site conditions and not on the rate of timber harvest. In general, forest fertilizers can increase nutrient levels in streams and cause algal blooms, especially during periods with high water temperatures (Chamberlin et al. 1991). However, there is no evidence that high levels of nutrients in streams occur in the study area as a result of fertilizers.

Section 3.2

Soils and Slope Stability

This section provides an overview of soil characteristics and conditions, soil erosion processes, and slope stability issues in the study area. For this section, the study area includes the following:

- the action area described in Section 3.0, Action Area and Study Area;
- areas outside the action area where sediment from the action area could enter receiving waters downstream of the action area; and
- areas outside the action area where sediment and debris from landslides within the action area could extend beyond the action area boundary.

3.2.1 Sources of Information

This section was prepared after review of geologic and soil survey maps, and literature on soil erosion and slope stability as affected by land management practices in the Oregon Coast Range. With respect to slope stability, literature specific to the action area was used to the maximum extent possible, as cited in the following text.

3.2.2 Affected Environment

3.2.2.1 Topographic Conditions

The study area is located in the southern portion of the Oregon Coast Range physiographic province. Physiographic provinces or regions are broad-scale geographic subdivisions based on terrain texture, rock type, and geologic structure and history (U.S. Geological Survey 2006). From a physiographic perspective, mountains of the Oregon Coast Range are characterized by highly dissected ridges with very steep side slopes and narrow, sharply defined ridge tops (Haagen 1989). Rock outcrops and cliffs occur throughout the study area, but are most common along the channels of steep-sided canyons (Biosystems et al. 2003).

Most slopes range from 30 to 90 percent, although slopes steeper than 100 percent have been reported in some parts of the study area (Haagen 1989; Natural Resources Conservation Service 2004). The southeastern portion of the study area generally has gentler slopes than the remainder of the study area. Elevations

range from near sea level to 2,100 feet above sea level (Oregon Department of Forestry 2006a).

The action area comprises three major watersheds:

- the Coos Watershed, comprising 47 percent of the action area and draining southwest to Coos Bay;
- the Umpqua Watershed, comprising 30 percent of the action area and draining north to the Umpqua River; and
- the Tenmile Watershed, comprising 23 percent of the action area and draining west to Tenmile Lakes.

All of these receiving waters drain to the Pacific Ocean within about 20 miles of the action area.

3.2.2.2 Climatic Conditions

Mean annual precipitation ranges from 70 to 90 inches per year in the western and central portions of the study area, generally increasing with elevation. Mean annual precipitation of 60 inches per year falls on the eastern edge due to the rain shadow effect of the interior high ridges. Annual variation is moderate, with mean annual precipitation about 10 inches higher in 20 percent of years, and about 10 inches lower in another 20 percent of years.

Most precipitation is in the form of winter rain (summer thundershowers and snowfall occur but are relatively uncommon, and persistent snowpack is absent). During winter storms, rainfall intensity is generally moderate, but duration may be lengthy. Short-term, high-intensity precipitation is common, and can trigger landslides on steeper slopes.

3.2.2.3 Geologic Conditions

The study area is underlain primarily by uplifted marine sedimentary rocks that formed in the Tyee Basin during the Eocene Epoch (54 to 56 million years ago). At the time of the sediment deposition, part of the area that is now the Oregon Coast Range was a deep marine basin that received sediments from massive underwater landslides. The coarser materials in the area were deposited before the finer-grained material, creating the distinctive alternating layers of coarse-grained sandstone overlain by finer-grained siltstone. This depositional process resulted in the interbedded nature of the rocks underlying the study area.

Although a number of geologic formations occur in the Tyee Basin, much of the study area is underlain by the Tyee Formation, which consists of sandstone beds (3 to 30 feet thick) separated by thin mudstone beds. The beds are gently dipping (Biosystems et al. 2003). The sandstone is weakly cemented, and the sandstone beds tend not to weather as readily as the siltstone. Underlying the Tyee Formation, but not exposed at the surface except in quarries and pits, is basaltic basement rock (Biosystems et al. 2003).

Subsequent periods of marine sediment deposition in the Tyee Basin, tectonic uplift, sea level changes, and erosion (particularly landsliding) have resulted in the landforms and topography present in the study area today (Oregon Department of Forestry 2006a).

3.2.2.4 Soil Characteristics

The U.S. Department of Agriculture (USDA) has created a detailed map of the soils in the study area (Haagen 1989; Natural Resources Conservation Service 2004). However, because of the large size of the study area, a general description of soils[1] is provided in this document (Figure 3.2-1).

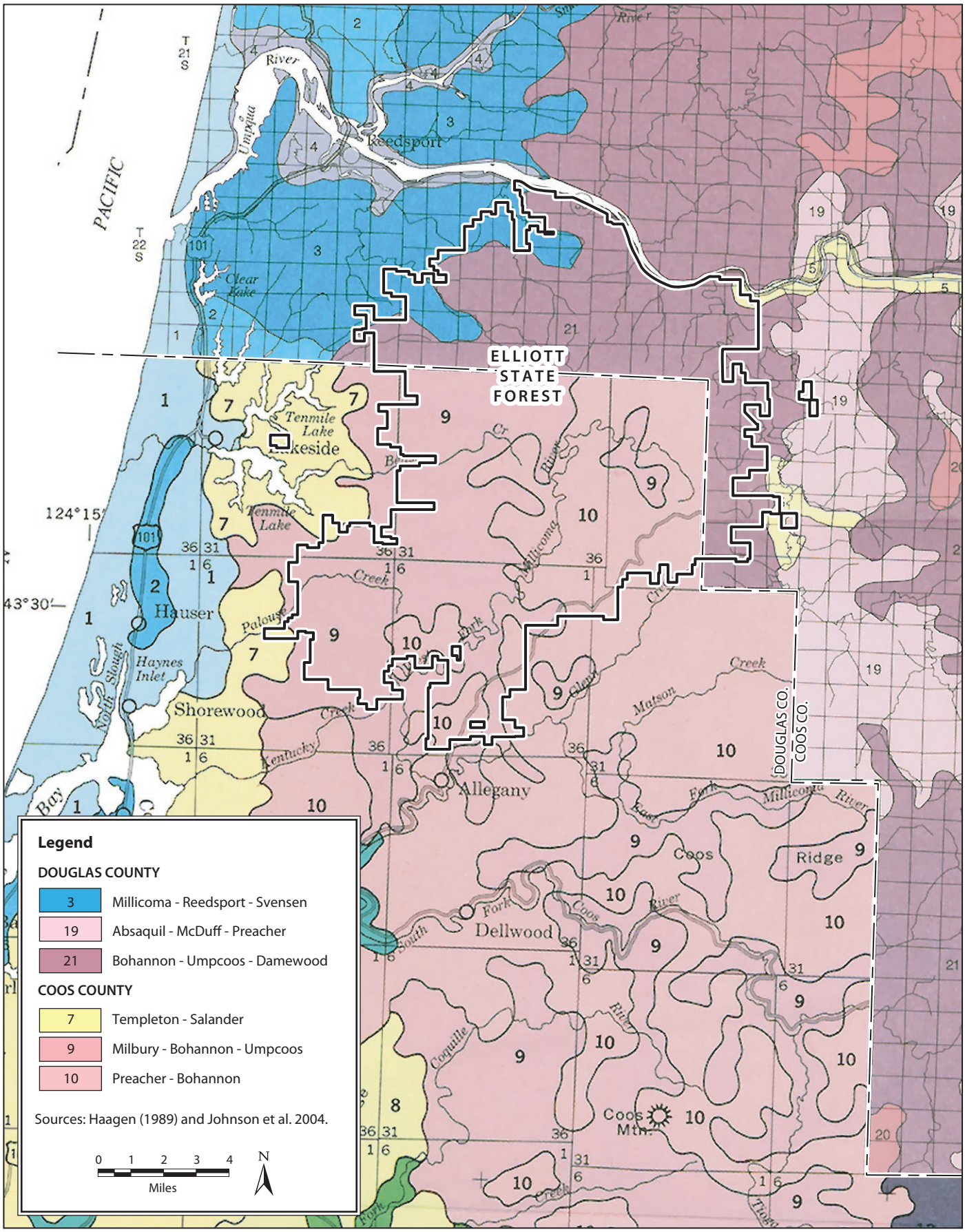
Most of the study area is underlain by residual or colluvial soils, including all of the soils described below. Two soil associations have been identified in the portion of the study area in Douglas County, described by USDA as follows:

- **Millicoma-Reedsport-Svensen Association.** This association occurs on side slopes and narrow ridges. The slopes range from 3 to 90 percent. Most areas of this association consist of soils that are moderately deep to deep, and have surface layers that are loam or gravelly loam. Parts of this association are naturally subject to slope failure (Natural Resources Conservation Service 2004).
- **Bohannon-Umpcoos-Damewood Association.** This association occurs on steep and very steep slopes. The slopes range from 30 to 90 percent. Most areas of this association consist of soils that are shallow to moderately deep, with a surface layer that is gravelly loam to extremely gravelly sandy loam. Parts of this association are naturally subject to slope failure (Natural Resources Conservation Service 2004).

Three soil associations have been identified in a portion of the study area in Coos County, described by USDA as follows:

- **Templeton-Salander Association.** This association occurs on low foothills. The slopes range from 0 to 75 percent. Most areas of this association consist of soils that are deep and loamy (Haagen 1989).
- **Milbury-Bohannon-Umpcoos Association.** This association occurs on strongly dissected mountains. The slopes range from 30 to 80 percent. Most areas of this association consist of gravelly loam soils that are shallow to moderately deep and are gravelly loams (Haagen 1989). Parts of this association are naturally subject to slope failure (Natural Resources Conservation Service 2004).

[1] General soil map units consist of a group of soils or miscellaneous areas that are geographically associated in a repeating pattern and defined and delineated as a single map unit. Additionally, it is noteworthy that because the soils in the two counties were mapped using different taxonomic classifications (i.e., soil series), the map unit names do not correspond at the County line.



04718.04 EIS (11-06)

Jones & Stokes

Figure 3.2-1
Soil Resources in the Study Area

- **Preacher-Bohannon Association.** This association occurs on high mountainous areas. The slopes range from 3 to 90 percent. Most areas of this association consist of soils that are moderately deep to deep, and are gravelly loams (Haagen 1989). Soils of this association are naturally subject to slope failure (Natural Resources Conservation Service 2004).

3.2.2.5 Slope Stability

The Tyee Core Area is an administratively defined area in the Oregon Forest Practices Act (FPA) and is prevalent in the Oregon Coast Range and study area (Oregon Department of Forestry 2004). These areas are commonly associated with thick sandstone beds that have few fractures, allowing rapidly weathering sandstone to concentrate water in shallow (overlying) soils. This condition leads to an increased hazard of shallow, rapidly moving landslides relative to other mountain slopes in Oregon.

The Tyee Core Area is generally located in coastal watersheds from the Siuslaw River Watershed south to and including the Coquille River Watershed, and that portion of the Umpqua River Watershed north of State Highway 42 and west of Interstate 5. All of the study area is in the Tyee Core Area.

The Oregon Department of Forestry (ODF) (2004) uses the following criteria to identify high landslide hazard locations in the Tyee Core Area:

- the presence of any slope steeper than 75 percent, or
- the presence of any headwall or draw steeper than 65 percent.

Using these criteria, all areas in the study area (except outcrops of competent bedrock) having slopes steeper than 75 percent, or headwalls or draws steeper than 65 percent, are classified as high landslide hazard areas. Geotechnical specialists may identify atypical site conditions that are more or less stable than the criteria would suggest.

In this section, the terms “lower-slope,” “mid-slope” and “upper-slope” are used. Lower-slopes include areas with relatively gentle slopes. Debris slides do not originate on such slopes, but may run out on these slopes. Streams in lower-slope environments are often perennial. Because streams are common, many roads on lower-slopes are locally connected to streams. Mid-slopes are steep enough that debris slides may initiate on these slopes. Streams on such slopes are typically not perennial unless they are spring-fed, and many small drainages initiate in mid-slope areas. Roads in mid-slope areas are connected to streams at and near stream crossings. Upper slopes, including ridge tops, are also steep enough that debris slides may initiate on these slopes. There are few drainages associated with upper-slopes, and the ones that do occur rarely contain perennial streams. Upper slope roads are seldom connected to streams.

Existing Landslides

Landslides, rather than surface (water) erosion, have been the predominant landform-building agent in the Oregon Coast Range. Landslides constitute a major natural process of erosion in sloping terrain and are a source of sedimentation in receiving waters in the Pacific Northwest.

Of the types of landslides that occur in the study area, debris slides are most common (Oregon Department of Forestry 2006a). Debris slides typically begin as relatively small and shallow features, but become debris flows or debris torrents when they enter steep-gradient, V-shaped channels (Oregon Department of Forestry 2006a). Depending on the geology and topography of an area, slopes steeper than 65 percent are the most susceptible to debris flow-initiating landslides, particularly in the Tyee Core Area (Seward and Mills 2002).

In addition to the many mapped and unmapped small landslides that exist in the study area, only about 10 large actual or inferred landslides have been mapped. A 230-acre landslide (37 acres of which are located in the study area) extends from a ridge top into Camp Creek. A 95-acre earth flow exists near Stulls Falls along a tributary to the West Fork Millicoma River. Farther downstream, an 80-acre earth flow occurred at the confluence of several small tributaries. None of these landslides are currently active (Biosystems et al. 2003). Risk of landslide initiation is greatest in scenic, unique, and visual (SUV) areas (Mills pers. comm. 2007).

Debris flows and torrents generally occur every winter in the Oregon Coast Range. Substantial landslide-producing storms occurred in western Oregon in November 1995 and February 1996. The November storms had the greatest effect on lands in the study area, and resulted in large numbers of landslides, debris torrents, and altered stream channels. In fact, portions of the study area were identified as having the highest rates of landslides and debris torrents in western Oregon during the November 1996 storms (Oregon Department of Forestry 1999). Intense storms on the Oregon Coast in December 2007 also caused landslides, although the landslides and their effects have not been inventoried in the action area.

Although the Oregon Coast Range is prone to landslides, the spatial extent of landslides at any given time is relatively small. Benda and Dunne (1997) modeled debris slides at the landslide scale using data indicating that landslides initiate in small (about 1 hectare [ha] or 2.5 acres) bedrock hollows on steep slopes (mid-slopes and upper-slopes). Such sites cover the majority of steep slopes in the Oregon Coast Range and the study area. Their modeling results document that landslides originate from these sites at intervals of 1,000 to 3,500 years (average 2,750 years) (Benda and Dunne 1997), indicating that only a small fraction of the Oregon Coast Range has been recently affected by landslides at any given time.

3.2.2.6 Road System in the Action Area

Table 3.2-1 summarizes road mileage by landscape position for each watershed in the action area. Few of the roads in the action area are paved (except the County road between Highway 38 and Loon Lake), and about 75 percent are graveled. Although ridge top roads dominate the road system in the action area, mid-slope roads are also fairly extensive. Roads located in valleys and riparian areas are limited, as Table 3.2-1 indicates. Roads crossing steep slopes are also common in the action area, as Table 3.2-2 shows.

Table 3.2-1 Road Mileages by Landscape Position for Each Watershed in the Action Area[1]

Watershed		Landscape Position: Valleys Less Than 100 feet from streams	Valleys Greater Than 100 feet from streams	Mid-Slope	Upper Slope	Total
Umpqua	Mileage	5.3	5.3	44.5	79.0	133.6
	Percent	4.0	3.9	33.3	59.2	100.0
Tenmile	Mileage	0.0	1.9	30.2	67.0	99.1
	Percent	0.0	2.0	30.5	67.5	100.0
Coos	Mileage	18.0	21.8	102.7	160.9	303.5
	Percent	5.9	7.2	33.8	53.0	100.0
Forest total	Mileage	23.3	29.0	177.5	306.4	536.2
	Percent	4.4	5.4	33.1	57.1	100.0

Source: Biosystems et al. 2003

[1] Road mileage by landscape position was derived from Table 6-7 in Biosystems et al. 2003. This mileage varies slightly from other road mileage presented in this section, and in Section 3.5, due to variations in the reference document. Additionally, the reported total mileage of 536.2 differs from the calculated mileage of 536.6. This difference, which is inherent in the source document, may be the result of a rounding error.

Table 3.2-2 Road Mileages by Side Slope Class for Each Watershed in the Action Area[1]

Watershed	Side-Slope Class: 0-4%	4-10%	10-25%	25-60%	>60%	Unidentified	Total
Umpqua	1.0	5.6	26.6	71.3	27.9	0	132.4
Tenmile	0.3	2.5	17.0	53.2	25.3	0.3	98.6
Coos	6.8	11.1	81.3	164.0	40.0	0.4	303.6
Total	8.1	19.2	124.9	288.5	93.2	0.7	534.6

Source: Biosystems et al. 2003

[1] Road mileage by side slope class was derived from Table 6-10 in Biosystems et al. 2003. This mileage varies slightly from other road mileage presented in this section, and in Section 3.5, due to variations in the reference document. The discrepancy between total mileages reported in Table 3.2-1 and Table 3.2-2 is inherent in the source document and may be the result of a rounding error.

Roads in the action area are managed to reduce rutting and sediment yield by locating high-use and wet-haul roads away from streams, closing unsurfaced roads during wet weather, and improving rock quality (e.g., where possible using rock that reduces sediment generation). Sedimentary rock in the action area produces fine sediment from road use more rapidly than some other rock types not found in the action area (Biosystems et al. 2003).

Biosystems et al. (2003) estimate that between 3 and 15 percent of the road mileage in the action area are connected to streams. For comparison, road to stream connectivity in the Tillamook State Forest, which has more lower-slope roads, is estimated at 15 to 20 percent (Mills pers. comm. 2007). It is possible to more precisely estimate road-stream connectivity in the action area by analysis of data presented in the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003), as detailed below.

There are between 23.3 and 49.4 miles of roads in the action area that are within 100 feet of a stream (Biosystems et al. 2003). The Coos Watershed supports approximately 75 percent of these roads, with approximately 20 percent in the Umpqua Watershed and 5 percent in the Tenmile Watershed. For the purposes of this analysis, it is assumed that these roads have a relatively direct surface hydraulic connection to the adjacent stream.

Additionally, there are between 8 and 20 miles of roadside ditches that convey road runoff to streams, of which between one-quarter and one-half are associated with roads that run within 100 feet of a stream (Biosystems et al. 2003). The distribution of these roads between watersheds is not precisely known, but is probably proportional to the total mileage of hillslope and valley bottom roads, rather than ridge top roads which rarely have direct hydrologic connections with streams. Under that assumption, about 65 percent of the roadside ditches in the action area are located in the Coos Watershed, 24 percent are in the Umpqua Watershed, and 11 percent are in the Tenmile Watershed (unpublished data used in preparing Biosystems et al. 2003 report).

Adding together roads near streams and roads with ditches draining to streams provides an estimate of road-stream connectivity of between 27.3 and 64.4 miles for the entire action area. This corresponds to a drainage network extension of 0.19 to 0.44 miles per square mile. The total stream density in the action area is about 4.92 miles per square mile (Table 3.3-2), so the road network currently extends the stream network by about 3.9 to 8.9 percent.

3.2.2.7 Activities in the Action Area Affecting Soil and Slope Stability

The following provides an overview of how human activity, and particularly forest management activities, may affect slope stability in the action area. This information is presented to provide context for understanding how past management practices have affected slope stability in the action area.

Human activities that affect soil and slope stability in the action area include disturbances that occurred during early European settlement (e.g., homesteading and farming); early logging and logging-related practices (e.g., splash dams and stream cleaning); and modern forest management activities implemented by ODF. The latter include road construction; harvest of trees that contributed root strength or conifer canopy cover to potentially unstable areas; cable yarding of trees during timber harvesting; occasional yarding by tractor; use of bulldozers for fire suppression; broadcast and pile-burning of harvest residue; and disturbance by recreationists from camping, campfires, and recreational vehicle use.

This timber management system has important implications for soil and slope stability. Today, the majority of logs harvested in the action area are brought upslope from the area in which they are felled to a roadside landing area by cable yarding; tractor yarding is used in less than 5 percent of the harvest units. Depending on terrain, logs are either completely suspended in the air or dragged over the soil surface with one end suspended. Cable yarding sites are accessed by the road system in the action area, which is primarily located on upper-slopes (Table 3.2-1).

Uphill yarding using cable systems reduces the potential for stream connectivity to areas disturbed by yarding (i.e., logs are most commonly pulled away from streams). Moreover, the dominant use of cable yarding rather than tractor yarding results in less overall soil compaction, which otherwise could induce decreased infiltration, increased runoff, and increased effects on streams. Rill and gully erosion are currently rare in the action area (Fields pers. comm. 2006a).

Roads in the action area are dominated by upper-slope and ridge top roads. Roads located in these general locations typically require less soil excavation, which could destabilize slopes and induce landslides. Roads in the action area are also not constructed on known unstable slopes, and current construction techniques, such as use of a full-bench road section and end-hauling cut materials, are considered by a geotechnical engineer for all roads constructed on mid-slope and upper-slope terrain to ensure slope stability. Benda and Dunne (1997) estimated that drainage heads located on mid-slope and upper-slope terrain in the action area are subject to failure on the order of 1,000 to 3,500-year intervals.

The predominance of upper-slope and ridge top roads in the action area reduces the potential for road surface erosion to deliver sediment to streams. As noted above, the road network currently only extends the stream network in the action area by about 3.9 to 8.9 percent, even though steep slopes prevail (ground slope averages about 65 percent).

Some slash resulting from timber harvest in the action area is reduced or eliminated through burning—either burning of slash piles on landings or broadcast burning of harvest areas. Currently about 40 acres per year are broadcast burned, primarily to provide some diversity in forage plants available for wildlife. Pile burning is almost exclusively limited to landing piles.

The infiltration capacity of soils can be reduced by the heat of surface fire, which, like compaction, has the effects of increasing rates of runoff and inducing soil erosion. When the effect is marked, soils are referred to as hydrophobic. While no data are available in the action area, research from the Cascade forests demonstrate that slash pile burning tends to create hydrophobic soils in the immediate area under the pile (Everett et al. 1995). Slash pile burning is done on gentle slopes, so the risk of runoff and erosion is low. Broadcast burning, if conducted under prescribed conditions, generally is cool enough not to induce soil hydrophobicity. Normal weathering processes gradually reverse hydrophobicity over time.

Section 3.3

Streams, Water Quality, and Water Quantity

This section provides information on stream types, influences of roads, water quality, and water quantity in the study area, including a discussion of water temperature, conventional chemical parameters, and forest chemicals. It is supplemented by Section 3.5, Fish and Their Habitat, which is focused on the many physical, chemical, and biological aspects of streams that affect habitat value for fish and other aquatic species. Roads and other influences on water quality are also discussed in Section 3.2, Soils and Slope Stability.

For this section, the study area encompasses all of the watersheds that include any portion of the action area, including the headwater portions of the Coos, Umpqua and Tenmile Watersheds as shown in Figure 3.3-1. Refer to Section 3.3.2.1, Study Area, for additional information on the extent and application of the study area for this section.

3.3.1 Sources of Information

The stream types identified in this section reflect the types of stream channels present in the action area, according to Oregon Department of Forestry (ODF) criteria and the classification system of the *Oregon Watershed Assessment Manual* (Oregon Watershed Enhancement Board 1999). Field data were not collected for the analysis in this section; instead, information in this section was based primarily on a review of the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003) and the *Environmental Assessment for the Habitat Conservation Plan, Elliott State Forest* (U.S. Fish and Wildlife Service et al. 1995). Other sources of information are cited in the following text.

The term reference condition is also used in this section. Reference conditions represent the interquartile range (25th to 75th percentile) of the distribution of sampled habitat from the Oregon Department of Fish and Wildlife (ODFW) Aquatic Inventories Project (AIP) reference sites from the Oregon Coast Range. These sites represent watershed areas with low impact from human activities, such as roads, development, and forest management. The ODFW believes the reference sites are representative of aquatic conditions in minimally influenced streams in western Oregon (Thom et al. 2001).

3.3.2 Affected Environment

3.3.2.1 Study Area

As noted above, for this section the study area encompasses all of the watersheds that include any portion of the action area, including headwater portions of the Coos, Umpqua, and Tenmile Watersheds. This study area is necessarily larger than the action area because sources of information on conditions in these watersheds do not all contain sufficient detail to discriminate conditions in the action area from conditions in the watershed as a whole. Where information specific to the action area is available, it is detailed within this section.

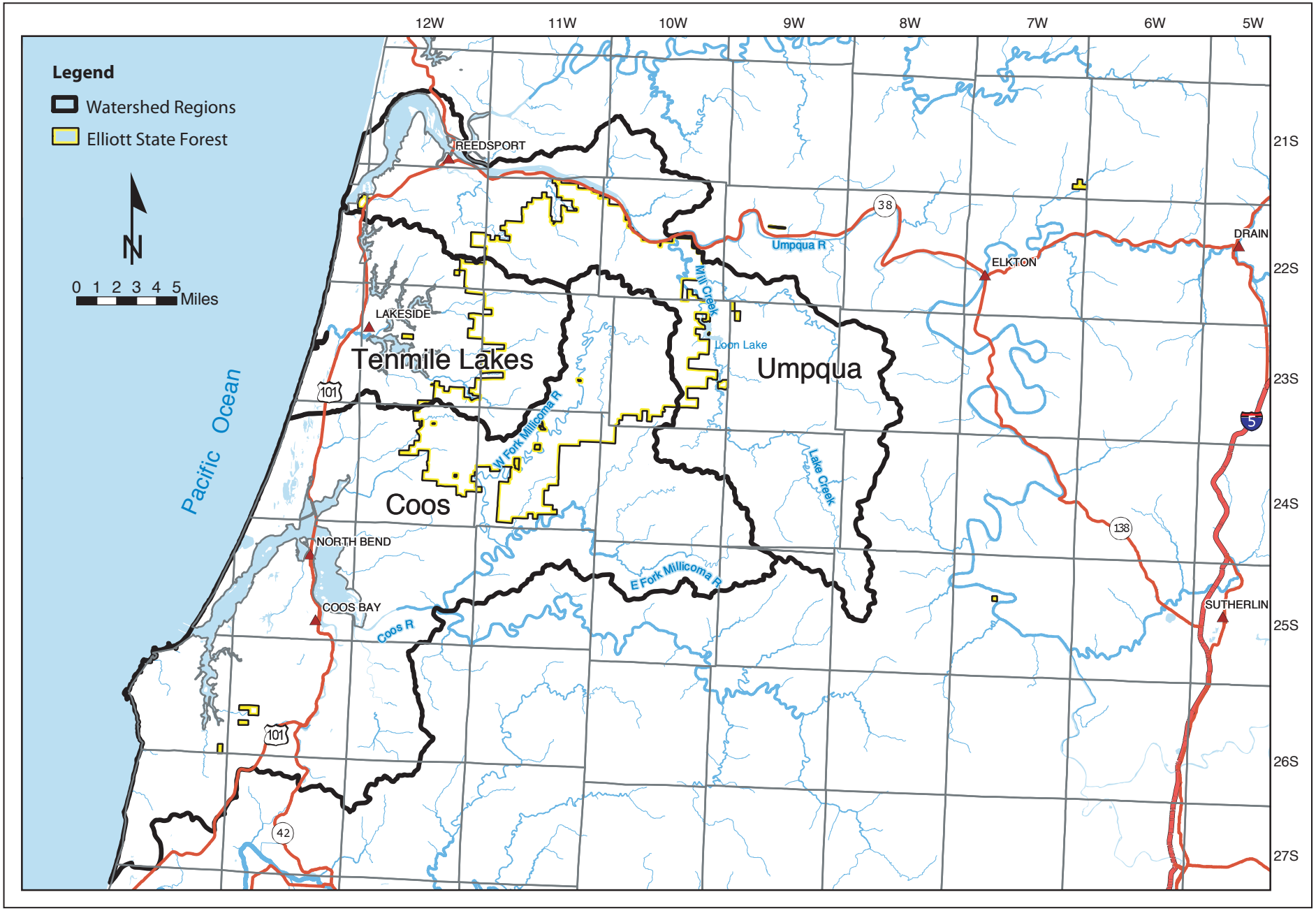
Figure 3.3-1 shows the extents of these watersheds and the location of the action area within them. As the figure indicates, the action area comprises about 40 percent of the Tenmile Watershed and less than 25 percent of the other two watersheds.

Figure 3.3-2 shows the boundaries of the 13 management basins with the action area, each of which are subwatersheds or portions of subwatersheds. The map also shows the distribution of the management basins among the three major watersheds. The acreages of each of the management basins are listed in Table 3.3-1.

Table 3.3-1 Extent of Management Basins in the Action Area

Watershed	Management Basin	Acreage	Percent of Total
Umpqua		28,198	30.2
	01 Mill Creek	5,356	5.7
	02 Charlotte-Luder	6,422	6.9
	03 Dean Johanneson	7,296	7.8
	04 Scholfield Creek	4,990	5.3
	13 Ash Valley	4,132	4.4
Tenmile		21,562	23.1
	05 Big Creek	7,823	8.4
	06 Benson-Roberts	7,417	8.0
	07 Johnson Creek	6,322	6.8
Coos		43,524	46.7
	08 Palouse Larson	6,541	7.0
	09 Henry Bend A	8,284	8.9
	10 Henry Bend B	6,512	7.0
	11 Millicoma Elk	10,873	11.7
	12 Trout Deer	11,314	12.1
Forest Total Acres		93,282	--

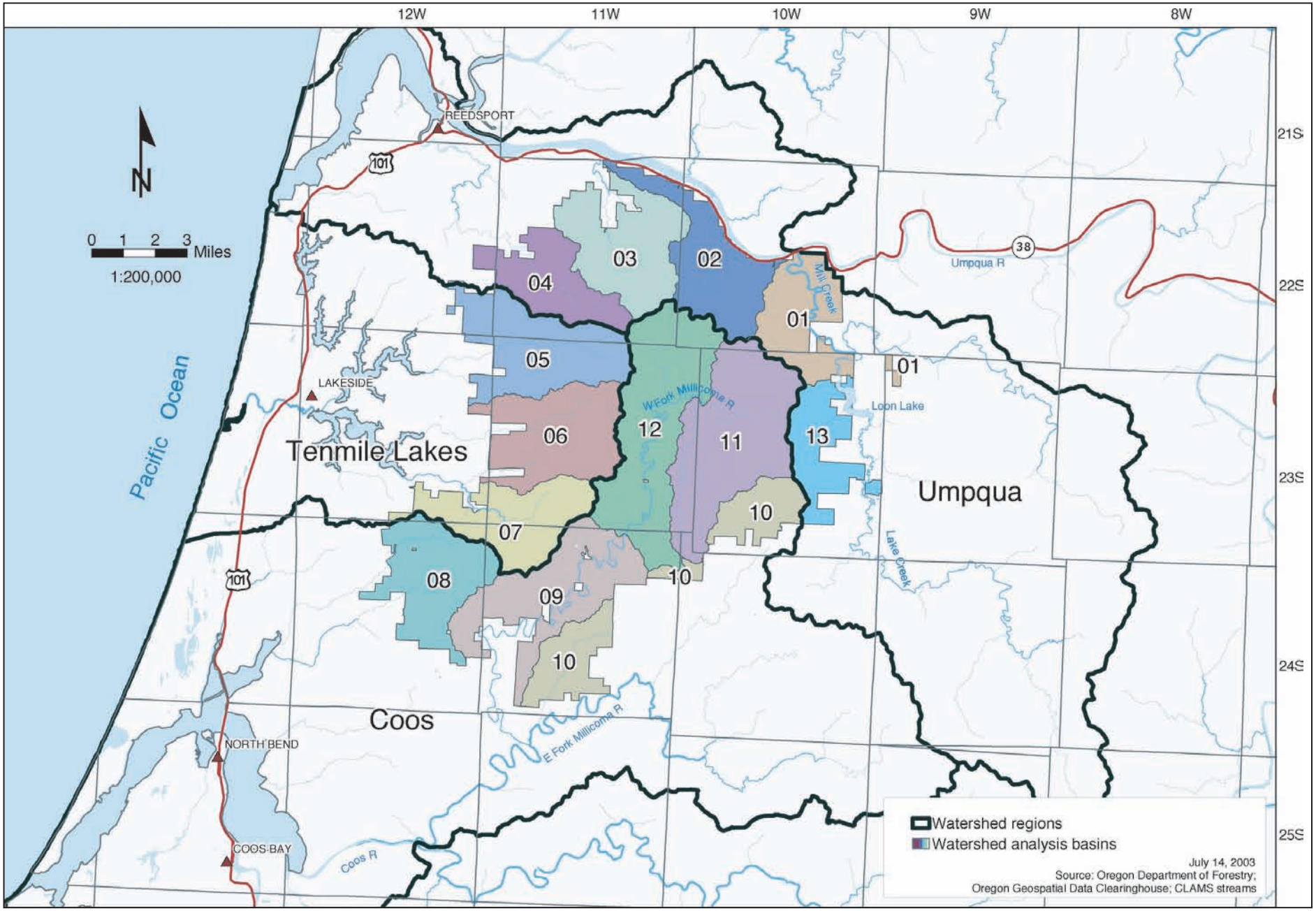
Source: Biosystems et al. 2003



04718.04 EIS (11-06)

Jones & Stokes

Figure 3.3-1
Watersheds Comprising the Study Area



04718.04 EIS (11-06)

Jones & Stokes

Figure 3.3-2
Management Basins in the Action Area

3.3.2.2 Streams

The action area has a high density of streams but few lakes, ponds, or wetlands (Figure 3.3-3). Where they do occur, ponds are located along stream channels and are often formed by beavers. Almost all ponds have been mapped as water sources for fighting fire. The 215-acre Loon Lake is located, in part, in the action area (Biosystems et al. 2003).

Classification by Flow

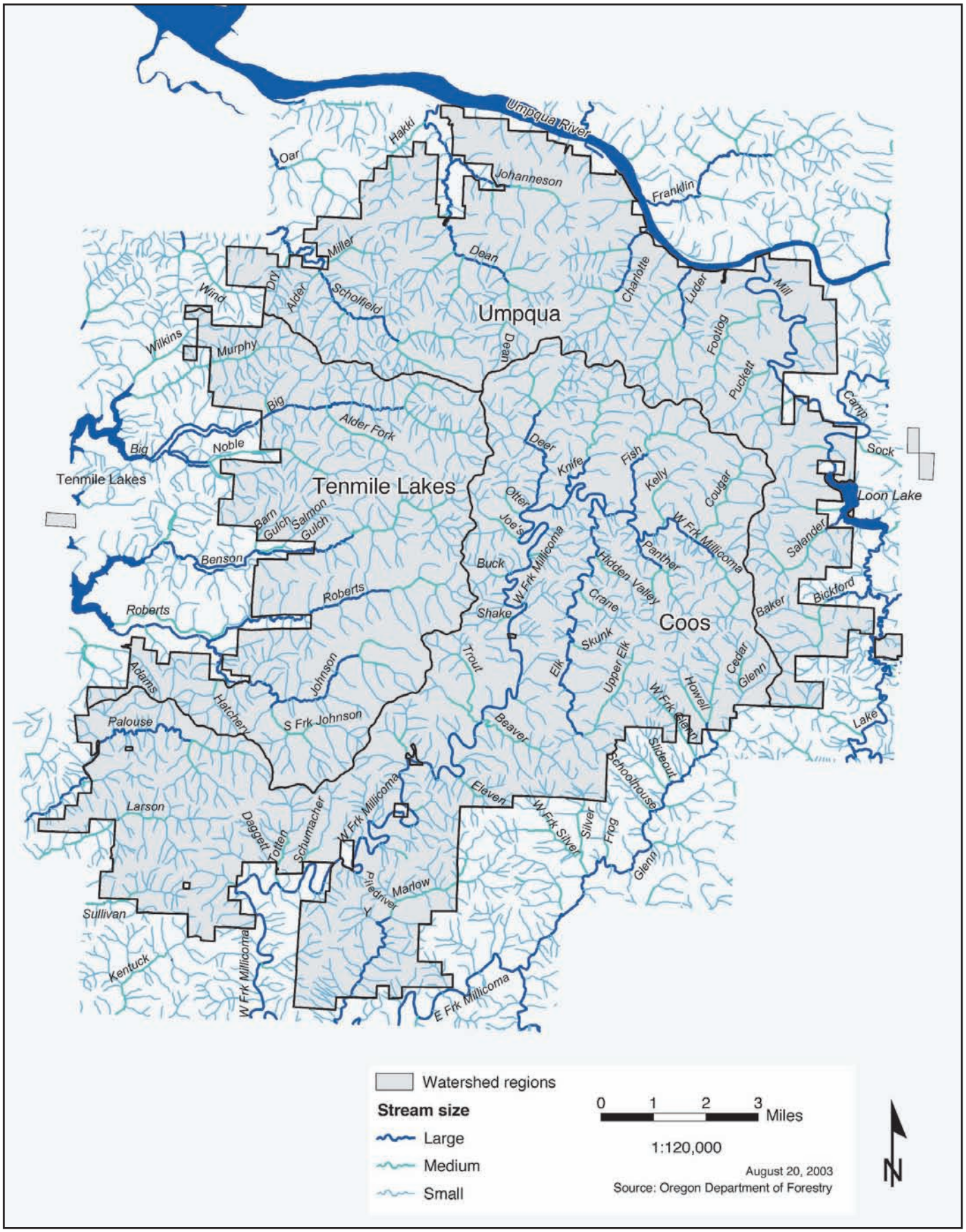
The ODF has adopted a stream size classification system based on the estimated average annual flow of a stream. Average annual flow is estimated by using an empirical equation based on watershed area and average annual precipitation. Three size classes are used: (1) large streams have an average annual flow greater than 10 cubic feet per second (cfs); (2) medium streams have an average annual flow between 2 and 10 cfs; and (3) small streams have an average annual flow less than 2 cfs.

Overall, the action area has similar densities of large and medium streams (0.45 and 0.47 miles per square mile, respectively) and a high density of small streams (4.00 miles per square mile) (Table 3.3-2). The density of large streams in the Coos Watershed is about twice that found elsewhere in the action area (Biosystems et al. 2003).

Table 3.3-2 Length of Stream and Stream Density by Size Class for Each Major Watershed in the Action Area

Watershed	Area [1] (square miles)	Stream Length (miles)			Stream Density (miles/square mile)		
		Large	Medium	Small [2]	Large	Medium	Small [2]
Coos	67.9	41.1	32.3	277.1	0.61	0.48	4.08
Umpqua	44.1	14.6	22.2	165.4	0.33	0.50	3.75
Tenmile	33.6	9.4	14.6	140.5	0.28	0.43	4.18
Combined	145.6	65.1	69.1	583.0	0.45	0.47	4.00

Source: Biosystems et al 2003, using 1996 orthophotographs
[1] Area of the watershed within the action area.
[2] Stream length for the small size class is dependent on subjective decisions on how far upstream to extend channels and which channels to include during mapping see text.



04718.04 EIS (11-06)

Jones & Stokes

Figure 3.3-3
Streams and Lakes in the Action Area

The action area has about 134 miles of large and medium streams, most of which are important for fish and other aquatic species, and 583 miles of small streams, many of which also support aquatic species. The mileage of small streams provided in Table 3.3-2 should be used as a relative reference only because the data depended on how far uphill the original cartographers extended stream lines and in which drainages or draws they chose to include a stream line. Such decisions varied among cartographers and the year in which a map was made (Biosystems et al. 2003). Additional stream classification data (miles of stream by stream type and biological use) for the action area have also been generated by ODF, as summarized in Table 3.5-5 in Section 3.5, Fish and Their Habitat.

3.3.2.3 Classification by Gradient and Confinement

A system of delineating stream segments with similar channel gradient and geometry was used in the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003) to provide a coarse evaluation of fish habitat and sediment transport.[1] That analysis, described below, only addressed fish-bearing stream segments. Combinations of channel gradient classes (less than 1 percent, less than 2 percent, 2 to 4 percent, and 3 to 10 percent) and channel confinement classes were determined for each segment. For streams in the action area, these confinement classes include the following:

- Unconfined – large floodplain; broad valley floodplain not confined by hill slopes
- Moderately Confined – floodplain width more than twice but less than four times bankfull width.
- Confined – floodplain width less than twice bankfull width.

Channel gradient was determined using a digital elevation model of the action area. Channel confinement was determined using a combination of field observations from ODFW fish habitat surveys and contour maps. This resulted in the following six distinct channel habitat types for fish-bearing streams in the action area.

- FP = low gradient (less than 1 percent), large floodplain (unconfined)
  - FP1 = large streams
  - FP2 = medium streams
  - FP3 = small streams
- LM = low gradient (less than 2 percent), moderately confined
- LC = low gradient (less than 2 percent), confined
- MM = moderate gradient (2 to 4 percent), moderately confined
- MC = moderate gradient (2 to 4 percent), confined
- MV = moderately steep gradient (3 to 10 percent), narrow valley (small or no floodplain; confined)

[1] The stream delineation system used in Biosystems et al. 2003 was proposed in the *Oregon Watershed Enhancement Manual* (Oregon Watershed Enhancement Board 1999).

More than 50 percent of fish-bearing stream mileage in the study area is MC; this type occurs in each of the 13 management basins in the action area (Figure 3.3-4, Table 3.3-3). The MV channel type is also widespread, making up about 19 percent of the overall stream mileage. Confined channels, regardless of gradient, make up nearly 75 percent of the miles of stream that support fish (Biosystems et al. 2003).

Table 3.3-3 Length of Fish-Bearing Streams by Watershed, Management Basin, Stream Class

		Stream Classification Variables					
		Gradient (percent)					
		< 1	< 2	< 2	2 to 4	2 to 4	3 to 10
		Confinement Code					
Watershed	**Management Basin**	**FP**	**LM**	**LC**	**MM**	**MC**	**MV**
Coos	8	---	3.1	---	---	4.7	---
	9	---	0.1	---	9.6	4.8	2.6
	10	---	---	---	3.9	3.4	2.5
	11	---	---	---	---	24.1	7.6
	12	---	---	---	9.1	15.7	6.5
	Combined	0.0	3.2	0.0	22.6	52.7	19.2
Umpqua	1	---	---	5.5	---	2.2	1.2
	2	---	---	---	---	0.7	5.3
	3	---	---	---	---	7.5	---
	4	4.1	0.2	---	---	2.0	1.0
	13	---	---	---	---	3.5	0.7
	Combined	4.1	0.2	5.5	0.0	15.9	8.2
Tenmile	5	7.7	---	---	0.8	3.0	1.5
	6	1.7	0.5	---	---	5.7	1.5
	7	1.8	1.2	---	---	5.8	0.8
	Combined	11.2	1.7	0	0.8	14.5	3.8
Forest-Wide Total Length (miles)		15.3	5.1	5.5	23.4	83.1	31.2
Percent of total		9.4	3.1	3.4	14.3	50.8	19.1

Source: Biosystems et al. 2003

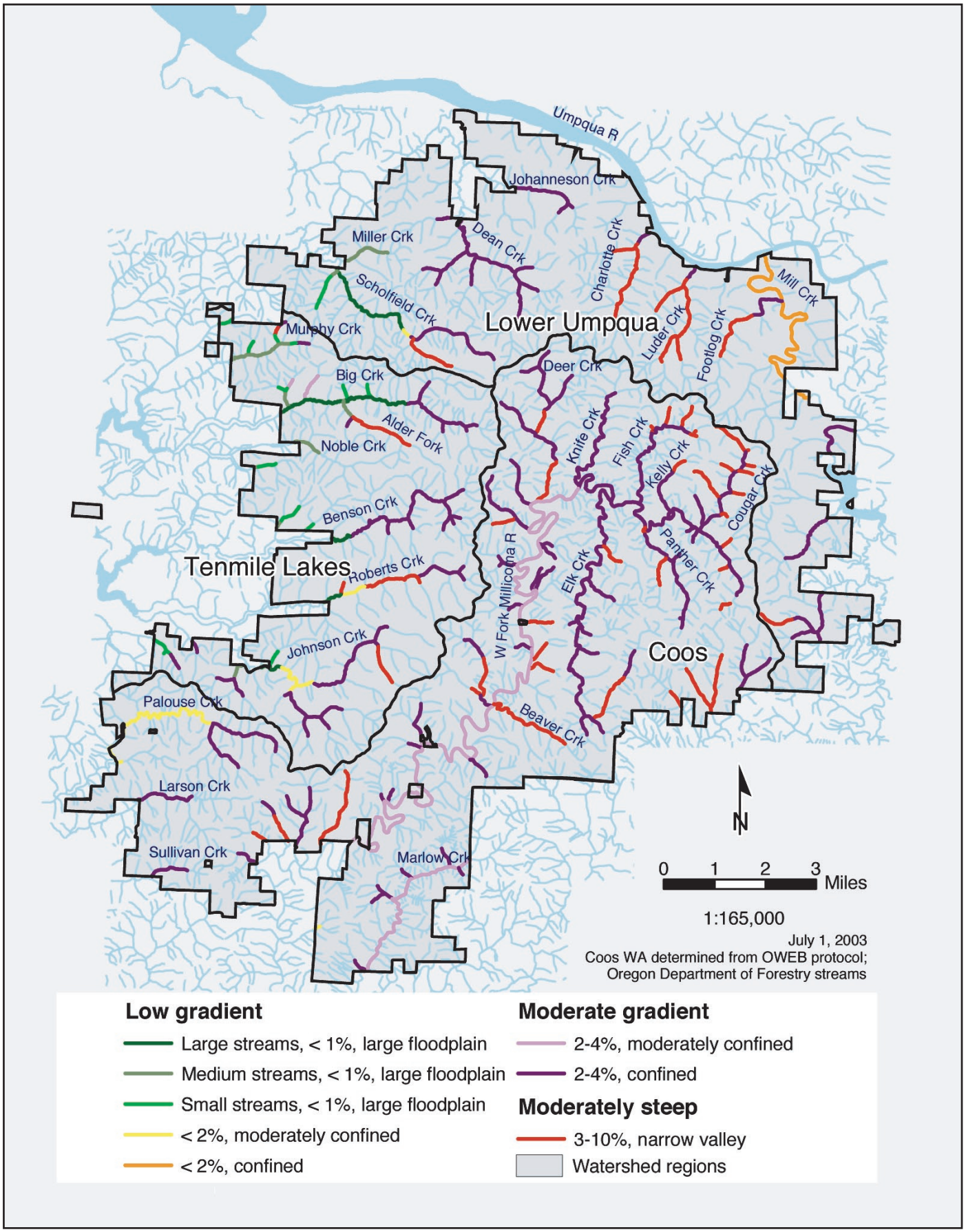
FP = low gradient, large flood plain (unconfined); LM = low gradient, moderately confined; LC = low gradient, confined; MM = moderate gradient, moderately confined; MC = moderate gradient, confined; MV = moderately steep gradient, narrow valley (small or no floodplain; confined); < = less than

Confinement classes are defined as follows:

Unconfined: Large floodplain; broad valley flood plain not confined by hill slopes

Moderately confined: Floodplain width is more than two times but less than four times the bankfull width.

Confined: Floodplain width is less than two times the bankfull width.



04718.04 EIS (11-06)

Jones & Stokes

Figure 3.3-4
Stream Classifications for the Action Area

The MM channel type is found mostly in the Marlow Creek and lower West Fork Millicoma River, which drain south to Coos Bay. The LM channel type is relatively rare and occurs along Palouse and Johnson Creeks in the southwestern portion of the action area (Biosystems et al. 2003). Low-gradient channels with a large floodplain occur only in Scholfield Creek and at the downstream end of each large stream in the Tenmile Watershed. Over 33 percent of the fish-bearing stream miles in the Tenmile Watershed are of this channel type (Biosystems et al. 2003).

Fish-bearing streams throughout most of the action area have gradients less than 4 percent but are tightly confined by adjacent hill slopes. Some roads constructed parallel to streams have further confined stream channels. The energy conveyed by water flowing through narrow and non-meandering channels is considerable at high flows. Consequently, zones of slower water are provided mostly by large wood in the channel. The unconfined streams, mostly found in the Tenmile Watershed, provide unique, high-quality habitat for fish not found elsewhere in the study area. These low-gradient streams are more likely to provide high-quality refuge habitat during high flows, since the channel can meander freely and create backwater areas (Biosystems et al. 2003).

Stream Condition

Studies concerning channel morphology of streams—useful for assessing variability in channel planform and bedform, sediment transport capacity of different channel types, and recent sediment transport history of those channel types—have not been conducted for streams in the study area. However, some additional information on in-channel structural elements, including the distribution of large woody debris and deep pools, is provided in Section 3.5.3, Fish and Their Habitat -Affected Environment. That analysis also provides information on past channel modification activities, the condition of riparian zones, and the past effects on stream habitat that have occurred due to fine sediment contributions from roads and shallow-rapid landslides that deliver sediment to stream channels.

Road surface erosion and landslides, which can be major sources of sediment delivery to stream channels, are also discussed in the Section 3.2, Soils and Slope Stability.

Forest Roads

The following discussion provides context for understanding how existing forest roads affect stream channels and the current condition of the aquatic environment in the action area. There are between 23.3 and 49.4 miles of roads in the action area within 100 feet of a stream channel.[2] The proximity of these roads to stream channels could limit ecological function in the riparian zone and restrict channel migration processes (Biosystems et al. 2003). The magnitude of this effect varies, depending on channel size and type. For instance, highly confined

[2] Mileage derived from Table 8-1 in Biosystems et al. 2003. This mileage varies slightly for road mileage presented in Section 3.2, Soils and Slope Stability, due to variations in the reference document.

channels with steep side slopes have relatively narrow riparian zones and little channel migration potential, but roads can still affect such channels by reducing large woody debris recruitment. Conversely, in a less confined channel, a road through the floodplain may prevent the channel from migrating across the portion of the floodplain blocked or occupied by the road.

In addition, roadside ditches may act similarly to ephemeral streams by intercepting shallow subsurface flows and conveying them to stream channels, carrying sediment to the stream in the process, and reducing infiltration to groundwater. This phenomenon, called hydrologic connectivity, affects 3.9 to 8.9 percent of the current road system in the action area (Section 3.2.2.6, Road System in the Action Area).

The runoff from roads into ditches or directly into stream channels typically has impaired water quality when compared to runoff from fully forested watersheds without roads. Common water quality impairments include higher fine sediment loading and higher turbidity. Depending on the intensity of road use, the runoff may also contain metals or petrochemicals washed from the road surface. Such water quality impairments have not been quantified in the action area (Biosystems et al. 2003).

Further information about roads in the action area is provided in Section 3.2, Soils and Slope Stability.

3.3.2.4 Water Quality

Regulatory Framework and Water Quality-Limited Water Bodies

Federal and state laws mandate water quality protection. The goal of the Federal Water Pollution Control Act is to restore and maintain the natural chemical, physical, and biological integrity of the nation's waters. The state of Oregon has adopted statutes and rules to achieve these goals. The quality of water coming from the action area falls under the authority of the Oregon Department of Environmental Quality (DEQ). Regulations protecting water quality in the study area are codified under Oregon Administrative Rules (OAR) 340-041. The regulation provides numerical criteria for water temperature, a variety of chemical parameters, narrative criteria protecting beneficial uses, and a description of an anti-degradation policy. Water temperature criteria, which are variable depending on the type of fish use in a water body, are further detailed in maps and regulations available at *http://www.deq.state.or.us/wq/standards/WQStdsTemp.htm*.

Oregon Administrative Rules 340-41 also provides for total maximum daily load (TMDL) limitations for specific water quality-limited water bodies. Within the study area, TMDLs have been issued for the Umpqua River for temperature, bacteria, nutrients, and biological criteria, and for Tenmile Lakes for management of weeds and algae (Oregon Department of Environmental Quality 2006a, 2006b).

Total maximum daily loads are prepared for water bodies that have been identified as water quality-limited on a statewide listing of such streams. A water quality-limited stream is not necessarily one impaired by human activity. Designation as water quality-limited simply means that a numeric or narrative water quality criterion established by DEQ has been exceeded. The list of water quality limited streams, called the 303(d) list[3], is prepared biennially by the state and reviewed by the U.S. Environmental Protection Agency (EPA). The most recent 303(d) listing approved by EPA is dated February 26, 2007. No 303(d) listed streams are present in the study area, but the action area does occupy a portion of the headwaters of a number of listed streams, as shown in Table 3.3-4. Two formerly listed streams, the Umpqua River and Scholfield Creek, have recently had TMDL plans finalized and thus are no longer 303(d) listed; however, due to the very recent adoption of these TMDLs, it can be presumed that these streams remain water quality-limited.

Water Temperature

When groundwater, snowmelt, or precipitation enters a stream channel, its temperature is immediately influenced by the new surroundings. Solar radiation striking the water surface and heat exchange with the air results in warming. To some extent, this warming is offset by heat lost to the channel substrate, by water evaporating, and by vegetation intercepting the solar radiation. The subsurface component of streamflow, or that portion which moves through the stream substrate, experiences a somewhat different energy exchange. Most notable is the lack of solar radiation input and heat exchange with the air. Consequently, the subsurface component of flow is usually cooler than the surface flow; and where the two intermix, such as in a deep pool, the net result is a cooling of the above-ground component of stream flow. The subsurface component of stream flow does not exist for streams with a bedrock bottom.

Complex interactions driven by local climate, shading, substrate, and channel dimensions result in water temperatures that continually change along the length of a stream. Nevertheless, streams generally warm from their headwaters to their mouths. Another generalization is that the maximum temperatures for any given reach of stream vary annually, depending on the timing of maximum air temperature and low flows. Usually, maximum water temperatures in Oregon coastal streams occur from mid-July to mid-August, a time when the sun is high in the sky, flows are relatively low, and air temperature is highest (Biosystems et al. 2003).

[3] Preparation of such a list is mandated under Section 303(d) of the Federal Clean Water Act.

Table 3.3-4 Waterbodies Downstream of the Study Area on the 303(d) List or Having TMDLs

Waterbody	Listing parameter	Comment	Contributing Watersheds and Management Basins
Umpqua River	Temperature	A final TMDL was adopted in October 2006 (Oregon Department of Environmental Quality 2006a).	All of Umpqua Watershed: • Basins 01, 02, 03, 04, 13
North Tenmile Lake and South Tenmile Lake	Aquatic weeds and algae	A draft water quality management plan and a draft TMDL for Tenmile Lakes was issued by the DEQ in March 2006 (Oregon Department of Environmental Quality 2006b). The plan addresses a variety of limiting parameters, including aquatic weeds, floating algae, pH, and chlorophyll A, which together represent eutrophication[1] of the lakes caused primarily by inputs of sediment and nutrients (Oregon Department of Environmental Quality 2006b).	All of Tenmile Watershed: • Basins 05, 06, 07
Larson Slough	Water temperature, coliform bacteria	Larson Slough is listed from the confluence of Larson and Sullivan Creeks (1.8 miles downstream of the action area boundary) to Haynes Inlet on Coos Bay. The upper portions of Larson and Sullivan Creeks are managed by ODF and are heavily shaded throughout their lengths. Once Larson Creek exits the action area, it flows through pasture with little shade. A future DEQ assessment of the potential sources of high bacteria counts in lower Larson Creek will address wildlife, cattle grazing, and possible human sources. Portions of the bacterial load from wildlife likely originate in the study area. These loads are often considered background and are not part of human-caused loads.	A portion of Coos Watershed: • Basin 08
Scholfield Creek	Coliform bacteria	Cattle graze along this stream downstream of the study area. A TMDL covering this stream was adopted in October 2006 (Oregon Department of Environmental Quality 2006a).	A portion of Umpqua Watershed: • Basin 04

Source: Biosystems et al 2003, except where otherwise noted.

[1] Eutrophication is the process by which a body of water becomes enriched in dissolved nutrients (as phosphates) that stimulate the growth of aquatic plant life, usually resulting in the depletion of dissolved oxygen.

TMDL = total maximum daily load; DEQ = Oregon Department of Environmental Quality; ODF = Oregon Department of Forestry

The water temperature standard adopted by the DEQ that applies to streams in the study area is codified for the Tenmile and Millicoma River watershed basins at OAR 340-41-0300, and for the Umpqua River watershed basin at OAR 340-41-0320. Fish-bearing streams in the study area are rated for salmon and trout rearing and migration (OAR 340-41, Figures 300A and 320A). Most streams in the study area are rated for salmon and steelhead spawning from October 15 to May 15, but a few widely scattered headwater streams are rated for such use from January 1 to May 15. Many scattered headwater streams are not rated for

spawning use at all (OAR 340-41, Figures 300B and 320B). For the streams rated for rearing and migration, the applicable water quality criterion is that the seven-day-average-daily-maximum temperature may not exceed 18° C (64.4° F). For the streams rated for spawning use, the applicable water quality criterion is 13°C (55.4° F) during the time that the stream is rated for spawning (OAR 340-41-0028(4)). Not all streams are naturally cooler than this standard; many Oregon coastal streams with abundant shade commonly exceed these criteria.

Water temperature and riparian shade data were collected for 21 streams in the action area during preparation of the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003). Water temperature records were available for 14 sites in the West Fork Millicoma River and seven sites in the Tenmile Watershed. Thirteen streams (62 percent) had summer maximum temperatures in excess of a 7-day maximum standard of 18°C (64°F) for salmonid fish migration and rearing. The distribution of temperature exceedances included 10 sites in the West Fork Millicoma River and three in Tenmile Watershed. No temperature data are available for streams in the action area in the Umpqua River. However, the TMDL report for the Umpqua River includes data from the lower mainstem Umpqua River that shows high seasonal water temperatures and a natural thermal potential in excess of 26.7°C (80°F) at river mile 25 immediately upstream of tidal influence in the study area (Oregon Department of Environmental Quality 2006d). Effective shade on the Umpqua River mainstem is naturally low (usually below 10 percent effective shade) because the river is large and wide (Oregon Department of Environmental Quality 2006d). In addition, the substantial flow volumes act to moderate any longitudinal variability in stream temperatures.

Because measured stream temperature data are not available for most streams in the action area, it was necessary to develop a model that could predict which streams are at risk of exceeding water temperature criteria. This is a common problem in forest land management, and most models rely heavily on stream shading as an estimator of stream temperature. Most of the variance in measured maximum water temperatures in the action area was explained by a combination of distance from a drainage divide and amount of riparian shade (Biosystems et al. 2003). Shade levels were generally equal to or exceeded the levels found in undisturbed forest ecosystems, and the data do not exclude the possibility that many of these streams could be expected to achieve maximum temperatures higher than the DEQ standard even with 100 percent riparian shade. It is therefore possible that some of the analyzed streams are naturally warm (Biosystems et al. 2003).

One factor that may be causing streams to be somewhat warmer than natural in the action area is the role of streambed gravel in keeping water cool. Stream temperature can cool considerably when all or some of the stream flows through subsurface (hyporheic) zones (U.S. Environmental Protection Agency Technical Temperature Workgroup 2001). The current scarcity of gravel in action area streams (due in part to the removal of large wood and a prevalence of channels scoured to bedrock) could be causing streams to be warmer than normal (Biosystems et al. 2003). Large wood in streams plays an important role in

trapping gravels (Bilby and Bisson 1998). As large wood concentrations increase in the future, a reduction in water temperature may occur.

Canopy Closure

Since riparian canopy closure over stream channels provides a blocking element for both incoming and outgoing solar radiation (Adams and Sullivan 1990; Washington Forest Practices Board 1997), canopy closure can moderate stream temperature highs and daily fluctuations. Stream shade values throughout the action area were obtained from ODFW stream surveys. Those surveys indicate the amount of shade is generally high. The average level of shade for the three watersheds varied between 65 percent and 90 percent along streams, depending upon the active channel width. Shade values did not vary much among regions for streams with the same active channel width (Table 3.3-5).

Table 3.3-5 Mean Percent Shade for Active Channel Width Categories by Watershed

	Width of Active Channel[1]		
Watershed	**0–30 feet**	**31–60 feet**	**60–120 feet**
Coos	89 (12)	83 (13)	68 (11)
Umpqua	82 (14)	83 (13)	65 (21)
Tenmile	87 (14)	78 (15)	---

Source: Biosystems et al. 2003
[1]Standard deviation is shown in parentheses for each mean width

Surface water temperatures in the action area were modeled using the View-to-Sky temperature model (Washington Forest Practice Board 1997) to approximate natural conditions for streams based on channel size, elevation, and full canopy coverage. The likely ranges in stream temperature were modeled in the portion of the stream network less than 10 miles from the topographic divide for small, medium and large channels. Table 3.3-6 illustrates the predicted temperatures for the reported elevations (feet above mean sea level) under the quartile (and median) channel sizes and ODFW AIP shade levels.

Table 3.3-6 Predicted Temperature Ranges and Mean Temperature by Channel Width and Elevation[1]

Channel Widths	Elevation in feet above MSL	Temperature Range (ºC) / (ºF)	Mean Temperature (ºC) /(ºF)
Small Channels (5- to 13-foot width)	1960	13.5–14.0 / 56 –57	13.7 / 57
	1640	14.3–14.8 / 58 - 59	14.5 / 58
	1160	15.0–15.5 / 59 – 60	15.2 / 59
	680	15.8–16.3 / 60 – 61	16.0/ 61
	200	16.5–17.0 / 62 – 63	16.7/ 62
Medium Channels (13- to 26-foot width)	1960	13.0–13.6 / 55 – 57	13.5 / 56
	1640	13.8–14.4 / 57 – 58	14.2 / 58
	1160	14.5–15.1 / 58 – 59	15.0 / 59
	680	15.3–15.9 / 60 – 61	15.7 / 60
	200	16.0–16.6 / 61 – 62	16.6 / 62
Large Channels (26- to 103-foot width)	1960	13.1–14.7 / 56 – 59	13.8 / 57
	1640	13.8–15.5 / 57 – 60	14.5 / 58
	1160	14.6–16.2 / 58 – 61	15.3 / 60
	680	15.3–17.0 / 60 – 63	16.0 / 61
	200	16.1–17.7 / 61 – 64	16.8 / 62

Source: Washington Forest Practices Board 1997
[1] Data representative of all channels less than 10 miles from topographic divide
MSL = mean sea level

Anticipated water temperatures for streams more than 10 miles from the topographic divide were derived from Biosystems et al. (2003). Water temperatures were based on maximum shading along median stream sizes, as indicated in Table 3.3-7.

Table 3.3-7 Anticipated Water Temperature for Streams More Than 10 Miles from Topographic Divide

		7-Day Maximum Temperature	
		°F	°C
Distance (miles)	Maximum Percent Shade	Regression [1]	Conversion
3.8	100	61	16.0
8.9	100	64	17.5
10.0	100	64	17.8
11.8	100	65	18.0
20.0	100	66	19.0
30.0	100	67	19.7
36.8	100	68	20.0
40.0	100	68	20.2
50.0	100	69	Ambient [2]
75.0	100	70	Ambient [2]
100.0	100	71	Ambient [2]

Source: Biosystems et al. 2003

[1] Multiple regression equation derived for the Millicoma River in the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003). Temp °F = 81.0 + 3.17*ln (Distance) - 0.243 * ODFW shade; adjusted square multiple R = 0.89.

[2] Because channels become too wide for complete shading and too deep for rapid daily responses in stream temperatures to radiation, the portion of the watershed where vegetation has some effect on surface water temperatures may lie within 30 to 40 miles of the watershed divide in coastal regions (Sullivan et al. 1990). Further downstream from this point, water temperatures will tend toward ambient air temperatures.

The DEQ uses a similar approach in defining a Natural Thermal Potential (NTP) for a water body. Specifically, DEQ uses best available methods of analysis and the best available information on the site potential riparian vegetation, stream geomorphology, stream flows, and other measures to reflect natural conditions. (OAR 340-041-0002). When the NTP is warmer than the numeric criterion for a water body, the NTP becomes the new criterion. The NTP in the lower Umpqua River upstream of tidal influence, as modeled by HeatSource, is in excess of 26.7°C (80°F) (Oregon Department of Environmental Quality 2006d).

Based on existing information, riparian shade levels are high across the action area and in line with reference conditions in the region for small and medium channel types (Kavanagh et al. 2005). Large channels also support high levels of shade but are slightly less than the quartile range and median for reference streams (Thom et al. 2001; Kavanagh et al. 2005).

Current surface-water temperatures appear generally warmer than anticipated along the mainstem of the West Fork Millicoma River, downstream of the 8000 Road Bridge and along the lower Umpqua River mainstem. Streams in the Tenmile Watershed generally supports cooler surface water temperatures than other streams in the study area, regardless of riparian conditions. This is likely

because the watershed lies close to the ocean (Biosystems et al. 2003). Two streams in the Tenmile Watershed have exceeded the DEQ temperature standard for migration and rearing, and five are cooler than the standard (Biosystems et al. 2003).

In the West Fork Millicoma and lower Umpqua Rivers, it does not appear that elevated temperatures are universally related to the amount of existing shade because shade levels in those areas are high. Instead, it appears that the distance from the watershed divide is great enough for many streams to be naturally warm. However, channel conditions may contribute to elevated surface water temperatures in certain reaches. Such channel conditions may include wide, shallow cross-sections, large areas of exposed bedrock, and low gravel retention in streams, all of which can be caused by reduced large wood loading, (Biosystems et al. 2003). Regardless, it appears that a variety of factors other than riparian shade have a substantial influence on surface water temperatures across the action area.

Suspended Sediment and Turbidity

Suspended sediment increases turbidity in streams and may alter stream substrates when it settles out. Fine sediment is often a major contributor to phosphorous loading in streams and lakes. Suspended fine sediment loads were measured for three streams in the Tenmile Watershed (Big, Benson, and Murphy Creeks) for one year and modeled according to the methods described in Arnold et al. (1995). The results indicate that streams in the action area have suspended sediment loads that are less than measured sediment loads for three similar coastal watersheds with no previous timber harvest, and are much less than for watersheds with various levels of timber harvesting. However, because the model has no mechanism for determining sediment yields caused by landslides, the role of mass wasting as a suspended sediment source remains unclear.

The ODFW AIP data on percent fines (less than 2 millimeters (mm) size fractions) for small, medium and large streams across the action area, based on visual methods, are within the range of natural conditions for reference streams in the study area (Thom et al. 2001; Kavanagh et al. 2005). The ODFW reference sites represented watershed areas with low impact from human activities such as roads, development, and forest management. The ODFW believes the sites provide an accurate representation of the stream sizes, geology, and ecoregions and that they are representative of aquatic conditions in minimally influenced streams that exist in coastal drainages of western Oregon (Thom et al. 2001).

Based on the limited suspended sediment monitoring and modeling conducted to date, it appears suspended sediment and turbidity of streams are within the range of natural variation for the region and the natural disturbance history experienced in the action area.

Nutrients, Dissolved Oxygen, and pH

The abundance of nutrients, the amount of sunlight striking a stream surface, and the type of channel substrate largely control the production of aquatic plants (including algae) and insects occupying a stream. Usually, productivity is greatest and species most varied where nutrients and sunlight are abundant and the substrate consists of gravel and cobbles. Nevertheless, the conditions that lead to high productivity can sometimes have adverse effects on water quality. Profuse aquatic plant growth in a stream can elevate pH values, and nighttime respiration by plentiful aquatic plants can depress dissolved oxygen concentrations in the water. Sunlight, which boosts primary productivity, also may warm the water to the point that the ability for aquatic life to function properly is affected (Biosystems et al. 2003).

Timber harvest entails short-term loss of nutrients from surrounding slopes because the dense root mat dies, and roots from the new trees and brush take some years to reoccupy the site. Although nitrogen is highly mobile in soils, its uptake by roots, bacteria, and other organisms in the soil help keep it on site.

The loss of phosphorus after timber harvest is minor because it tightly adheres to soil particles. The main pathway for phosphorus to enter a stream is through erosion of the soil. Even when in the stream, phosphorus usually remains attached to soil particles, although low dissolved oxygen concentrations, such as those commonly found in the bottom of lakes, can cause phosphorus in the bottom sediment to come into solution (Biosystems et al. 2003).

Queries were made to the EPA Storage and Retrieval (STORET) database for water quality data related to the action area. The queries generated no records for streams in the action area (U.S. Environmental Protection Agency 2005). The *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003) reports nutrient data collected by various agencies for seven sites in the study area. All summer orthophosphate levels were extremely low, ranging from the detection limit of 0.005 milligrams per liter (mg/L) to a maximum of 0.012 mg/L. These values are so low that the lack of phosphorus probably limits nitrogen uptake by algae. Accordingly, summer concentrations of total nitrogen (nitrate plus nitrite) are more variable, ranging from 0.04 mg/L to 0.56 mg/L, values low enough to not cause concern about potential effects such as eutrophication.

All pH measurements were slightly alkaline (average value of 7.3), possibly reflecting the calcareous component of bedrock sediments. Summer dissolved oxygen concentrations were relatively steady and high, with high saturation (88 to 100 percent). These values indicate a healthy stream ecosystem with relatively low algal productivity. State water quality standards for water column dissolved oxygen were not exceeded during the summer surveys conducted between mid-June and mid-September. However, no data on spring, fall, and winter water quality are available (Biosystems et al. 2003).

In natural systems, inorganic phosphorus inputs to streams are predominantly derived from the weathering of rocks. Biosystems et al. (2003) report that the high phosphorus levels causing eutrophication in Tenmile and Eel Lakes could

be attributable to sediment derived from forest practices, or could be organic in origin, derived from septic systems associated with development around the lakes (Eilers et al. 2001, 2002 *in* Biosystems et al. 2003). The role of forest practices as a potential source of phosphorus to these lakes was tested by examining suspended sediment inputs from streams, including those that primarily drain the study area. Suspended sediment loads were measured for three streams (Big, Benson, and Murphy Creeks) for one year and then modeled using the Soil Water Assessment Tool model (Arnold et al. 1995). This model was originally developed to estimate sediment production due to rill and gully erosion; it has no mechanism for determining sediment yields due to landslides, which episodically contribute large volumes of both fine and coarse sediment to streams in the study area. The modeling results indicated that streams in the study area had suspended sediment loads that were less than measured sediment loads for three similar coastal watersheds with no previous timber harvest, and were much less than watersheds with various levels of timber harvesting. These results would suggest that fine sediment from surface erosion is not a substantial contributor of phosphorus in Eel and Tenmile Lakes, although the role of mass wasting as a phosphorus source remains unclear (Biosystems et al. 2003).

Fertilizers, potentially a substantial source of both nitrogen and phosphorus, are used infrequently by ODF in the action area. When used, they are applied from the air in areas where low soil nitrogen is retarding tree growth. In recent years, only one fertilizer application (in 1997) has been undertaken in the action area. That project involved application of urea at a rate of 200 pounds per acre on approximately 3,500 acres. The ODF estimates fertilizer has been applied on about 1,000 acres within any given 10-year period. Forest fertilizers, if delivered to streams, can cause algal blooms, especially during periods with high water temperatures (Chamberlin et al. 1991). However, there is no evidence that high levels of nutrients in streams occur in the action area as a result of silvicultural use of fertilizers.

Forest Chemicals

The use of forest chemicals (primarily herbicides) in the action area is described in Section 3.1, Forest Conditions. Forest chemicals are commonly applied with surfactants that enhance their effectiveness, and water quality can be degraded if forest chemicals, surfactants, or the byproducts of their chemical degradation are delivered to surface waters via mechanisms such as aerial deposition, overland flow, or groundwater flow. There are no data describing the occurrence of forest chemicals in surface waters of the action area. However, it is possible that some forest chemicals, including their residues, are delivered to surface waters in the action area after application.

3.3.2.5 Water Quantity

Streamflow Characteristics

The only gauging site within or near the study area with a record long enough to sufficiently evaluate streamflow characteristics is on the lower West Fork

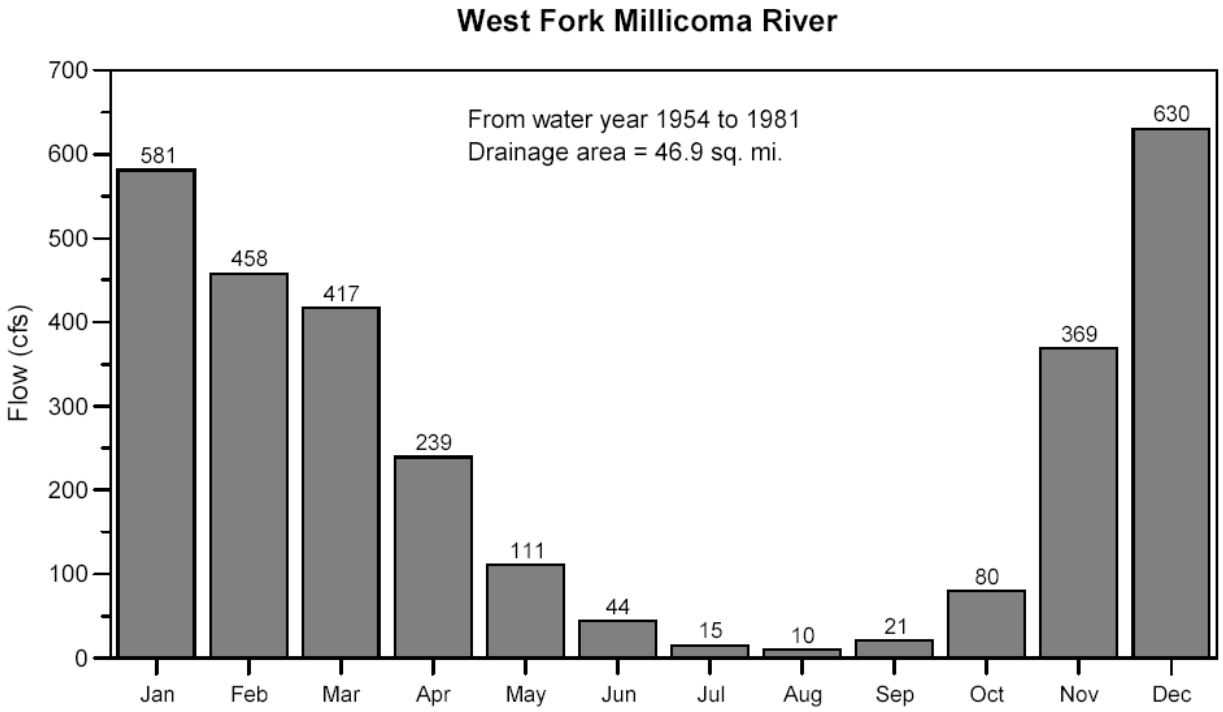
Millicoma River. No gauging information exists for river basins of similar size on the central or southern Oregon Coast, which experienced little or no timber harvest during the last 30 years. Consequently, there is not a control watershed that would allow examination of how flows in the West Fork Millicoma may have changed over several decades of road construction and timber harvest (Biosystems et al. 2003).

The West Fork Millicoma River gauging site was operated by the U.S. Geological Survey (USGS) from 1955–1981 (27 years of record) and was reactivated by the Coos Watershed Association in 2002. Only the 1955 to 1981 flow records were used in the flow analysis for the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003). Nearly all of the land upstream of the West Fork Millicoma River gauge is within the action area (46.9 square miles), and precipitation in this river basin is typical of most river basins comprising the study area. (Streams flowing from the western edge of the action area may have slightly different flow characteristics; summer flows in these streams may not be as low due to their proximity to moist, marine air and diminished solar radiation due to persistent fog). Water withdrawals upstream of the gauging site were either small or non-existent during the period of record. The gauge is located near the boundary between the action area and private ownership (Biosystems et al. 2003).

Monthly and annual instantaneous peak flow data for the West Fork Millicoma River were obtained from the USGS web site. Because the annual peak flow value for water year 1980 seemed erroneously low in the digital record (115 cfs versus 1,830 cfs for the next highest value), this year was not used in the analysis of peak flows (Biosystems et al. 2003).

The data show that streams in the study area experience a period of extended low flow from June through September. The average flow in December, the month with the highest runoff, was 65 times greater than the average flow in August, the month with the lowest runoff (Figure 3.3-5).

Figure 3.3-5 Average Monthly Flows for the West Fork Millicoma River



Source: Biosystems et al. 2003

The peak flow associated with the 50-year recurrence interval was 9,800 cfs or a unit flow of 208 cfs per square mile of drainage area for the West Fork Millicoma River (Table 3.3-8). This is typical for lower-elevation mountains of the central Coast Range. No peak flow events in the West Fork Millicoma River record stand out as unusually high. Even the floods in 1972 and 1965, abnormally high events elsewhere in western Oregon, were not unusually high in the West Fork Millicoma River (Biosystems et al. 2003).

Table 3.3-8 Peak Flow Recurrence Intervals for the West Fork Millicoma River

	Flow Recurrence Interval (years)						
	1	**2**	**5**	**10**	**25**	**50**	**100**
Peak flow (cfs)	4,700	5,900	7,200	8,100	9,100	9,800	10,300

Source: Biosystems et al. 2003
cfs = feet per second

Water Uses

The state's water supplies are under the authority of the Water Resources Commission. Water from the study area sustains forest, aquatic, and riparian ecosystems. The holders of existing out-of-stream water rights are authorized to use water in or from the study area for irrigation and domestic purposes. Several

adjacent landowners draw surface water from sources within the action area (U.S. Fish and Wildlife Service et al. 1995).

Two sites in the study area are classified as Watershed Use under the ODF's land-use classification system. On Watershed Use lands, timber harvest may occur only when it will not interfere with the special use of the land (U.S. Fish and Wildlife Service et al. 1995). The sites are a 16-acre area serving as a backup water supply for the Ash Valley School and a 3-acre area protecting a spring that serves as a domestic water supply.

The ODF occasionally draws water from the streams in the study area. Water is used on managed forestland for fighting fire and filling herbicide application tanks and dust abatement trucks. Typically, small dams or road fills are constructed to pond water in areas with springs and small tributaries, or water is extracted directly from larger streams. Collectively, these are referred to as pump chances. Water use permits issued by the Oregon Water Resources Department (OWRD) are required for the storage and use of water for these purposes. Each point of diversion is assigned a maximum storage rate (in acre-feet) or use rate (in cfs), although the actual consumption of water for forest management is invariably small and infrequent (Biosystems et al. 2003).

A recent inventory of the study area indicates that 115 pump chances exist. Seventeen of these pump chances have a water use permit or certificate issued by the OWRD (Table 3.3-9). If a pump chance is in an unimproved location where water can be found in an emergency, it does not require registration. Under Oregon Revised Statute [ORS] 537.141, water withdrawal for use in fire control and certain forest management activities can be exempt from water rights.

Instream water rights are held in trust by the OWRD for a number of streams in the study area. Subject to older or "senior" water rights, these instream water rights protect stream flows to sustain aquatic life and habitat. Water may be used under newer or "junior" water rights only to the extent that stream flows do not fall below the instream water right levels (Biosystems et al. 2003).

Instream water rights exist on 23 streams that flow partially or completely across the action area (Table 3.3-10). Instream water rights are used to retain water within streams to benefit fish and other aquatic life. Most of the larger fish-bearing streams in the action area have instream water rights. These rights were granted to the ODFW between 1974 and 1992.

As with all other types of water rights, instream water rights have priority dates and are superseded by more senior water rights. Since most of the instream water rights were granted in 1990 and 1992, older consumptive water rights usually control the amount of water in streams during the summer. Nevertheless, the existence of instream water rights on these streams has largely prevented any further allocation of water, especially during the summer. However, the OWRD can continue to grant domestic water rights (usually less than 0.01 cfs) for streams that are otherwise closed to further allocation.

Table 3.3-9 Water Rights in the Study Area

Identification Number Priority Date Use	Name	Maximum Storage or Use	Location Section (S), Township (T), Range (R)
#69165 1/1/1993 Forest Management	Scholfield Ridge Reservoir	0.21 acre-foot	NW¼ of SW¼ of S35, T22South, R11West
	Bickford Ridge Reservoir	0.46 acre-foot	SE1/4 of SW1/4 of S 22, T23South, R10West
	Footlog Ridge Reservoir	0.18 acre-foot	NE1/4 of SW1/4 of S 22, T22South, R10West
	Salander Creek Reservoir	0.97 acre-foot	NW1/4 of NE1/4 of S10, T23South, R10West
#69166 1/1/1993 Forest Management	Big Saddle Reservoir	0.13 acre-foot	S6, T24South, R10West
	Beaver Point Reservoir	0.09 acre-foot	S2, T24South, R11West
	Trail Buhe Reservoir	0.58 acre-foot	NE1/4 of SW1/4 of S8, T24South, R11West
	Elk Wallow Reservoir	0.57 acre-foot	SW1/4 of SW1/4 of S25, T22South, R11West
	Elk Peak Reservoir	0.06 acre-foot	NW1/4 of SE1/4 of S 29, T23South, R10West
	Elkhorn Ridge Reservoir	0.15 acre-foot	NE1/4 of SW1/4 of S24, T23South, R11West
#S53234 6/10/1994 Forest Management	Scholfield Creek	0.7 cfs	NW1/4 of SW1/4 of S35, T22South, R11West
	Mill Creek	0.7 cfs	NE1/4 of SW1/4 of S22, T22South, R10West
	Unnamed tributary to Matson Creek	0.7 cfs	SE1/4 of SW1/4 of S22, T23South, R10West
	Unnamed tributary to Salander Creek	0.7 cfs	NW1/4 of NE1/4 of S 10, T23South, R10West
#S53235 6/10/1994 Forest Management, recreation and wildlife	Unnamed tributary to W. Fork Millicoma R.	0.7 cfs	S2, T24South, R11West
	Schumacher Creek	0.7 cfs	NE1/4 of SW1/4 of S8, T24South, R11West
	Elk Creek	0.7 cfs	NE1/4 of SW1/4 of S24, T23South, R11West

Source: Biosystems et al. 2003
cfs=cubic feet per second

Table 3.3-10 Instream Water Rights for Streams Partially or Completely in the Action Area

Region	Stream	Priority Date	Minimum flow in Fall (cfs)	Minimum flow in Winter (cfs)	Location of Instream Right (section (S), township (T), range (R))
Tenmile	Wilkins	1992	0.2	13.9	From headwaters (NW¼SW¼ S25, T22South, R12West) to mouth
Tenmile	Murphy	1992	0.5	17.0	From headwaters (SW¼SW¼ S29, T22South, R11West) to mouth
Tenmile	Big	1992	2.1	26.0	From tributary (NW¼NW¼ S 4, T23South, R11West) to mouth
Tenmile	Noble	1992	0.5	12.0	From headwaters (SW¼NE¼ S8, T23South, R11West) to mouth
Tenmile	Benson	1992	1.3	60.4	From tributary (NE¼ S16, T23South, R11West) to mouth
Tenmile	Roberts[1]	1992	1.1	17.0	From tributary (NW¼SW¼ S21, T23South, R11West) to mouth
Tenmile	Johnson	1992	2.8	17.0	From tributary (SE¼SW¼ S31, T23South, R11West) to mouth
Tenmile	Robertson	1992	0.1	3.8	From headwaters (NE¼ S35, T23South, R12West) to mouth
Tenmile	Adams	1992	0.5	9.0	From tributary (SE¼SE¼ S28, T23South, R12West) to mouth
Coos	Palouse[2]	1990	1.5	26.0	From tributary (SW¼NW¼ S 10, T24South, R12West) to mouth
Coos	Larson	1990	1.5	26.0	From Sullivan Creek to mouth
Coos	Sullivan	1992	0.3	14.0	From headwaters (SE1/4 S23, T24South, R12West) to mouth
Coos	West Fork Millicoma (upper)	1990	3.1	100.0	From headwaters (S16, T23South, R10West) to Deer Cr
Coos	West Fork Millicoma (lower)	1990	7.1	155.0	From Deer Creek to mouth
Coos	Deer	1992	0.5	26.0	From tributary (SE¼ S2, T23South, R11West) to mouth
Coos	Knife	1992	0.4	17.0	From tributary (SE¼ S31, T22South, R10West to mouth
Coos	Fish	1992	0.3	17.0	From headwaters (NE¼ S5, T23South, R10West) to mouth
Coos	Elk	1992	1.0	43.0	From tributary (SE¼, S24, T23South, R11West) to mouth

Region	Stream	Priority Date	Minimum flow in Fall (cfs)	Minimum flow in Winter (cfs)	Location of Instream Right (section (S), township (T), range (R))
Coos	Marlow	1992	0.7	31.7	From tributary (NW¼, S23, T24South, R11West) to mouth
Coos	Glenn	1992	2.1	85.0	From Silver Creek to mouth
Umpqua	Mill	1974	20.0	130.0	From Camp Creek to mouth
Umpqua	Dean	1974	2.0	20.0	From Hakki Creek to mouth
Umpqua	Scholfield	1974	2.0	20.0	From Oar Creek to mouth

Source: Biosystems et al. 2003

[1] Roberts Creek also has an instream water right with a priority date of 1980; it applies throughout its main channel and tributaries. The amounts are 1 cfs in the fall to 10 cfs in the winter.

[2] Palouse Creek also has an instream water right with a priority date of 1980; it applies to a point near the mouth at tidewater (Sec 25, T.24S, R.13W). The amounts are 2 cfs in the fall to 15 cfs in the winter.

cfs-cubic feet per second

Mill, Dean, and Scholfield Creeks have instream water rights with a priority date of 1974, while instream water rights for Roberts and Palouse Creeks date to 1980. These latter two streams also have 1990 or 1992 instream rights that are only slightly different than the 1980 versions. All other instream water rights date to 1990 or 1992. The permits specify minimum streamflow to be maintained in the stream (after satisfying all other senior rights), and vary by month, with higher flows in the winter and lower flows in the summer and fall (Table 3.3-10).

Like all other water rights, enforcement of instream water rights is largely complaint driven. The OWRD has no program to determine the summer flow of streams in the study area or ensure that junior water rights do not infringe on the maintenance of instream flows downstream of the action area.

Section 3.4
Vegetation

This section describes the vegetation in the study area, and the potential for rare plants to occur there. For this section, the study area is the same as the action area described in Section 3.0, Action Area and Study Area.

3.4.1 Sources of Information

The descriptions of ecoregions presented in this section were derived from a national framework developed by Omernik (1987). Ecoregion descriptions (Bryce and Woods 2000) and associated geographic information system (GIS) data were obtained from the Oregon Geospatial Data Clearinghouse (OGC). Vegetation cover type mapping, derived from the Oregon Gap Analysis Project Final Report (OR-GAP) (Kagan et al. 1999) was used in this section to provide an additional, finer-scale assessment of vegetation in the study area. OR-GAP is based on Comer et al. (2003). Associated GIS data for the vegetative cover type mapping were obtained from the OGC, which is based on 1:100,000 scale U.S. Geological Survey (USGS) mapping. Wetland data included within the OR-GAP data are based on National Wetland Inventory (NWI) mapping. Relative accuracy information may be found in the OR-GAP (Kagan et al. 1999).

Specific ecoregions and vegetation cover types were identified by overlaying the digital boundaries of the study area onto OR-GAP layer information and analyzing the resulting intersections. GIS metadata and OR-GAP information were then modified, as needed, to improve clarity and provide detail specific to the study area. Information on rare plant species was taken from the *Elliot State Forest Management Plan* (Oregon Department of Forestry 2006a).

3.4.2 Affected Environment

3.4.2.1 Ecoregions in the Study Area

Ecoregions are geographic areas with similar features, such as climate, vegetation, geology, geomorphology, soils, and ecosystem processes. They tend to support characteristic natural ecological communities and are typically used to provide natural resource managers with a common basis to aid in managing similar resource areas.

Ecoregions are separated into four levels, Level 1 to Level IV. The ecoregion levels that are the smallest and generally the most pertinent to management activities within the study area are Levels III and IV. The study area falls within the Coast Range (Level III) Ecoregion (1)[1], which is composed of low-elevation, productive mountains dominated by coniferous forests. The Coast Range Ecoregion tends to receive large amounts of rain (exceeding 200 inches per year in some circumstances) during the fall, winter, and spring, and may often receive moisture from fog and low clouds during the summer.

Historically, Sitka spruce forests dominated much of the Coast Range Ecoregion, with a mosaic of western redcedar, western hemlock, and late-seral Douglas-fir dominating more inland areas. Douglas-fir-dominated plantations have now replaced many of these forests.

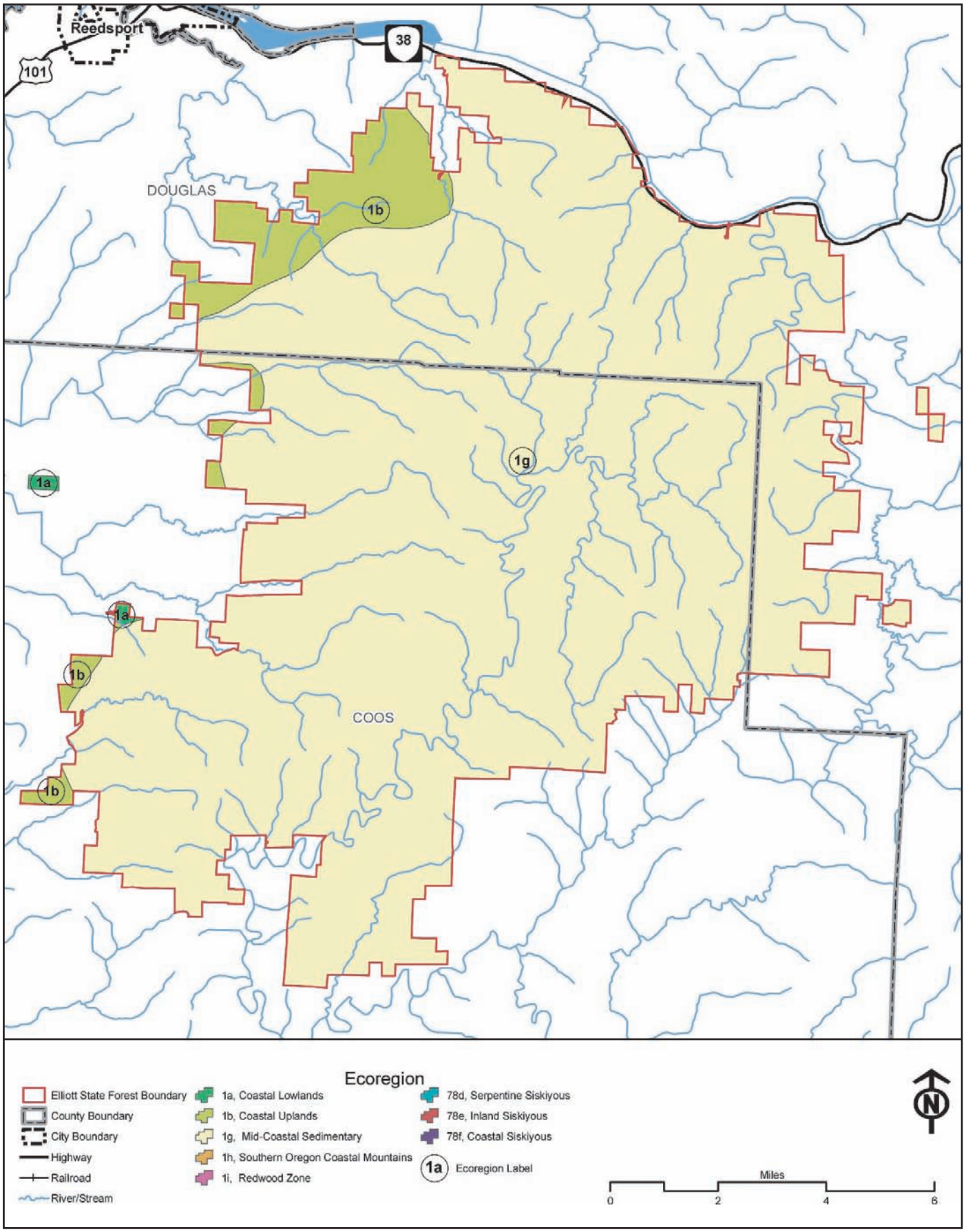
There are three Level IV Ecoregions in the study area (Figure 3.4-1). The Mid-Coastal Sedimentary (1g)[2] Ecoregion dominates the study area, comprising greater than 94 percent of the land area. Massive beds of siltstone and sandstone typically underlie this ecoregion. Mountains here tend to be fairly rugged and stream gradients and associated fluvial erosion rates can be high. Soils may be prone to mass movement when vegetation is removed.

Several portions of the western edge of the study area are comprised of the Coastal Uplands (1b; 5.5 percent) and Coastal Lowlands (1a; 0.1 percent) Ecoregions. The Coastal Uplands Ecoregion extends to an elevation of about 500 feet, is more marine-influenced, and is characterized by an extended rainy season, summer fog, and ocean-moderated temperatures. This ecoregion roughly corresponds with the historical distribution of Sitka spruce, although the extent of that original forest in this ecoregion has been greatly reduced by logging and conversion to managed timber or other agriculture. Two very small portions of the study area, both near the City of Lakeside, are within the Coastal Lowlands Ecoregion. This ecoregion includes estuarine marshes, freshwater lakes, blackwater streams, marine terraces, and sand dunes at elevations from sea level to 300 feet.

3.4.2.2 Vegetation Types in the Study Area

Ecoregions are generally characterized by certain types of vegetation, sometimes called cover types or associations, depending on the classification systems. The classification system used in this section, OR-GAP, recognizes 65 cover types, eight of which occur in the study area (Table 3.4-1). These cover types are described below.

[1] Class III Ecoregions are denoted by a numeric code, e.g., “1” corresponds to the Coast Range ecoregion and “78” to the Klamath Mountains ecoregion.
[2] Class IV Ecoregions are denoted by an alphanumeric code, the number corresponding to the Class III Ecoregion (1 for Coast Range and 78 for Klamath Mountains) and the lowercase letter the Class IV Ecoregion, e.g., 1a for Coastal Lowlands, 78d for Serpentine Siskiyous.



04718.04 EIS (11-06)

Jones & Stokes

Figure 3.4-1
Level IV Ecoregions

Table 3.4-1 Proportions of OR-GAP Vegetation Cover Types in the Study Area

Code	Cover Type	Acreage	Percent of Study Area (%)
49	Douglas-fir-Western Hemlock-Western Redcedar Forest	76,561	81.9
67	Mixed Conifer-Mixed Deciduous Forest	12,742	13.6
32	Sitka Spruce-Western Hemlock Maritime Forest	2,444	2.6
121	Grass-shrub-sapling or Regenerating young forest	984	1.1
201	OR-GAP Palustrine Shrubland	295	0.3
63	Red Alder Forest	257	0.3
130	Open Water	89	0.1
203	NWI Palustrine Emergent	76	0.1
	Total	93,448	100.0

Source: Kagan et al. 1999
Accuracy limited by source data
OR-GAP = Oregon Gap Analysis
NWI = National Wetland Inventory

Douglas-Fir-Western Hemlock-Western Redcedar Forest (49)

The Douglas-fir/western hemlock/western redcedar forest cover type is the most common low to mid-elevation forest found in western Oregon. It extends from the foothills of the western Cascades to approximately 4,500 feet in elevation and is common throughout the Coast Range to the coastal margin forests. At maturity, this coniferous cover type contains numerous large trees, multi-story tree canopies, numerous snags, and downed logs. Subcanopies are composed of shade-tolerant conifer species and deciduous trees where there is discontinuous overstory canopy cover. Early seral and commercial forests have dense accumulations of smaller trees (typically dominated by Douglas-fir) and single story canopies. Shrub and herbaceous layers are dense and rich in species in mid-to-late successional forest stands.

Currently, Douglas-fir dominates most of the overstory in these stands, with western hemlock, western redcedar, and grand fir present as codominants in localized areas. Western hemlock and western redcedar form the bulk of the intermediate tree and regeneration layers. Pacific yew (*Taxus brevifolia*) also occurs in the subcanopy. Bigleaf maple, and, to a lesser extent, red alder are common in riparian strips and stands that do not have continuous conifer overstories.

Large shrubs are common in the Cascades stands; vine maple (*Acer circinatum*), Pacific rhododendron (*Rhododendron macrophyllum*), fool's huckleberry (*Menziesia ferruginea*), and red huckleberry (*Vaccinium parvifolium*) are common. Lower shrub layers are dominated by salal (*Gaultheria shallon),*

evergreen huckleberry (*Vaccinium ovatum*), elderberry (*Sambucus racemosa*), and salmonberry (*Rubus spectabilis*).

Herbaceous layers are rich in species and abundance. Ferns can dominate the herb layer, with swordfern, bracken (*Pteridium aquilinum*), deer fern (*Blechnum spicant*), and ladyfern (*Athyrium filixfemina*) being the most common. Other forbs include inside-out flower (*Vancouveria hexandra*), twinflower (*Linnea borealis*), Siberian springbeauty (*Claytonia sibirica*), vanilla leaf (*Achlys triphylla*), bedstraw (*Galium triflorum*), western iris (*Iris tenax*), and Oregon oxalis (*Oxalis oregana*).

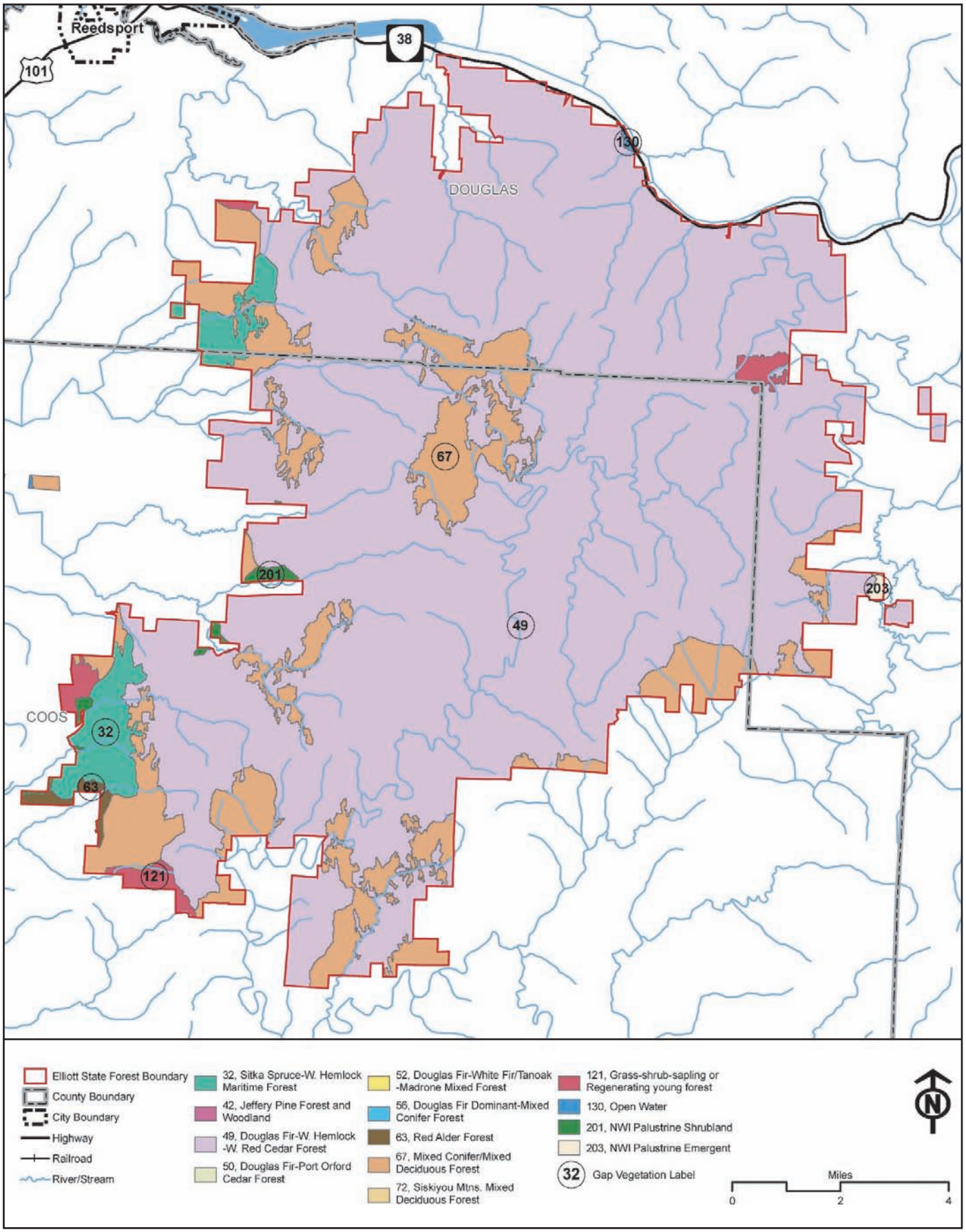
The Douglas-fir/western hemlock/western redcedar forest cover type dominates the study area, accounting for approximately 82 percent of the total study area (Figure 3.4-2). The abundance of this cover type reflects both the natural vegetation that would occur in this area and effects of an active timber management program.

Mixed Conifer-Mixed Deciduous Forest (67)

The conifer-deciduous forest cover type is an early-successional forest occurring throughout the Coast Range and Cascade Mountains of western Oregon at low to mid-elevation. This cover type tends to exist as a patchwork mosaic with younger clearcuts and established forests. The overstory canopy is composed of co-dominant conifers, including Douglas-fir, western hemlock, western redcedar, grand fir, and Sitka spruce. Deciduous components include red alder and bigleaf maple.

This cover type is typical of older clearcuts or relatively young forests following other disturbance. Canopies tend to be single-story and closed. The deciduous component is often a remnant of earlier clearcut succession where red alder and bigleaf maple can dominate the overstory. Over time, conifers out-compete the deciduous trees, relegating them to more minor components. Understory vegetation is often negligible, as the dense canopy casts heavy shade.

This cover type occurs at the center and along the south and eastern periphery of the study area (Figure 3.4-2) accounting for approximately 14 percent of the total study area. It is generally associated with sites that were logged heavily in the past century and are regenerating.



04718.04 EIS (11-06)

Jones & Stokes

Figure 3.4-2
OR-Gap Vegetation Cover Types

Sitka Spruce-Western Hemlock Maritime Forest (32)

The Sitka spruce-western hemlock maritime forest conifer cover type extends the length of the Oregon Coast but is narrowly restricted, frequently covering no more than a strip 2 miles wide from the coastal margin to its bordering cover type. It is most widely distributed in the rolling hills and coastal plain of the northwest coast, but is restricted to the windward sides of hills along the south coast. This closed-canopy, multistory conifer forest typically has a dense understory of shrubs, forbs, and ferns. Sitka spruce and western hemlock dominate the overstory, with Douglas-fir and western redcedar becoming more frequent as the cover type grades into inland forest covers.

Shrub cover is diverse and often dominates the understory. Common species include evergreen huckleberry, salal, vine maple, Pacific rhododendron, salmonberry, elderberry, and devil's club (*Oplopanax horridum*).

Herbaceous cover is diverse and typically contains several fern species, including swordfern, deer fern, bracken, and chain fern (*Woodwardia fimbriata*). Other common forbs are false lily-of-the-valley (*Maianthemum dilatatum*), inside-out flower, and Oregon oxalis.

This cover type occurs in two areas at the northwest- and southwest-most extensions of the study area (Figure 3.4-2) and accounts for a small proportion (less than 3 percent) of the vegetation in the study area.

Grass-Shrub-Sapling or Regenerating Young Forest (121)

The grass-shrub-sapling or regenerating young forest cover type is common throughout the mountains of Oregon where timber harvest or wildfire has occurred. It often appears as a patchwork mosaic among surrounding local forest cover types. It results from fire restoration efforts or site preparation following timber harvest, where soil damage has been caused by wildfire or burning of slash (often leaving little large woody debris), followed by seeding of a mix of annual grasses to retard soil erosion and conifer planting. As the stand matures, there may be a phase where large shrubs dominate the overstory canopy layer, either from re-sprouting from stumps or germination from the seed bank. Conifer saplings will eventually emerge through the shrub canopy and form continuous canopies. A variety of shrubs and forbs may be present in this cover type, depending on regional flora and site history.

This cover type occurs in several areas near the study area periphery (Figure 3.4-2). This cover type generally develops in areas that have been recently harvested. Because the OR-GAP GIS coverage was completed in 1999, current acreage and mapped locations of this vegetation type are likely to be somewhat different than indicated in Figure 3.4-2.

Gap Palustrine Shrubland (201)

The gap palustrine shrubland cover type is closely associated with surface hydrologic features, such as lakes and low-gradient streams. Western Oregon palustrine shrublands are also dominated by willow species (especially Sitka willow [*Salix sitchensis*] and Hooker's willow [*S. hookeriana*]), Douglas spirea (*Spiraea douglasii*), redosier dogwood (*Cornus sericea*), snowberry (*Symphoricarpos albus*), and black hawthorn (*Crataegus douglasii*). These tall-shrub riparian areas are rare in the Coast Range Ecoregion and are much more common in eastern Oregon.

This cover type coincides with low gradient streams along the western edge of the study area (Figure 3.4-2) and accounts for less than 1 percent of the total study area.

Red Alder Forest (63)

The red alder forest cover is a lowland riparian association common throughout the Coast Range, particularly along streamside corridors. It is typically dominated by moderately high (20 to 50 feet), closed-canopy stands of red alder that become established after site disturbance. These stands stabilize slopes, help to retard surface soil erosion, and provide nitrogen fixation. These stands may eventually give way to coniferous forest types, but may remain present if disturbance is frequent.

Understory shrubs typically include vine maple, salmonberry, thimbleberry (*Rubus parviflorus*), evergreen huckleberry, and salal. Herbaceous species typically include Oregon oxalis, swordfern, foamflower (*Tiarella trifoliata*), vanilla leaf, beadlily (*Clintonia uniflora*), skunk cabbage (*Lysichitum americanum*), coltsfoot (*Petasites frigidus*), and twinflower.

This cover type occurs mainly along Larson Creek in the southwestern portion of the study area (Figure 3.4-2) and accounts for less than 1 percent of the total study area.

Open Water (130)

The open water cover type includes lakes, ponds, and reservoirs larger than 10 acres. This cover type occurs along Larson Creek in the southwestern potion of the study area (Figure 3.4-2) and accounts for less than 1 percent of the total study area.

Gap Palustrine Emergent Wetland (203)

The gap palustrine emergent wetland cover type is composed of freshwater herbaceous wetlands distributed throughout the State, including the coastal margin. It is restricted to perennially flooded regions, or where subsoils are persistently saturated. This cover type is typically composed of graminoids (e.g., grasses, sedges) that occur in dense mosaics, depending on substrate and

water depth. Common herbaceous plants include cattail (*Typha latifolia*), several bulrush species (*Scirpus olneyi, S. acutus, S. validus*, and *S. americanus*), and burreed (*Sparganium emersum* and *S. eurycarpum*), which occur in shallow standing water. In drier reaches where subsoils remain saturated, sedges (*Carex* spp.) and rushes (*Juncus* spp.) often dominate. Spikerush (*Eleocharis* spp.) can also be an important component in this seasonal flooded margin. Commonly associated grasses include blue wildrye (*Elymus glaucus*), tufted hairgrass (*Deschampsia caespitosa*), bluejoint reedgrass (*Calamagrostis canadensis*), reed canarygrass (*Phalaris arundinacea*), American sloughgrass (*Beckmannia syzigachne*), and northern mannagrass (*Glycera borealis*). This cover type occurs along Lake Creek in the southeastern potion of the study area (Figure 3.4-2).

3.4.2.3 Rare Plant Occurrences

As described above, ecological communities and vegetative cover types in the study area are relatively diverse, both physically and floristically, particularly in the more southern portions. This diversity creates opportunities for the evolution of rare plants, as well as a host of diverse and readily accessible non-timber forest products, such as moss, swordfern, salal, and cedar boughs. Rare plant species considered in this Section include the following:

- species listed as threatened or endangered under the Federal or State Endangered Species Acts (ESA),
- species currently *proposed for listing* under the State or Federal ESA,
- species that are *candidates for listing* or *species of concern* under the State or Federal ESA,
- species identified as sensitive by the Oregon Department of Fish and Wildlife (ODFW), and
- any other species with a special status related to rarity as recognized by the Oregon Department of Forestry (ODF).

No comprehensive assessments or basic systematic surveys for rare plants have been conducted in the study area (Oregon Department of Forestry 2006a). In the late 1990s, individual harvest units were surveyed for rare plants. In addition, ODF has developed a base list of State-listed plants, using the Oregon Natural Heritage Information Center (ORNHIC) list of May 2004, with the assistance of a botanist from the Bureau of Land Management (BLM), specific to lands in the study area (Oregon Department of Forestry 2006a).

Of the 25 species of rare plants that are found in Coos and Douglas Counties, only three plant species have habitat and ranges that coincide with the study area (Table 3.4-2). Most potentially occurring species can be eliminated because they occur only on serpentine soils (a soil type not found in the study area), high elevations, coastal dunes, or boggy areas in the dunes. Other potential species appear to have similar habitat requirements as found in the study area, but there have been no discoveries of them within this range (i.e., north coast to south coast).

As summarized in Table 3.4-2, the three species that are likely present in the study area are bensonia (*Bensoniella oregana*), tall bugbane (*Actaea elata*), and Howell's montia (*Montia howellii*). None of these species have been confirmed to be present in the study area, but have been discovered within reasonable proximity on adjacent lands. Bensonia has been found above 2,500 feet at Signal Tree, above Camas Valley. Tall bugbane typically occurs in lowland Douglas-fir forests with maple and swordfern, and populations are known on adjacent BLM-managed lands. Howell's montia is found on moist lowland areas in vernally wet sites. These three species are on the State candidate list (Table 3.4-2).

Table 3.4-2 Rare Plants Potentially Occurring in the Study Area

Species	Status	Habitat
Bensonia (*Bensoniella oregana)*	State candidate for listing	Found in wet meadows and moist streamside sites in pre-Cretaceous metasedimentary rock at elevations above 2,500 feet.
Tall bugbane (*Actaea elata)*	State candidate for listing	Found in lowland Douglas-fir forests with maple and swordfern.
Howell's montia (*Montia howellii)*	State candidate for listing	Found in moist lowland areas, vernally wet sites, often on compacted soil less than 1,300 in elevation.

Source: Oregon Department of Forestry 2006a

The ODF is not aware of any other federally listed threatened or endangered plant species that are likely to occur in the study area (Oregon Department of Forestry 2006a).

Current Management

The ODF currently protects listed plant species in accordance with the State and Federal ESAs. If occurrences in the study area are discovered during project planning, ODF maps the area and identifies appropriate conservation measures.

The rare plant list for the study area is updated annually, as necessary, to reflect new or supplemental information in the ORNHIC database. Forest management personnel are trained to recognize listed plant species and the habitats in which they are likely to occur. If rare plant communities are discovered in the study area, they are recorded on a statewide GIS that also indicates locations of such communities on adjacent lands. This database is consulted during timber sale planning; however, ground surveys of each sale area are not conducted due to the difficulty of inspecting all such areas during the flowering period.

Section 3.5

Fish and Their Habitat

This section provides information on fish and their habitat in the study area. For this section, the study area encompasses the streams and rivers in the vicinity and downstream of the action area associated with the Coos, Umpqua, and Tenmile Watersheds where the effects of the proposed action could influence fish or their habitat. A description of the action area is presented in Section 3.0, Action Area and Study Area.

3.5.1 Sources of Information

Information in this section is drawn from a variety of literature sources, including the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003), the *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a), the Oregon Department of Fish and Wildlife (ODFW) Aquatic Inventories Project (AIP) surveys performed through 2002 (Kavanagh et al. 2005, Oregon Department of Fish and Wildlife unpublished data), and the *Oregon Coastal Coho Assessment* (Nicholas et al. 2005). Much of the text in Section 3.5.3, Aquatic Habitats in the Study Area, was derived from the *Elliott State Forest Watershed Analysis* and AIP report.

3.5.2 Affected Environment for the Fish Species of Interest

As described in detail below, the streams and rivers within the study area provide habitat for 16 species of fish (Table 3.5-1). Eight of these fish species were selected for detailed discussion in this section (species of interest) because they are either anadromous species of social and economic importance, or special status species identified by State or Federal resource management agencies. All eight of these species are proposed for coverage in the draft *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008) (Table 2-6).

The seven anadromous fish species evaluated in detail in this section include Chinook salmon (*Oncorhynchus. tshawytscha)*, coho salmon (*O. kisutch*), chum salmon (*O. keta*); steelhead trout (*O. mykiss irideus)* cutthroat trout (*O. clarki clarki)*; Pacific lamprey (*Lampetra tridentata)* and river lamprey *(L. ayresi)*. One additional resident fish of interest, brook lamprey (*L. planeri*), is also evaluated in this section. The listing status of these fish species is presented in Table 3.5-1.

According to the Oregon Department of Forestry (ODF) Coos District geographic information system (GIS) database, the action area contains 188 miles of known fish-bearing streams (Oregon Department of Forestry 2008; Dent pers. comm. 2007). The majority (111 miles or 59 percent) of the stream habitat is contained within the Coos River Watershed. The remainder is divided between the Umpqua (43 miles or 23 percent) and Tenmile (34 miles or 18 percent) Watersheds. Currently, coho salmon, Chinook salmon, steelhead trout, cutthroat trout, and the three identified lamprey species are found in many streams throughout the action area and the study area. The other fishes have more restricted distributions. Aquatic habitats within the study area have been affected by past floods, windstorms, timber harvest, and stream clearing activities. Currently, the primary factors limiting freshwater aquatic production are thought to be the amount of suitable in-channel habitat (channel complexity, in-channel large wood) and riparian habitats, including a general lack of large conifer trees (Biosystems et al. 2003, Nicholas et al. 2005).

Table 3.5-1. Fishes Located in Streams and Rivers in the Study Area

Species	Listing Status		Life History Strategy	Distribution in the Study Area
	Federal	State		
Coho salmon (*Oncorhynchus kisutch*)	Threatened	Sensitive / Critical	Anadromous	Occupy the majority of streams in the Coos, Umpqua, and Tenmile Watersheds.
Chinook salmon (*O. tshawytscha*)	Not Listed	Not Listed	Anadromous	Are found in the Umpqua and Millicoma Rivers.
Chum salmon (*O. keta*)	Not Listed	Sensitive / Critical	Anadromous	Spawning population is in Marlow Creek and the West Fork Millicoma River.
Steelhead trout (*O. mykiss irideus*)	Species of Concern	Sensitive / Vulnerable	Anadromous	Occupy the majority of streams in the Coos, Umpqua, and Watersheds.
Coastal cutthroat trout (*O. clarki clarki*)	Species of Concern	Sensitive / Vulnerable	Anadromous and resident	Occupy the majority of streams in the Coos, Umpqua, and Tenmile Watersheds.
Pacific lamprey (*Lampetra tridentate*)	Species of concern	Sensitive / Vulnerable	Anadromous	Thought to be located in the majority of streams in the Coos, Umpqua, and Tenmile Watersheds.
River lamprey (*Lampetra ayresii*)	Species of concern	Not Listed	Anadromous	Thought to be located in the majority of streams in the Coos, Umpqua, and Tenmile Watersheds.
Western Brook lamprey (*Lampetra richardsoni*)	Not Listed	Not Listed	Resident	Undocumented. Considered abundant in Oregon Coastal streams.
Umpqua Chub (*Oregonichthys kalawatseti*)	Species of Concern	Sensitive / Vulnerable	Resident	Native to the Umpqua River mainstem adjacent to the study area.

Species	Listing Status		Life History Strategy	Distribution in the Study Area
	Federal	State		
Millicoma longnose dace (*Rhinichthys cataractae* spp.)	Species of Concern	Sensitive / Peripheral or Naturally Rare	Resident	Native to the Coos River.
Speckled dace (*R. osculus*)	Not Listed	Not Listed	Resident	Occupy most ESF streams and rivers.
Redside shiner (*Richardsonius balteatus*)	Not Listed	Not Listed	Resident	Occupy larger streams and rivers of the ESF.
Threespine Stickleback (*Gasterosteus aculeatus*)	Not Listed	Not Listed	Resident	Occupy ponds and backwaters along ESF streams.
Largescale sucker (*Catastomus macrocheilus*)	Not Listed	Not Listed	Resident	Occupy most ESF streams and rivers.
Coast Range sculpin (*Cotus aleuticus*)	Not Listed	Not Listed	Resident	Occupy most ESF streams and rivers.
Prickly sculpin (*Cotus asper*)	Not Listed	Not Listed	Resident	Occupy most ESF streams and rivers.

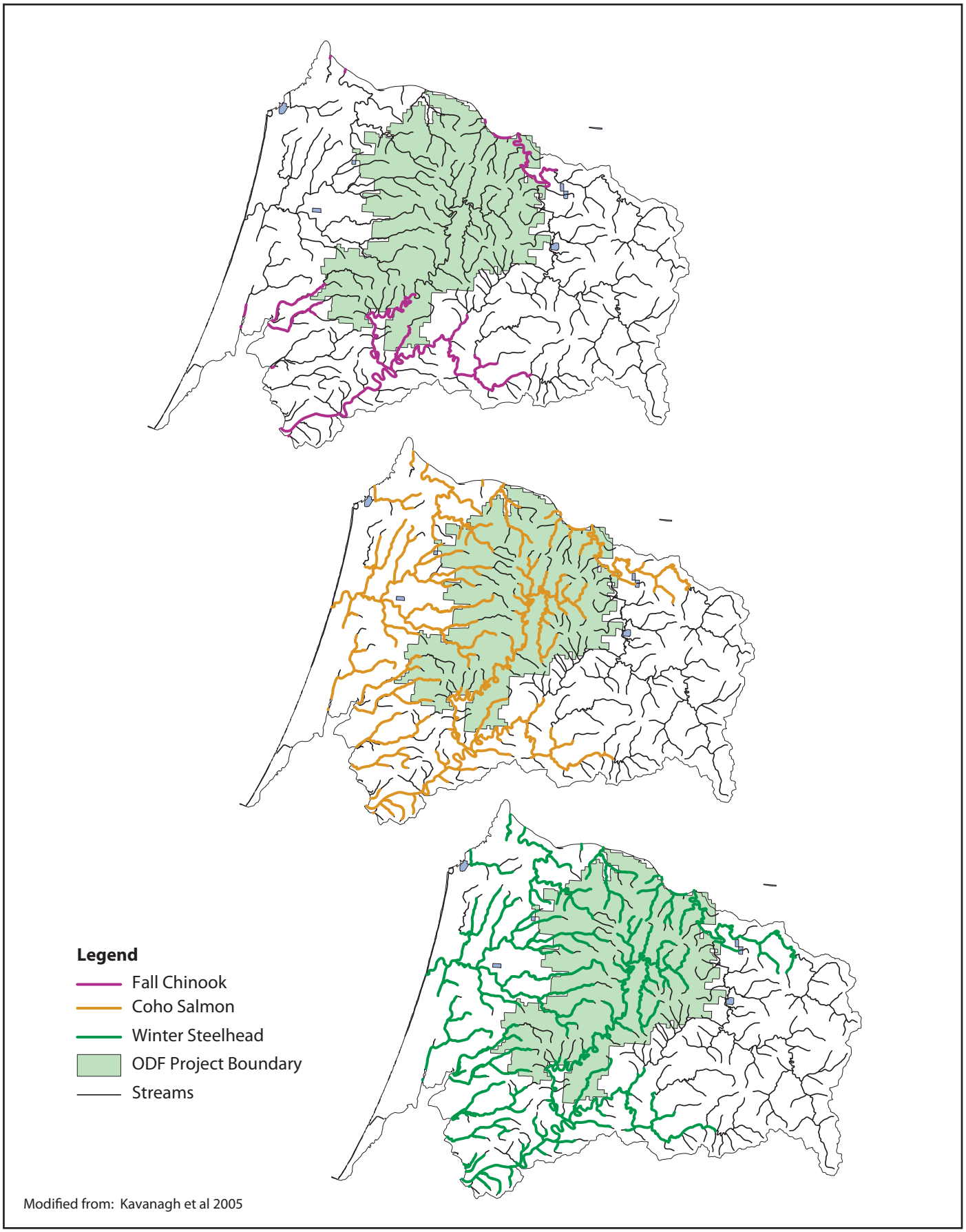
ESF = Elliott State Forest

3.5.2.1 Coho Salmon

Species Ecology

Current Distribution

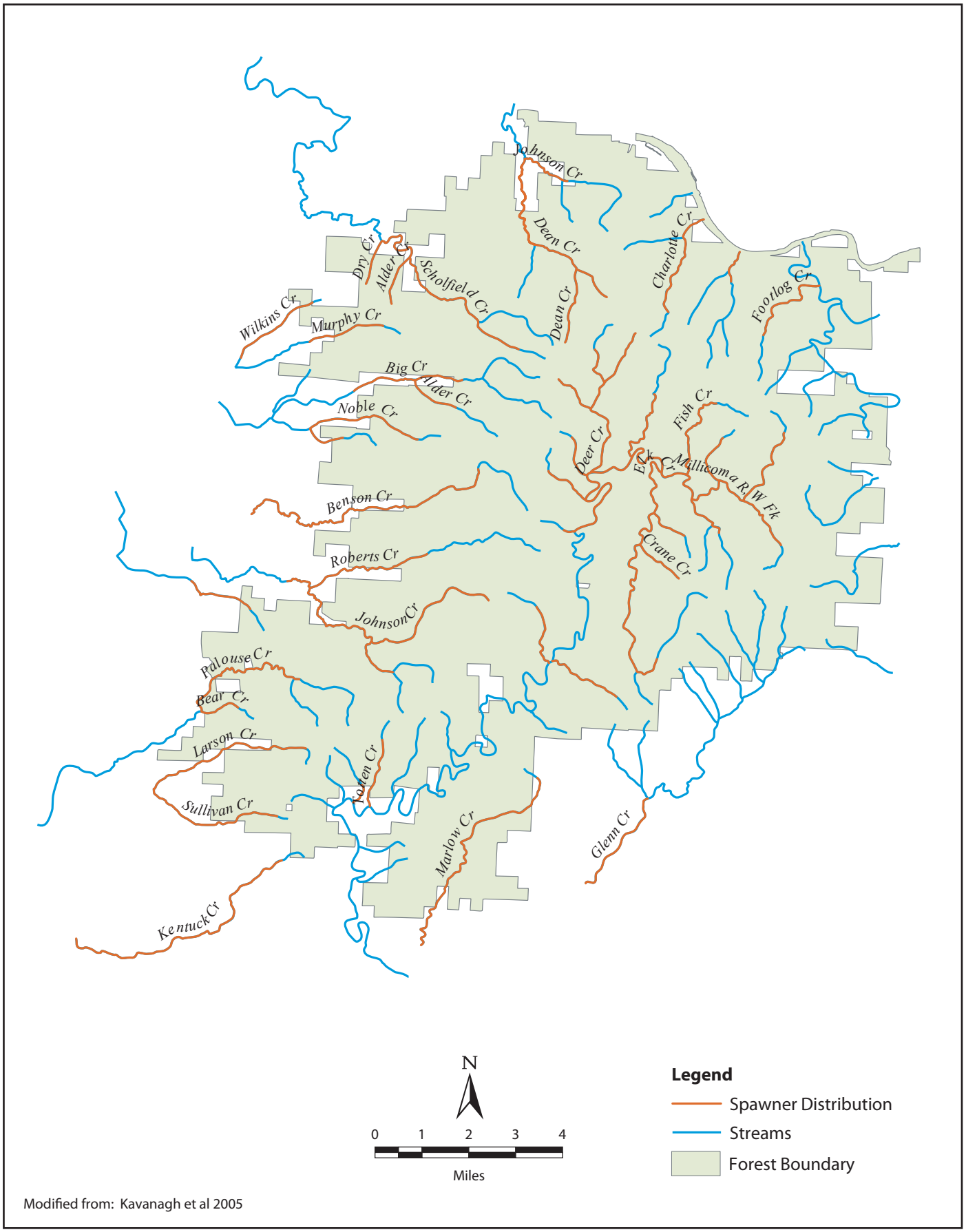
The natural range of coho salmon is within the North Pacific basin, from the Sea of Japan north to Alaska and south to the Sacramento River in California (Groot and Margolis 1991). Coho salmon are native or indigenous to all coastal rivers and streams of Oregon, including the Coos, Tenmile, and Umpqua Rivers. Coho salmon are distributed throughout the rivers and streams in the study area (Figure 3.5-1). The distributions of spawning and rearing habitats are somewhat different, with rearing habitat covering a greater portion of waters in the study area (Figure 3.5-2).



04718.04 EIS (11-06)

Jones & Stokes

Figure 3.5-1
Coho Salmon Distributions in the Study Area



Modified from: Kavanagh et al 2005

04718.04 EIS (11-06)

Jones & Stokes

Figure 3.5-2
Coho Spawning and Rearing Habitat Distribution in the Study Area

Behavior and Reproduction

Like other Pacific salmon, coho salmon are an anadromous species, meaning they reproduce and spend their early life history in fresh water. They metamorphose into smolts capable of living in salt water and migrate to the sea for a period of adult growth, development, and maturation. The majority of Oregon coho salmon return from the sea to reproduce as 3-year-old fish. An exception to this pattern is 1- to 2-year-old jacks (young male salmon that mature earlier than other fish in their age class) that are a natural component of many coho populations. Oregon coho salmon return to the tributaries where they were hatched in November, and spawn from November through February (Nickelson et al. 1992). Coho salmon often move into fresh water with fall freshets (a water flow resulting from sudden rain or snow melt), making migration somewhat dependent on weather conditions (Weitkamp et al. 1995). On average, a female coho salmon deposits 2,500 eggs into their gravel nests (redds). Adult coho salmon die after spawning.

The length of incubation for coho salmon ranges from 35 to 101 days (Laufle et al. 1986), depending upon stream temperature. Egg mortality occurs at stream temperatures above 13.3 degrees Celsius (ºC) (56 degrees Fahrenheit [ºF]) (Spence et al. 1996). After hatching, larval fish typically spend 2 to 3 weeks in the gravel before they completely emerge in early March to mid-May (Laufle et al. 1986, McMahon 1983).

Generally, juvenile coho salmon rear in fresh water for about 15 months prior to migrating downstream to the ocean, but some rear in fresh water for up to 2 years (Sandercock 1991). The smolt outmigration begins in February and may continue into June, with the migration timing of smolts being influenced by spring storms. Oregon coho salmon will spend 18 months growing in saltwater before returning to spawn. Jacks will return from the sea after 5 to 7 months (Weitkamp et al. 1995).

Habitat Requirements

Newly emerged fry usually congregate along stream margins and in backwater pools. As juveniles grow, they disperse and aggressively defend their territory. This activity results in displacement of excess juveniles downstream to potentially less favorable habitat (Wydoski and Whitney 2003). Aggressive behavior may be an important factor in maintaining the numbers of juveniles within the carrying capacity of the stream. Once territories are established, individuals rear in selected areas of the stream, feeding on drifting benthic organisms and terrestrial insects until the following spring (Hart 1973). During their first winter, juveniles use a variety of slow water habitats, including alcoves, side channels, beaver pools and dam pools (Nickelson et al. 1992). In the winter, this complex habitat provides low velocity refuge from high stream flows. Complex large wood structures and side channels are important habitats for coho salmon during the summer low-flow period (Grette and Salo 1986). The cited studies suggest juvenile coho salmon production is a factor of freshwater habitat diversity, particularly high pool-to-riffle ratios, and of the degree of habitat complexity.

Adult coho salmon require deep holding cover for resting during upstream migration and sufficient stream flows for upstream movement into tributaries.

Laufle et al. (1986) reported minimum depths of 18 centimeters (cm) (7 inches) are needed for upstream migration of adult coho salmon. For spawning and incubation, coho salmon require clean gravel and prefer cool water temperatures between 11.7°C and 14.4°C (53 - 58°F) (Reiser and Bjornn 1979). To fully support the pre-emergent stages of coho development, McCullough et al. (2001) recommended that the 7-day average of daily maximum temperatures should not exceed 8.9 to 12.2°C (48 to 54°F) during early spring months. As discussed in McCullough et al. (2001), the optimum growth of juvenile coho salmon with limited food intake occurs between 10 and 15.6°C (50 and 60°F), and the risk of disease is high at or above constant temperatures of 17.8 to 20°C (64 to 68°F).

Management and Status in Western Oregon

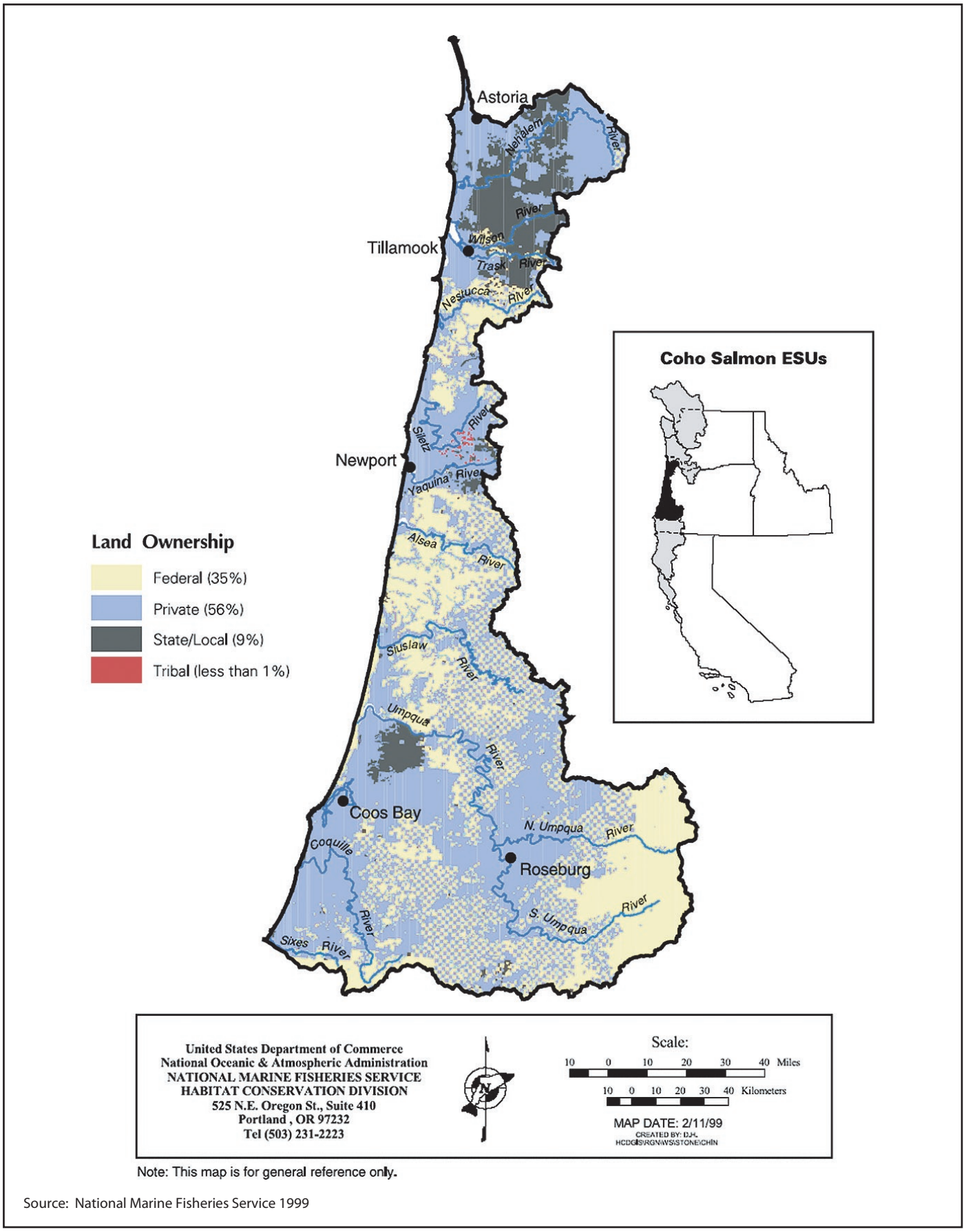
Regional Population Estimates

Coho salmon populations on the west coast of the United States have declined dramatically from historical levels. Fifty separate stocks (specific populations of fish spawning in a particular stream during a particular season) have been identified as extinct or at immediate risk of extinction (Nehlsen et al. 1991). Coho populations have been extirpated (are extinct in a given area, but survive in other areas) in 56 percent of their natural range, and are declining and facing threat of extinction in another 38 percent of their range (Weitkamp et al. 1995).

Coho salmon within the study area are part of the Oregon Coast Evolutionarily Significant Unit (ESU) as shown in Figure 3.5-3. A population must satisfy two criteria to be considered an ESU:

- the population must be largely reproductively isolated from other population units of the same species, and
- it must represent an important component in the evolutionary legacy of a species (69 *Federal Register* [FR] 31355).

The Oregon Coast ESU of coho salmon is considered to be a declining population and was recently listed as threatened (73 FR 7816) under the Federal Endangered Species Act (ESA). The ODFW (2005) estimated the total run size, the amount of harvest, and numbers of natural-origin coho salmon escaping harvest to spawn annually in the Oregon Coast ESU streams since 1950, as shown in Figure 3.5-4. As shown in that figure, total population size has decreased over the last 50 years; however, with a marked reduction in the amount of harvest since 1980, the level of spawners have remained within a consistent range. Estimates of coho salmon spawning escapement abundance indicate that the ESU has exceeded its 50-year average number of spawners annually since 2001. Researchers believe the variability in run size strength is a factor of cyclical patterns in ocean conditions that influence salmon productivity.



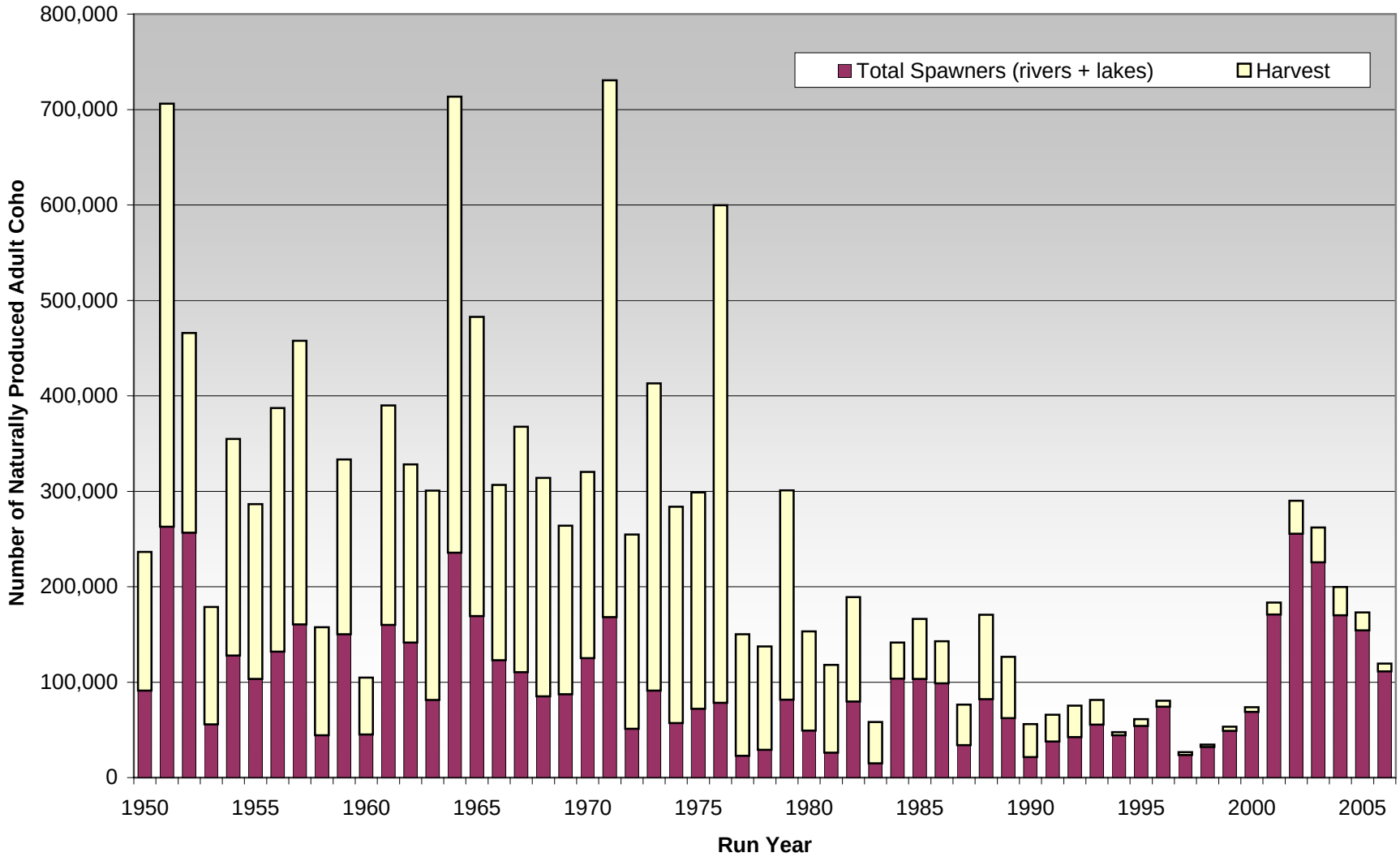
Note: This map is for general reference only.

Source: National Marine Fisheries Service 1999

04718.04 EIS (5-07)

Jones & Stokes

Figure 3.5-3
Oregon Coast Coho Salmon Evolutionarily Significant Unit



Source: Oregon Department of Fish and Wildlife 2005

04718.04 EIS (01-08)

Jones & Stokes

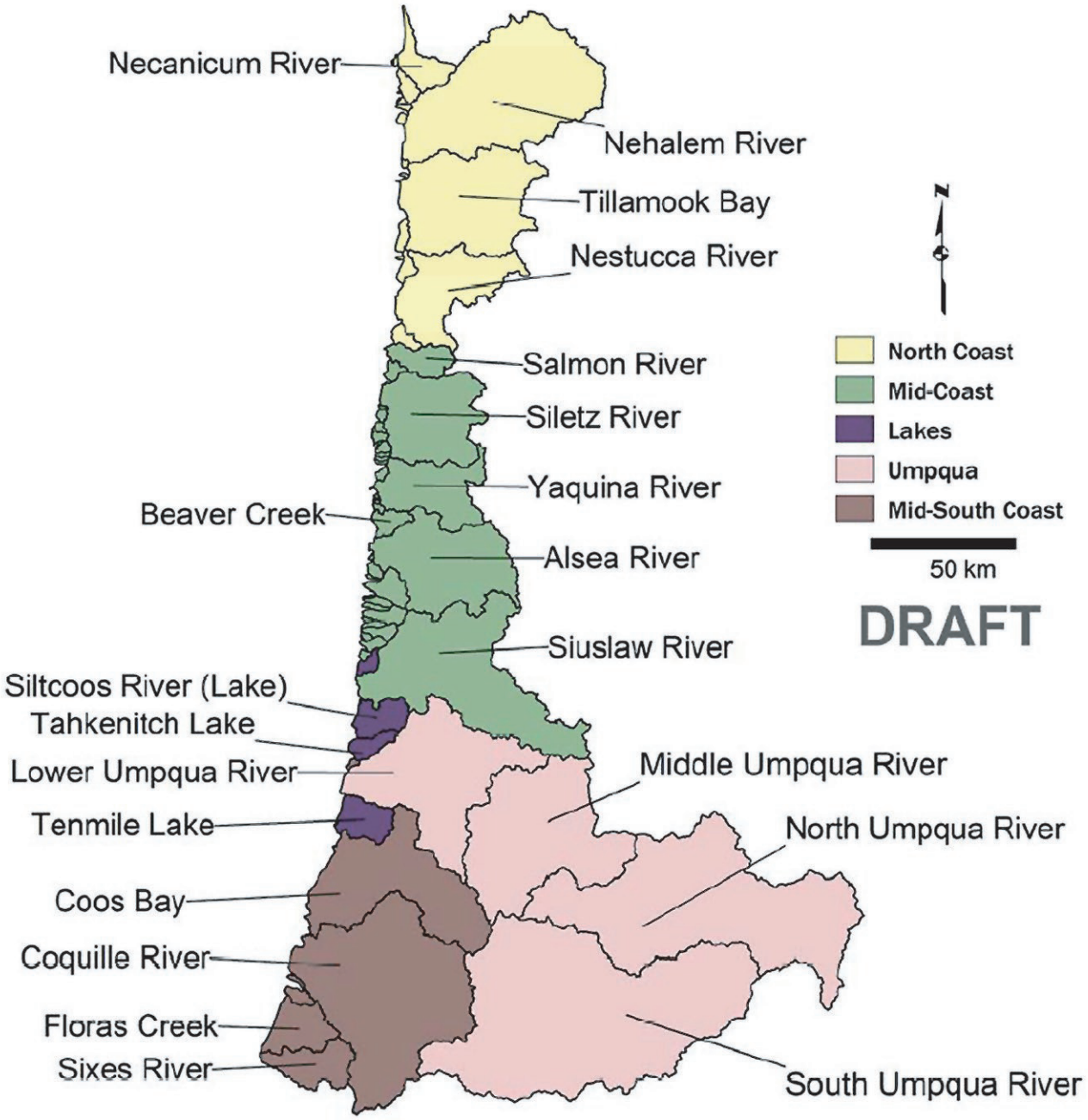
Figure 3.5-4
Estimated Total Run Size, Including the Amount of Harvest and Spawning Escapement of Natural Origin Spawners in Oregon Coast Coho Evolutionarily Significant Unit

Status in the Study Area

Twenty-one distinct populations of coho salmon in five geographic strata were identified within the Oregon Coast ESU as shown in Figure 3.5-5 (Nicholas et al. 2005). Portions of the Lakes, Lower Umpqua and Coos populations reside within the study area. The Lakes complex was ranked the highest of the coastal complexes with respect to relative abundance and viability and is considered one of the best coho producing systems in Oregon. The Coos and the Umpqua populations follow closely behind the Lakes population with high marks for overall population status (Nickelson 2001, Nicholas et al. 2005). All coho populations in the study area were rated as passing each of five population criteria established for assessing viability (Chilcote et al. 2005).

The action area provides about 117 miles of coho spawning habitat; 53 miles in the Coos Watershed, 38 miles in Tenmile Watershed, and 26 miles in the Umpqua Watershed (Jacobs 2004). Coho salmon abundance in these population units has been estimated annually since 1990. Estimates for the Lakes population have been extrapolated from spawning survey counts conducted in index areas. Estimates for the other populations were obtained using a stratified random survey methodology. The most recent 10-year geometric mean annual estimates of wild coho spawners are approximately 7,900, 6,700, and 10,700 for the Lakes, Umpqua, and Coos populations, respectively (Oregon Department of Fish and Wildlife 2005).

Comparable to trends in the ESU, ODFW data indicate coho spawner abundance in the study area greatly improved beginning in 2001, compared to relative low level of returns in the 1990s. The overall trend in wild coho salmon spawning abundance in all three of the populations encompassing the study area has been positive since 1990 (Figure 3.5-6). The average density of spawners in study area streams over the past 10 years has been consistently greater than in other coastal streams (Figure 3.5-7).

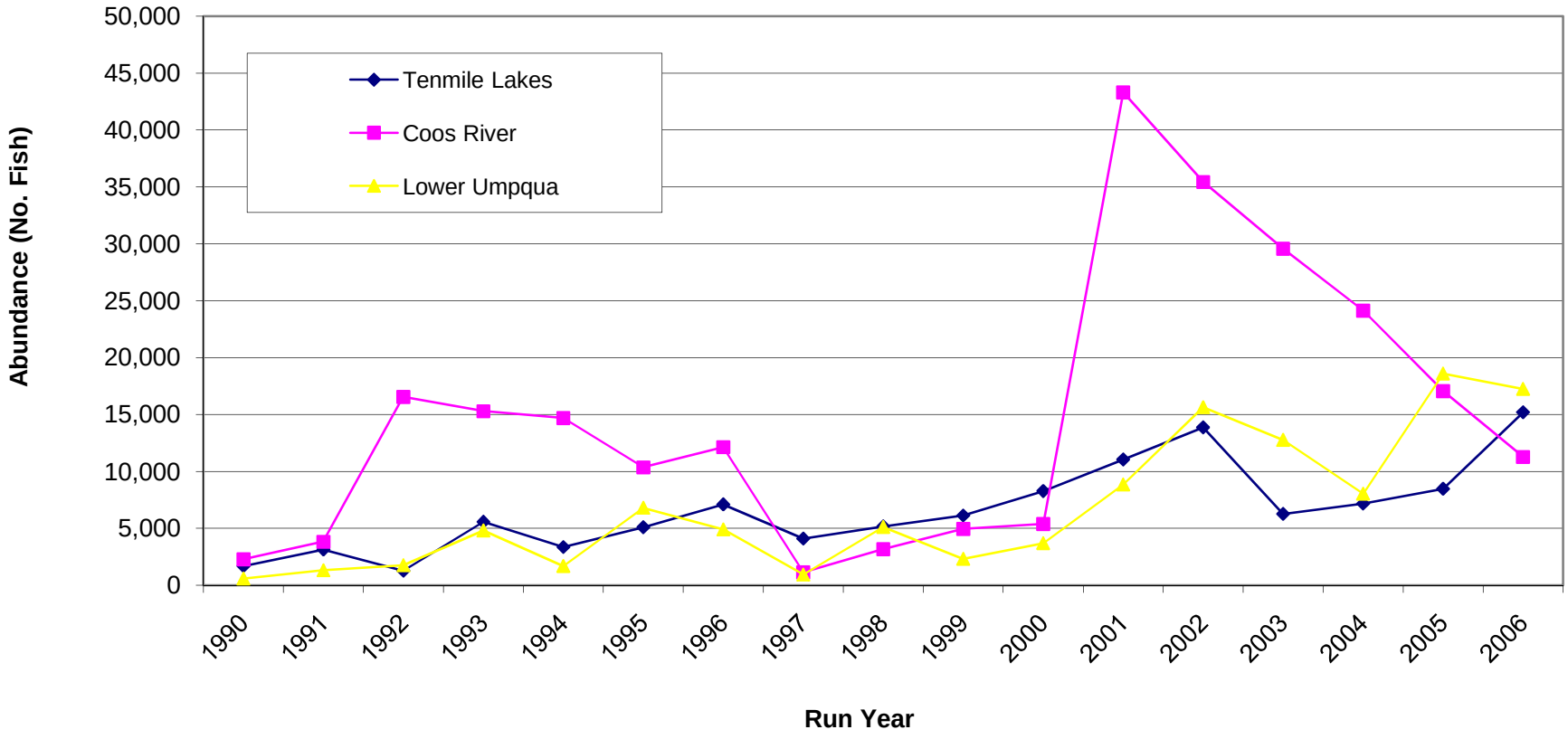


Source: Oregon Department of Fish and Wildlife 2006

04718.04 EIS (5-07)

Jones & Stokes

Figure 3.5-5
Independent Populations and Geographic Strata of the Oregon Coast Coho Evolutionarily Significant Unit

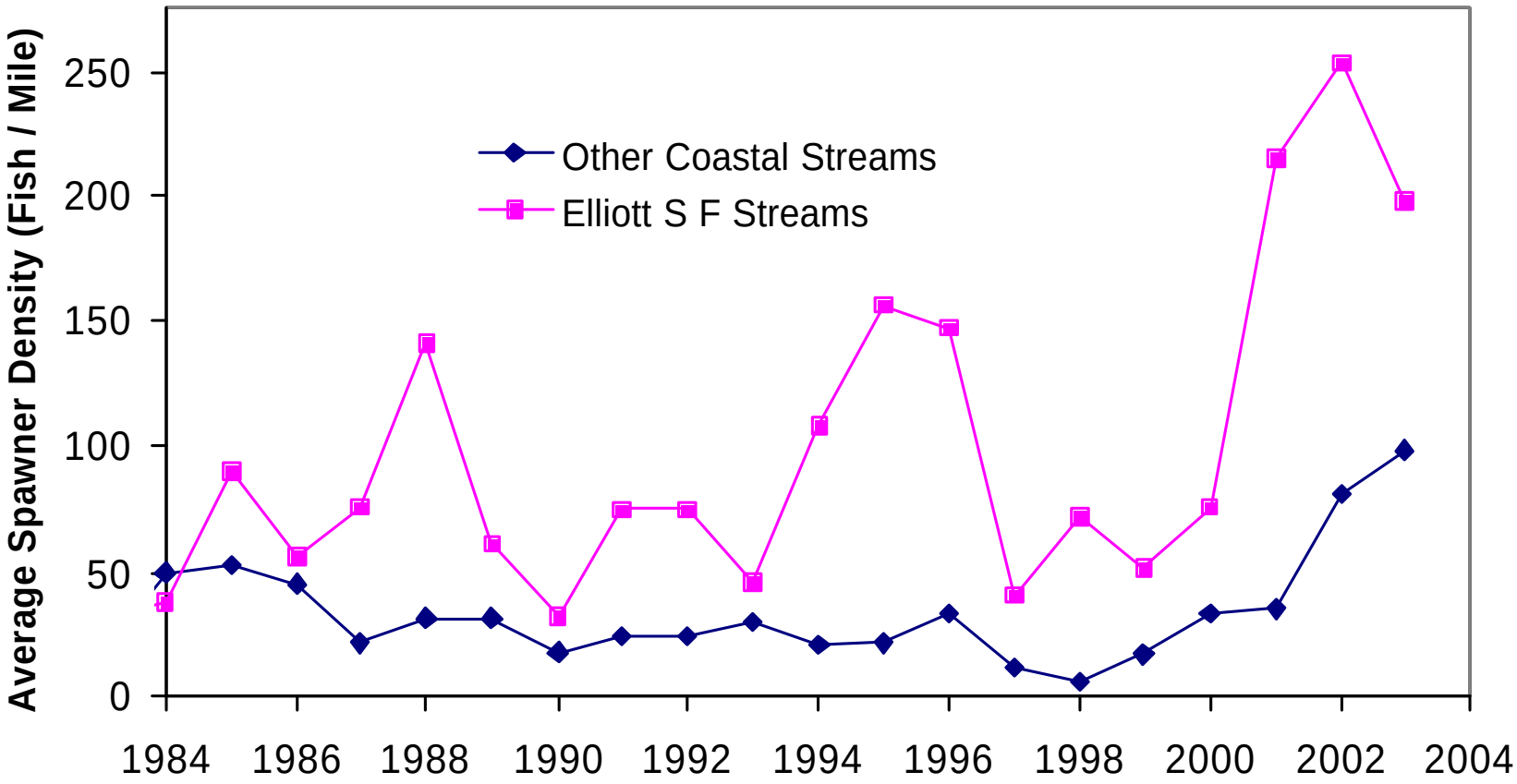


Source: Oregon Department of Fish and Wildlife 2005

04718.04 EIS (01-08)

Jones & Stokes

Figure 3.5-6
Estimated Spawning Escapement of Natural Origin Spawners in Action Area Streams



Source: Kavanagh et al. 2005

04718.04 EIS (01-08)

Jones & Stokes

Figure 3.5-7
Twenty-Year Trend in Coho Salmon Spawner Abundance in Streams Originating in the Action Area and Streams in Other Portions of the Oregon Coast Range

Good coho salmon productivity in study area streams depends on the availability of high quality rearing habitat (Jacobs 2004), particularly winter rearing habitat in the Coos and Tenmile Watersheds. These watersheds have the first and third highest winter smolt production densities (i.e., 2.2 and 2.1 parr per mile), respectively of the population units in the ESU (Nicholas et al. 2005). Overall, streams in the study area support better than average capacities for juvenile coho salmon summer and winter rearing and subsequent spawning populations than other streams in the Oregon Coast ESU (Nicholas et al. 2005). According to the Oregon coastal coho assessment (Nicholas et al. 2005), the primary limiting factor for coho salmon in both the Coos and Umpqua Watersheds is channel structural complexity (principally insufficient in-channel loading of functional large wood pieces). The primary limiting factor in the Tenmile Watershed according to Nicholas et al. (2005) is the presence of exotic fishes. However, during periods of good ocean survival, warm surface water temperatures in the summer may be limiting coho salmon production in the Umpqua Watershed (Nicholas et al. 2005). The State of Oregon's analysis of risk factors to the viability of the Oregon Coast Coho ESU concluded winter habitat (i.e., habitat complexity) was a higher priority for restoring coho populations than water quality (i.e., water temperature); with the exception of the Umpqua population during periods of good ocean survival rates (Nicholas et al. 2005).

Factors for Decline and Limiting Factors

Several factors have been identified as likely contributing to the population decline of native coho salmon. Factors for decline include spawning and rearing habitat degradation, over fishing, artificial propagation, and poor ocean conditions (Weitkamp 1995). Coho spawning habitat in the study area is limited because of lack of in-channel large wood (which slows water flow and provides shelter) in low to mid-gradient streams (slope of stream bed in a downhill direction), and associated lack of spawning gravel deposits (Biosystems et al. 2003). Rivers and streams in the study area generally have poor habitat complexity, and lack sufficient in-channel structure and abundance of pool habitats causing the availability of overwintering habitat for rearing to be an important limiting factor (Kavanagh et al. 2005). The coastal coho assessment concluded winter smolt production capacity, as a factor of channel structure and habitat complexity, was more limiting than summer rearing habitat for all populations in the study area, with the exception of populations in the Umpqua Watershed (Nicholas et al. 2005). During periods of good ocean conditions, the Umpqua populations are limited by summer rearing capacity, primarily related to water quality (temperature) and quantity (Nicholas et al. 2005). Threats to the species that contribute to current or future limiting factors include: urbanization, lowland agriculture uses (including livestock grazing), logging in riparian areas and on unstable slopes, and instream or floodplain gravel mining.

3.5.2.2 Chinook Salmon

Species Ecology

Current Distribution

In North America, Chinook salmon are distributed from the San Joaquin River in Central California to the Coppermine River in the Canadian Arctic (Groot and Margolis 1991). In Oregon, Chinook salmon are distributed in most coastal rivers and throughout the Columbia River Basin. Chinook salmon distribution in the study area includes portions of the Umpqua and Millicoma Rivers (Kostow 1995).

Behavior and Reproduction

Two races of Chinook salmon are found in Oregon coastal streams: spring-run Chinook salmon and fall-run Chinook salmon. The races are distinguished based on the river entry timing of returning adults. Spring-run Chinook salmon generally enter Oregon coastal rivers from the ocean in April through summer, while fall Chinook salmon entry peaks in September and October. Variations in freshwater entry and run timing exist in local populations and are in response to the local temperature and water flow regimes (Myers et al. 1998). For example, spring-run Chinook in the Umpqua Watershed exhibit an early spawning migration entering the basin from March through June. Fall-run Chinook enter from July into October (Kostow 1995) and are the most abundant race in rivers in the study area.

Chinook salmon mature and begin their spawning migration from age 3 to 6 years. However, the majority of adults spawn between ages four and five (Kostow 1995). They are the largest of all Pacific salmon, and can achieve weights of over 100 pounds, but average approximately 22 pounds. Spring Chinook salmon spawn in Oregon coastal streams from September through November, and fall Chinook salmon spawn predominately during October through December. Females deposit between 3,000 and 6,000 eggs depending on age and body size (Nickelson et al. 1992).

Similar to all salmon, Chinook salmon egg incubation varies with temperature. Chinook salmon eggs hatch in about 159 days at 3ºC (37ºF), and in 32 days at 16ºC (61ºF) (Healey 1991). Prior to emerging, the young remain in the gravel for 2 to 3 weeks after hatching (Wydoski and Whitney 2003). Many variations in juvenile life history are possible. Some juvenile Chinook salmon may move into the ocean quickly, while others use extended rearing strategies in the streams or estuaries (Reimers 1973). Environmental cues such as streamflow reductions, food supply, changes in photoperiod (length of daylight), and temperature increases are all factors leading to the evolution and expression of particular juvenile outmigration strategy (Myers et al. 1998). In Oregon coastal streams, most Chinook salmon exhibit subyearling strategies, where juveniles rear in natal streams for 3 to 6 months and then move downstream to estuarine habitats (Kostow 1995).

Habitat Requirements

Juvenile Chinook salmon occupy a variety of habitats during their freshwater residence. They can be found along stream margins, in pools, side channels and back water habitats and are often associated with fallen trees, root wads, or areas with bank cover. They require some velocity and will move into habitat with increasing velocities as they increase in size (Groot and Margolis 1991).

Owing to their large body size, adult Chinook salmon require deep holding water and sufficient stream flow for upstream migration. The large body size also enables the fish to use larger gravel and cobble substrates for spawning than other anadromous fish species (Raleigh et al. 1986). Chinook salmon spawn in water depths ranging from 10 cm (4 inches) to several meters deep (Groot and Margolis 1991). According to McCullough et al. (2001), the optimal spawning temperature lies in the range between 9 and 10°C (48 to 50°F). Successful incubation requires daily maximum temperatures generally less than 14.5°C (58°F) (McCullough et al. 2001) and clean water that percolates through the spawning gravels (Groot and Margolis 1991). Optimal growth for juvenile Chinook salmon occurs between 10.0 and 15.5°C (50 to 60°F) with limited food supply, or as high as 19°C (66°F) with unlimited food rations (McCullough et al. 2001). As discussed in McCullough et al. (2001), the risk of disease is high at or above constant temperatures of 17.8 to 20°C (64 to 68°F).

Management and Status in Western Oregon

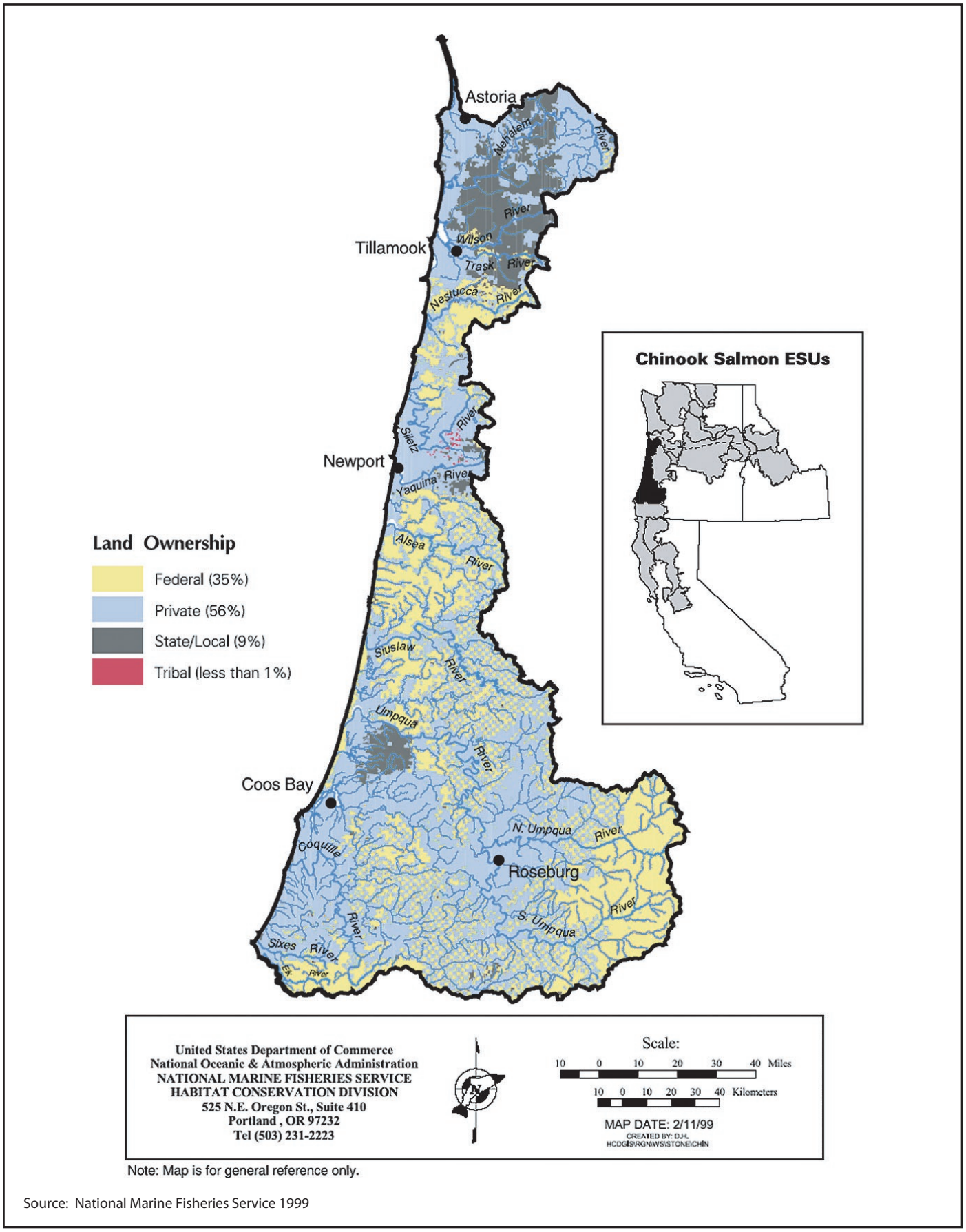
Regional Population Estimates

Chinook salmon in the study area are part of the Oregon Coast ESU (Figure 3.5-8). Currently Chinook salmon in this ESU do not have special status at the State or Federal level (Table 3.5-1). Forty-five populations have been identified within this ESU (Kostow 1995). A 5-year mean spawning escapement for the ESU was estimated at 136,000 Chinook salmon.[1] The population trend over a recent 50-year period was determined to be stable or increasing (Myers et al. 1998). Both long-term (50-year) and short-term (10-year) fall-run Chinook population trends in the Coos and the West Fork Millicoma Rivers similarly show increasing spawning escapement (Myers et al. 1998).

Status in the Study Area

Population data for fall Chinook salmon in rivers in the study area were not uniformly available. The 5-year geometric mean number of fall-run Chinook salmon spawners in the Coos and Umpqua Rivers averaged 10,300 and 8,200, respectively (Myers et al. 1998). Both of these populations were judged to be stable or increasing. The 5-year geometric mean number of spring Chinook salmon spawners in the Umpqua River averaged 3,300 adults and this population was judged to be stable (Myers et al. 1998). The index survey was not extended to the population level. The ODFW conducted a spawning ground survey on the West Fork of the Millicoma River downstream of the action area. Counts from this index survey ranged from 2 to 209 Chinook salmon spawners over a 40-year period (Myers et al. 1998).

[1] Escapement is defined as the number of adult anadromous fish escaping ocean and terminal fish harvests and thereby returning to their natal streams to spawn.



Note: Map is for general reference only.

Source: National Marine Fisheries Service 1999

04718.04 EIS (5-07)

Jones & Stokes

Figure 3.5-8
Oregon Coast Chinook Salmon Evolutionarily Significant Unit

Factors for Decline and Limiting Factors

Similar to many other Pacific salmon, habitat loss and degradation due to logging and road practices have affected Chinook salmon populations. In the Oregon Coast and Southern Oregon/Northern California ESUs, habitat loss and degradation have been associated with human activities such as dam construction, water withdrawal, logging, and agriculture. Logging and agricultural practices were identified as activities that have resulted in modifications to stream structure and reductions of riparian habitat (Myers et al. 1998). Lack of in-channel structure and associated gravels were reported to limit Chinook spawning habitat in the study area (Biosystems et al. 2003).

3.5.2.3 Chum Salmon

Species Ecology

Current Distribution

Chum salmon have the widest distribution among the Pacific salmon, ranging from Korea to the Lena River in Russia and from the Mackenzie River in the Canadian Arctic south to Monterey, California (Groot and Margolis 1991). In Oregon, chum salmon are found in the Columbia River and along the coast as far south as the Coquille River (Kostow 1995). Chum salmon are found in the study area in the Millicoma River (Kostow 1995). Specific spawning populations have been observed in Marlow Creek and the West Fork Millicoma River (Oregon Department of Forestry 2008).

Behavior and Reproduction

Run timing data for Oregon Coast chum salmon are available only for Tillamook Bay. Groot and Margolis (1991) report that chum salmon migrate upstream during October and November and spawning can continue into December (Cooney and Jacobs 1994). In general, upstream chum migration can occur quickly, with transport rates of 30 miles per day. The length of embryo incubation is influenced primarily by water temperature. For example, eggs at 15ºC (59ºF) hatch approximately 100 days before eggs incubated at 4ºC (39ºF). Health of the emergent chum fry, as with the other salmonid fish species, is also dependent on dissolved oxygen, gravel composition, spawner density, stream discharge, and genetic characteristics (Salo 1991).

Juvenile chum salmon rear in fresh water for a period of a few days to several weeks before migrating downstream to saltwater (Grette and Salo 1986). In Washington, downstream chum salmon migration occurs from late January to May (Johnson et al. 1997). Chum outmigration is associated with increasing day length and warming of estuarine waters. Juvenile chum have longer rearing times in estuaries than most salmon, and estuarine survival appears to play a major role in determining subsequent adult return to fresh water (Johnson et al. 1997). Simenstad et al. (1982) found chum salmon generally moved offshore at a size of 50 to 160 millimeters (mm) (2 to 6 inches) fork length. Chum salmon mature anywhere between 2 to 6 years of age (Salo 1991).

Habitat Requirements

Juvenile chum salmon migrate from fresh water shortly after emergence and rear primarily in estuarine waters for a period of up to several months. Fry may remain near the mouth of their natal river after entering the estuary or may disperse rapidly throughout the estuarine system into tidal creeks and sloughs (Johnson et al. 1997).

Chum salmon are reported to spawn in shallow, slow-velocity streams and side channels (Johnson et al. 1997). Preferred spawning areas include groundwater-fed streams or at the head of riffles (Grette and Salo 1986). Groundwater upwelling is important to redd site selection (Johnson et al. 1997).

Management and Status in Western Oregon

Regional Population Estimates

Chum salmon is listed as a State Sensitive species in Oregon (Kostow 1995). Little data are available on the Pacific Coast ESU. In Oregon, spawning surveys of the Tillamook Bay population show large fluctuations year to year but overall the populations have been relatively stable since 1962 (Kostow 1995). The mean spawning escapement for the period from 1987 to 1991 was 12,500 chum salmon (Johnson et al. 1997).

Status in the Study Area

The Marlow Creek chum salmon population in the study area is small, but the habitat is considered to be of high quality and stable (Kostow 1995). No data were available on the West Fork Millicoma River chum salmon population.

Factors for Decline and Limiting Factors

While chum salmon do not have special status at the State or Federal level, and populations appear stable, several activities are thought to affect population levels. Johnson et al. (1997) listed variations in fresh water and ocean environment and artificial propagation as contributing to fluctuations in chum population abundance. Kostow (1995) reported chum salmon spawning habitat in Oregon has been affected by gravel mining operations, channelization, and siltation associated with road construction and logging. Losses and degradation of estuarine habitats have also likely had a large adverse impact on chum salmon populations Kostow (1995).

3.5.2.4 Steelhead

Species Ecology

Current Distribution

Steelhead trout, an anadromous form of rainbow trout, are distributed widely in North America. Three subspecies of steelhead occur in North America:

- the inland group, *O. mykiss gairdneri*,
- the coastal group, *O. m. irideus*, and

- Oregon redband trout, *O. m. newberrii*.

The coastal subspecies is found along the west coast from Kuskiokwim River in Alaska to the Otay River in California (Kostow 1995). In Oregon, this subspecies occupies most rivers and streams west of the Cascades. Steelhead are found in most streams in the Coos, Umpqua, and Tenmile Watersheds.

Behavior and Reproduction

Steelhead trout may have the greatest life history diversity of all the salmonid fishes. The two races of steelhead—summer and winter steelhead—are distinguished by timing of reproductive maturation and return to fresh water. Most of the steelhead populations in Oregon coastal rivers are winter steelhead. Summer steelhead are found only in the Nestucca, Siletz, Wilson, Kilchis, North Umpqua, and Rogue Rivers (Kostow 1995, Busby et al. 1996).

Winter steelhead adults return to streams from November through April, and exhibit late stages of maturity upon entering fresh water. Summer steelhead adults generally return to the rivers as immature fish from May through October (Busby et al. 1996). Steelhead adults overwinter and mature for spawning the next spring. Native winter and summer steelhead spawning occur from early March to late May or early June, and overlap considerably. Similar to all anadromous trout species, steelhead can spawn more than once. Reproductively spent adults, or kelts, return to the ocean for a period of additional growth before they ascend their natal streams to spawn again.

The juveniles of each race share common behavior patterns (Stolz and Schnell 1991). Steelhead fry emerge from redds in late spring and early summer. In Oregon, steelhead juveniles may spend from 1 to 4 years in fresh water before they begin their seaward migration (Nickelsen et al. 1992). However, the majority of smolts will leave after 2 or 3 years of freshwater rearing (Busby et al.1996). Time in the ocean is also variable; however, most steelhead reside in the ocean 2 years before entering fresh water to spawn (Busby et al. 1996). Most coastal steelhead mature at a total age of 4 years, although this can range from 2 to 7 years.

Habitat Requirements

After emergence, juvenile steelhead use channel margins and slow water habitats. As the fish grow, they are able to use habitats with faster velocities, like pools, glides, and riffles. During winter, juvenile fish occupy a variety of habitats and are often found associated with instream structure such as accumulations of large wood and large substrate bed elements.

Adult steelhead trout require holding and resting sites during their upstream migration (Spence et al. 1996). Summer steelhead arrive at spawning sites months before spawning or hold in mainstem rivers for weeks to months before moving into spawning tributaries (Bjornn and Reiser 1991). Large wood, instream boulders, and other structures create the necessary slow water and pool habitat needed for resting and cover during migration (Spence et al. 1996). The use of coldwater pools for resting conserves energy needed for subsequent spawning by lowering the metabolic expenditures of the fish (Spence et al. 1996). Energy conservation can be especially important for summer steelhead, because

they enter the river up to 10 months prior to the spawning season. Unlike salmon, steelhead trout need suitable habitat for feeding during their adult freshwater phase. Preferred feeding areas are slow velocity water adjacent to fast water. These areas carry food to the fish with little need for energy expenditure (Spence et al. 1996).

Spawning steelhead generally prefer higher gradient locations in the channel network than Chinook or coho salmon, with fast, relatively shallow water in mainstem or tributary streams (Everest and Chapman 1972). Preferred spawning substrate consists of predominantly large gravel with some small cobble (Caldwell and Hirschey 1989). Adult fish waiting to spawn, or in the process of spawning are vulnerable to disturbance and predation. Thus, preferred spawning habitats are those areas with appropriate substrate and suitable cover provided by undercut banks, submerged vegetation, deep water, or turbulence. According to McCullough et al. (2001), the upper range of optimal temperatures for spawning and incubation lies between 11 and 12°C (52 to 54°F).

Management and Status in Western Oregon

Regional Population Estimates

The Oregon Coast ESU of steelhead is listed as a Federal Species of Concern and a State Sensitive Species in Oregon (Table 3.5-1). Past run size and escapement estimates have been based on expansions of angler catch using assumed harvest rates (Nickelson et al. 1992). The total 5-year mean escapement for major streams in the Oregon ESU was 96,000 steelhead (82,000 winter, 14,000 summer). These totals did not include all streams in the ESU, and thus the escapement may be underestimated. Because of concerns with the escapement estimate methodology, the National Marine Fisheries Service (NMFS) conducted a trend analysis for 42 independent stocks within the Oregon Coast ESU (Busby et al. 1996). Thirty-six stocks were found to have a declining trend, and six exhibited increasing escapement over the last 15 years. Population estimates for adult escapement and 15-year trends in abundance for streams in the study area are shown in Table 3.5-2

Table 3.5-2 Adult Winter Steelhead Trout Escapement Estimates and Population Trends (1996)

River Basin (Subbasin)	Spawning Escapement (total number)	15-Year Trend in Escapement (percent)
Umpqua	11,900	- 3.4
Tenmile	400	+ 5.4
Coos	5,600	- 3.4
Coos (Millicoma River)	3,100	- 0.5

Source: Busby et al. 1996

Status in the Study Area

In 2003, ODFW initiated a coast-wide winter steelhead spawning survey (Oregon Department of Forestry 2006f). Surveys have been conducted within the study

area in the Coos and Umpqua Watersheds. Data from six sites showed counts ranging from 10 to 53 steelhead redds/mile in 2003 and 2004, respectively (Oregon Department of Fish and Wildlife unpublished data). These data were consistent with counts in other Oregon Coast rivers (Oregon Department of Forestry 2008).

Factors for Decline and Limiting Factors

Kostow (1995) reported that substrate siltation, loss of structural complexity, loss of riparian habitat from road building, and logging have affected steelhead populations in mid-Oregon coastal streams. Additional threats include channelization, water withdrawals, and development. Busby et al. (1996) reported similar threats to coastal steelhead trout populations and added concerns regarding streamflow and temperature in areas where water withdrawals have been considerable or where removal of streamside vegetation had occurred.

3.5.2.5 Coastal Cutthroat Trout

Species Ecology

Current Distribution

Coastal cutthroat trout are found along the Pacific coast of North America from the Eel River in northern California north to the Prince William Sound, Alaska, and west to the Kenai Peninsula, Alaska (Johnson et al. 1999). The eastern extent of the fish population is bounded by the Cascade Mountain Range in California, Oregon, and Washington, and by the Coast Range in British Columbia and Alaska. In Oregon, coastal cutthroat trout are distributed from the Columbia River south to the Winchuck River (Kostow 1995). Cutthroat trout are native to all drainages in the study area (Biosystems et al. 2003). Recent ODFW surveys indicate these fish remain widely distributed throughout the study area, with resident populations inhabiting locations above passage barriers.

Behavior and Reproduction

The rivers and stream in the study area support both resident and anadromous (sea-run) coastal cutthroat trout populations. Both life history forms belong to the subspecies *O. clarki clarki*. The discussion in this section focuses primarily on the anadromous form, as fresh water ecology is similar for all forms of cutthroat trout.

In Oregon, the coastal cutthroat trout spawning season is thought to occur from December through May. Stolz and Schnell (1991) report cutthroat trout spawning is initiated at 10ºC (50ºF) water temperature. Coastal cutthroat trout spawn in low gradient reaches of small tributaries or in the lower reaches of streams (Trotter 1997). Use of this spawning habitat is likely an adaptation to reduce competition from other, more competitive species such as steelhead (Stolz and Schnell 1991). The preferred spawning substrate is pea- to walnut-sized gravel in 15 to 45 cm of water, with pools nearby for cover. Spawning by individual females may extend over a period of 2 to 3 days (Trotter 1997). Females will deposit from 200 to 4,400 eggs.

Similar to other salmonids, the timing of cutthroat trout incubation and emergence are regulated by temperature. Embryos will incubate for approximately 30 days at 10ºC (50ºF), and emerge 15 to 20 days later (Stolz and Schnell 1991). Peak emergence occurs in mid-April, although emergence may extend through June (Trotter 1997). Cutthroat trout can spend many years in fresh water before migrating to the ocean (Emmett et al. 1991). However, most coastal cutthroat trout will migrate at 2 years of age (Grette and Salo 1986). Seaward migration of cutthroat trout in Oregon occurs from January through June, with the peak in April or May (Nickelson et al. 1992).

Similar to steelhead, adult coastal cutthroat trout can be repeat spawners. Cutthroat trout can live 7 or 8 years and may spawn a number of times during their life span (Trotter 1997). Some trout may spawn annually (Giger 1972); others may not (Tomasson 1978). Some trout will return to saltwater after spawning, while others will remain in fresh water for at least another year (Giger 1972, Tomasson 1978). Although true anadromy exists in cutthroat populations, this trait is not strongly developed. Generally, most coastal cutthroat trout remain close to shore or in areas of reduced salinity (Trotter 1997). These fish rarely overwinter in saltwater. Thus, some of the trout returning from the sea are migrating into natal tributaries to spawn. Other returning trout that are not intent on spawning do not have fidelity to their natal streams (Trotter 1997). Coastal cutthroat trout are usually smaller than other anadromous salmonid fishes, and rarely exceed 50 cm (20 inches) in length. Variation in the age and size of cutthroat trout at maturity is considerable.

Habitat Requirements

Coastal cutthroat trout are found in small tributaries having low to medium gradient and in small headwater streams (Johnson et al. 1999). They are generally distributed higher in the system than other salmonid fishes, although some overlap in species distributions is common (Johnson et al. 1999). The small adult size of cutthroat trout allows them to use small aquatic systems and avoid competition with large salmonids (Pearcy 1997). Resident forms of coastal cutthroat often have a migratory component, with seasonal migrations between tributaries and into and out of mainstem rivers.

Large wood and instream structure are important components of cutthroat freshwater habitats. Juvenile cutthroat trout prefer pools and other slow water habitats that have root wads and large wood for cover. They are also known to use riffles, glides, and steep gradient sections of streams (Johnson et al. 1999). Often coho salmon or steelhead fry compete with juvenile cutthroat for habitat. In the presence of the large salmonids, the cutthroat trout use non-preferred habitats (Johnson et al. 1999). In winter, coastal cutthroat trout are found in pools with complex structure or overhanging banks (Bustard and Narver 1975).

In the marine environment, most coastal cutthroat trout use estuarine or tidally influenced waters, usually in areas relatively close to their natal streams (Moyle 1976). Generally, they do not cross open water (Johnson et al. 1999). Both gravel intertidal beaches with upland vegetation, and nearshore areas containing large logs and other large woody debris, are used during the marine residency phase. Some coastal cutthroat trout leave the estuary and have been

captured as far as 66 kilometers (km) (40 miles) offshore (Loch and Miller 1988, Pearcy et al. 1990).

Management and Status in Western Oregon

Regional Population Estimates

The anadromous run of coastal cutthroat trout within the Umpqua River basin was listed under the ESA as endangered in 1996 (National Marine Fisheries Service 1996). However, the latest status review indicates that the coastal cutthroat trout population, as a whole, is not warranted for listing anywhere along the Oregon Coast ESU (65 FR 20915). In that status review, the NMFS determined that the Umpqua River cutthroat trout population was part of a larger population segment that previously was determined to be neither endangered nor threatened.

Currently, coastal cutthroat trout are considered a Federal Species of Concern and a State Sensitive Species in Oregon, with a vulnerable ranking (Table 3.5-1). Coastal cutthroat trout in the streams and rivers in the study area are part of the Oregon Coast ESU. Adult abundance data in this ESU are available for only a few streams and would not be indicative of the status of the ESU as a whole. Thus, NMFS used other available information to evaluate population trends for this ESU in 1999 (Johnson et al. 1999). An analysis of recreational harvest data indicated that the numbers of large cutthroat trout have been declining. However, trends in juvenile abundance have been stable or positive in most locations (Johnson et al. 1999).

Status in the Study Area

Available data on the abundance of coastal cutthroat trout in streams in the study area, including the mean number of fish collected and long-term data trends are summarized in Table 3.5-3. The trends in adult abundance estimates from scientific collections have been declining over the past decade. Increasing trends in the numbers of juvenile cutthroat trout and outmigrating smolts in both the Tenmile and Coos Watersheds are generally offset with decreasing adult trends in the Coos and Umpqua Watersheds (Table 3.5-3).

Factors for Decline and Limiting Factors

Habitat degradation appears to be the prime concern regarding the future status of coastal cutthroat trout populations. Habitat degradation and increases in stream temperatures have been noted in many small tributaries in the Oregon coastal region (Kostow 1995). More specifically, Johnson et al. (1999) reported that logging practices decrease instream habitat quality because of increases in water temperature and siltation, removal of large wood, changes in river basin hydrology, and improper placement of culverts. The increased culvert numbers in coastal cutthroat trout streams was noted as a serious threat, because of their effectiveness in compromising fish migrations (Johnson et al. 1999). Culverts in the headwater areas of channel networks are generally more numerous than in large streams, making habitat fragmentation a greater concern for cutthroat trout than for the other salmonid fish species.

Table 3.5-3 Coastal Cutthroat Trout Abundance Estimates and Population Trends (1999)

River Basin	Stream	Life-History Stage	Abundance 5-year Geometric Mean	10-Year Trends in Abundance (percent)
Coos Basin	Millicoma River	Juvenile	0.25 [1]	+ 11.3
		Adult	0.12 [1]	- 9.8
	S. Coos River	Juvenile	0.05 [1]	+ 10.6
		Adult	0.04 [1]	- 2.5
Tenmile Basin	Tenmile Cr.	Juvenile	98	+ 1.2
		Smolt	331	+ 2.0
	Cummins Cr.	Juvenile	71	+30.3
		Smolt	94	+30.4
Umpqua Basin	N Umpqua River Winchester Dam	Adult	18	- 6.2

Source: Johnson et al. 1999
[1] Number of fish collected during scientific research activities (fish per seine haul)

3.5.2.6 Pacific Lamprey

Species Ecology

Current Distribution

Pacific lamprey are widely distributed throughout the North Pacific from Hokkaido Island, Japan, north and east to Alaska and south through North America to the Rio Santo Domingo in Baja California (Moyle 2002). They occur throughout coastal rivers and streams in Oregon and throughout the Columbia River basin (Kostow 2002). Pacific lamprey are present in streams in the study area (Kavanagh et al. 2005).

Behavior and Reproduction

Pacific lamprey are an anadromous and parasitic species. The parasitic phase is restricted to the marine environment where lamprey can attach to large fish and marine mammals. In Oregon, adult Pacific lamprey leave the ocean to spawn in freshwater streams (Wydoski and Whitney 2003). The upstream migration generally occurs between July and October. Pacific lamprey overwinter in fresh water and spawn from February through May (Kostow 2002), when water temperatures are between 10ºC and 15ºC (50 to 59ºF) (Close et al. 1995). Both sexes construct a shallow nest in the stream gravel (Morrow 1976). Flowing water (1.6 to 3.3 feet per second [fps]) in low gradient sections is preferred for spawning (Close et al. 1995). After preparation of the nest, the female attaches herself to a rock with her oral sucker while the male attaches to the head of the female. The male and female coil together while the eggs and sperm are released. The fertilized eggs adhere to the downstream portion of the nest (Moyle 1976). The adults then cover the eggs with gravel. The process is repeated several times in the same nest site. Spawning Pacific lamprey are often observed during steelhead spawning surveys as they spawn in similar habitat

(Jackson et al. 1996, Foley pers. comm.1998). It is thought that Pacific lamprey die after spawning, but a recent ODFW report documents observation of out-migrating lamprey and evidence of repeat spawning (Kostow 2002).

Juvenile Pacific lamprey, or ammocoetes, swim up from the nest and are washed downstream where they burrow into mud or sand to feed by filtering organic matter and algae (Moyle 1976). The ammocoetes generally remain buried in the substrate for 5 or 6 years, moving from site to site (Wydoski and Whitney 2003). Such an extended freshwater residence makes them especially vulnerable to degraded stream and water quality conditions, including bedload disturbances. Larval lamprey transform to juveniles from July through October (Close et al. 1995). During this transition they become ready for a parasitic lifestyle, developing teeth, tongue, eyes, and the ability to adapt to saltwater. After metamorphosis, juvenile lamprey may remain in fresh water up to 10 months before passively migrating with the current downstream to the ocean in late winter or early spring (Wydoski and Whitney 2003). Juvenile lamprey have been captured in Tenmile Creek during their seaward migration in fall and winter, and have been collected in spring and summer on the nearby Rogue River (Kostow 2002)

After reaching the ocean, Pacific lamprey attach to, and parasitically feed upon, other fish (Moyle 1976). They may remain in saltwater for up to 3.5 years (Close et al. 1995). Pacific lamprey return to fresh water in the fall, overwinter, and spawn the subsequent spring (Close et al. 1995). They do not feed during the spawning migration. At maturity, Pacific lamprey may reach a size of 70 cm (2.3 feet) (Hart 1973).

Habitat Requirements

Lamprey migrate into rivers and streams to spawn, sometimes migrating several hundred miles to headwaters streams. Once in streams, adults hide under rocks and other structures while undergoing reproductive maturation. Spawning sites of Pacific lamprey generally occur in low gradient stream sections where gravel is deposited (Kan 1975). The nest sites are constructed at the tail areas of the pools and in riffles (Pletcher 1963, Kan 1975). Pacific lamprey spawning occurs over gravel composed of pebbles and sand (Mattson 1949, Kan 1975). Flow velocity is also an important parameter of spawning suitability. Spawning occurs in lotic (fast water) habitat with velocities ranging from 0.5 to 1.0 meter per second (1.6 to 3.3 fps) (Pletcher 1963, Kan 1975). The water depth where spawning occurs varies, ranging from 0.4 to 1.0 meters (1.3 to 3.3 feet) (Pletcher 1963, Kan 1975).

Ammocoetes move into habitats with slow currents and appropriate substrates. Close et al. 1995 noted greater densities of ammocoetes in floodplain sections of rivers with low gradients. In laboratory experiments, Pletcher (1963) determined that ammocoetes preferred, in relative order, mud, sand, and gravel. Burrowing was inhibited in water velocities greater than 0.31 meter per second (1.0 fps). Ammocoete beds in Oregon streams have been located in habitats with water velocities ranging from 0.1 to 0.5 meters per second (0.3 to1.6 fps) (Kan 1975). Laboratory experiments have also shown that ammocoetes require appropriate levels of oxygen in the water. Under conditions of low partial pressures of oxygen (7 to 10 mm mercury), and 15.5°C (60ºF), ammocoetes emerged from

their burrows and died. Ammocoetes remained buried and survived under partial pressure of oxygen between 18 and 20 mm mercury (Potter et al. 1970). Although reportedly preferring cold water (Close et al. 1995), ammocoetes have been found in waters ranging up to 25°C (77ºF) in Idaho (Mallatt 1983).

Management and Status in Western Oregon

Regional Population Estimates

Although previously petitioned for listing, Pacific lamprey have not been listed under the Federal ESA. They are considered a Federal Species of Concern and a State Sensitive Species in Oregon with a vulnerable ranking (Table 3.5-1). No information is available on lamprey abundance in Western Oregon. Long-term count data are available from two Columbia River dams and two dams on the Oregon Coast (Kostow 2002). These data sets indicate that this species may have declined in numbers from levels detected in 1970.

Status in the Study Area

Little information was available on the status of the Pacific lamprey in the study area. Starting in 2003, ODFW included counts of lamprey redds (nests) when conducting steelhead spawning surveys (Oregon Department of Forestry 2006a). In 2004, 13 stream survey reaches in the Elliott State Forest (ESF) were sampled. These surveys targeted steelhead, but crews were also trained to note lamprey adults and redds. Lamprey or lamprey redds were observed in nine of the survey reaches.

Factors for Decline and Limiting Factors

Freshwater habitat degradation is likely the most significant threat to Pacific lamprey populations. Habitat issues potentially affecting lamprey ammocoetes (larval stage) include streambed siltation, water pollution, hydrologic modifications, and development in or upstream of rearing areas (Kostow 2002). Migrating adult lamprey have difficulty negotiating fish ladders. As a result, in-channel structures, dams, and perched culverts could inhibit access to spawning habitats. In addition, when migrating downstream to the ocean, lamprey are thought to be highly susceptible to injury and mortality at fish screens because of their small size.

3.5.2.7 River Lamprey

Species Ecology

Current Distribution

River lamprey are distributed from streams north of Juneau, Alaska, south to tributaries of San Francisco Bay, California (Moyle 2002). River lamprey are thought to be present in streams and river in the study area but no data specific to river lamprey distribution were available.

Behavior and Reproduction

Like Pacific lamprey, adult river lamprey are anadromous and parasitic. Primary food items for the river lamprey include herring and young salmon (Beamish

1980). Adult river lamprey migrate into fresh water from spring (Close et al. 1995) through late winter (Beamish and Youson 1987). Spawning is presumed to take place in the spring, from February through May (Moyle 2002), although observation of adults in fresh water are rare (Kostow 2002). Female fecundity estimates range from 11,400 to 174,000 eggs per female (Kostow 2002, Moyle 2002).

The larval forms, ammocoetes, are similar to other lamprey in that they are blind and toothless, feeding on algae and microscopic organisms. River lamprey ammocoetes are morphologically similar to Pacific lamprey, making positive distinction between the two difficult (Wang 1986). River lamprey metamorphosis takes 9 to 10 months (Moyle 2002), beginning as early as July and continuing through April (Kostow 2002), when they are as small as 11.7 cm (less than 5 inches) in length (Wydoski and Whitney 2003). River lamprey become parasitic soon after this transformation and it is at this phase during their life history that they can become predatory on juvenile salmon (Beamish 1980). During the extended period of December through June, river lamprey migrate from freshwater habitat into saltwater (Beamish 1980). Unlike Pacific lamprey, adult river lamprey remain close to shore when in the marine environment. They also only remain in salt water for a brief period of 3 to 4 months (Moyle 2002) compared to years spent in saltwater by the Pacific lamprey.

The adult river lamprey is smaller than the Pacific lamprey, with a body length of only 30 cm (less than 1 foot) (Hart 1973). Beamish (1980) indicated the possibility of a resident life history form of river lamprey that exists only in lakes and feeds on resident salmonid fishes. Upstream migration of river lamprey often takes place through rapids, and over waterfalls (Beamish 1980). The life span of river lamprey from metamorphosis to death after spawning is 2 years (Beamish 1980).

Habitat Requirements

There is a paucity of information regarding the habitat requirements of river lamprey. Moyle (2002) noted that they spawn in tributary streams in gravel-dominated riffle substrates. Ammocoetes are thought to occupy silty backwaters and eddies (Moyle 2002).

Management and Status in Western Oregon

Regional Population Estimates

River lamprey is a Federal Species of Concern. No population data are available for the river lamprey in western Oregon.

Status in the Study Area

No data were available on the status of river lamprey in the study area.

Factors for Decline and Limiting Factors

Threats to habitat presented above for Pacific lamprey are similar to those for river lamprey.

3.5.2.8 Western Brook Lamprey

Species Ecology

Current Distribution

The distribution of the western brook lamprey (brook lamprey) is limited to coastal rivers in western North America from California to British Columbia (Wydoski and Whitney 2003). They are common in forested coastal rivers and streams in Oregon. Brook lamprey are thought to be present in streams in the study area, however no data specific to brook lamprey distribution were available.

Behavior and Reproduction

The brook lamprey is a resident freshwater species and, unlike the other lampreys, has only a non-parasitic form. The brook lamprey is a filter feeder and feeds upon plankton and detritus as a larvae, and does not feed after transformation into an adult. These lamprey remain relatively small in size, approximately 8 to 12 cm (5 to 8 inches total length) (Scott and Crossman 1973). These fish live to about 6 years of age and are thought to move very little within stream and river habitats.

Western brook lamprey spawn from spring into summer depending on local water temperatures. In Washington, the spawning season may extend from February to mid-July (Wydoski and Whitney 2003). Peak spawning is thought to occur at temperatures ranging from 8.9 to 11.1°C (48 to 52ºF) (Scott and Crossman 1973). Multiple lampreys often spawn in the same nest (Scott and Crossman 1973, Wydoski and Whitney 2003). Eggs hatch after about 10 days in 10 to 15°C (50 to 59ºF) (Scott and Crossman 1973, Wydoski and Whitney 2003). Ammocoete larvae typically leave their nest within a month of hatching and burrow into nearby sandy or silty sediments to rear (Scott and Crossman 1973). Ammocoete metamorphose into adults from August through November. Adult western brook lamprey die shortly after reproducing (Wydoski and Whitney 2003).

Habitat Requirements

Western brook lamprey are thought to prefer small streams (Wydoski and Whitney 2003) and tributaries and are not prevalent in mainstem rivers (Center for Biological Diversity 2006). Spawning occurs in cool streams in areas of coarse gravel and sand (Scott and Crossman 1973) and in moderate to swift water (velocities of 1.6 to greater than 3 fps) (Wydoski and Whitney 2003). Ammocoetes rear in silty sediments in backwater areas (Wydoski and Whitney 2003) or along stream margins (Scott and Crossman 2003).

Management and Status in Western Oregon

Regional Population Estimates

The western brook lamprey has no State or Federal listing status. No population data were available for this lamprey in western Oregon.

Status in the Study Area

No data were available on the status of western brook lamprey in the study area.

Factors for Decline and Limiting Factors

Freshwater habitat degradation including streambed siltation, water pollution, hydrologic modifications, and development in or upstream of rearing areas (Kostow 2002) are likely the most significant threats to this filter feeding organism.

3.5.3 Affected Environment of Aquatic Habitats in the Study Area

This section addresses the aquatic habitat conditions within the study area. Section 3.5.3.1, Watershed Condition, provides an overview of the disturbance history and channel network at a landscape level to provide context for understanding how the current freshwater habitat conditions in the study area may relate to their suitability for fish use and production. Riparian functions and current riparian conditions are described in Section 3.5.3.2, and current aquatic habitat conditions, including habitat access, water quality, hydrology, and habitat elements, are described in Section 3.5.3.3.

3.5.3.1 Watershed Condition

Disturbance History

Natural Disturbances

Habitats typically vary in quality and quantity through a range of conditions as a result of weather and climate; hydrological and geological processes; vegetation growth and succession; and large-scale habitat disturbances such as wildfire, flood, windstorm, tectonic uplift, mass wasting events, and channel debris flows. Natural disturbances have affected and created Oregon's forests for thousands of years.

Debate about the frequency and magnitude of these events is considerable. Forest disturbance frequencies vary considerably throughout Oregon's forests, based on location, climate, and ecosystem. Old-growth forest coverage in the Oregon Coast Range varied from 25 to 75 percent during the past 3,000 years with a mean of 47 percent, and never fell below 5 percent (Wimberly et al. 2000). The current coverage is estimated at less than 5 percent.

The following elements provide a summary of the disturbance history in the study area, and, where available, the disturbance history for the action area. Much of this information was drawn from the *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a).

- **Wildfires.** Large stand-replacing fires occurred in the action area in 1840 and 1868. The fires consumed trees believed to have originated in the late 1650s (Biosystems et al. 2003). While not frequent in occurrence (averaging

less than once every 100 years), large magnitude and catastrophic fires undoubtedly burned riparian vegetation, influencing various physical processes and functions of riparian zones and aquatic habitats. The fires changed vegetative succession pathways, and periods of accelerated surface erosion and stream sedimentation likely followed the fires.

A large proportion of sediment discharged from the upper basins to storage locations in low elevation, fluvial channel environments in the action area may have been delivered in pulses from fire-driven events. The fires may also have contributed to cycling nutrients, shifts in stream substrates, and to forming stream channel structure. Pulses of large wood recruitment to streams from landslides often followed fires under the natural disturbance regime (Reeves et al. 2003).

The natural frequency of large stand replacement fires in the Coast Range is typically on the order of centuries (Wimberly et al. 2000). With the advent of fire suppression in the 1900s, fire frequency today is likely much longer than historical rates.

- **Floods.** Streams in the study area experience floods generated by high rainfall storms. Floods have helped shape aquatic habitat in the study area by changing channel morphology, sediment transport and deposition, and adjacent stream vegetation. Habitat quality for fish and other aquatic organisms is affected by the interaction of these elements. Channel-forming flows are generally considered to recur, on average, every 2 to 2.5 years depending upon channel characteristics, although large catastrophic floods recur only on the order of many decades to centuries.

- **Windstorms.** The study area is in the direct path of large winter storms from the Pacific Ocean. Extreme windstorms occurred in 1880, in 1951, when 3.7 billion board feet of timber blew down (Ruth and Yoder 1953), and in 1962, when about 3 billion board feet of timber blew down throughout the Coast Range. Less severe windstorms have also blown down trees along the edges of clearcuts, including riparian buffer areas. Windstorms severe enough to cause substantial tree uprooting along clearcut edges in the Coast Range occurred in 1971, 1973, 1981, 1983, and 2002 (Oregon Climate Service 2003).

  Windstorms have shaped the study area by toppling trees, creating canopy openings, and changing vegetative succession. Aquatic habitats may experience the benefits of windstorms through a pulse of downed wood levels across the landscape and in stream channels. However, salvage operations and stream cleaning activities between the late 1800s and the early 1980s removed much of this wood from channels.

- **Landslides.** Mass-wasting events such as shallow-rapid landslides, are a natural occurrence in the study area, given the steep topography and highly dissected channel network. Landslides reaching stream channels can provide coarse and fine sediment and woody debris to channel networks. The influence of landslides on watershed functions, without the development of associated debris flows or dam-break floods, is generally localized. Management-induced increases in the natural frequency of mass-wasting

events from either road construction or timber harvesting can accelerate sediment inputs and alter sediment supply rates compared to natural frequencies, as described in the following section.

Landslides, depending upon the level of sediment deposition, can beneficially or adversely influence aquatic habitats. Fish spawning habitat in particular is dependent upon well-sorted gravel deposits nearly free of fine sediment. Thick layers of coarse sediment or high levels of fine sediment are not desirable. Channel streambed structure, such as large boulder clusters or large wood, help store and stabilize the sediment bedload. Without this channel structure, the desirable sediment size fractions for spawning and rearing habitat mobilize during peak floods and are carried downstream. As discussed in the large wood section below, channel structure is generally lacking in streams in the study area and desirable sediment is scare in many channels (Kavanagh et al. 2005).

Debris flows are initiated by small landslides that become channelized and are sustained by water and debris mass inertia. These flows may accumulate additional mass and volume as they travel downslope, and are capable of abrasive scour into bedrock. They are also capable of dislodging and transporting large boulders and wood down steep channel gradients. Debris flow return intervals in the study area are linked to return intervals of large rainstorms. The typical rainstorm capable of triggering landslides occurs on the order of every 10 to 50 years.

Floods and debris flows in the study area have a direct influence on channel structures, riparian vegetation, and aquatic habitats. This natural process has redistributed both soil and wood downslope from the hill slopes to the channel systems. Similar to what happens after wildfires, a large proportion of the sediment discharged from the upper basins to storage locations in low elevation, fluvial channel environments in the study area, may have been delivered in pulses from debris flows.

Human-Caused Disturbances

Aquatic habitats in the study area have been altered over the last 150 years as a result of land management activities associated with timber management. Changes to hydrologic regimes, sediment supply and transport characteristics, floodplains, and stream channels have occurred, affecting aquatic habitats. An overview of the effects of past land uses on current aquatic habitat conditions in the study area is provided below. A more complete description is provided in Chapter 2, Alternatives, Section 3.1, Forest Conditions, Section 3.2, Soils and Slope Stability, and Section 4.1, Forest Conditions, of this Environmental Impact Statement (EIS), and in the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003).

- **Timber Harvest.** Through the 1960s, it was common practice in the region to harvest trees along streams and to yard through streams. Timber harvest was also conducted on unstable slopes and roads were often built without adequate drainage systems. Removing large wood from streams to “clean stream channels” was a normal timber harvest practice in the mid-1900s. In some limited instances, heavy equipment was operated in streams, and splash

dams were common in channels throughout the region.

Such regional activities affected many riparian areas and streams, resulting in soil erosion, mass wasting, loss of large woody debris from channels, and the loss of large trees within riparian areas. These activities reduced in-channel loading of large wood and the potential for large wood recruitment to channels for many decades. As a result, streams and rivers in the action area are lacking large wood and are not currently functioning properly for salmonid fish species (See Habitat Elements-Large Wood below). The historical practice of splash damming, stream cleaning efforts, and the legacy of harvests in riparian zones are discussed below.

- **Splash Damming.** Historical forest practices in the region included the use of splash dams to store large quantities of wood and water. The timber was inexpensively transported downstream by means of sluicing with a sudden dam breach. However, compared to many other areas on the south-central Oregon Coast, the action area had relatively little historical splash damming activity (Biosystems et al. 2003).

  Splash dams were discontinued in 1956, prior to the beginning of extensive timber harvests in the action area. Although documentation is sparse, only four splash dam sites in or adjacent to the action area have been identified. Although they were generally located outside the action area, splash dams in headwater regions may have had limited impact on some downstream conditions within the study area.

- **Stream Cleaning.** Early logging operations in the region (e.g., splash dams, slash disposal in streams, log drives) often resulted in substantial logjams. In some cases, these jams could be a mile or more in length and may have impeded anadromous fish passage. As a result of this debris accumulation in streams, in the 1930s the Oregon Game Commission began to require loggers to prevent woody debris from entering streams.

  Stream cleaning (removing existing debris from the stream channel) in the action area began in 1956 and probably extended into the mid-1980s. Given that the contribution of large wood in streams can last for many decades or a century prior to depletion, decay, or downstream transport, the loss of large wood as a result of these efforts continues to have an effect on fish habitat in the study area.

- **Riparian Harvest and Management Activities.** Riparian buffer strips were left in some timber harvest areas beginning in the late 1960s. Buffer widths have increased several times since then with changes in the Oregon Forest Practices Act (FPA) and forest management planning. The legacy of prior forest practices, including reduced large wood recruitment and increased sediment from riparian roads and management-induced landslides (Section 3.2, Soils and Slope Stability), continues to affect current aquatic habitats and will for many decades.

Current riparian protection measures in the action area include 100 foot no-harvest buffers on perennial fish-bearing streams and 50-foot no-harvest buffers on perennial, non-fish-bearing streams (seasonal, non-fish-bearing streams are currently not afforded riparian buffers). Riparian harvest and other timber management activities, including harvest rate, volume and rotation age by watershed, and the resulting stand structures, are reported in Section 3.1, Forest Conditions.

Streamside vegetation in the action area is currently composed of a patchy array of confer, mixed conifer-hardwood, and hardwood-dominant vegetation classes, reflecting the history of harvesting, road building, debris flows, and natural disturbances in the study area (Biosystems et al. 2003). The age-class distribution of conifer riparian stands is equally patchy throughout the action area, with stands 100 years old or older as the dominant age class. Current riparian stand characteristics also dictate large wood recruitment potential, as described below in Section 3.5.3.2, Riparian Functions and Current Riparian Condition.

- **Roads.** Roads can increase erosion and sediment delivery to stream channels, and can contribute to increased peak flows in streams (Beschta 1978). Roads within riparian zones have the potential to reduce shade and disrupt future sources of large wood recruitment to streams. Road crossing failures can be a major source of sediment to streams (Lee et al. 1997). Plugged culverts and fill slope failures can lead to catastrophic increases in stream channel sediment, especially on old abandoned or unmaintained roads (Weaver et al. 1987). Road failures can also increase the frequency of debris flows compared to natural conditions. These effects can influence aquatic habitats by increasing fine sediment levels, reducing pool volumes, increasing channel width, and increasing seasonal temperature extremes. Culverts can also be migration barriers to fish (Furniss et al. 1991).

  Road building in the action area began with the first haul roads in 1935. The first large increase in road building occurred in concert with timber sales beginning in 1955. During the 7-year period between the start of management in the action area until the Columbus Day windstorm, about 143 miles of road were built. The 1962 Columbus Day windstorm accelerated the road building program to accomplish timber salvage harvests. An estimated 150 miles of new roads were built to access the sale areas. These roads generally did not meet normal engineering standards of the day. Construction involved an abundance of sidecast soil, no surfacing or ditches, and a minimal 14-foot width. In 1966, the Oregon Department of Forestry (ODF) began upgrading the roads in the action area to include surfacing, ditches, and upgraded bridges (i.e., converting bridges from log stringers to concrete). By 1968, an all-weather road system in the action area was completed.

  Currently, the road building program includes extending spur roads to access individual timber harvest sites, upgrading roads and culverts to improve their performance, and disconnecting water and sediment delivery from roads to

streams. The legacy influence of roads on aquatic habitats was likely considerable prior to the 1970s. Due to the use of science-based best management practices (BMPs) for road maintenance, road improvements, and road abandonment the adverse influence of road construction is on a decreasing trend. The existing road system has been described in Section 3.2, Soils and Slope Stability. A more detailed description of the drainage network, including the road system in the action area, is provided in Section 3.5.3.3, Aquatic Habitat.

- **Other Forest Management and Policy Changes.** A land use zoning and classification system began in the action area in 1970. Lands were zoned as 1) scenic corridors (State Highway 38, Loon Lake, Mill Creek County Road), 2) limited production (above domestic water supplies), and 3) regular production (Oregon Department of Forestry 2006a). Stream classification mapping and testing also began in 1970. By 1984, high risk areas with the potential for landslides were identified in timber sale areas.

- **Agriculture and Rural Development.** Early settlers generally sought farmlands in the lower river valleys on the periphery of the action area. These farms were established fairly early in the settlement process, as immigrant migration spread along river corridors. Early farms and settlements were also located in uplands in places with flat terrain and plentiful water, such along Upper Glenn Creek above Golden Falls and in the Ash Valley area south of Loon Lake along Lake Creek.

  Only a few early settlements were established within the interior of the action area. The Vaughn Ranch, located along the West Fork Millicoma River, was an early settlement with a farm and sawmill. The Elkhorn Ranch, which was originally homesteaded in 1910 and subsequently purchased by ODF, was located further upstream on the West Fork Millicoma River. The Cornell Place, located on Palouse Creek, was also purchased and added to the action area after the 1982 flood deposited large amounts of debris onto its fields from uplands in State ownership. Other properties on Palouse Creek were purchased in 1983 for the same reason.

  These settlements usually had an early influence on channel habitat conditions by reducing the amount of riparian vegetation adjacent to streams and by using the creek water as a source of domestic and farmland water supply as well as for wastewater disposal. As a consequence, hydrologic changes and water quality degradation may have influenced habitat conditions locally. However, given the small number and size of the early settlements in the action area, most of these adverse effects were localized and relatively inconsequential in the context of the stream network as a whole.

Channel Network

The study area for addressing fish habitat conditions encompasses the streams and rivers in the vicinity and downstream of the action area associated with the Coos, Umpqua, and Tenmile Watersheds. The extent of the watersheds and the location of the action area within each are shown in Figure 3.3-1. The action

area comprises about 40 percent of the Tenmile Lakes Watershed and less than 25 percent of the other two watersheds. Figure 3.3-2 shows the boundaries of the 13 management basins in the action area, each of which are subwatersheds or portions of subwatersheds. The channel network (Figure 3.3-3) has been described in detail in Section 3.3.2.2, Streams, including information on flow, gradient, and channel confinement.

The following section provides a regional overview of stream habitat inventories throughout the channel network in the study area.

ODFW Stream Habitat Inventories

In collaboration with ODF in 1993, ODFW began inventorying stream habitats in the study area in accordance with the ODFW AIP methods (Moore et al. 2002). Habitat inventories have been completed for most of the extent of anadromous salmonid fish distributions in the study area. Instream habitat characteristics collected during both summer and winter periods include pool size and depth, active channel width, amount of wood in the channel, streamside vegetation, and valley width, among other habitat attributes. Summer habitat surveys provided information during low flow conditions, while winter habitat surveys characterized stream habitat during higher flows. Pools and off-channel habitat features offer fish species an escape from high stream velocities in winter and are important for juvenile survival when stream temperatures and fish swimming abilities subsequently decline. As such, the winter habitat surveys provided important information about conditions that could limit salmonid fish populations, especially resident or anadromous species with overwintering juvenile life histories.

An Elliott State Forest Watershed Analysis Team summarized ODFW survey information through 2002 for the stream reaches inventoried in the study area. The following information was largely derived from the *Elliott State Forest Watershed Analysis* performed by Biosystems et al. (2003) and from an update of the AIP surveys by Kavanagh et al. (2005).

Fish use about 161 miles of streams in the action area. More miles of fish-bearing streams probably exist, but field surveys have been incomplete. The watershed analysts used fish-bearing stream miles identified in the ODF database but concluded many streams in the study area, not yet identified as fish-bearing streams, likely support resident cutthroat trout (Biosystems et al. 2003). They also noted that most stream segments supporting anadromous salmon and steelhead have been properly identified in the database.

The density of fish-bearing streams averages 1.4 mile per square mile for the Coos Watershed and only 0.8 mile per square mile for the Umpqua Watershed (Biosystems et al. 2003). The reported density of fish-bearing streams in the Umpqua Watershed may be somewhat low due to the fact that ODFW prioritizes their AIP habitat surveys in accordance with anadromous fish presence and potential future timber harvest activity. As such, the general survey effort in the Umpqua Watershed has been low because of a lack of anadromous fish upstream of Loon Lake and the low level of timber harvest in tributaries upstream of Loon Lake in the past two decades.

The aquatic habitat inventories cover more than 120 stream miles in the study area. Most of the inventoried stream length is in the Coos Watershed, which has the most total miles of streams compared to the other two watersheds. The inventories encompass a range of stream channel gradients, from low gradient areas to steep headwater streams near the upper end of fish distribution (Table 3.5-4). As of 2002, aquatic habitat inventories have been completed on 64 percent of the known fish-bearing streams throughout the action area. The Coos Watershed has the highest percentage of inventoried fish-bearing streams (72 percent), followed by the Tenmile (62 percent), and Umpqua (42 percent) Watersheds. More than 60 percent of inventoried stream miles are low gradient channels (less than 4 percent channel slope), which provide good information on the preferred habitats for most of the salmonid fish species.

Table 3.5-4 Miles of Streams and Percent of Total by Watershed and Gradient Class

	Gradient Class											
	Less than 2%		2- 4%		4- 8%		8-12%		More than 12%		Total	
Watershed	Miles	(%)	Miles	(%)	Miles	(%)	Miles	(%)	Miles	(%)	Miles	(%)
Coos	39.8	51	22.0	28	10.7	14	5.0	6	0.8	1	78.3	100
Umpqua	3.7	20	8.6	46	3.7	20	1.4	8	1.3	7	18.7	100
Tenmile	7.1	30	4.1	17	6.6	28	5.0	21	1.0	4	23.8	100

Source: Biosystems et al. 2003
% = percent

Stream channel gradient is a key factor in determining the extent of fish distribution and use by species and life stage (migration, spawning, and rearing). As described in Section 3.5.2, Affected Environment for the Fish Species of Interest, the range of cutthroat trout generally extends to steep gradient streams (i.e., up to 12 percent gradient). This species often sustains isolated populations upstream of waterfalls in perennial flowing streams. Cutthroat trout will usually spawn in channels up to 8 to 10 percent gradient. Steelhead trout will spawn in channels up to 6 percent gradient. Coho salmon prefer spawning in channels of less than 4 percent gradient (Biosystems et al. 2003).

Salmonid fish use of streams can be seasonal. Cutthroat trout, in particular, are known to occupy the smallest headwater streams when high flows predominate in the early spring. They migrate downstream as flows diminish over the summer months. Cutthroat and steelhead trout commonly spawn in streams during the spring and juveniles emerge prior to a lack of stream flow in summer. Lamprey have been observed in the study area using most of the same stream habitats used by anadromous salmonid fishes.

Overall, high quality stream habitats are present in the study area, particularly in the Tenmile Watershed and selected streams in the Coos Watershed, such as Palouse Creek. The watershed analysis team defined high quality habitat as low gradient stream channels bordered by mature (greater than 99 years old) coniferous riparian forests with in-channel wood loadings that exceeded 500

cubic feet per 100 feet of stream. However, most stream reaches in the study area have limited volumes of large wood in stream channels, lack complex pool habitats, and are deficient in gravels in many riffle habitats (Kavanagh et al. 2005). High quality habitats and habitats with high intrinsic potential are described below in the subsection Off-Channel Habitats/Refugia: Watershed-scale.

Oregon Department of Forestry Coos District Geographic Information System Data

Many evaluations of the stream channel network have occurred over time. Most recently the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003); the *ODFW Aquatic Inventories Program* (AIP as summarized in Kavanagh et al. 2005); and ODF Coos District have inventoried the fish-bearing streams in the action area. Stream mile distances generated from these sources are similar in magnitude but not identical. The ODF Coos District GIS database related to stream miles of fish-bearing and non-fish-bearing waters in the action area (Table 3.5-5) represents the most recent and accurate data available. In keeping with the best commercially available information, the Coos District GIS database has been used for the riparian structure analysis comparison in Chapter 4, Environmental Consequences.

Table 3.5-5 Stream Length (Miles) of Various Channel Sizes and Fish Uses in Action Area Watersheds

	Channel Size							Stream Miles		
	Small			Medium		Large		Total		
Watershed	Type F	Type Np	Type Ni	Type F	Type N	Type F	Type N	Type F	Type N	Total
Umpqua	15	91	62	13	9	15	0	43	162	205
Tenmile	12	84	47	13	1	9	0	34	133	167
Coos	38	173	113	31	2	42	0	111	287	398
Forest wide	65	348	222	57	12	66	0	188	582	770
Percent	8	45	29	7	2	9	0	24	76	100

Source: Oregon Department of Forestry 2008, Dent pers. comm. 2007
Type F = Fish-bearing stream
Type N = Non-fish-bearing stream
Type Np = Perennial non-fish-bearing stream
Type Ni = Intermittent non-fish-bearing stream
Refer to Table 2-5 for the definition / characteristics of small, medium and large streams

3.5.3.2 Riparian Functions and Current Riparian Condition

Riparian habitat is the area adjacent to streams, rivers, lakes, and wetlands and includes floodplains and stream-associated seeps and springs. A wide variety of hydrologic, geomorphic, and biotic processes determine the character of riparian areas. Portions of riparian areas are disturbed from periodic inundation, and water is present at or near the soil surface during all or part of the year. These unique characteristics result in variable soil moisture conditions and distinct

plant, animal, and invertebrate communities that are often more diverse than surrounding upland areas.

Riparian areas have distinct resource values and characteristics that make them important zones of interaction between terrestrial and aquatic ecosystems (Knutson and Naef 1997). These areas are especially dynamic segments of a watershed. Disturbance processes in upland areas (e.g., fire, mass wasting, and windthrow), as well as disturbance processes unique to stream systems (e.g., bank erosion, peak flows, floods) can affect riparian areas (Benda et al. 1998, Montgomery and Wohl 2004, Spence et al. 1996, Reeves et al. 1995).

Riparian vegetation is important for maintaining streambank and floodplain integrity. Vegetation slows water velocity on the floodplain, and plant roots inhibit erosion along streambanks, reducing sediment input to streams. Riparian vegetation also helps to provide shade, leaf and needle litter important to aquatic food chains and nutrient cycling, and large wood to stream channels, which is an important component of instream fish habitat. Vegetation typical of riparian areas is described in Section 3.4, Vegetation.

Riparian ecosystems are important for a variety of plant and wildlife species. They provide the primary habitat for many of the State's amphibians and provide important reproductive and foraging areas and corridors for species dispersal and movement for a wide variety of other wildlife (Section 3.6, Wildlife and Their Habitats).

The following section provides a description of riparian zone processes and the riparian function for providing aquatic habitats. It also summarizes the current riparian condition in the study area. Much of the information for factors influencing habitat conditions in this discussion comes from other sections of the EIS (Section 3.1, Forest Conditions, Section 3.2, Soils and Slope Stability, and Section 3.3, Streams, Water Quality and Water Quantity). The information is summarized in this section to identify key relationships to fish habitat.

Riparian Functions

The functions of riparian areas have been described by many authors (Karr and Schlosser 1977, Meehan et al. 1977, Raedeke 1988, Bilby 1988, Murphy and Meehan 1991, Beschta 1991, Castelle et al. 1992). The most important recognized functions of stream riparian areas include recruitment of large wood to stream channels, stream shade, leaf litter, needle litter and nutrient production, streambank stability, groundwater recharge, stream energy dissipation, and the routing and trapping of sediment. Streambank stability and sediment filtration functions of riparian zones are described in Section 3.2, Soils and Slope Stability. Channel and hydrology-related functions associated with riparian zones are described in Section 3.3, Streams, Water Quantity and Water Quality. The other riparian functions important for fish habitat (large wood recruitment, stream shade, and nutrient production) are briefly summarized below.

Large Wood Recruitment

Riparian areas are an important source of large wood that is recruited to (enters) the stream channel. Large wood includes entire trees, root wads, and large branches typically greater than 4 inches in diameter and longer than 6 feet. Studies have shown large wood in channels is an important component of fish habitat (Bryant 1983, Bisson et al. 1987, Naiman et al. 1992). Trees that fall into streams are critical for sediment retention (Keller and Swanson 1979, Sedell et al. 1988), gradient modification (Bilby and Ward 1989), structural diversity (Ralph et al. 1994), nutrient production (Cummins 1974), and protective cover for fish from predators. Large wood also creates storage sites for sediment in all sizes of streams. In small headwater streams, wood controls sediment movement downstream. In large streams, accumulation of coarse sediment behind large wood debris often provides spawning gravels (Bilby and Bisson 1998, Montgomery et al. 2003).

Large wood recruitment originates from a variety of processes including tree mortality, windthrow, undercutting of streambanks, debris avalanches, deep-seated mass soil movements, shallow-rapid landslides and redistribution of wood from upstream channels (Swanson and Lienkaemper 1978). Headwater streams can provide wood downstream to large channels (Potts and Anderson 1990, Pritchard et al. 1998, Coho and Burges 1991). Wood can also be transported from upstream during high flows or debris flows (Swanson and Lienkaemper 1978). Much of the wood that falls into small streams is too large to float, so high flows rarely redistribute large volumes of wood from small streams (Swanson and Lienkaemper 1978). Although less frequent than high flows, debris flows can introduce large amounts of wood to the channel network. Wood can be transported in this fashion the entire runout distance downstream of the debris flow (Lamberti et al. 1991). Research indicates that 10 to 72 percent of large wood in stream channels is recruited from slope failures and debris flows (Reeves et al. 2003, McDade et al. 1990, Benda and Sias 1998, Benda et al. 2003, May and Gresswell 2003). The proportion of large wood recruitment supplied by mass-wasting and debris flows is highly variable and in part dependent on stream size and location in the channel network.

Debris flows originating in managed forests occur at a rate much higher than that of unmanaged forests (Swanston and Swanson 1976, Morrison 1975). The majority of debris flows and dam-break floods are initiated in small, headwater streams (Coho and Burges 1991). Debris flows can propagate many miles downstream to large channels, where they typically terminate along low gradient depositional reaches on valley floors. Debris flows can cause substantial damage to riparian vegetation and aquatic habitat during and after the event (Coho and Burges 1991). Wood and coarse sediment deposits from debris flows originating in or passing through forested areas can also offer diversified habitats at tributary junctions by supplying large wood pieces that forms pools, cover, channel complexity, and spawning gravel (Benda et al. 2003). Due to unique and complex habitat conditions, tributary junctions offer key areas to aquatic species on a watershed scale.

The potential size distribution of large wood pieces in riparian areas is also an important factor when considering potential stream functions. Beechie and Sibley (1997) define “functional wood” as a piece large enough to form pools in

the adjacent channel size. As a subset of "functional wood," Fox (2001) considers "key piece size wood," to be a fundamental measurement of important wood recruitment sizes. Key pieces are large and effective in trapping other small, more mobile pieces of large wood (i.e., forming logjams). Key wood pieces are also more likely to have long-term stability (Bilby and Ward 1989, Fox 2001, Hyatt and Naiman 2001, Collins et al. 2002).

Minimum size of functional in-stream wood increases with channel width (Bilby and Ward 1989, Bilby and Wasserman 1989, Beechie and Sibley 1997, Beechie 1998, Washington Forest Practices Board 1997). For example, mean functional wood diameter increased from a minimum size of 4 inches in 5-foot-wide channels, to 22 inches in channels 44 feet wide (Bilby and Ward 1989, Beechie and Sibley 1997).

Oregon established guidelines for diameter and lengths of logs for wood placement projects (Oregon Department of Forestry and Oregon Department of Fish and Wildlife1995). The minimum diameter required for functional wood placement pieces depends on the channel width, as summarized in Table 3.5-6.

Table 3.5-6 Oregon Minimum Diameter Requirements for Large Wood Placement Projects

Bankfull Width (feet)	Minimum Diameter (inches)
0 to 10	10
10 to 20	16
20 to 30	18
Over 30	22

Source: Oregon Department of Forestry and Oregon Department of Fish Wildlife 1995

The debris piece length recommended in the Oregon guidelines is at least twice the length of the stream's bankfull width, unless a rootwad is attached, in which case the wood piece (including the rootwad) should be 1.5 times the bankfull width.

Key piece size is also related to stream size. Recommended key piece sizes generally run about 15 percent larger in diameter than functional piece size for a 40-foot-wide stream (Washington Forest Practices Board 1997, Bilby and Ward 1989).

Riparian zones are the primary source of wood to channels, where they can provide appropriate pieces, volumes, and sizes to serve as both functional and key piece-sized wood (Murphy 1995). A discussion of large wood recruitment potential in the study area is provided in the following subsection titled Current Condition of Riparian Areas. Additional information related to large wood in the study areas is provided in Section 3.5.3.3, Aquatic Habitat – Large Wood.

Stream Shade

There are several factors that make up the heat balance of water, including air temperature, solar radiation, evaporation, convection, conduction, and advection

(Brown 1980, Adams and Sullivan 1990). Other site-specific factors such as latitude, regional climate, weather, elevation, stream size, groundwater inflow, streambed composition, and distance from watershed divides all can affect stream temperature (Beschta et al. 1987, Sullivan et al. 1990, Dent and Walsh 1997, Biosystems et al. 2003). Instream water temperature is also influenced by the temperature of water entering the stream (from rain, snowmelt, groundwater, or runoff from lakes, wetlands, or ponded waters), the aspect and topographic shading of the streambed, the size (width and depth) of the stream, and the amount of vegetative shade along the streamside. During the summer when stream temperatures are the highest, the combination of warmer air temperatures, increased direct solar radiation and decreased stream flows are the major factors affecting stream temperature (Beschta et al. 1987, Sullivan et al. 1990, Caldwell et al. 1991, Poole and Berman 2001, Biosystems et al. 2003). Section 3.3.2.4, Water Quality, summarizes water temperature conditions in the study area.

Of the factors influencing water temperature, forest management can have the greatest effect on direct solar radiation by reducing shade. Riparian canopy closure over stream channels provides a blocking element for both incoming and outgoing solar radiation (Adams and Sullivan 1990, Sullivan et al. 1990, Washington Forest Practices Board 1997). As a result, the level of canopy closure can have a large influence on moderating stream temperature maxima and daily fluctuations at certain elevations in the study area. Shade alone does not physically cool streams. However, shade prevents further heating of streams and maintains the cool water temperatures from groundwater inputs or tributaries (Poole and Berman 2001). Shade from riparian vegetation has been shown to minimize or eliminate increases in stream temperature associated with timber harvest (Brazier and Brown 1973, Lynch et al. 1985). Other factors that affect shading include local topography, stream size and aspect, stand age, composition, and stand density.

The term ‘shade’ has been used in several different contexts in the scientific literature. This EIS uses the term “effective shade,” defined as the percent reduction of potential daily solar radiation load delivered to the water surface (Oregon Department of Environmental Quality 2006d). Shade is often used as a tool to manage water temperature, since there are fewer external factors that influence shade levels than there are external influences on water temperature. Shade is easily understood and measured, and land use management activities can directly influence near-stream vegetation and shade.

Nutrient Production

Nitrogen and phosphorus are two nutrients that stimulate aquatic plant growth. The balance between available nitrogen and phosphorus in solution determines the primary productivity of water bodies. Forested mountain streams in the Oregon Coast Range are generally very low in both nitrogen and phosphorus and primary productivity is often naturally low.

Forest streams commonly have very low background concentrations of nitrogen compounds, often less than 0.010 milligrams per liter (mg/L) (MacDonald et al. 1991). Nitrogen levels vary considerably during the year with annual maximums in autumn during leaf fall. The presence of nitrogen-fixing plants in the riparian

forest such as red alder can increase levels of dissolved nitrate (NO_3) in streams (Binkley and Brown 1993, Compton et al. 2003).

Conversely, phosphorus is very tightly conserved within the forest ecosystem (Salminen and Beschta 1991). Substantial amounts of phosphorus are adsorbed onto fine-grained sediments and are, for the most part, unavailable for biological uptake. Salminen and Beschta (1991) report background concentrations of total phosphorus for streams draining forested watershed in the Northwest ranged between 0.012 and 0.090 and averaged 0.034 mg/L. Only a third of the total was found dissolved in solution as orthophosphate and available for biological uses. Based on the typical range of nutrient concentrations observed in Pacific Northwest streams, MacDonald et al. (1991) state most streams are both low in primary productivity and nitrogen limited.

In streams, vegetative organic materials either originate within the stream, such as algae production, or from sources outside the stream, such as leaf and needle litter and organic debris. Stream benthic communities (e.g., aquatic insects) are highly dependent upon algal production and detritus (i.e., organic debris) deposits. The abundance and diversity of aquatic species can vary substantially depending upon the total and relative amounts of algae and leaf litter inputs to a stream (Independent Multidisciplinary Science Team 1999). For example, grazing insects are more commonly found in stream reaches with algae production, while shredding insects are more commonly found in areas rich in leaf and needle input (Independent Multidisciplinary Science Team 1999). Detritus is the primary source of organic productivity in heavily shaded, small- and medium-sized streams (Gregory et al. 1991, Richardson 1992). In contrast large, wide streams with high levels of direct sunlight, or small streams with open riparian canopy, have more algal production. As riparian stands age, the amount of litter increases (Independent Multidisciplinary Science Team 1999). The importance of detritus input varies among streams, but it can provide up to 60 percent of the total energy input into stream communities (Richardson 1992). Small streams are important sources of nutrients and contribute substantially to the productivity of large streams in downstream reaches of a watershed (Independent Multidisciplinary Science Team 1999).

Current Conditions of Riparian Areas

Riparian buffer strips were left along fish-bearing and some non-fish-bearing streams in timber harvest area beginning in the late 1960s. Buffer widths have increased several times since, with changes in the FPA and with forest management planning strategies. The legacy of pre-1970s forest practices continues to affect current aquatic habitats, and will continue to do so for many decades. The pre-1970 practices have influenced habitat conditions present today and, given the length of time required to grow large trees, will likely continue to affect habitat conditions in the future, regardless of current riparian management practices.

Riparian Stand Characteristics

The *Elliott State Forest Watershed Analysis* (Biosystems et al 2003) characterized current streamside forests along all fish-bearing streams in the

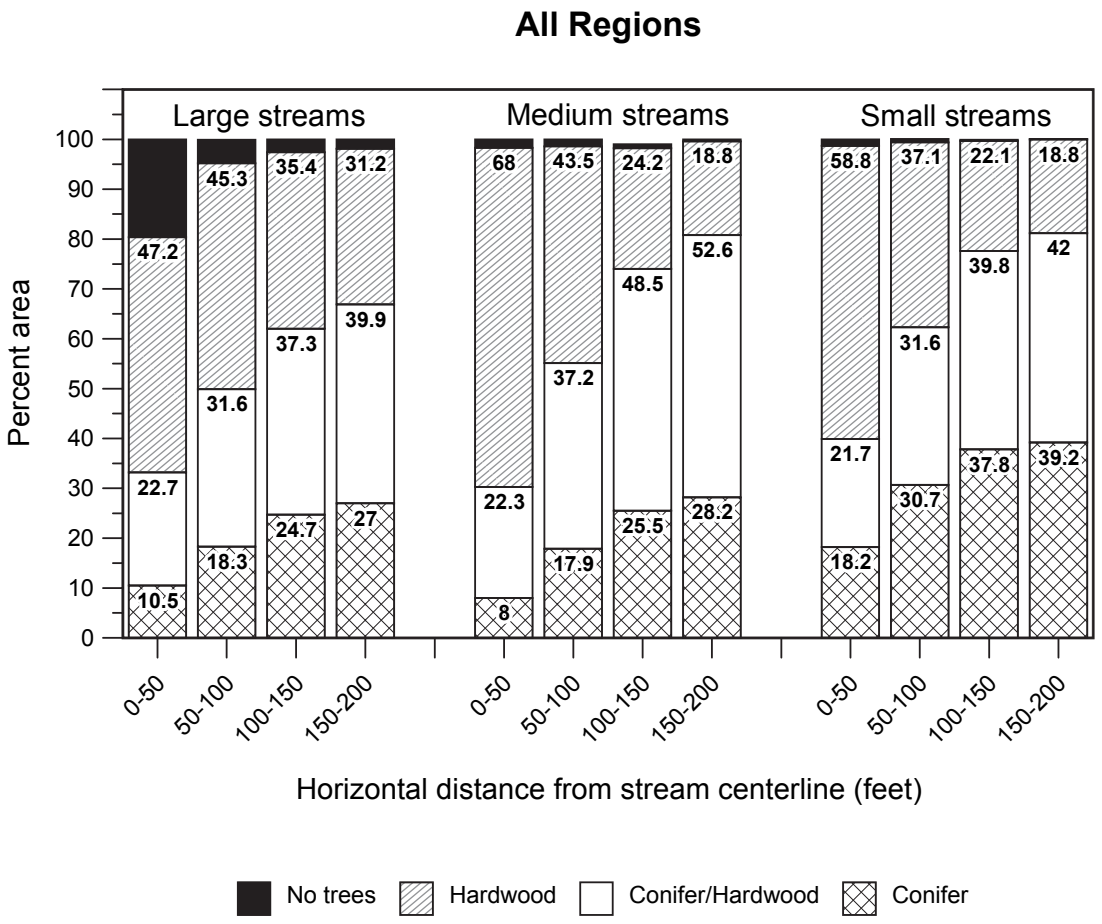
action area. The results indicate that streamside vegetation is a patchy array of conifer, mixed conifer-hardwood, and hardwood-dominant vegetation classes, reflecting the history of harvesting, road building, debris flows, and natural disturbances in the study area. In addition, young hardwood trees along some of the large streams, especially in the Tenmile Watershed, are a result of recolonization of streamside areas that were once cleared for pasture.

Under natural conditions, conifer populations along streams in the action area tend to be sparse, probably because of moist soil conditions and competition from riparian tree and shrub species that thrive in the presence of unlimited water supply during the growing season. Hardwoods (deciduous trees, such as red alder) are the most dominant stand type found within 100 feet of the stream for all stream size classes (Figure 3.5-9). Hardwood dominance decreases with increasing distance from the streams. Nevertheless, hardwoods occupy one-third of the land within 150 to 200 feet of large streams. Mixed conifer-hardwood stands occupy the majority of areas at distances of 100 to 200 feet from the stream. Conifer-dominated stands occupy a minority of the streamside areas.

Hardwood dominance along most streams is natural. Most riparian areas without streamside roads or a history of debris flows usually have a band of hardwoods growing close to the stream. Among managed stands, hardwood domination of streamside stands is greatest where roads parallel streams, or where streamside buffers are retained without further silvicultural management (Biosystems et al. 2003).

Hardwoods are an important component of riparian structure and hardwoods may have historically dominated significant miles of riparian areas in the Oregon Coast Range. This condition occurs because hardwoods have a competitive advantage over conifers in the highly disturbed zones next to streams and along debris flow pathways. Current research has documented differences in nutrient cycling and nitrogen levels from streams that are alder-dominated in the Oregon Coast Range (Compton et al. 2003) and from small alder-dominated streams in Alaska (Deal and Wipfli 2004). Nitrate and dissolved organic nitrogen generally increase as the percent of red alder increases (Compton et al. 2003). Researchers suggest red alder-dominated stands increase habitat quality for wildlife, stream productivity, and nutrients for fish, amphibians, songbirds, and invertebrates.

The age-class distribution of conifer riparian stands is patchy throughout the action area, corresponding to past management activities. Conifer stands 100 years old or older are prevalent, except within 50 feet of medium and small streams where hardwood species dominate (Figure 3.5-10). The area with young conifer trees, less than 13 years old, is very small. The lack of young trees near stream channels reflects the recent practice of retaining dense buffers along fish-bearing streams when timber is harvested in the uplands, such that conifer regeneration is not feasible (Biosystems et al. 2003). The abundance of riparian conifers in managed stands is highest next to recent clearcut harvest units, since the penetration of sunlight allows a degree of conifer regeneration and the development of a second cohort. Conifer trees are also present in harvest units where aggressive site preparation and conifer planting followed harvest (Biosystems et al. 2003).

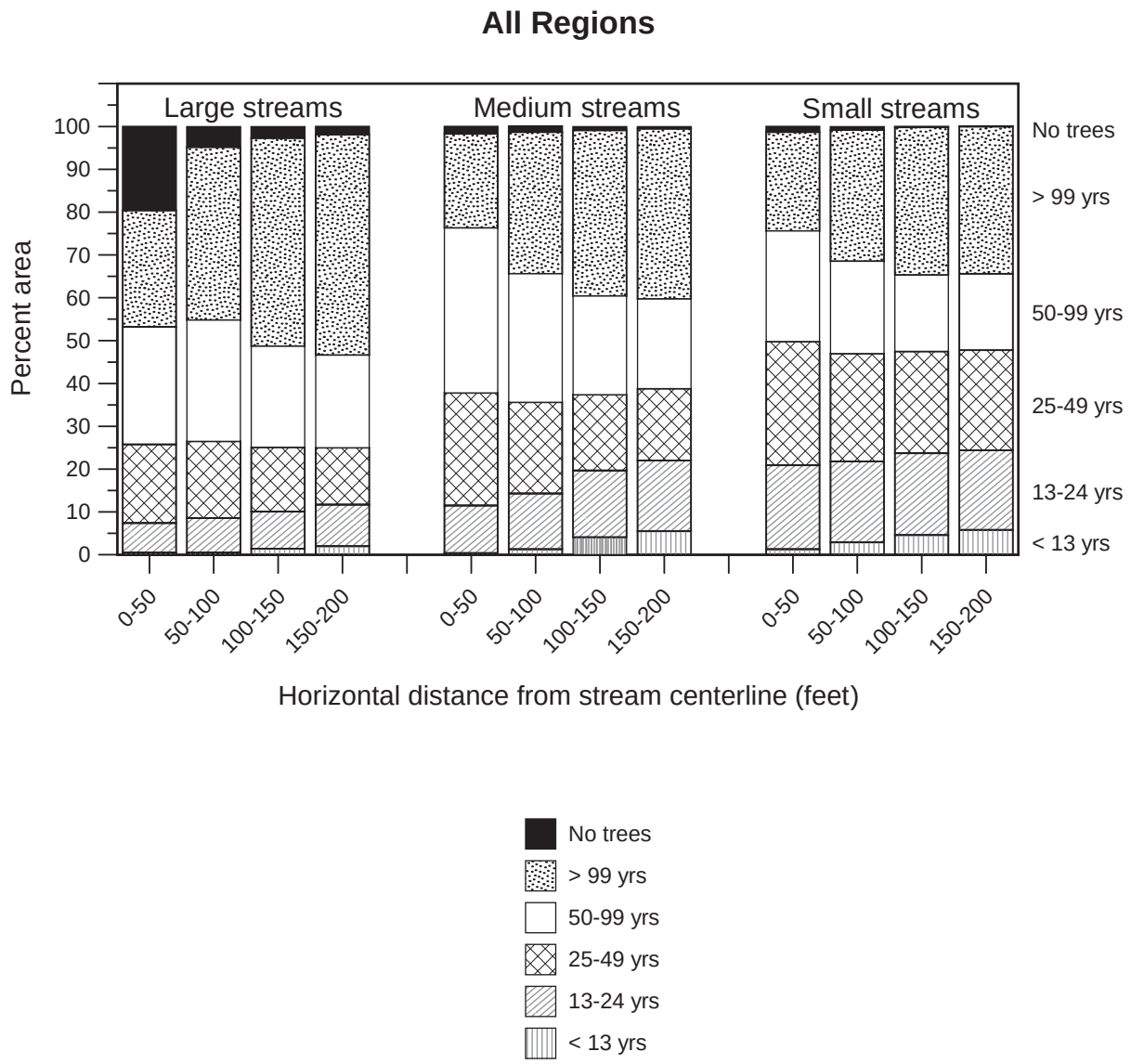


Source: BioSystems et al. 2003

04718.04 EIS (11-06)

Jones & Stokes

Figure 3.5-9
Percent Riparian Stand Type
by Size of Fish-Bearing Streams in the Action Area



Source: BioSystems et al. 2003

04718.04 EIS (11-06)

Jones & Stokes

Figure 3.5-10
Percent Riparian Stand Age
by Size of Fish-Bearing Streams in the Action Area

Stand Structural Diversity

Current riparian stand characteristics, including stand structure and certain age classes, were modeled by ODF to approximate current conditions in the action area (Oregon Department of Forestry 2006b). Riparian structures vary in the action area as a result of vegetation growth and succession, weather and climate, and natural disturbances such as floods, landslides, debris flows, blowdown, insect, disease, and fires. Results of the modeling effort for the action area are summarized in Table 3.5-7.

Table 3.5-7 Existing Stand Structure and Age Class Data from Riparian Areas by Watershed in the Study Area

Riparian Stand Characteristics	Coos Watershed (%)	Tenmile Watershed (%)	Umpqua Watershed (%)	Total Forest (%)
Stand Structure				
Early	11	3	2	7
Intermediate	55	45	56	53
Advanced	34	52	42	40
Advanced-1	11	18	18	14
Advanced-2	15	17	14	16
Advanced-3	8	17	6	10
Age Class				
< 70	58	40	51	52
70 – 80	5	1	0	2
80 – 100	3	2	1	3
> 100	34	57	48	43

Source: Oregon Department of Forestry 2006b

Similar to the structural categories used to define upland stands, ODF classifies their riparian stands as early structure, intermediate structure, and advanced structure (see Section 3.1, Forest Conditions, for definitions). In general, early and intermediate structure stands represent young forests capable of supporting some aquatic functions (bank stability, erosion control and nutrient input), but have limited ability to meet full function for shade and large wood on large streams until the late stages of intermediate stand structure.

Advanced structure stands represent mature forest with trees of sufficient size and number to make significant contributions to large wood loads in streams and shade. These stands include a multiple storied structure of a mix of shade-tolerant (e.g., western redcedar, western hemlock, bigleaf maple) and intolerant tree species (e.g., Douglas-fir), as well as shrub and herb species (vine maple, huckleberry, salmon berry, and swordfern), and provide the greatest level of structural diversity. For this analysis, advanced structure was broken into three

categories to represent the varying stages of mature stand structure development over time.

- Advanced Structure-1. Stands that meet the following definition:
  - Twenty or more trees per acre of 18 inches or larger diameter-at-breast-height (dbh) and 100 feet or more in height, of which there are at least 10 overstory trees per acre at least 24 inches dbh. The quadratic mean diameter must be 15 inches or more.
  - Understory trees that average 30 feet in height.
  - Stands with a basal area being at least 150 square feet per acre, and no more than 325 square feet per acre.
- Advanced Structure-2. Stands that meet the above advanced structure definition, but that contain more than 8 trees per acre greater than 32 inches dbh.
- Advanced Structure-3. Stands that meet the above advanced structure definition, but that contain more than 8 trees per acre greater than 32 inches dbh, including 4 trees per acre that are greater than 38 inches dbh.

The amount of functional wood and shade provided by advanced structure in riparian areas depends in part on stand parameters that are not specified in the definition (e.g., total tree density). The functional value of the wood and shade are a factor of the size of the stream channel. Large streams generally require larger trees to provide functional pieces of wood and shade than medium and small streams. Since Advanced Structure-2 and Advanced Structure-3 contain, by definition, progressively larger trees than Advanced Structure-1, they are similarly more likely to provide the amounts of large wood and shade associated with desirable conditions than other structural classes, especially in large channel sizes.

Several studies have described forest structure in both managed and unmanaged riparian stands along Oregon Coast Range watersheds as “patchy” or “heterogeneous” at multiple scales owing to both regional and site-specific conditions (Minore and Weatherly 1994, Benda and Dunne 1997, Nierenburg and Hibbs 2000, Hibbs and Gordano 1996, Pabst and Spies 1999). In a study of unmanaged riparian forests, Past and Spies (1999) concluded riparian structure was highly variable, but organized along a gradient from streamside to hillslope. They proposed riparian plant communities were a function of: (1) hillslope processes and associated moisture gradients, (2) hydrologic disturbance, (3) species tolerance of saturated valley floor soils, (4) shade tolerance, and (5) mineral soil disturbance.

The studies indicate riparian structure varies at both the watershed and site scales due to hydrologic and geomorphic processes, climatic constraints, and plant community interactions. These factors at the watershed and site scales may control riparian structure and composition and help explain the observed range of conditions in the study area.

There is common agreement in the literature that unmanaged riparian forest structure is expected to vary at large and small spatial and temporal scales.

Using the available scientific information for the Oregon Coast Range, ODF, the U.S. Fish and Wildlife Service (FWS), NMFS, and ODFW established the following goals (Desired Future Conditions) for riparian stand structure in the study area:

- Early Structure: 5 to 15 percent
- Intermediate Structure: 15 to 45 percent
- Advanced Structure: 45 to 70 percent

Riparian zones in all three of the watersheds in the study area currently support less than 15 percent early stand structure (Table 3.5-7). However, existing stand structure data suggest advanced structure is presently lower than what might be anticipated in riparian areas under natural conditions in two of three watersheds and across the action area as a whole (Table 3.5-7). Only the Tenmile Watershed is composed of advanced structural forest within the desirable range.

Similar to the age class data presented in the *Elliott State Forest Watershed Analysis*, ODF modeling results indicate a large percentage (34 to 57 percent) of riparian stands in the action area are also in excess of 100 years in age. The distribution of current age classes is shown in Table 3.5-7.

Large Wood Recruitment Potential from Existing Stands

Riparian areas are important sources of large wood recruitment to stream channels. Research indicates that 70 to 100 percent of large wood recruited from the near-stream zone comes from trees within 100 feet of streams (Van Sickle and Gregory 1990, McDade et al. 1990, Bilby and Bisson 1998). Between 10 percent and 72 percent of large wood in streams is recruited from slope failures and debris flows (Reeves et al. 2003, McDade et al. 1990, Benda and Sias 1998, Benda et al. 2003, May and Gresswell 2003). The proportion of large wood recruitment supplied by mass wasting and debris flows is highly variable and in part dependent on stream size and location in the channel network.

Current riparian stand characteristics and wood recruitment potential were evaluated in the action area during the *Elliott State Forest Watershed Analysis*. The model used to forecast wood recruitment to streams was adapted from the Riparian Aquatic Interaction Simulator (RAIS) after Welty et al. (2002). This model predicts wood inputs from streamside stands and the loss of wood in streams from decay. Large wood can be recruited to a stream by tree mortality, bank erosion, deposits from landslides, or intentional placement of habitat logs. The loss of wood from a stream generally occurs through the processes of wood decay and downstream movement as a result of peak streamflows. The *Elliott State Forest Watershed Analysis* team concluded the recruitment potential was a function of the stand composition, with conifer-dominated stands providing the greatest potential for wood inputs to streams, followed by conifer inputs from mixed stands. Hardwood stands provided little overall long-term value to in-channel wood because of the short life span and fast decay rates of hardwood species (Biosystems et al. 2003). A typical hardwood-dominated stand was

expected to produce a large wood volume of only one-tenth of a conifer-dominated riparian stand.

Existing riparian management areas (RMA) in the action area offer riparian ecosystems that are apparently functioning at some reduced level of current and future large wood recruitment potential because of prior timber harvests and road building in the riparian zone, and the dominance of hardwood species adjacent to channels. Whereas historical hardwood galleries likely occurred adjacent to streams, prior management in the riparian zones has increased the abundance of hardwood species over time.

3.5.3.3 Aquatic Habitats

This section describes the aquatic habitat conditions in the study area including habitat access (fish passage), water quality (temperature, suspended sediment, dissolved oxygen, forest chemicals, and nutrients), stream flow hydrology, and habitat elements (substrate for spawning habitat, pools, off-channel habitat, refugia, and channel conditions).

Fish Passage

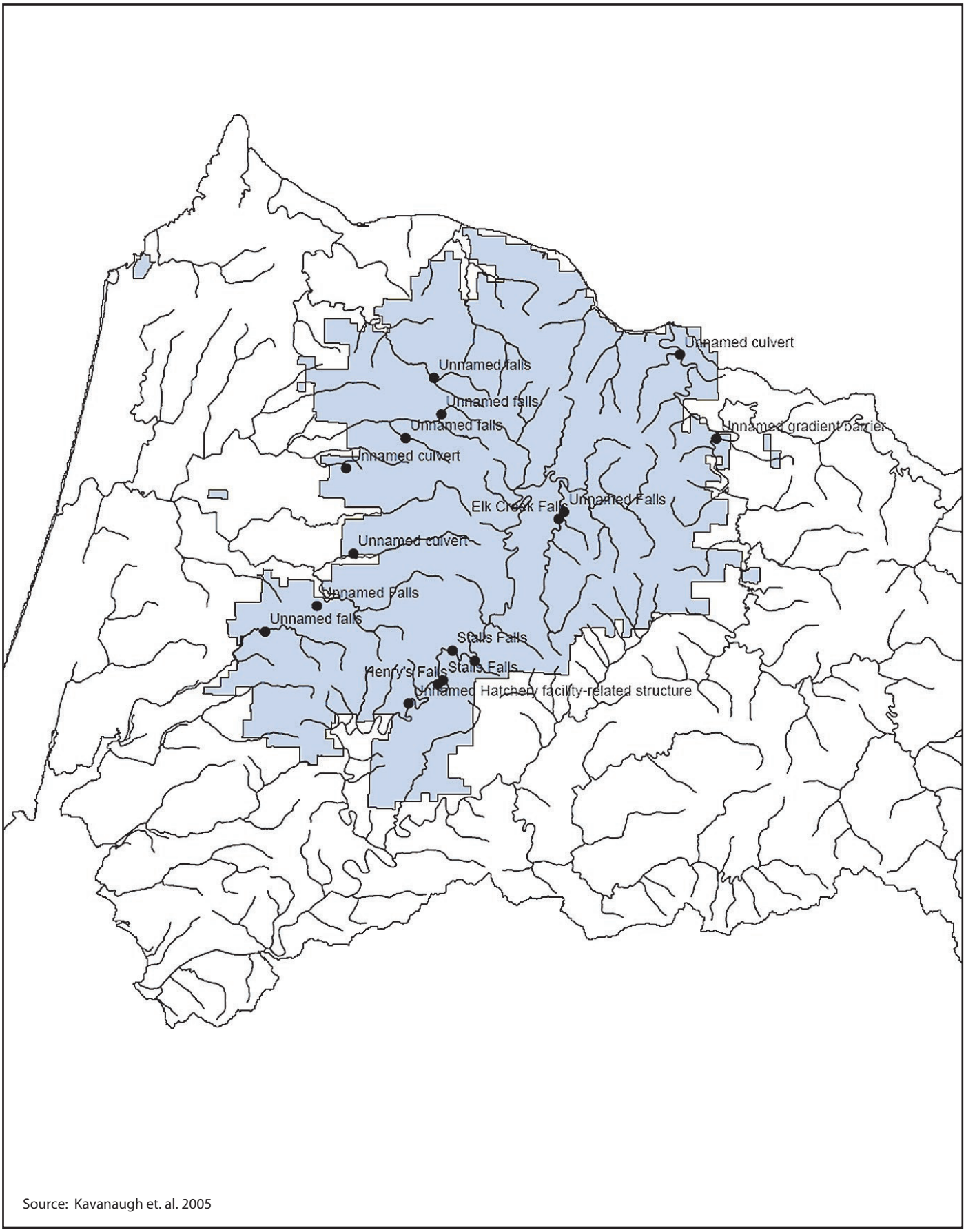
Physical Barriers

Natural Fish Passage Barriers

The extent of fish distributions in streams is constrained by lack of sufficient flow (either in headwater origins or seasonally), steep gradients, and/or impassible natural barriers. Debris flows, logjams, and beaver dams can create temporary barriers to fish passage. Fish and other aquatic vertebrates may be isolated by geomorphic conditions. Barriers and impediments to fish passage over time determine the composition of species in each stream. Fish presence surveys were used to determine the upper extent of fish use and to identify passage barriers in the study area (Kavanagh et al. 2005).

The action area has a number of significant natural geomorphic barriers and impediments to fish passage (Figure 3.5-11). The known extent of fish (anadromous and resident) within the action area and a number of the natural barriers are shown on Figure 3.3-3. The distribution of natural barriers is especially important for limiting the upstream spawning and rearing distribution of anadromous fish.

Mill Creek has two identified barriers, both probably the result of the Loon Lake deep-seated landslide. The lowermost slide is a gradient barrier below Mill Creek's confluence with Cold Creek. This gradient barrier likely represents the most downstream extent of the landslide deposit. The second barrier is the falls at Loon Lake. According to ODFW fish distribution information, the lower gradient barrier restricts anadromous fish access to Loon Lake and upstream. These two barriers block access to considerable low gradient streams, especially in the Salander and Bickford Creek drainages in the upper Mill Creek basin in the action area.



Source: Kavanaugh et. al. 2005

04718.04 EIS (5-07)

Jones & Stokes

Figure 3.5-11
Streamnet Barriers Identified by Record ID in the Action Area

On the southeast portion of the study area, another pair of permanent, geomorphic barriers exists at Golden and Silver Falls on Glenn Creek. However, fish passage is blocked about 0.5 mile downstream by a cascade that drops 45 feet over a 100-foot section of stream length. This cascade is identified as a complete barrier to anadromous fish (Biosystems et al. 2003). Only resident cutthroat trout inhabit streams in the basin above the falls (West Fork Silver, West Fork Glenn, Howell, and Cedar Creeks).

The West Fork Millicoma Basin historically contained at least seven falls that blocked or impeded anadromous fish passage. The lowest two, Pidgeon Falls (8-foot drop) and Henry's Falls (7-foot drop), impede passage at low stream flows for all species. Fish are able to pass these two sites during freshets and high flows in the West Fork Millicoma River. The next waterfall upstream in the basin, Stulls (Stahls) Falls (15-foot drop), was historically a complete passage barrier. In 1958, the Oregon Fish and Game Commission blasted steps and jump pools to create upstream fish passage. During the 1960s, the bedrock cascade at Elk Falls on Elk Creek was also improved to initiate fish passage. These actions were unsuccessful in obtaining adequate anadromous passage. As a result, a fish ladder was constructed in 1973 to enhance anadromous fish use of the basin above Elk Falls.

The remaining impediments and barriers to fish passage typically occur in high gradient, low order streams. In the ODFW database, these features are called unnamed falls or cascades. They are the primary anadromous fish blockages in the Coos Bay, Lakeside, and Lower Umpqua 5th-field Hydrologic Unit Code basins.

Constructed Fish Passage Barriers

Road culverts are the primary constructed fish barriers in the action area. They can block the access of anadromous and resident fish to upstream spawning habitat. Culverts also can block seasonal movement of juvenile salmon and steelhead, as well as resident cutthroat trout. Culverts commonly create a drop at the outlet that may be higher than fish can leap. One-foot drops at culvert outlets can stop small fish. High flow velocity in the culvert is another form of blockage. Juvenile and small fish have a reduced ability to swim upstream in fast water.

The FPA, *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a) and the Forest Roads Manual require all new culverts to be installed to allow passage of both adult and juvenile fish. Culverts on fish-bearing streams are relatively rare throughout the action area, averaging only one for every 4.5 square miles of watershed. A total of 32 culverts in fish-bearing streams were identified during the *Elliott State Forest Watershed Analysis* (Table 3.5-8). More than one-third of the culverts have been replaced or decommissioned in the last few years. The watershed analysis process prioritized the balance of culverts for improving fish passage, based on the length of upstream fish-bearing stream. Only three blocking culverts in fish-bearing waters have been identified in the Streamnet data base in the action area (Figure 3.5-11).

Table 3.5-8 Status of Culverts in Fish-Bearing Streams in the Action Area as of 2003

Culvert Status	Number of Culverts	Percent of Total
Old culverts currently in use	14	44
Culverts recently replaced	11	34
Culverts removed/decommissioned	5	16
Culvert and fill washed out	2	6
Total	32	100

Source: Biosystems et al. 2003

Other than road culverts, no other human-made barriers to fish passage are present in the action area. Although the number of culverts currently blocking passage is low, ODF is in the process of correcting all culvert blockages in fish-bearing waters. Some barriers to fish migration remain. Most of the existing barriers are upstream of anadromous fish zones.

Water Quality

Surface Water Temperature

As described in Section 3.5.3.2, Riparian Functions and Current Riparian Condition, riparian forests provide a forest canopy that can shade streams and effectively moderate both peak stream temperatures and daily fluctuations (Beschta et al. 1987, Sullivan et al 1990, Poole and Berman 2001). Since fish are cold-blooded species, stream temperatures constitute an important control on salmonid fish production, metabolism, growth, survival, behavior, and habitat use. The optimum temperature for salmon and trout ranges from 6.0 to 10.0°C (43 to 50°F) for egg incubation to 16.0°C (60°F) for adult migration (U.S. Environmental Protection Agency 2003). Due to increased metabolic rates, growth of juvenile salmon and trout decreases above 16°C to 19°C (61°F to 66°F), depending on food ration (Bell 1991, U.S. Environmental Protection Agency 2001). Lethal temperatures over a 1-week period for salmon and steelhead occur at temperatures greater than 21 to 24°C (70 to 75°F) for juveniles and greater than 23 to 26° C (73 to 79°F) for adults, depending upon the species, degree of temperature acclimation, and other factors (Hickman and Raleigh 1982, U.S. Environmental Protection Agency 1986, Bell 1991, Bjornn and Reiser 1991, Oregon Department of Environmental Quality 1995, U.S. Environmental Protection Agency Technical Temperature Workgroup 2001).

Water temperature and riparian shade data for streams in the action area is described in Section 3.3.2.4, Water Quality. Based on the information presented in that section, it is likely the temperature regimes in the study area are likely functioning properly for fish rearing and migration with the exception of the lowermost reaches of the West Fork Millicoma River and the lower Umpqua mainstem, where the distance from the watershed divide is large enough that streams tend to be naturally warm. The current thermal regime at these locations represents conditions close to their Natural Thermal Potential (NTP). For instance, the mainstem Umpqua River in the study area has a naturally high NTP because the channel is too wide to be significantly shaded by riparian vegetation

(Oregon Department of Environmental Quality 2006d). Smaller tributary waters are easier to shade and have lower NTPs. The background and current total heat exchange in the Umpqua River at tidewater (river mile 25) are nearly identical, indicating current thermal conditions are consistent with the NTP for this location (Oregon Department of Environmental Quality 2006d).

Suspended Sediment (Turbidity)

Current suspended sediment loads in the action area are described in Section 3.3.2.4, Water Quality. Based on the information presented in that section, it is likely that suspended sediment and turbidity conditions are currently allowing proper ecosystem functioning for fish species in the action area (i.e., the frequency and duration of high turbidity events is similar to historical conditions).

Dissolved Oxygen

No known intergravel dissolved oxygen samples or fine sediment samples are available to estimate the re-aeration capacity of gravels in the action area. However, based on the limited summer dissolved oxygen samples from surface water gathered to date (summarized in Section 3.3.2.4), this water quality factor is currently allowing proper ecosystem functioning for fish species.

Forest Chemicals

Known levels and existing use of fertilizers and pesticides in the action area are described in Section 3.1.2.6, Forest Chemicals. Based on the information presented in that section, it is unlikely that forest chemical application is substantially affecting water quality in study area streams.

Nutrients

Excessive nutrient concentrations have not been reported, and are likely similar to historical conditions. No nutrient sources, other than forest vegetation, are present in the action area, with the exception of septic tank drain fields around Tenmile and Eel Lakes. Nutrient contributions from red alder-dominated hardwood stands are likely similar to or slightly exceed historical levels.

Additional data on nutrient sources and concentrations are described in Section 3.3.2.4, Water Quality. Based on the information in that section, nutrient concentrations in the action area are apparently consistent with the low levels reported in forested streams in the Pacific Northwest (MacDonald et al. 1991) and are currently allowing proper ecosystem functioning for aquatic species.

Hydrology

Peak Flow

Two types of peak stream flowscan influence aquatic habitat conditions: (1) seasonal peak flows occurring every winter in response to rain; and (2) exceptional peak flows that produce floods with a recurrence interval of once every several years or more. Seasonal peak flows do not normally produce substantial changes in stream channel structure, but they can potentially cause

redd scour or bed mobility. Such scour would be important for fish species with embryos incubating in gravel beds during winter months (Lisle 1981).

Conversely, floods are generally regarded as channel-forming events, particularly the floods that occur frequently (i.e., once every 2 to 3 years on average). Floods may move large amounts of substrate sediment and large wood, producing fundamental changes in channel structure. Floods typically occur in association with exceptional storms that can trigger shallow-rapid landslides and/or debris flows (Benda et al. 1998, Fetherston et al. 1995) which are an important channel forming agents in the action area.

As discussed in Section 3.3.2.2, Streams, and in Biosystems et al. (2003), peak flows in action area streams are evidently typical of low elevation mountains in the Oregon Coast Range. As such, they are currently judged to be allowing proper ecosystem functioning.

Drainage Network

Little quantitative information is available to assess whether channel lengths have changed with human caused disturbances related to roads, trails, conveyance ditches, compaction, or construction of impervious surfaces that may have lead to changes in streamflow regime. Hydrologic connectivity to streams is an accepted measure of potential impacts of roads on stream systems in western North America (Forman et al. 2003, Bilby et al. 1998, Dent et al. 2003, Reid and Dunne 1984, Wemple et al. 2001). The location of the roads, their proximity to channels, and the level of disconnection from the stream network have a large effect on whether or not the drainage network is extended upslope.

Determining hydrological connectivity from road ditches into streams in the action area is difficult due to data gaps in existing forest road surveys. As discussed in Section 3.2.2.6, Road System in the Action Area, less than 10 percent of the 536 total road miles within the action area are located in riparian or valley bottom areas (Biosystems et al. 2003), suggesting the potential for hydrological connectivity is likely low. Road-stream connectivity is estimated to occur on between 3 and 15 percent of the total road mileage in the action area. Combining roads near streams and roads with ditches potentially draining to streams, Biosystems et al. (2003) found that between 27 and 64 miles of roads were potentially connected to the road system in the late 1990s. This estimated range of road miles with connected ditches to streams equates to a drainage network extension of 0.19 to 0.44 miles per square mile, or an extended stream network of about 3.6 to 8.5 percent.

Since, the road network in the action area is not a part of the historical landscape condition, hydrologic connection, and road locations (parallel to and within 100 feet of streams) are assumed to be currently causing some streams to function at a slight risk to aquatic habitats, as discussed in Section 3.3, Streams, Water Quality and Water Quantity, and highlighted in the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003). Based on the road locations, the Coos Watershed is at greater risk for adverse habitat influences than the Umpqua Watershed. The Tenmile Watershed consists of the lowest risk of adverse influences of roads hydrologically connected to streams of the three watersheds (Table 3.2-1).

A review of the scientific literature concerning the influence of roads on water quality, channel conditions and biological resources, established that proper implementation of road BMPs can reduce negative effects of roads on public resources. However, threshold values have not been reported for selected key metrics of hydrologic connectivity for roads parallel to and adjacent to streams. Using BMPs, ODF has been in the process of disconnecting the road system from the channel network. Undisturbed forest soils in most of the action area are porous, resulting in high infiltration rates. Design standards and BMPs used during forest management activities in the last decade have helped to direct road drainage onto these porous soils and away from direct entry to streams. Based on ODF's improved road drainage systems in the action area, this potential risk may be substantially less than described in Biosystems et al (2003).

Habitat Elements

Substrate/Spawning Habitat

Suitable spawning areas include stable gravels and cobbles of sufficient depth to bury eggs and prevent scour, and adequate stream flows over and through clean gravel to provide oxygen to developing embryos and to carry away waste products. Spawning habitats in the action area are influenced by the limited amounts of in-channel wood that help retain and sort gravels. Since salmon spawning usually takes place in low gradient (generally less than 4 percent) channels, wood in these stream segments is especially important for spawning populations and juvenile survival (Nickelson et al. 1992).

Many of the salmonid fish species require deep holding pools close to spawning areas. In the action area, large-bodied fish like Chinook salmon are confined primarily to the large tributaries in the West Fork Millicoma River and the lower portions of Mill Creek. In these areas, the key limiting spawning habitats are deep pools and stable spawning gravels. Limited large wood, especially large wood jams in the large channels of the river, limits the creation of deep holding pools and the retention of spawning gravels.

Spawning Substrate

Gravel substrate in stream channels is important for providing spawning habitat and creating pools and other high quality habitats. The ODFW established aquatic habitat quality benchmark for gravel area is 35 percent of the total riffle area composed of spawning gravel (Jacobsen and Thom 2001). According to this benchmark, 35 percent of the riffle surface in gravels is desirable and less than 15 percent is undesirable. The ODFW AIP data from reference streams near the study area indicate a quartile range between 21 and 61 percent gravel in riffle area. Based on these data, Kavanagh et al. 2005 updated the benchmark to range between 26 and 54 percent of the total riffle area. All of the average AIP gravel data for the Coos, Tenmile, and Umpqua Watersheds fell within the benchmark range prompting ODFW to rate the existing gravel accumulation in riffle habitats as moderate habitat levels.

Most of the inventoried stream reaches during the *Elliott State Forest Watershed Analysis* also supported average percent gravels in riffle areas near the 35 percent

ODFW habitat benchmark (Table 3.5-9). However, the distribution of riffle gravels varies considerably, with almost no association between gravel retention and active channel width (Biosystems et al. 2003). The wide channels of the West Fork Millicoma River, with limited large wood or other structure to capture material, had the lowest gravel retention.

Table 3.5-9 Average Gravel Percentages in Riffles for Inventoried Stream Reaches

Location	Average Percent Gravel [1]	Average Percent Gravel [2]
Large Channel Types		
Coos Watershed	45	49
Tenmile Watershed	40	38
Umpqua Watershed	34	50
Small and Medium Channel Types		
Coos Watershed	--	20
Tenmile Watershed	--	40
Umpqua Watershed	--	55

Sources: [1] Kavanagh et al. 2005, [2] Biosystems et al. 2003

Fine Sediment

Fine sediments (less than 0.85 mm) enter stream networks naturally through bank erosion, soil creep, and mass wasting events. Forest practices can dramatically influence delivery rates of fine sediment by affecting erosion from road surfaces and harvest units, and by increasing rates of mass wasting (Beschta 1978, Sullivan and Duncan 1980, Reid and Dunne 1984, Bilby 1985). Artificial sources of fine sediment from the action area result from road construction and use, mass wasting caused by logging and road placement, and increased streambank erosion caused by changes in peak flows. Fine sediments can have detrimental effects on salmonid fish spawning success, if sediment is deposited on redds during the spawning and incubation period (Chapman 1988, Tappel and Bjornn 1983). Peterson et al. (1992) concluded that survival and development of embryos and growth of alevins can be reduced if fine sediment size fractions exceed 12 percent by weight of the total sample volume. Accumulations of fine sediment can reduce pool volume or eliminate small pockets of habitat between rocks, thereby reducing feeding, resting, and overwintering areas for juvenile salmon (Chamberlin et al. 1991). Densities of benthic macroinvertebrates can be lowered by accumulation of fine sediment, thereby reducing the food supply for salmonid fishes (Gregory et al. 1987).

The ODFW classified the amount of gravel in the streambed as ‘moderate’ in the three watersheds in the study area (Kavanagh et al. 2005). As shown in Table 3.5-10, gravel in small, medium, and large channels had the same or better distributions as the reference streams and fell within the ODFW benchmarks.

Samples of fine sediment in gravel sources in the action area have not been collected. Thus, the current level of gravel embeddedness and the potential fine sediment levels in salmonid fish redds cannot be estimated. The ODFW AIP data reporting visual estimates of percent fines (less than 2 mm size fractions) and for spawning gravels (2 to 64 mm size fractions) in riffle habitats of small, medium and large streams across the action area are within the range of natural conditions for reference streams in the study area (Kavanagh et al. 2005).

Based on the limited sediment monitoring conducted to date, it appears fine sediment and gravel distributions in the action area are normal for streams in the study area and similar to reference conditions. It is likely fine sediment or gravel concentrations are currently allowing proper ecosystem functioning for covered fish species.

The habitat element of bedrock substrate, however, exceeds reference conditions (Table 3.5-10) and is likely altering proper ecosystem functioning. According to the Biosystems et al. (2003), bedrock substrate in action area streams is most likely associated with a reduction in large in-channel wood with resulting scour of streams beds to bedrock. A high frequency of bedrock in channels may also be one reason water temperatures are greater than anticipated in specific locales (Dent and Walsh 1997).

Table 3.5-10 Sediment Data in the Action Area Compared to ODFW Reference Streams

	Channel Size	Action Area AIP Habitat Assessment Data [1] 117 Reaches 25th-75th quartile (median)	ODFW Mid/South Coast AIP Reference Data [2] 57 Reaches 25th-75th quartile (median)	ODFW Oregon Coast AIP Reference Data [2] 124 Reaches 25th-75th quartile (median)	ODFW AIP Benchmark Range
Percent Gravel in Riffles (Visual estimate (%) of substrate of particles between 2 and 64 mm diameter)	Small	36 – 53 (40)	19 – 48 (43)	26 – 48 (40)	26 – 54
	Medium	33 – 54 (45)	32 – 59 (45)	34 – 61 (46)	26 – 54
	Large	24 – 66 (42)	26 – 57 (40)	21 – 48 (31)	26 – 54
Percent Fines in Riffles (Visual estimate (%) of substrate of particles < 2 mm diameter)	Small	10 – 27 (19)	25 – 54 (34)	13 – 59 (37)	8 – 25
	Medium	6 – 21 (11)	3 – 20 (11)	7 – 25 (12)	8 – 25
	Large	6 – 17 (11)	9 – 21 (12)	9 – 18 (12)	8 – 25
Percent Bedrock in Stream (Visual estimate (%) composed of solid bedrock)	Small	0 – 29 (13)	0 – 3 (0)	0 – 17 (5)	1 – 11
	Medium	10 – 31 (21)	2 – 17 (8)	2 – 15 (7)	1 – 11
	Large	0 – 33 (17)	0 – 8 (1)	1 – 10 (5)	1 – 11

Sources: [1] Kavanagh et al. 2005, [2] Thom et al. 2001.

Large Wood

Large wood was measured in streams in the action area in the 1990s, 2001, and 2002 as part of the ODFW AIP. The ODFW surveys included a majority of the fish-bearing streams in the action area. Large wood metrics used for effects assessments include: total pieces (greater than 6 inches in diameter and length greater than 6 feet) per 100 meters, and key pieces (greater than 24 inches in diameter and greater than 40 feet in length) per 100 meters of channel. Desirable channel conditions for large wood were derived from AIP data and represent the 25th to 75th percentile and the median of the distribution from coastal reference sites (Table 3.5-11).

Table 3.5-11 Large Wood Volume and Density in Action Area Streams and in Oregon Coastal Reference Streams

Location	Number of Reaches	Mean Wood Density 25th – 75th percentile (median) No. of pieces /100m	Mean Wood Volume 25th – 75th percentile (median) m^3/100m	Mean No. of Key Pieces (No./100m)
Elliott State Forest				
Small	29	12 – 27 (20)	9 – 27 (14)	0.1 – .07 (0.2)
Medium	45	12 – 23 (17)	10 – 50 (23)	0.2 – 2.5 (0.6)
Large	43	5 – 29 (12)	5 – 32 (16)	0.1 – 0.6 (0.3)
Combined	117			
ODFW Reference Streams				
Small	15	9 – 29 (16)	23 – 85 (43)	0.9 – 4.3 (2.3)
Medium	51	11 – 23 (15)	21 – 64 (35)	0.9 – 4.3 (2.3)
Large	58	7 – 21 (13)	14 – 47 (28)	0.5 – 2.1(1.3)
Combined	124			

Sources: Biosystems et al. 2003, Kavanagh et al. 2005, Thom et al. 2001.
m = meters
m^3 = cubic meters

Volume

The median volume of in-channel large wood observed in action area streams was 17 cubic meters for each 100 meters of stream (Kavanagh et al. 2005). Median wood volume was calculated for each watershed within the study area as follows (Kavanagh et al. 2005):

- 17 cubic meters /100 meters for the Coos Watershed,
- 21 cubic meters /100 meters for the Tenmile Watershed, and
- 16 cubic meters /100 meters for the Umpqua Watershed.

These volumes are on the low end of the ODFW desirable habitat condition breakpoints of 17 to 58 cubic meters /100 meters based on the distribution of

wood volume data from reference streams (Kavanagh et al. 2005). The *Elliott State Forest Watershed Analysis* reported that Johnson Creek has the highest wood volume of in-channel large wood at 35 cubic meters /100 meters. Relatively high amounts of large wood are also found in Palouse, Charlotte, Luder, Johanneson, and Noble Creeks. Scholfield and Footlog Creeks have the lowest wood volume at 3 and 9 cubic meters /100 meters, respectively (Biosystems et al. 2003).

Density

Median wood density (pieces per 100 meters of stream length) reported in the most recent ODFW surveys for the action area is 17 pieces/100 meters. Median wood density was calculated for each watershed within the study area as follows (Kavanagh et al. 2005):

- 17 pieces/100 meters for the Coos Watershed,
- 18 pieces/100 meters for the Tenmile Watershed, and
- 15 pieces/100 meters for the Umpqua Watershed.

The number of in-channel wood pieces qualifying as large woody debris in the three watersheds and across the action area were found to be consistent with desirable reference breakpoints of 8 to 21 pieces (Kavanagh et al. 2005).

Key Pieces

The density of key pieces for each reach was also calculated as part of the ODFW AIP survey. Key piece density provides an indicator of the stability of wood jams in a stream. Median key piece density (pieces per 100 meters of stream length) reported in the most recent ODFW surveys for the action area was 0.3 piece, but it varied by stream size as shown in Table 3.5-12.

Table 3.5-12 Key Piece Density in Action Area and Reference Streams by Stream Size

	Key Piece Density (pieces per 100 meters of stream length)	
Stream Size	**Action Area**	**Reference Streams**
Small	0.2	2.3
Medium	0.6	2.3
Large	0.3	1.3

Source: Sources: Biosystems et al. 2003, Kavanagh et al. 2005

The density of key pieces in large channels in the action area is approximately half of the density in medium streams. Current median number of large key piece-sized wood in small, medium and large streams in the action area are approximately an order of magnitude less than the number of key pieces in nearby reference streams (Tables 3.5-11 and 3.5-112). Key piece-sized wood is equally low for all watersheds in the action area (Kavanagh et al. 2005):

- 0.4 key piece/100 meters for the Coos Watershed,
- 0.5 key piece/100 meters for the Tenmile Watershed, and
- 0.2 key piece/100 meters for the Umpqua Watershed.

As shown in Table 3.5-11, the existing AIP data reported in Kavanagh et al. (2005) suggest the number of total large wood pieces in the action area is consistent with reference sites in small, medium, and large streams, but that the number of key pieces and hence total volume of pieces is well below reference conditions. This finding is consistent with the *Elliott State Forest Watershed Analysis* that found in-channel wood volumes to be lacking in most streams across the action area (Biosystems et al. 2003).

The low wood volumes recorded during the ODFW surveys of streams in the action area are likely a result of past management practices. In the 1960s and 1970s, streams were cleared of wood under the mistaken belief that logjams created impediments to salmonid fish migration (see Section 3.5.3.1, Introduction and Overview). In addition, the observed low wood volume may be partially due to timber harvest in some riparian areas and on unstable slopes, or removal of riparian trees as part of road construction.

The habitat element for key pieces of large in-channel wood is not allowing proper ecosystem functioning for covered fish species, and is likely due to historical wood removal programs, legacy and recent timber harvests in some riparian zones and on unstable slopes, removal of riparian trees as part of road construction, and the length of time required for riparian stands to produce key piece sizes of wood for potential recruitment to streams.

Pools

Pool Frequency and Quality

Pool habitat is a good indicator of aquatic habitat quality. Pools provide feeding opportunities for fish, as well as adequate stream depths for cover from avian and terrestrial predators. A pool area of 35 percent of the total stream area is the established ODFW aquatic habitat quality benchmark (Jacobsen and Thom 2001). According to ODFW, 35 percent of the stream surface in pools is desirable and less than 10 percent is undesirable for rearing salmonid fishes.

In addition to percent pool area, an indication of pool depth and complexity provides information on habitat quality. According to the aquatic inventory protocol, complex pools must have at least three pieces of wood within the pool. Pools over 3.3 feet (1 meter) deep have been inventoried to provide information on these important habitats. In general, the Tenmile Watershed has the highest quality pool habitats, measured by percent pool area, depth, and complexity (Table 3.5-13). Tenmile is the only watershed in the study area that exceeds the ODFW benchmark for percent pools (Biosystems et al. 2003).

Table 3.5-13 Average Pool Characteristics for Inventoried Stream Reaches of Less Than 4 Percent Gradient in the Action Area

Watershed	Number of Reaches	Average Percent Pools	Average Number of Pools > 3.3 ft (1m) deep (pools/mi.)	Average Number of Complex Pools (pools/mi.)
Coos	32	27	2.7	4.7
Tenmile	14	40	3.9	9.7
Umpqua	11	25	4.1	3.2

Source: Biosystems et al. 2003
> = greater than
ft = feet
m = meter
mi = mile

Pool-Forming Elements (Large In-Channel Wood)

Large wood is an important component in the development of instream pool habitats critical to rearing salmonid fishes; however, the importance varies by species, stream gradient, and time of year (Campbell and Neuner 1985). A detailed discussion of existing in-channel large wood levels is included in the subsection *Habitat Elements, Large Wood*.

The amount of rearing space is often considered the most limiting factor to salmonid fish production (Chapman 1966, Reeves et al. 1989). Two key attributes of summer rearing habitat, percent pools and in-channel large wood, were assessed for low gradient stream reaches of less than 4 percent during the *Elliott State Forest Watershed Analysis*. More than 46 miles of small and medium sized streams are characterized by limited habitat complexity, as expressed in percent pools and/or large wood in the channel (Table 3.5-14). These streams are found in all of the watersheds in the study area, with the largest number in the Coos Watershed.

More than 32 miles of large streams have low percent pools and/or large wood in the channel (Table 3.5-15). These streams also are found primarily in the Coos Watershed, particularly the West Fork Millicoma River and Elk Creek.

A limited number of areas with high quality summer rearing habitat are present in the action area. These reaches are characterized by a high frequency of deep, complex pools, a good level of in-channel large wood, and channels bordered by mature coniferous or mixed riparian forests. Very few low gradient stream reaches (1.3 miles) in the action area meet the threshold value of large wood outlined in Biosystems et al. 2003 (Table 3.5-16). Only two streams, Palouse Creek in the Coos Watershed and Nobel Creek in the Tenmile Watershed, have wood volumes greater than 46 m^3/100 meters of stream. Both streams are very productive systems of coho salmon. Similarly, very few streams in the action area (less than 13 miles) are bordered by mature riparian stands (Table 3.5-16). The Coos Watershed has the greatest length of streams with mature riparian

stands, with most of these stands located along the West Fork Millicoma River and Elk Creek.

Table 3.5-14 Miles of Small and Medium Stream Reaches with Limited Pools and In-Channel Wood Loading Levels by Watershed in the Study Area

		Attributes [1]		
Watershed	**Streams**	**Pools < 20% by Reach**	**Large Wood < 23 m^3/100 m of Stream**	**Pools < 20% by Reach and Large Wood < 23 m^3/100 m of Stream**
Coos	Larson, Sullivan, Marlow, Cougar, Elk, Fish, Panther, West Fork Millicoma, Deer, Joes, Knife, Otter, Trout	---	14.4	16.6
Tenmile	Alder Fork, Big, Murphy, Benson, Roberts	---	8.8	0.0
Umpqua	Footlog, Charlotte, Luder, Johanneson, Dean, Scholfield	1.1	4.0	1.8
All Watersheds Combined		1.1	27.2	18.4

Source: Biosystems et al. 2003
< = less than
m = meters
m^3 = cubic meters
% = percent
[1] Total reach lengths for each attribute are reported separately in each column. The combined limited pool frequencies and large wood column is intended to show the stream miles where the attributes may be working dependently.

Table 3.5-15 Miles of Large Stream Reaches with Limited Pools and In-Channel Wood Loading Levels by Watershed in the Study Area

		Attributes [1]		
Watershed	**Streams**	**Pools < 20% by Reach**	**Large Wood < 23 m^3/100 m of Stream**	**Pools < 20 percent by Reach and Large Wood < 23 m^3/100 m of Stream**
Coos	West Fork Millicoma; Elk	---	1.7	24.6
Tenmile	Johnson; Johnson Tributary 1	---	2.2	0.7
Umpqua	Charlotte, Dean, Scholfield	1.6	2.0	---
All Watersheds Combined		1.6	5.9	25.3

Source: Biosystems et al. 2003
< = less than; m = meters; m^3 = cubic meters
[1] Total reach lengths for each attribute are reported separately in each column. The combined limited pool frequencies and large wood column is intended to show the stream miles where the attributes may be working dependently.

Table 3.5-16 Miles of Stream Reaches with Likely High Quality Summer Rearing Habitat Potential based on High Levels of In-Channel Wood Loading Levels and Adjacent Wood Recruitment Potential

		Attribute	
Watershed	**Streams**	**Large Wood > 46 m^3/100 m of Stream**	**Mature Conifer within 15 m of Stream**
Coos	Palouse, West Fork Millicoma, Cougar, Elk, Fish, Panther, Joes, Knife, Otter,	0.8	9.3
Tenmile	Big, Murphy, Noble, Benson, Johnson Tributary 1	0.5	0.6
Umpqua	Footlog, Charlotte, Luder, Dean, Johanneson, Scholfield	---	3.0
All Watersheds Combined		1.3	12.9

Source: Biosystems et al. 2003
> = greater than; m = meters; m^3 = cubic meters

The ODFW AIP estimates of pool habitat in small streams across the action area (Kavanagh et al. 2005) are within the range of conditions for reference streams in the region (Table 3.5-17). The AIP data for medium and large streams are slightly below reference values and these streams may be currently operating at a risk to fish species.

The habitat element for pools is operating at risk to properly ecosystem functioning for fish species in medium and large stream channels in the action area because of the lack of large in-channel wood and channel structure for gravel retention (Biosystems et al. 2003). Most of the current channels offer either a high percentage of bedrock, large bed element sizes, or thin layers of pliable substrates that are more resistant to the creation of deep pools.

Off-Channel Habitat and Refugia

Off-channel and side channel habitats are important components of juvenile salmonid fish rearing habitat related to winter refugia (sheltering environment). Secondary channels increase the potential habitat available to fishes, particularly to juvenile life history stages. Off-channel habitat can provide slower moving water than the primary channel, providing overwintering and summer rearing habitat for juvenile fish. Winter rearing potential in the West Fork of the Millicoma River has been suggested as a limiting factor for coho salmon and steelhead trout production (Oregon Department of Forestry 2006a). Pool frequencies and the quality of pools described as either deep or complex have been summarized above under the subsection titled Habitat Elements-Pools.

Table 3.5-17 Percent Pool Data in the Action Area Compared to ODFW Reference Streams

	Percent Pools [1]			
	Action Area AIP Habitat Assessment Data [2]	ODFW Mid/South Coast AIP Reference Data[3]	ODFW Oregon Coast AIP Reference Data [3]	ODFW AIP Benchmark [3]
Channel Size	117 Reaches 25th-75th quartile (median)	57 Reaches 25th-75th quartile (median)	124 Reaches 25th-75th quartile (median)	Range
Small	3 – 16 (12)	5 – 29 (11)	4 – 58 (11)	19 – 45
Medium	7 – 35 (24)	27 – 60 (42)	26 – 51 (39)	19 – 45
Large	11 – 59 (31)	26 – 58 (42)	23 – 50 (35)	19 – 45

Sources: [2] Kavanagh et al. 2005, [3] Thom et al. 2001.
[1] Visual estimate (%) of habitat composed of pools
AIP = Aquatic Inventory Project; ODFW = Oregon Department of Fish and Wildlife

Most channels in the action area are of a confined nature, implying stream flow and fluvial energy are concentrated. Given the confined nature of most stream channels on the action area, secondary channels are uncommon, so slow water refugia are provided mostly by large wood in the channels. Unconfined streams, mostly found in the Tenmile Watershed, provide unique, high quality habitat for fish not found elsewhere in the study area. These low gradient streams are more likely to provide high quality refuge habitat during high water because channels can meander freely and create backwater areas (Biosystems et al. 2003).

The ODFW AIP coastal reference reaches suggest a desirable amount of secondary channels lies between 0.8 percent and 5.3 percent or more of the total channel area (Kavanagh et al. 2005). The authors found the median value for secondary channel habitat in action area streams between 1993 and 2003 was 2, 3, and 3 percent in the Coos, Tenmile and Umpqua Watersheds, respectively. Kavanagh et al. (2005) concluded all three watersheds in the study area supported a moderate level of secondary channel habitat. Twenty-one stream miles in the action area exceeded the reference value of 5.3 percent. The percentage of reaches exceeding this reference value was found to be similar for each of the three major watersheds in the study area (11 percent Coos, 9 percent Tenmile, 10 percent Umpqua). The habitat element for off-channel habitat appears to be functioning within the natural range of off-channel frequencies in the region.

Refugia for fish species was assessed on both a reach scale with respect to refuge from routine storm related processes and on a watershed scale with respect to refuge from major disturbances or poor overall lifecycle production (e.g. poor ocean conditions).

Refugia-Reach-Scale

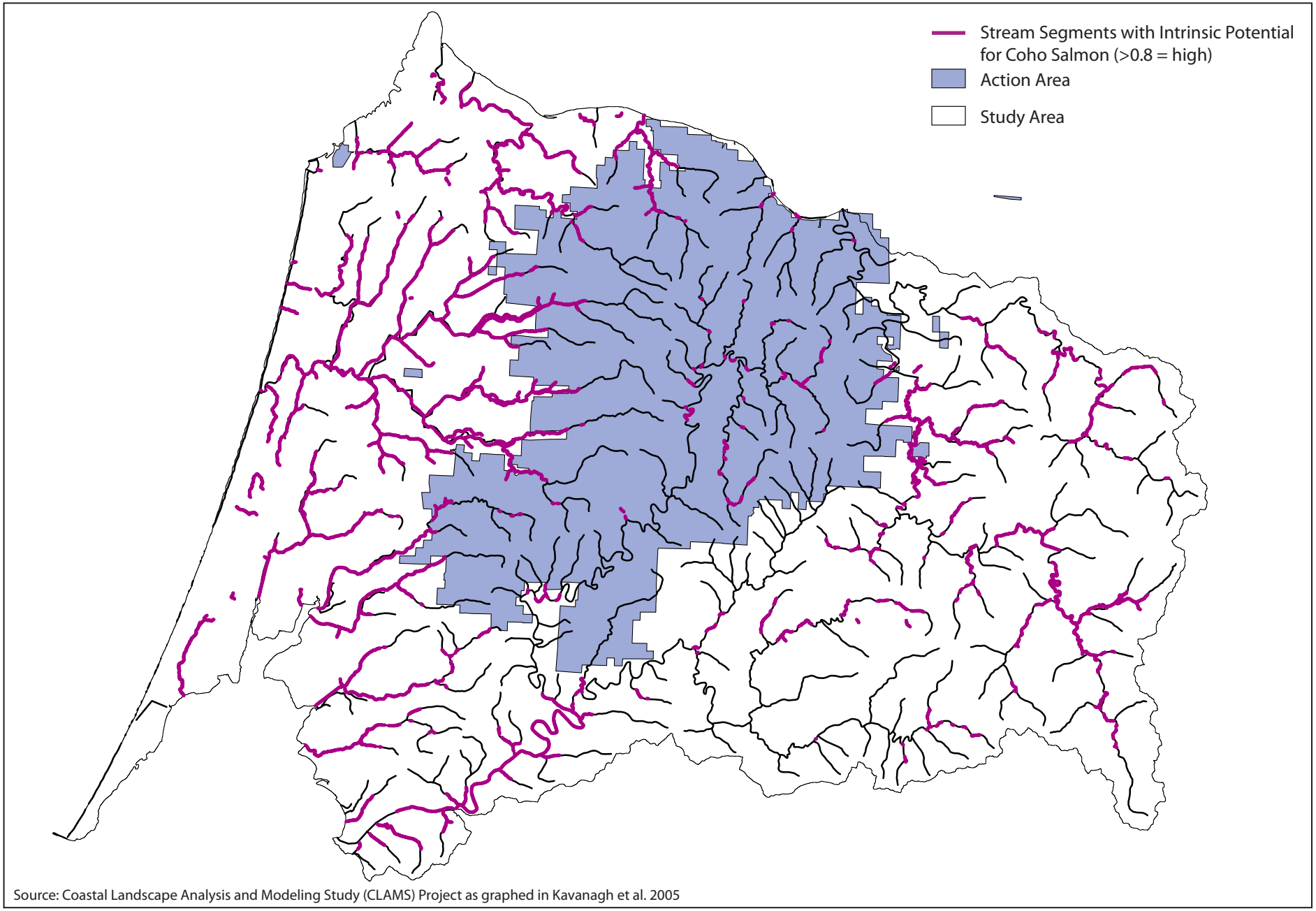
Due to the general lack of deep pools, low large wood loads in channels, and the prevalence of bedrock-scoured channels in the action area, it is assumed the

habitat element for refugia is functioning at some degree of risk to fish species on a reach scale. As a result, both winter and peak flow refugia are likely in short supply (Biosystems et al. 2003). Conversely, Kavanagh et al. (2005) report moderate levels of off-channel habitat areas and floodplain connections are available in all watersheds in the study area. These habitats offer important winter and peak flow refugia and help offset other habitat characteristics in short supply. Nevertheless, the amount of available winter habitat with adequate channel complexity has been identified as a limiting habitat feature in both action area and study area streams (Biosystems et al. 2003, Jacobs 2004, Kavanagh et al. 2005, Nicholas et al. 2005).

Refugia-Watershed-Scale

From a conservation biology point of view, refugia on a watershed scale for anadromous fish species can be regarded as habitat that offers a stronghold for sustaining fish populations over time. This type of refugia is consistent with the concept of ‘core-satellite’ metapopulation areas (Harrison 1991). Such areas include exceptional spawning or rearing habitat features that may be available to maintain populations during poor marine survival conditions and support population expansion into adjacent non-core areas during average or good marine conditions.

High intrinsic habitat potential for coho salmon production based on channel gradient, valley width and active channel width, per the Coastal Landscape Analysis and Modeling Study (CLAMS), was determined for both action area and study area streams, as shown in Figure 3.5-12. Similarly, Kavanagh et al. (2005) modeled high quality winter and summer rearing habitats for the action area using the Habitat Limiting Factor Model (HLFM) (Nickelson 1998) and HabRate Model (Burke et al. 2001), as illustrated in Figure 3.5-13 and Figure 3.5-14, respectively. These high quality habitats may be regarded as surrogates for identifying the best available population refugia in the action area.

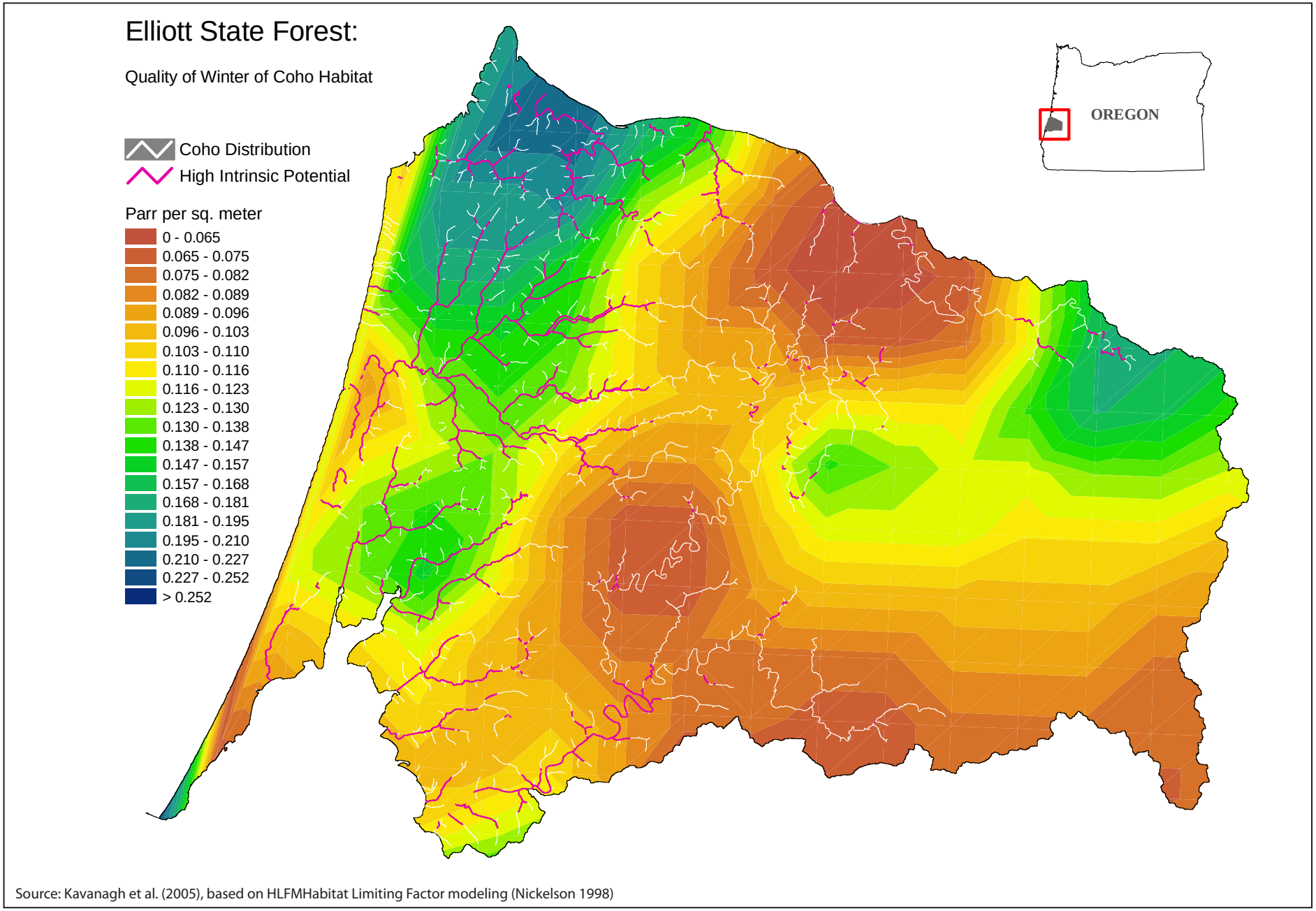


Source: Coastal Landscape Analysis and Modeling Study (CLAMS) Project as graphed in Kavanagh et al. 2005

04718.04 EIS (01-08)

Jones & Stokes

Figure 3.5-12
High Intrinsic Potential for Coho Salmon in the Action Area and Study Area

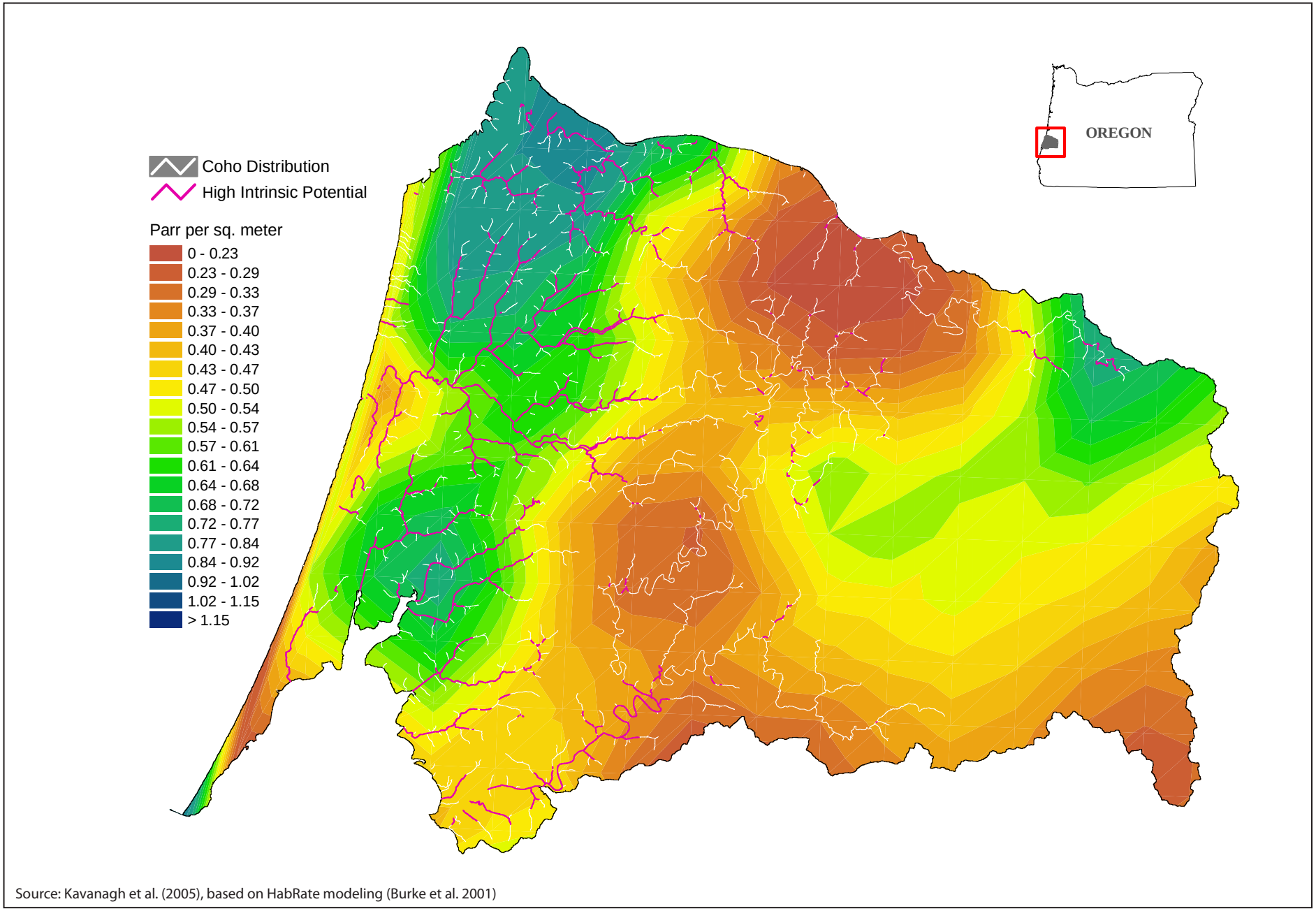


Source: Kavanagh et al. (2005), based on HLFMHabitat Limiting Factor modeling (Nickelson 1998)

04718.04 EIS (01-08)

Jones & Stokes

Figure 3.5-13
Quality of Winter Rearing Habitat for Coho Salmon in the Study Area



Source: Kavanagh et al. (2005), based on HabRate modeling (Burke et al. 2001)

04718.04 EIS (01-08)

Jones & Stokes

Figure 3.5-14
Quality of Summer Rearing Habitat for Coho Salmon in the Study Area

As shown in Figure 3.5-12 through Figure 3.5-14, the amount of habitats with high intrinsic potential or high quality winter and summer rearing habitats are limited in the action area and are generally found in low watershed elevations of the study area. The habitats with high intrinsic potential to produce coho salmon are based solely on channel geomorphic conditions and encompass small stream sections in the lowermost reaches in the action area. On the west side of the action area, these areas include Dean and Scholfield creeks in the Umpqua Watershed, Murphy, Big, Benson and Johnson creeks in the Tenmile Watershed, and Palouse Creek in the Coos Watershed. They are generally connected to downstream reaches with high intrinsic potential and have the capacity to symbolize extended zones of connected watershed-scale refugia.

Conversely, small sections of stream reaches on the east side of the action area rated with high intrinsic potential to produce coho salmon are generally disconnected with other reaches of similar designation (Figure 3.5-12). It is unlikely these areas have the quality to represent watershed-scale refugia. Nearly all of the moderate to high quality summer and winter rearing areas are located downstream of the action area. Connectivity of stream habitat processes and fish populations on and off the action area is important for the productivity of anadromous fish populations in all three watersheds, primarily on the west side of the action area.

Channel Condition and Dynamics

According to the ODF Coos District GIS stream layer, the action area has about 135 miles of large and medium streams, most of which are important for fish, and 635 miles of small streams, many of which also support fish. The current ODF fish distribution data assume about 10 percent (65 miles) of the small streams are fish-bearing streams (Oregon Department of Forestry 2008, Dent pers. comm. 2007).

Channel Cross-Sections: Channel cross sections are measured in the AIP protocols by means of a width-to-depth ratio. The active channel width is divided by the active channel height to arrive at the width-to-depth ratio. The width-to-depth ratio is an indicator of habitat quality. Relatively deep, narrow stream channels tend to provide better fish habitat than shallow, wide channels.

Wide and shallow stream channels may be indicators of high sediment supply or stream bank disturbance that extends the banks beyond a channel normally fit to its hydrologic regime. Wide, shallow streams (large width-to-depth ratios) are more exposed to solar radiation and result in high maximum temperatures and wide temperature fluctuations. They often offer more plane-bedded channel habitat conditions than typical meandering, pool-riffle channels. Width-to-depth ratios typically increase directly with channel sizes, so a review of small, medium, and large channels is appropriate.

A comparison of AIP data in the action area with regional reference stream AIP data in Table 3.5-18 suggests the distribution (25th, 50th, and 75th percentiles) of width to depth ratios in small, medium and large streams on the action area are functioning at a slight risk to fish species. The width-to-depth ratios are wider than reference conditions for all channel sizes at each of the distribution points, particularly for the large channel types.

Table 3.5-18 Stream Width-to-Depth Ratios in the Action Area Compared to ODFW Reference Streams (Active Channel Width/Active Channel Height)

Channel Size	Action Area AIP Habitat Assessment Data[1] 117 Reaches 25th-75th quartile (median)	ODFW Mid/South Coast AIP Reference Data[2] 57 Reaches 25th-75th quartile (median)	ODFW Oregon Coast AIP Reference Data[2] 124 Reaches 25th-75th quartile (median)	ODFW AIP Benchmark [1] Range
Small	8 – 17 (10)	5 – 15 (7)	6 – 11 (9)	Not applicable
Medium	13 – 28 (18)	11 – 19 (15)	12 – 18 (15)	Not applicable
Large	20 – 73 (36)	20 – 26 (22)	19 – 29 (23)	Not applicable

Sources: [1] Kavanagh et al. 2005, [2] Thom et al. 2001.
AIP = Aquatic Inventory Project; ODFW = Oregon Department of Fish and Wildlife

Streambank Conditions

The AIP database includes bank erosion under stream bank conditions as a visual determination of the percent reach length with actively eroding banks. Although bank erosion is a natural process, actively eroding banks are sources of silt and sand. The effects of fine sediments are described in Section 3.5.3.5, Habitat Elements, Substrate/Spawning Habitat. Actively eroding banks tend to inhibit the development of undercut banks, which provide desirable rearing habitat for fish species. Unstable, actively eroding banks also degrade riparian vegetation.

A comparison of AIP data in the action area with regional reference stream AIP data suggest the distribution (25th, 50th and 75th percentiles) of eroding streambanks in small, medium and large streams are currently similar to reference conditions for all channel sizes (Table 3.5-19). The habitat element for streambank conditions appears to be functioning properly within the natural range of bank erosion frequencies for the study area.

Floodplain Connectivity

Less than 10 percent of the fish-bearing stream miles in the action area are floodplain stream channels. Such channels are most frequently found in the Tenmile Watershed (35 percent of the fish-bearing stream miles), where unconfined stream channels offer unique, high quality habitat for fish not found elsewhere in the action area (Biosystems et al. 2003). These low gradient streams likely provide off-channel and side channel connections to floodplains, where overbank flows occur, and maintain wetland, riparian, and hydrological functions.

Table 3.5-19 Percent Stream Bank Erosion in the Action Area Compared to ODFW Reference Streams

	Stream Bank Erosion (Percent)[1]			
	Action Area AIP Habitat Assessment Data [2]	**ODFW Mid/South Coast AIP Reference Data [3]**	**ODFW Oregon Coast AIP Reference Data [3]**	**ODFW AIP Benchmark [3]**
	117 Reaches	**57 Reaches**	**124 Reaches**	
Channel Size	**25th-75th quartile (median)**	**25th-75th quartile (median)**	**25th-75th quartile (median)**	**Range**
Small	1 – 23 (13)	2 – 78 (10)	0 – 13 (3)	Not applicable
Medium	0 – 18 (4)	6 – 28 (17)	2 – 18 (7)	Not applicable
Large	0 – 16 (4)	3 – 8 (5)	1 – 9 (5)	Not applicable

Sources: [2] Kavanagh et al. 2005, [3] Thom et al. 2001.
[1]Visual % estimate of extent of actively eroding banks per reach length
AIP = Aquatic Inventory Project; ODFW = Oregon Department of Fish and Wildlife

There are no AIP data available at this time to assess the floodplain connectivity indicator. However Kavanagh et al. (2005) assumed the amount of secondary off-channel area, described in Section 3.5.3.3 Aquatic Habitat, Habitat Elements, Off-Channel Habitat/Refugia, indicates moderate connectivity to floodplains.

Physical modifications of stream channels in the action area are few, with the exception of stream crossings and prior removal of wood from channels. The potential for valley-bottom roads to cut off floodplains from mainstem rivers exists, however valley-bottom roads in the action area are limited, ranging between 1.0 and 2.5 percent of the existing road network in the three watersheds. Historical large wood removal programs have likely contributed to converting channel morphologies to a plane-bedded character, resulting in a general straightening and steepening of stream channels. This conversion may have adversely changed floodplain connection by incising channels to a greater degree than normal in some locations. Conversely, the natural landscape consists of predominately confined channels, which inherently restrict floodplain connectivity.

It is unknown if the hydrologic connectivity to the floodplain is currently placing ecosystem functioning at some level of risk to fish species.

Section 3.6
Wildlife and Their Habitat

This section describes the biology, habitat requirements and status for 10 species of wildlife selected for coverage under the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008), and associated with one or more of the alternatives described in Chapter 2, Alternatives. The 10 species covered in this section are:

- Northern spotted owl (*Strix occidentalis caurina*)
- Marbled murrelet (*Brachyramphus marmoratus*)
- Bald eagle (*Haliaeetus leucocephalus*)
- Northern goshawk (*Accipiter gentilis*)
- Olive-sided flycatcher (*Contopus cooperi*)
- Western bluebird (*Sialia mexicana*)
- Fisher (*Martes pennanti*)
- Northern red-legged frog (*Rana aurora aurora*)
- Coastal tailed frog (*Ascaphus truei*)
- Southern torrent salamander (*Rhyacotriton variegatus*) (formerly *R. olympicus variegates*)

The Federal and State listing status for these wildlife species is presented in Table 1-1 in Chapter 1, Purpose and Need. These species were selected for inclusion in the *Elliott State Forest Habitat Conservation Plan* because of their perceived sensitivity to the types of forest management activities being proposed in the study area, and the likelihood that they may occupy these lands over the next 50 years. This section also briefly describes the biology and habitat requirements of game species (e.g., elk, deer, and bear) and non-game species that do or could occur in that study area but that are not listed under the State or Federal Endangered Species Acts (ESAs). The study area for the analysis of effects on wildlife is the same as the action area, as described in Section 3.0, Action Area and Study Area.

3.6.1 Sources of Information

A combination of literature review, including the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008), and site-specific information provided by the Oregon Department of Forestry (ODF) was used to describe the affected environment for the wildlife described in this section. The literature review, which included reports from ODF-sponsored research, was conducted to establish habitat requirements and population status range-wide within the Oregon Coast Range, and in the study area. Current habitat conditions in the study area were provided by ODF using its forest inventory system and existing geographic information system (GIS) data.

3.6.2 Affected Environment

The study area provides habitat for most native species found in forests of the Oregon Coast Range (Johnson and O'Neil 2001). About 191 species are known or expected to occur on, or adjacent to, the study area: 51 mammals, 116 birds, and 24 amphibians and reptiles. Each of these species requires habitat conditions that may be found within one or more of the plant communities and seral stages present in the study area. Wildlife diversity is generally correlated with the presence of a variety of habitat conditions, seral stages, and stand structural attributes across the landscape.

Conifer forests cover almost all of the study area, providing the predominant habitats for terrestrial-associated wildlife. About half of the conifer forest present is younger than 85 years old, with most of the remaining conifer forest between 86 and 145 years old. Other vegetation types that provide minor wildlife habitat include grasslands, brushlands, and hardwood forest.

The study area has a high density of streams, but few lakes, ponds and wetlands. Approximately 135 miles of large and medium streams, and 635 miles of small streams have been identified in the study area (Oregon Department of Forestry 2008, Dent pers. comm. 2006). Where they do occur, ponds and wetlands are usually part of stream channels and are often the result of beaver activity. These streams, ponds, and wetlands provide habitat for aquatic-associated wildlife. Riparian habitat present around streams, ponds, and wetlands are utilized by both aquatic and terrestrial-associated wildlife. Riparian areas are among the most important wildlife habitats in Oregon (Johnson and O'Neil 2001).

The following provides a detailed description of the ecology, status, and current management practices for the 10 wildlife species listed in Table 1-1, and for other game and non-game species that could occur in the study area.

3.6.2.1 Northern Spotted Owl

Species Ecology

Distribution

The northern spotted owl is found in conifer forests of northwestern North America, primarily in Washington, Oregon, and northern California. The current range of the species is about the same as its historical range, extending from southwestern British Columbia to the San Francisco Bay area, and from the Pacific Ocean east across the Cascades (U.S. Fish and Wildlife Service 1992a).

Behavior and Reproduction

Northern spotted owls are non-migratory nocturnal predators of medium-sized mammals and occasionally birds or insects. Like other nocturnal owls, spotted owls have excellent eyesight and hearing, and they have feathers modified to enable silent flight. Their foraging strategy is to perch and wait (watch and listen) before silently approaching and pouncing on prey in trees or on the ground (Forsman et al. 1984; Thomas et al. 1990).

Northern spotted owls begin breeding in March. They do not construct their own nests but prefer to use existing structures. Nesting occurs in cavities or platforms, such as abandoned goshawk nests or dwarf mistletoe brooms (Buchanan et al. 1993; Forsman et al. 1984; Thomas et al. 1990). Eggs are incubated for about 30 days. Juveniles remain in the nest for 3 to 5 weeks. Young often leave the nest before they can fly, and climb into nearby branches or fall to the ground. Both parents feed the young until they disperse in early fall (late September or early October) (U.S. Fish and Wildlife Service 1992a). Juveniles begin to hunt in late summer while they are still dependent on their parents. After dispersal of the young, the adults expand their home ranges and spend less time together until breeding begins again in March. Pairs tend to stay together for life (LaHaye 2004).

Habitat Requirements

Median home range size for northern spotted owl pairs in the Oregon Coast Range is approximately 4,500 acres, but home ranges for northern spotted owls associated with the study area are smaller than those reported for other study areas in the Coast Range and western Cascades of Oregon (Anthony et al. 2000a; Glenn et al. 2004). Estimates of the average home range size of individual northern spotted owls in the study area vary by the calculation methods used, and range from 2,080 acres (plus or minus 284 acres) for the 95 percent Fixed Kernel method to 2,738 acres (plus or minus 339 acres) for the 100 percent Minimum Convex Polygon method. Home range overlap between individuals of mated pairs in the study area averages 61.5 percent (Glenn et al. 2004). Individual owl "core use area" has been estimated to be 215 acres according to the 50 percent Fixed Kernel method, and average overlap of core use areas within mated pairs was 76.5 percent. (Glenn et al. 2004). The size of a home range may be related to the availability of prey, and owls may have smaller home ranges in forests with abundant prey (Carey et al. 1992; Forsman et al. 1984). Northern spotted

owls usually occupy the same general home range from year to year, but they commonly use different nest trees or have alternate activity centers (concentrated use areas) within their home ranges (Oregon Department of Fish and Wildlife 1992 cited in Oregon Department of Forestry 2008). Home ranges may overlap to some degree with other spotted owls (Forsman et al. 1984).

Forest stand structure suitable for nesting is a crucial habitat requirement (Tappeiner et al. 1992 cited in Oregon Department of Forestry 2008). Within the broad range of habitat used by northern spotted owls, late-seral or old-growth forests are preferred (Blakesley et al. 1992; U.S. Fish and Wildlife Service 1992a). These stands are characterized by multi-storied canopies dominated by large overstory trees and well-developed understories (Spies and Franklin 1991). The stands often have mixed tree species, with two or more age classes resulting from disturbances such as fire, windthrow, and root diseases. Large snags and fallen logs within the stands are common.

In managed forests, northern spotted owls usually occupy areas with structural diversity and a high degree of canopy closure, which typically contain large-diameter live trees from the current or previous stand (U.S. Fish and Wildlife Service 1992a). Bart and Forsman (1992) found northern spotted owl detections and reproduction to be positively correlated with increasing amounts of older forest (stands 80 or more years old). Landscapes with more than 60 percent older forest, by this definition, had seven times the density of northern spotted owl pairs and 40 times the number of young fledged per square kilometer, compared to landscapes with 20 percent or less older forest. Thomas et al. (1990) report similar results.

In the central Oregon Coast Range, nest sites have higher densities of snags smaller than 21 inches in diameter-at-breast height (dbh), higher densities of broad-leaved trees, and higher numbers of vegetation layers than random sites (Thrailkill et al. 1998 cited in Blakesley 2004). Densities of live conifer trees and snags in the 21 to 33 inch dbh size range were lower at nest sites than random sites.

Management and Status in Western Oregon

The northern spotted owl is listed as threatened under the Federal ESA (U.S. Fish and Wildlife Service 1990) and the Oregon ESA. Threatened status was recently reaffirmed in a 5-year status review (Courtney et al. 2004). Estimates of northern spotted owl populations vary widely (Thomas et al. 1990; U.S. Fish and Wildlife Service 1992a). Because surveying for owls greatly increased during the last two decades of the 20th century, total population estimates also increased during that time. However, recent demographic analyses suggest the populations may actually be declining. These analyses use λ (lambda, the annual rate of population change) as a measure of population trends. Stationary populations are represented by a λ of 1.0. Decreasing populations have a λ of less than 1.0. The most recent demographic analysis by Anthony et al. (2006) found spotted owl populations in 13 demographic study areas in Washington, Oregon, and northern California had an overall average λ of 0.963 from 1985 through 2003, suggesting

that the population in these areas may be declining at a rate of 3.7 percent per year. Two of these demographic study areas (Oregon Coast Range and Tyee) are in the vicinity of the study area. The population in the Oregon Coast Range demographic study area (north of the study area) experienced a decline of 20 to 30 percent from 1985 through 2003, while the population in the Tyee demographic study area (east of the study area) was stationary (Anthony et al. 2006).

The U. S. Fish and Wildlife Service (FWS) designated critical habitat for the northern spotted owl in 1992 (U.S. Fish and Wildlife Service 1992b). All State lands were deleted from the final designation of critical habitat. Therefore, the study area does not include any federally designated critical habitat.

At the time the northern spotted owl was listed as threatened, five factors were assessed with respect to their contribution to the imminent or probable future risk of extinction to the species (U.S. Fish and Wildlife Service 1990). These five factors included the following:

- the present or threatened destruction, modification, or curtailment of the spotted owl's habitat or range;
- over-utilization of the spotted owl for commercial, recreational, scientific, or educational purposes;
- disease or predation;
- the inadequacy of existing regulatory mechanisms at protecting spotted owls; and
- other natural or artificial factors affecting the continued existence of the spotted owl.

The *Scientific Evaluation of the Status of the Northern Spotted Owl* (Status Report) (Courtney et al. 2004) reviewed all previously identified threats to the spotted owl to determine whether they have increased, decreased, remained the same, or been eliminated since the 1990 listing. The Status Report also considered whether any new potential threats to spotted owls have developed and whether new information or analysis challenges any of the conclusions in the original listing determination. A summary of their findings concerning factors relevant to management of the study area is provided below.

The Present or Threatened Destruction, Modification, or Curtailment of the Spotted Owl's Habitat or Range: Loss of habitat from timber harvest was one of the primary threats indicated at the time of listing (U.S. Fish and Wildlife Service 1990). Since then, the rate of habitat loss from timber harvest on Federal lands has been greatly reduced because of implementation of the Northwest Forest Plan (NWFP) in 1994. Habitat loss and fragmentation resulting from past timber harvest may still be affecting the long-lived species, but the threat has likely been reduced since the species was listed in 1990.

The majority of habitat loss from timber harvest currently takes place on non-federal lands. Habitat conservation plans are seen as an important conservation measure reducing or mitigating habitat loss on non-federal lands. However, timber harvest is still occurring across all ownerships in the region.

According to the 2004 Status Report, the potential threat of habitat loss from catastrophic wildfire is continuing or increasing, particularly in the eastern Cascades, Klamath region, and on Federal lands. Currently, insect damage and windthrow are not considered immediate threats to northern spotted owl habitat. Sudden Oak Death is not generally considered a present threat, but may be a threat in the future within the southern portion of the northern spotted owl's range.

Barred Owl: In 1990, impacts from competition and potential interbreeding with barred owls (*Strix varia*) were of concern, but the potential impacts were unknown (U.S. Fish and Wildlife Service 1990). Barred owls are somewhat larger, more aggressive, use a wider variety of habitats, and feed on a broader range of prey than northern spotted owls. The Status Report did not find widespread evidence that barred owls were displacing northern spotted owls, but concluded that the barred owl represents a current and future threat to the spotted owl. Occasional hybridization between barred owls and northern spotted owls has been observed in the wild, but has not been found to be very common. Hybridization is not considered a current major threat to the northern spotted owl (Courtney and Gutiérrez 2004). Overall, competition from barred owl currently constitutes a significantly greater threat to the northern spotted owl than was originally considered at the time of listing. However, substantial uncertainty is associated with the effect of the barred owl on the northern spotted owl (Gutiérrez et al. 2004).

Considerable uncertainty also exists as to the effect of forest management on the relationship between spotted owls and barred owls. It has been suggested that habitat alteration and fragmentation due to commercial forestry may be increasing the rate at which barred owls displace spotted owls from established territories, but recent findings cast doubt on that theory. Barred owls are known to occupy unmanaged old-growth forest in Washington (Pearson and Livezey 2003), and barred owl numbers have been found increasing within unharvested old-growth forest previously known to be occupied by spotted owls in the Olympic National Park (Gremel 2000, 2001). Given the uncertainty surrounding barred owls, it is not possible to make a meaningful analysis of the influence of management on the relationship between barred owls and spotted owls in the study area.

The recently completed Recovery Plan for the Northern Spotted Owl (Recovery Plan; U.S. Fish and Wildlife Service 2008) identifies the most important range-wide threats to the survival and recovery of the species as, "competition with barred owls, ongoing loss of suitable habitat as a result of timber harvest and catastrophic fire, and loss of amount and distribution of suitable habitat as a result of past activities and disturbances." As a guidance document, the Recovery Plan recommends 34 actions to address overall recovery through management of the barred owl, maintenance and restoration of suitable habitat

for spotted owls, monitoring of avian diseases, and development and implementation of a delisting monitoring plan. Barred owl management would involve further research into the interactions between barred and spotted owls, and control of barred owl populations. Management and restoration of habitat would occur in Managed Owl Conservation Areas (MOCA) on Federal lands and Conservation Support Areas (CSA) on strategically-located non-federal lands. All landowners (Federal and non-federal) outside MOCA and CSA are encouraged to retain "older and more structurally complex multi-layered conifer forest," to provide additional habitat for spotted owls. The Recovery Plan also contains a number of actions to encourage and facilitate the development of Habitat Conservation Plans on non-federal lands within the range of the subspecies.

The Elliott State Forest is identified as neither a MOCA nor a CSA in the Recovery Plan. The only element of the Recovery Plan pertinent to the study area would be:

- **Recovery Action 32**, which encourages the retention of structurally complex forest suitable for resident spotted owls on non-federal lands, and
- **Recovery Actions 13, 14 and 15**, which address HCPs and other incentive-based programs to encourage management for spotted owl habitat on non-federal lands.

Status in the Study Area

Use of Habitats

Research conducted in the study area has shown that northern spotted owls select mature, old, and "mixed age" coniferous habitats, consistent with other studies (Anthony et al. 2000a; Carey et al. 1990; Forsman 1980; Forsman et al. 1984). In addition, Anthony et al. (2000a) found spotted owls tend to select hardwood habitats in the study area, particularly when less than 20 percent old and mature conifer habitat was available (Anthony et al. 2000a). Hardwood habitats included hardwood trees with relatively complex canopies, such as big leaf maple and myrtlewood. An analysis of habitat edge types found that northern spotted owls selected the edge (or *ecotone*) between hardwood and conifer forest more often than expected, based on availability (Anthony et al. 1999 cited in Oregon Department of Forestry 2008). Northern spotted owls avoided habitat types with no apparent ecotone, and avoided certain edge types containing pole size trees or open forest components.

Within nine known northern spotted owl home ranges in the study area, forest density, structure, and species composition were compared between high use areas (nesting and foraging habitat) and low use areas (Tappeiner et al. 2000). The study revealed no difference in tree size or density between nesting/foraging and low use areas, and no relationship between these characteristics and the relative success of owl sites (as measured by owl reproduction and occupancy). Similarly, downed woody debris was equally common between nesting, foraging, and low use areas, suggesting it is not a limiting factor in the study area. However, some habitat characteristics related to the abundance of large trees and

snags did vary between high use and low use areas. Of the 100 largest trees measured in the study plots, nesting and foraging areas tended to have a greater abundance of larger trees than did low use areas (Tappeiner et al. 2000). In addition, the number and size of snags was greater in nesting areas than in foraging and low use areas. Within nesting areas, nest trees tended to be larger than the average of the trees and snags present.

In addition to measuring characteristics of habitat within owl home ranges, tree growth rates were investigated adjacent to known northern spotted owl sites by examining tree stumps (Tappeiner et al. 2000). The results of this work indicated that initial tree densities (the number of trees present at the seedling stage of stand development) likely were relatively low in some of these stands in the study area. The investigators also noted that 10 to 15 percent of the foraging plots had been thinned 15 to 40 years prior to the study. These results suggest that lower tree density contributes to owl habitat, whether created naturally or through management.

For purposes of this analysis, advanced structure forest is considered northern spotted owl foraging habitat; and advanced structure forest with at least eight trees per acre that are at least 32 inches dbh is considered nesting-roosting-foraging (NRF) habitat (Section 3.1, Forest Conditions, provides definitions of the forest structure classes). A summary of northern spotted owl habitat in the study area using this classification is provided in Table 3.6-1. Excluded from this summary is advanced structure forest in riparian management areas (RMAs) that are adjacent to recent clearcuts or young forest (less than 70 years old), since spotted owls are not likely to use these narrow, isolated patches of habitat. Consequently, the acreage values in Table 3.6-1 may be less than acres of all advanced structure forest reported elsewhere in this Environmental Impact Statement (EIS).

Table 3.6-1 Summary of Northern Spotted Owl Habitat in the Study Area

		Habitat Type (acres) [1]			
Management Basin	**Basin Area (acres)**	**Foraging [2]**	**Nesting-Roosting-Foraging [3]**	**Total Suitable Habitat [4]**	**Intermediate Structure Forest**
1	5,356	1,113	765	1,878	3,118
2	6,422	2,101	2,068	4,169	1,841
3	7,296	1,700	1,757	3,457	3,405
4	4,990	430	1,157	1,587	2,934
5	7,823	1,165	2,607	3,772	3,415
6	7,417	1,538	2,577	4,115	2,656
7	6,322	998	2,177	3,175	2,529
8	6,541	597	2,048	2,645	3,100
9	8,284	1,170	1,143	2,313	4,450
10-A	3,325	868	0	868	2,047
10-B	480	0	154	154	269
10-C	2,707	0	233	233	1,634
11	10,873	801	4,292	5,093	3,781
12	11,314	1,068	2,520	3,588	5,024
13	4,132	232	1,370	1,602	2,079
Total	93,282	13,781	24,868	38,649	42,282

Source: Oregon Department of Forestry 2006b

[1] Acres of advanced structure forest do not include habitat within riparian management areas (RMA) that are outside areas designated as Habitat Conservancy Areas (HCAs), Marbled Murrelet Management Areas (MMMA) or scenic, unique, and visual (SUV) areas under the 1995 *Elliott State Forest Habitat Conservation Plan* and adjacent to forest less than 70 years old.

[2] Acreage values in this column include only advanced structure forest with fewer than 8 trees per acre at least 32 inches diameter-at-breast height (dbh).

[3] This column includes only advanced structure forest with at least 8 trees per acre at least 32 inches dbh.

[4] This column includes all advanced structure forest except that in RMAs that are outside areas designated as HCA, MMMA or SUV under the 1995 *Elliott State Forest Habitat Conservation Plan* and adjacent to forest less than 70 years old.

Table 3.6-1 also summarizes intermediate structure forest, as defined in Section 3.1, Forest Condition. Although forest that meets the minimum definition of intermediate structure probably does not receive use by spotted owls, intermediate structure forest at the upper end of the range (forest with larger trees and greater structural diversity) likely does support spotted owl foraging. Intermediate structure forest also can decrease the effects of forest fragmentation on spotted owls by reducing the amount of edge between advanced structure and early structure forest, and by providing forest cover for spotted owls moving between patches of NRF and foraging habitat. A substantial portion of intermediate structure forest would meet the definition of marginal foraging habitat (dispersal habitat) for spotted owls developed by Thomas et al.

(1990). To be consistent with the methods applied to advanced structure forest, intermediate structure forest in isolated RMAs was not included as habitat in this analysis.

Population

Northern spotted owl surveys were conducted in the study area from 1991 to 1998 (Anthony et al. 2000b). Survey effort and methodology were different in 1991 and 1992, so trends cannot be inferred using numbers of northern spotted owl sites from these years. From 1993 through 1998, a consistent methodology was in place as part of a demographic study. The methodology of the survey provides estimates of density and demographic parameters (such as survival and rate of population change). In 2003, a survey for northern spotted owls in the study area was conducted using the 1993 to 1998 protocol to estimate a northern spotted owl density index in the study area for comparison with previous years (Perkins and Ellingson 2003). Density estimates from 1993 through 1998, and 2003, are given in Table 3.6-2.

Table 3.6-2 Number of Spotted Owls, Owl Activity Centers and the Crude Densities of Spotted Owl Activity Centers in the Study Area, 1993–1998 and 2003[1]

	Number Observed [2]		Density (per square mile) [3]	
Year	Activity Centers	Owls	Activity Centers	Owls
1993	21	40	0.144	0.274
1994	18	35	0.123	0.233
1995	19	30	0.130	0.206
1996	13	23	0.089	0.158
1997 [4]	11	20	0.075	0.137
1998 [4]	11	19	0.075	0.130
2003 [5]	13	25	0.089	0.171

Source: Perkins and Ellingson 2003

[1] Spotted owl surveys are not required under the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 1995), so no consistent surveys have been conducted since 2003. No new spotted owl activity centers have been identified in the study area since 2003.

[2] Includes active pairs and resident singles.

[3] Represents the number of owls or territories divided by 146 square miles (378 square kilometers).

[4] Minimum estimates, because only previously known owl sites were surveyed.

[5] 1-year (6-visit) surveys.

Survival rate (the percentage of the population that survives from one year to the next) for adult spotted owls appeared to be declining in the action area over the course of the study (1993-1998) (Anthony et al. 2000a). The average overall adult survival rate was estimated to be 0.85 (similar to rates found in other studies), while juvenile survival rate averaged 0.54 (greater than rates found in most other studies).

Because owl sites in the action area are not isolated from one another, or from adjacent populations, immigration into the area should contribute to population stability (Anthony et al. 2002a cited Oregon Department of Forestry 2008). However, the declining trends in density from 1993 to 2003 (Table 3.6-2; Perkins and Ellingson 2003) and adult survival from 1993 to 1998 (Anthony et al. 2000a) are cause for concern in the study area and may indicate the overall population is declining.

As of 2003, ODF reported 18 spotted owl activity centers on or adjacent to the study area that had status of pair or resident single at some time between 1992 and 2003 (Table 3.6-3), including the 13 activity centers analyzed as part of the density estimate (Table 3.6-2). The Sock Creek, Murphy Creek and Noble Creek activity centers were not included in the density estimate because no spotted owls were detected during six-visit protocol surveys in 2003, but all three activity centers are still considered occupied because a single year of absence is not sufficient to classify them historic (see Appendix F of the *Elliott State Forest Habitat Conservation Plan* [Oregon Department of Forestry 2008]). Another of the 18 activity centers (Palouse Creek) was excluded from the density estimate because it did not reach resident single status in 2003 (a single adult male was detected only twice). The last of the 18 activity centers (Upper Mill Creek) had a spotted owl present in 2003, but that owl later moved to the Tom Fool activity center, so Upper Mill Creek is no longer considered an independent activity center. Consistent surveys for spotted owls have not been conducted in the study area since 2003 (none are required under the 1995 *Elliott State Forest Habitat Conservation Plan*) and no new activity centers have been discovered.

Table 3.6-3 Spotted Owl Activity Centers Reported In or Adjacent To the Study Area as of 2003[1]

Activity Center	Basin	Highest Status [2]	Included in Density Estimate [3]
Upper Mill Creek	1	Pair	No
Lower Mill Creek	1	Pair	Yes
Tom Fool Creek	1	Pair	Yes
Sock Creek	1	Resident Single	No
Dean Creek	3	Pair	Yes
Wind Creek	4	Pair	Yes
Alder Creek	5	Pair	Yes
Murphy Creek	5	Pair	No
Noble Creek	5	Resident Single	No
Benson Creek	6	Pair	Yes
Roberts Creek	6	Pair	Yes
Johnson Creek	7	Pair	Yes
Palouse Creek	8	Pair	No
Fourmile Creek	10	Pair	Yes

Activity Center	Basin	Highest Status [2]	Included in Density Estimate [3]
Marlow Creek	10	Pair	Yes
West Glenn Creek	10	Pair	Yes
Panther Creek	11	Resident Single	Yes
Salander Creek	13	Pair	Yes

Source: Oregon Department of Forestry 2008

[1] Spotted owl surveys are not required under the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 1995), so no consistent surveys have been conducted since 2003. No new spotted owl activity centers have been identified in the study area since 2003.

[2] Highest status reported between 1992 and 2003; may not reflect current (2003) status.

[3] Only sites with status of Pair or Resident Single in 2003 were included in the density estimate.

3.6.2.2 Marbled Murrelet

Species Ecology

Distribution

The marbled murrelet is found in nearshore marine water from the Aleutian Islands in Alaska to central California (Marshall 1988). The distribution of murrelets within this range is considered to be mostly continuous, but some gaps occur along the Aleutian Islands, southwest British Columbia, and in the southern portion of the range along portions of the southern Oregon and northern California coast (McShane et al. 2004).

Behavior and Reproduction

Marbled murrelets are unique among seabirds of the family *Alcidae* in that they nest primarily in forest habitats (Nelson 1997). Most marbled murrelets nest in old-growth conifers, although nests in younger trees have been found, especially in western hemlock trees infected with dwarf mistletoe (Nelson and Wilson 2002). Nests have been found on the ground and in deciduous trees in Alaska and British Columbia (Simons 1980; Hirsch et al. 1981; Day et al. 1983; Johnston and Carter 1985; Bradley and Cooke 2001), but only tree nests are known to occur in Washington, Oregon, and California (McShane et al. 2004). In a study of nest site characteristics in British Columbia, most nests were located on branches 6 to 29 inches in diameter in large conifers (Burger 2002). The majority of nests (84 percent) were located at elevations below 3,280 feet.

Marbled murrelets have a longer breeding season in Oregon and California than in Washington, British Columbia, and Alaska. Egg laying and incubation are estimated to last from late April to late July in Washington, early May to mid-July in British Columbia and mid-May to late July in Alaska (Hamer and Nelson 1995b). In Oregon, egg laying is estimated to begin from late March to the end of July, and young are fledged from June to September (Hamer and Nelson

1995b). The extended breeding season in California and Oregon may result from second broods, renesting following a failed nesting attempt, or variations in the time of nest initiation (Hamer and Nelson 1995b). Marbled murrelets lay a single egg, usually on a wide, moss-covered branch high in the canopy of a mature or old-growth conifer stand (Marshall 1988). Although there is no evidence of murrelets laying a second egg after successfully fledging one young (McShane et al. 2004), evidence of murrelets laying a replacement egg following early nest failure has been reported in California and British Columbia (Herbert et al. 2003; Tranquilla et al. 2003). Burger (2002) estimated that relaying occurs 5 percent of the time following egg loss.

Both adult murrelets incubate the egg for 27 to 30 days in 24-hour shifts, and usually exchange places just before dawn (Hamer and Nelson 1995b). Chicks are attended by an adult for 1 to 2 days following hatching, and are then left alone while both parents spend most of their time on the water. Chicks are fed small fish by both parents up to eight times a day until fledging, which occurs an average of 28 days after hatching (Hamer and Nelson 1995b). Upon fledging, marbled murrelet chicks fly directly to marine waters. Once juveniles reach marine waters, they are not thought to be attended or fed by adults (Nelson 1997).

There is some evidence that marbled murrelets exhibit fidelity to nesting areas and return to the same nesting stand in consecutive years, but this may be most common where large old-growth trees or predation are limited (McShane et al. 2004). Marbled murrelets have been documented to follow natural features such as rivers and streams during their flights inland; however the extent that this occurs seems to be uncertain and may be restricted to geographic regions with tall ridges (Burger 1997). In a radar study conducted in the Elliott State Forest (ESF), Cooper and Augenfeld (2001) observed that 81.6 percent of marbled murrelet flights occurred over ridges, 18.1 percent followed valleys, and 0.3 percent exhibited different qualities. Marbled murrelets typically use a consistent flight path in the vicinity of the nest to access nest stands and trees (Nelson 1997) by following creeks or other gaps in the forest canopy such as areas of blowdown (Nelson and Peck 1995).

Marbled murrelets have been observed inland during both breeding and non-breeding seasons, although flights below the canopy are rare during the non-breeding season (Naslund 1993; O'Donnell 1993; O'Donnell et al. 1995). Activity levels measured by looking and listening for birds in forest landscapes are highest during the breeding season, although variation in activity level within the breeding season has differed between studies. Within the breeding season, inland activity has been reported to increase from May to July, peak in July (Eisenhawer and Remchen 1990; Rodway et al. 1993; O'Donnell et al. 1995; Jodice and Collopy 2000), and drop off dramatically in August (Cooper et al. 2001). Using radar in British Columbia, Burger (2001) recorded low activity levels in early May and after mid-July, which were attributed to incubation and post-breeding periods, respectively.

Habitat Requirements

The marbled murrelet forages on near-shore marine waters for fish and invertebrates, and nests inland in mature and old-growth forest. Since this EIS does not deal with marine habitat, the following discussion of marbled murrelet habitat focuses only on nesting habitat.

The distance marbled murrelets will travel inland to nests is variable across the geographic range of the species. The *Marbled Murrelet Effectiveness Monitoring Plan* for the NWFP considers primary nesting habitat in Oregon to be within 35 miles of the coast (U.S. Department of Agriculture and U.S. Department of the Interior 1994). Surveys of marbled murrelet activity have found that murrelet abundance is correlated with abundance of suitable habitat, which is generally defined as late-seral forest with at least 70 percent crown closure of conifers, including at least 10 percent from trees greater than 21 inches dbh. Using radar to conduct marbled murrelet surveys on the Olympic Peninsula in Washington, Cooper et al. (1998) found the number of landward-flying murrelet detections was significantly correlated with the amount of late-seral coniferous forest. Also on the Olympic Peninsula, Raphael et al. (2002a) found that although the overall amount of suitable habitat within drainages was important in predicting marbled murrelet abundance, the distribution of the habitat within the drainages was less so.

The characteristics of nest trees selected by marbled murrelets are consistent across their range; however, the species of tree most frequently used varies depending on geographic context. For example, in British Columbia, yellow cedar (*Chamaecyparis nootkatensis*) is most commonly used along the Sunshine Coast, while western hemlock, Sitka spruce, western redcedar, and Douglas-fir are used in equal amounts elsewhere (Burger 2002). In a study on the nest tree characteristics on State lands in Oregon, Nelson and Wilson (2002) found nests most commonly in western hemlock and Douglas-fir, and less commonly in Sitka spruce and western redcedar.

Marbled murrelets usually select tall, large-diameter trees (often greater than 39 inches dbh) with many potential nesting platforms (often greater than four platforms), and abundant cover of moss or other epiphytes (Manley and Nelson 1999; Burger 2002; Conroy et al. 2002; Nelson and Wilson 2002). In most regions, nests have been found only in mature or old-growth trees (Nelson 1997). However, in the northern Coast Range of Oregon murrelets are known to nest in trees as small as 11 inches dbh with witches' brooms (branch deformities caused by dwarf mistletoes or other pathogens) (Nelson and Wilson 2002). The presence of canopy gaps has also been shown to influence nest site selection (Manley and Nelson 1999). In his review of existing literature on nest trees used by murrelets across their range, Burger (2002) noted that given a choice, it appears murrelets select nest trees with the following characteristics:

- sufficient height to allow stall-landing and jump-off departures,
- openings in the canopy for unobstructed flight access,
- sufficient diameter to provide a nest site and landing platform,

- some soft substrate to support a nest cup, and
- overhead foliage cover.

Management and Status in Western Oregon

The marbled murrelet is listed as threatened under the Federal ESA (U.S. Fish and Wildlife Service 1996) and the Oregon ESA. Population estimates of marbled murrelets in North America range from 600,000 (DeGange 1996) to nearly 950,000 (McShane et al. 2004). The majority of the population is located in Alaska (859,100) and British Columbia (66,500) (McShane et al. 2004). The mean population estimate in Washington, Oregon, and California from 3 years of at-sea surveys conducted from 2000 through 2002 is 21,500 marbled murrelets (McShane et al. 2004).

In Oregon, surveys have been conducted to estimate populations since 1992, although estimates using standardized, statistically rigorous sampling methods are available only for the 2000 to 2003 seasons (Huff et al. 2006). Estimates of marbled murrelet population sizes using the new standardized sampling efforts showed a decrease from 11,100 in 2000 to 9,600 in 2003 (Table 3.6-4).

Table 3.6-4 Estimates of Marbled Murrelet Population Size in 2000 through 2003 in Oregon

Year	Region	Density (murrelets per square mile)	Standard Error	Population Estimate	95 Percent Confidence Interval for Population Estimate
2000	Zone 3, North Coast Stratum	3.89	1.01	1,000	500 – 1,500
	Zone 3, Central Coast Stratum	15.89	4.06	5,700	3,200 – 8,700
	Zone 3, Total	10.92	2.63	6,700	4,000 – 9,900
	Zone 4 (Oregon Portion)	15.58	5.24	4,400	3,000 – 8,700
	Total			11,100	
2001	Zone 3, North Coast Stratum	4.52	1.12	1,200	600 – 1,700
	Zone 3, Central Coast Stratum	17.69	2.54	6,400	4,300– 8,000
	Zone 3, Total	12.24	1.65	7,500	5,300 – 9,300
	Zone 4 (Oregon Portion)	12.00	3.14	3,400	2,400 – 5,900
	Total			10,900	
2002	Zone 3, North Coast Stratum	1.98	0.71	500	300 – 1,000
	Zone 3, Central Coast Stratum	15.98	3.79	5,800	3,500 – 9,200
	Zone 3, Total	10.18	2.36	6,300	4,000 – 10,100
	Zone 4 (Oregon Portion)	13.52	1.97	3,800	2,600 – 5,000
	Total			10,100	

2003	Zone 3, North Coast Stratum	3.09	0.72	800	500 – 1,200
	Zone 3, Central Coast Stratum	14.08	2.49	5,100	3,200 – 6,600
	Zone 3, Total	9.52	1.55	5,900	3,900 – 7,600
	Zone 4 (Oregon Portion)	13.01	2.66	3,700	2,600 – 5,700
	Total			9,600	

Source: Huff et al. (2006)

Although sampling efforts prior to 2000 did not use the standardized methods established as part of the *Marbled Murrelet Effectiveness Monitoring Plan*, which was developed to assess and quantify existing habitat and the effect of the NWFP in affording species protection, sampling efforts in Oregon have been consistent across years; thus information on population trends and abundance patterns are available. However, the lack of randomization in sampling efforts may reduce the ability to make valid inferences from the sampling plot to the overall population (Ramsey and Schafer 1997). Thus, conclusions derived from data collected prior to 2000 should be considered as speculative. Nevertheless, important historical information is available from surveys conducted prior to 2000. As noted in *A Literature Review on Ecology and Effects of Forest Management on the Marbled Murrelet: A Report Submitted to Oregon Department of Forestry* (Weikel 2003), estimated populations of murrelets in Oregon ranged from approximately 3,900 to 10,000 between 1992 and 1999. In addition, Strong (2003) observed an abrupt 50 percent drop in populations of marbled murrelets in 1996, with no apparent decline prior to 1996 and no apparent recovery between 1997 and 1999. The decline in marbled murrelet numbers was most apparent in southern Oregon. Strong (2003) could not explain the sudden drop, but speculated that it was caused by low prey availability during summer or low survival over winter.

The "Evaluation Report" for the *5-Year Status Review of the Marbled Murrelet in Washington, Oregon, and California* (McShane et al. 2004) reports the results of demographic modeling of marbled murrelet populations. The FWS established six conservation zones extending from the Washington-British Columbia border to the mouth of San Francisco Bay. These demographic models suggest that populations in all zones studied are in decline, with mean annual rates of decline per decade ranging from 2.1 to 6.2 percent over four decades. In Conservation Zone 3, which extends from the Columbia River to North Bend, Oregon, mean annual rates of decline per decade ranged from 2.3 to 3.9 percent.

McShane et al. (2004) estimated that within Washington, Oregon, and California there are a total of 2,223,048 acres of suitable marbled murrelet nesting habitat, although the definition was inconsistent across the range of administrative units contributing to the study. Some of the habitat included in the estimate is as young as 80 years old, so it is likely an overestimate. The estimated total does not include suitable habitat located on private lands in Oregon and some private lands in Washington. The habitat is located primarily on Federal lands (91 percent), with 47 percent in Washington, 35 percent in Oregon, and 18 percent in California.

The FWS published a proposed designation of critical habitat for the marbled murrelet in August 1995 (U.S. Fish and Wildlife Service 1995). Under the proposal, the entire study area was to be designated as critical habitat. However, because ODF had developed an HCP for the study area and had obtained an incidental take permit (ITP) from the FWS for the murrelet, it was exempted when the final designation was published in May 1996 (U.S. Fish and Wildlife Service 1996).

Current threats to the survival and recovery of the marbled murrelet were identified in the literature review conducted by Weikel (2003), and are generally consistent with the subsequent findings of McShane et al. (2004). The *Recovery Plan for the Marbled Murrelet* (U.S. Fish and Wildlife Service 1997) listed threats to the species in both marine and terrestrial habitats. At-sea threats included mortality from fishing nets, oil spills, marine pollutants, and changes in prey abundance and distribution. Terrestrial threats included the loss of nesting habitat and poor reproductive success, primarily due to predation of nests and adults. This EIS addresses only terrestrial threats relevant to forest management activities covered by the three alternatives, as summarized below.

Loss of Nesting Habitat: In summarizing the marbled murrelet 5-year status review process, the FWS (McShane et al. 2004) noted that while the loss of nesting habitat was cited as a threat to the marbled murrelet at the time of listing in 1992, the rate of loss, particularly on Federal lands, has decreased since listing occurred. However, habitat originally lost has not been replaced by the in-growth of new habitat, and habitat loss continues on non-federal lands.

Poor Reproductive Success: Marbled murrelet nest success appears to be relatively low. In a summary of nest success for 77 nests with known outcomes, Manley and Nelson (1999) reported that most (more than 65 percent) failed, and the leading cause of failure was predation (over 60 percent of losses). Raphael et al. (2002b) noted that predation rates in the Manly and Nelson (1999) study (percent of nests lost due to predation) generally increased with decreasing latitude, with predation rates of 33 percent in Alaska, 48 percent in British Columbia, 53 percent in Oregon, and 60 percent in California. Although it has been speculated that marbled murrelets nesting close to the coast may have better success because they can make more trips inland to feed young, a study of variations in marbled murrelet commuting distances in British Columbia (Hull et al. 2001) failed to find a correlation between nest success and distance to saltwater.

Little research has been conducted on effects of factors other than predation on nest success. Murrelet nests are known to be depredated by Steller's jays (*Cyanocitta stelleri*), common ravens (*Corvus corax*), and sharp-shinned hawks (*Accipiter striatus*) (Hamer and Nelson 1995b; Long and Ralph 1998). Marbled murrelet remains have also been found at nests of northern goshawks, bald eagles, and peregrine falcons (*Falco peregrinus*) (Nelson 1997; Burger 2002). Species implicated, but not documented as predators, include the gray jay (*Perisoreus canadensis*), American crow (*C. brachyrhynchos*), great horned owl (*Bubo virginianus*), Cooper's hawk (*A. cooperii*), common raccoon (*Procyon lotor*), American marten (*Martes americana*), Townsend's chipmunk (*Eutamias*

townsendii), northern flying squirrel (*Glaucomys sabrinus*), Douglas squirrel (*Tamiasciurus douglasii*), and fisher (U.S. Fish and Wildlife Service 1997; Raphael et al. 2002b).

Most studies have shown that nest predation decreases with increasing distance from the forest edge. In their summary of 77 nests with known outcome, Manley and Nelson (1999) found that survival rates were lower (38 percent) for nests located within 164 feet of a stand edge, while nests located greater than 165 feet were more successful (62 percent). Raphael et al. (2002b) provide additional information, citing Manley and Nelson (1999). They note that whereas predation rates were greater within 164 feet of an edge, all nests greater than 492 feet from an edge were successful or failed from reasons other than predation. Hamer and Nelson (1995a) reported similar trends based on known nests as of 1993, with successful nests being located significantly farther from edges (mean distance from edge 508 feet versus 87 feet). In their study, Hamer and Nelson (1995a) defined an edge as an unnatural opening, including, but not limited to, roads and clearcuts.

In a study of predation on simulated marbled murrelet nests, Luginbuhl et al. (2001) note that predation rates increased with proximity to forest edge when the matrix contained human settlements and recreation areas, but not when the matrix was comprised of regenerating forests (Raphael et al. 2002b). In addition, nests within 164 feet of an edge tended to be preyed on faster and to a greater extent than nests farther into the interior of a stand. In their review of literature on effects of edge on nest predation, Marzluff and Restani (1999) speculated that Steller's jays might be especially attracted to edges between forests and clearcuts with abundant food resources (such as berry-producing shrubs). Separate research on habitat use by Steller's jays indicated jays were more abundant along clearcut edges than in interior forests (Masselink 1999).

Status in the Study Area

In the 1995 *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 1995), potential murrelet habitat was considered to be all coniferous forest stands that were 100 years and older. Currently about 42,683 acres of forest in the study area meet this definition. In a review of the model used by ODF to rate the likelihood of marbled murrelet occupancy in the study area, Hamer (1996) found that some areas of suitable habitat exist as small patches of trees with heavily mossed limbs within forest 100 to 120 years old. Hamer subsequently refined the definition of potential habitat in the model to include only forest 100 years and older that met threshold criteria for percent slope and platform abundance, but he made no estimate of the total number of acres meeting this new definition.

Since 2002, ODF has attempted to identify suitable marbled murrelet habitat based on structure rather than age through analysis of aerial photographs and field verification. Suitable habitat has been identified by inferring tree size from textural differences in the forest canopy visible on photos, and validated by comparing the vegetative characteristics of identified stands (including platform

density) to the characteristics of known occupied stands. The process for this mapping and a description of a study conducted to test the effectiveness of this method are described in Appendix H of the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008). Through this process, 16,680 acres of "mapped habitat" have been identified within the 13 management basins that make up the study area[1] (Table 3.6-5). This mapped habitat comprises about 18 percent of the study area, and ranges from 7 to 31 percent of each of the 13 individual management basins.

Table 3.6-5 Mapped Marbled Murrelet Habitat in the Study Area.

Basin	Total Basin Area (acres)	Mapped Marbled Murrelet Habitat	
		Acres	Percent of Basin
1	5,356	939	18
2	6,422	1,609	25
3	7,296	1,767	24
4	4,990	1,182	24
5	7,823	2,421	31
6	7,417	1,727	23
7	6,322	1.119	18
8	6,541	841	13
9	8,284	828	10
10 (A, B and C)	6,512	462	7
11	10,873	1,846	17
12	11,314	1,466	13
13	4,132	473	11
Forest	93,282	16,680	18

Source: Oregon Department of Forestry 2008

The marbled murrelet habitat identified using aerial photographs largely corresponds to forests aged greater than 100 years old; however, there are areas where overlap does not occur. Some forest over 100 years old was not considered suitable habitat in the photo review, and some habitat considered suitable in the photo review is not classified as 100 years or older in the forest inventory. There was no significant difference between mapped and known occupied stands in characteristics such as the number of trees with platforms and the percent moss on platform trees, characteristics associated with suitable murrelet habitat.

[1] The management basins are based on the *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a). Section 2.3.2, "Alternative 2 – Proposed Action," summarizes how the 13 management basins were identified. One of the management basins (Basin 10) consists of three subbasins that were considered separately in the analysis of effects on wildlife.

Some potential marbled murrelet habitat defined under the 1995 HCP was harvested during the first 5 years of that plan. This potential habitat was at the marginal end of the scale under that definition, and was considered the least likely to be occupied.

Marbled murrelet surveys were conducted in the study area from 1992 to 1995, and again from 2000 to 2006. These surveys were conducted primarily for the purpose of surveying proposed timber sales. However, some surveys were done for other purposes, such as identifying additional occupied sites to aid in characterizing occupied habitat. Not all mapped habitat in the study area has been surveyed, and the surveys that have been done are not sufficient to determine marbled murrelet population trends in the study area.

Detections of marbled murrelets during the surveys resulted in the identification of 3,395 acres of known occupied habitat at 85 sites, along with two possibly occupied sites. The two sites considered possibly occupied are based on questionable detections in a single year (2005), and additional surveys would be required to confirm their status and determine the number of associated acres of occupied habitat. For purposes of this EIS, all 87 sites are assumed to be used for nesting by marbled murrelets. As part of another study of nesting habitat (Nelson and Wilson 2002), 11 nests were identified in the study area. These 11 nests are assumed to represent only a portion of the total number of marbled murrelet nests in the study area.

3.6.2.3 Bald Eagle

Species Ecology

Distribution

Bald eagles breed throughout Alaska, Canada, the contiguous United States, and south to Baja California, in association with coastlines, rivers, lakes, and marshes (Csuti et al. 1997; Marshall et al. 2003). In Oregon, they are a common breeder at Upper Klamath Lake, along the lower Columbia River, and at Crane Prairie and Wickiup Reservoirs in Deschutes County. Bald eagle abundance in Oregon is greatest during the non-breeding season when the resident population is supplemented by migrant eagles that over-winter in the State. Bald eagles may be found throughout the State during the non-breeding season, concentrating wherever food is abundant.

Behavior and Reproduction

Bald eagles reach sexual maturity at 4 to 5 years of age. The breeding season in Oregon typically begins in January or February (Csuti et al. 1997; Marshall et al. 2003). Pair bonds are formed and nests are built or refurbished. The female usually lays one or two eggs between mid-February and late April. Both adults incubate the eggs, which hatch in about 40 days, and feed the chicks. Young eagles fledge at about 3 months of age, usually between late June and mid

August. For several weeks, the young stay near the nest site as they learn how to hunt. During this time, their parents feed them.

Bald eagles are territorial when breeding, but are gregarious at other times of the year (Stalmaster 1987). They are very strongly attached to their mates and territories. Resident breeders may remain near their nest sites throughout the year, or leave during late summer and fall (Marshall et al. 2003). Resident breeders usually roost at the nest site, and migrants roost singly or in groups near hunting areas (Marshall et al. 2003). Large congregations of eagles that roost communally are reported in the fall, winter, and spring in areas where prey is abundant. The Klamath Basin supports one of the largest winter concentrations of bald eagles in the lower 48 states.

Throughout the year, bald eagles spend much of their time perching. They perch for a variety of reasons, including resting, foraging, feeding, defending their territory, and protecting their nest (Stalmaster et al. 1985). On the lower Columbia River, Watson et al. (1991) found that bald eagles spent 94 percent of their time perching. Perch trees are often prominent snags and live conifer trees with dead tops or exposed lateral limbs that are usually associated with the nest site and primary foraging areas.

Habitat Requirements

In the Pacific Northwest, bald eagles primarily nest within uneven-aged conifer forest stands that contain prominent old-growth trees within the forest canopy (Marshall et al. 2003; Stalmaster 1987). Nest sites are closely associated with aquatic foraging areas such as estuaries, large lakes and rivers. Nests are usually within 1 mile of water (Anthony and Isaacs 1989; Stalmaster 1987). Douglas-fir and Sitka spruce are the tree species most commonly used for nesting west of the Oregon Cascades, while Douglas-fir, ponderosa pine (*Pinus ponderosa*) and sugar pine (*Pinus lambertiana*) are used east of the Cascades (Anthony and Isaacs 1989). Black cottonwoods (*Populus balsamifera*) are commonly used as nest trees along the Columbia and Willamette Rivers. Nest trees in the Douglas-fir region of Oregon averaged 67 inches in diameter and 184 feet in height (Anthony and Isaacs 1989).

Favored nest trees are usually prominent tree or snags in stands that provide an unobstructed view of the surrounding area and a clear flight to and from the nest (Marshall et al. 2003; Stalmaster 1987). Nests are usually built on limbs just below the crown, with the canopy above providing cover. Bald eagles are known for their large stick nests, which can weigh up to 1 ton. Bald eagle pairs frequently construct more than one nest in a territory, and may alternate their use from year to year (Garrett et al. 1993; U.S. Fish and Wildlife Service 1986).

Home range size for bald eagles varies greatly according to food abundance and the availability of suitable nest and perch trees (Stalmaster 1987). Breeding season home ranges in Oregon average between 1.75 and 8.38 square miles (Marshall et al. 2003). Bald eagles are opportunistic scavengers and predators that feed primarily on fish and birds, depending upon season and location (Frenzel and Anthony 1989; Marshall et al. 2003, Watson et al. 1991). Eagles have been documented feeding on small mammals, dead livestock, and road-

killed deer. Near the coast, they forage year-round on waterfowl and several species of fish. Bald eagles usually forage in large open areas with a wide visual field and suitable perch trees near the food source (Stalmaster 1987).

Communal night roosts are often used by bald eagles during the winter months. They have been documented along the Columbia River, in the Willamette Valley, and in eastern Oregon (Marshall et al. 2003). Trees used for roosting are usually mature and old-growth conifers, but eagles have also been found roosting in black cottonwood along river systems. Roosts may vary from a small group of trees used by a few birds to large forest stands used by hundreds of eagles. Use of roost areas by eagles may vary during winter months and from year to year, depending upon prey availability and weather conditions (Isaacs and Anthony 1987; Keister et al. 1987).

Management and Status in Western Oregon

The bald eagle was listed as threatened under the Federal ESA in 1978 and as a threatened species under the Oregon ESA in 1987. The FWS appointed a recovery team in 1979, and a *Pacific Bald Eagle Recovery Plan* for seven western states was approved in 1986 (U.S. Fish and Wildlife Service 1986). No critical habitat was designated for the bald eagle in Oregon or other western states.

The *Pacific Bald Eagle Recovery Plan* listed criteria that needed to be met before bald eagles could be considered recovered and delisted as a Federal threatened species. Bald eagle recovery objectives for the Pacific states addressed: (1) breeding populations, (2) nesting productivity, (3) habitat distribution, and (4) wintering populations (U.S. Fish and Wildlife Service 1986). The plan divided Oregon into 11 recovery zones. The study area is within the Coastal Recovery Zone.

The Coastal Recovery Zone breeding population objective for the bald eagle was met in 1996, with 49 eagle pairs found. Similarly, the recovery plan objectives for habitat management were reached in Western Oregon, and nesting productivity for the Coastal Recovery Zone was 1.61 young eagles per occupied territory between 1999 and 2003, which was above the recovery objective of 1.0 young bald eagle per occupied territory. Wintering populations have grown statewide over the past 10 years, and have met the recovery plan objective for stable or increasing wintering populations.

In 1998, the Oregon Fish and Wildlife Commission proposed to remove the bald eagle from the State list because most bald eagle recovery goals had been met or exceeded. The FWS announced its intent to begin the Federal process for delisting the bald eagle in 1999. On July 9, 2007, the FWS issued a final rule delisting the bald eagle in the lower 48 states. The delisting took effect on August 8, 2007. In association with the delisting, the FWS also released *National Bald Eagle Management Guidelines* (U.S. Fish and Wildlife Service 2007). The guidelines provide information that will minimize or prevent

violations of other federal laws that govern bald eagles (i.e., the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act).

Status in the Study Area

Bald eagles are considered year-round residents of the study area and vicinity. They are most often found near large inland lakes and marshes, along the Umpqua, Coos and Coquille Rivers, and along the Oregon Coast. Since nesting surveys began, four active bald eagle nests have been located in the study area. Nesting was first confirmed in 1985. Two nesting territories were documented as occupied in 2005; one nest produced a single chick, while the other nest was unsuccessful (Isaacs and Anthony 2005). Ten additional bald eagle nesting territories are located within 5 miles of the study area, nine of which were occupied in 2005 and produced five young (Isaacs and Anthony 2005).

Bald eagles in the study area are likely limited by the availability of large water bodies suitable for foraging, and territoriality by neighboring eagles. That portion of the study area to the north and east that borders on the Umpqua River, Mill Creek and Loon Lake provides excellent nesting and roosting habitat for bald eagles. In these areas, steep ridges containing abundant large Douglas-fir trees overlook foraging areas. A scarcity of large, dominant trees near the lower West Fork and East Fork Millicoma Rivers and east of Tenmile Lakes may limit current nesting opportunities there.

3.6.2.4 Northern Goshawk

Species Ecology

Distribution

The northern goshawk is a forest habitat generalist that is *holarctic* (ecozone covering much of Eurasia and North America) in its distribution (Marshall et al. 2003; Reynolds et al. 1982). In North America, the species occurs primarily in conifer forests, but it also occurs far to the south in the montane forests of the western United States and northern Mexico. Populations may be migratory or resident, depending upon locale.

In Oregon, northern goshawks nest primarily in conifer forest habitat of the Cascade, Blue, and Klamath Mountains (Marshall et al. 2003). Until 1995, when two nests were located west of Eugene (Thrailkill and Andrews 1996), northern goshawks had not been documented as nesting in the Oregon Coast Range. Additional nests in the Coast Range have been located since 1995 (Oregon Department of Forestry 2008). During migration periods and in winter, northern goshawks can be observed throughout Oregon in all habitat types.

Behavior and Reproduction

Most northern goshawks nest in late-successional stands of conifer forest (Csuti et al. 1997; Marshall et al. 2003). Nest trees are frequently the largest in a stand and are located near small breaks in the canopy. A nesting territory often contains more than one suitable nest tree. Their stick-built nests are located close to the trunks of large trees, 20 to 80 feet above ground. Their nesting territories are large, sometimes encompassing several hundred acres, and nests can be separated by as much as 3.4 miles (Csuti et al. 1997). They prefer to nest on north-facing slopes near fresh water. Because northern goshawks need large territories with large trees for nesting, they prefer large patches of late-successional forests with considerable canopy closure.

Goshawk nests are often reused from year to year. Nest building begins in March or April. Three to four eggs are incubated for 30 to 32 days, and young birds fledge 42 to 47 days after hatching (Marshall et al. 2003). Northern goshawks are known to be particularly fierce in defending their nests and will attack humans if approached too closely (Bent 1961).

Habitat Requirements

Northern goshawks nest and forage in a variety of coniferous and deciduous forest habitat, generally those that include large patches of late-successional forest structure, large trees, and considerable canopy closure (Csuti et al. 1997). Reproductive home ranges include foraging, nesting, and post-fledging family areas (Marshall et al. 2003). Nest trees are frequently the largest in a stand and are located near small breaks in the canopy. Foraging areas are typically 4,900 to 5,900 acres in size, comprising a forest mosaic that includes large trees, snags, downed logs, and forest openings. Post-fledging family areas are typically a 300-to 600-acre mosaic of large trees, snags, and downed logs that surround the nest site.

In Oregon, most northern goshawk studies have been conducted east of the Cascades. Nest sites have been identified primarily in coniferous forests, with a few nests in aspen groves (Marshall et al. 2003). In one study done west of the Cascades (an administrative survey of National Forests in western Oregon by the U. S. Forest Service [USFS]), 35 observed nest locations were equally divided between mixed conifer and Douglas-fir stands (Schommer and Silovsky 1994).

The northern goshawk is an ambush predator adapted to hunting the forested landscape. A member of the Accipiter family, their prey includes a wide variety of small to medium-sized birds and mammals. They can take prey as large as grouse and rabbits but also take squirrels, songbirds, smaller hawks, and insects (Csuti et al. 1997; Marshall et al. 2003). Northern goshawks use the top of stumps, fallen logs, rocks, or large horizontal limbs below the canopy as plucking posts for captured birds.

Management and Status in Western Oregon

The Oregon Department of Fish and Wildlife (ODFW) lists the northern goshawk as a sensitive/critical species, primarily because of its preference for

mature and old-growth forests for nesting. At one time the species was considered a candidate for listing under the Federal ESA. In response to a series of petitions to list the species, the FWS completed a status review throughout all western states (U.S. Fish and Wildlife Service 1998). The agency concluded that Federal listing was not warranted at that time, a determination upheld by court ruling. The northern goshawk is currently classified as a species of concern by the FWS.

Status in the Study Area

Northern goshawks have not been documented as nesting in the study area. However, no systematic surveys have been conducted in the study area for this species. Three sightings of northern goshawks have been documented on the Bureau of Land Management (BLM) lands adjacent to the study area, but no nesting territories have been located. Suitable goshawk habitat may exist within advanced structure forest habitats in the study area. The presence of goshawks, however, is uncertain because this species is regionally rare in the forests of the Oregon Coast Range.

3.6.2.5 Olive-Sided Flycatcher

Species Ecology

Distribution

The olive-sided flycatcher is a neotropical migrant songbird that winters in the South American mountains and returns to North America in the summer to breed. The species inhabits conifer forests from Alaska across Canada, through the upper midwestern United States, south to North Carolina in the east, south through the Rocky Mountain States, and throughout the coastal regions of the Pacific states (Csuti et al. 1997; Marshall et al. 2003). In Oregon, olive-sided flycatchers breed in low densities throughout conifer forests from sea level to the tree line in the Cascades and Blue Mountains.

In spite of its very wide range, highly significant population declines for olive-sided flycatcher have been documented across North America (Marshall et al. 2003). This has been attributed to deforestation of its Andean wintering range. Habitat alteration on its breeding grounds may also be contributing to the decline.

Behavior and Reproduction

Spring migration and the arrival of seasonal residents peaks in late May in Oregon (Marshall et al. 2003). Nest sites, chosen by females after acrobatic courtship displays, are usually located in conifer forests characterized by tall prominent trees and snags that serve as foraging and singing perches. Nest height is quite variable. Nest building usually occurs from late May to mid-June. The typical passerine cup nest is frequently found on top of a horizontal branch and well towards the tip of the branch. Overhanging branches usually provide

some protection from the weather, as well as cover from predators. The female constructs the nest from twigs, rootlets, and arboreal lichens. Three to four eggs are laid, and the female incubates the eggs for 14 to 15 days. The male will sometimes bring her food during early incubation. Fledglings leave the nest between 19 and 22 days after hatching and may spend some days scrambling around the nest tree branches before their first flight. Adults remain with the young for up to 2 weeks after fledging (Marshall et al. 2003). Fall migration peaks in late August and early September.

Habitat Requirements

Olive-sided flycatchers breed in non-uniform, fragmented areas of conifer forest (Csuti et al. 1997; Marshall et al. 2003). They particularly prefer areas within forest burns where snags and scattered live trees remain, riparian areas where standing dead trees are present, edge areas, and open or semi-open forest stands. The species is more abundant in landscapes containing highly fragmented late-seral forest with high-contrast edges than in less fragmented landscapes (Marshall et al. 2003). Tall, prominent trees and snags that serve as foraging and singing posts are common features in nesting habitat. Territories are relatively large for a passerine, generally ranging from 35 to 45 acres per pair, but may reach 100 acres per pair (Marshall et al. 2003). Olive-sided flycatchers are observed in a great variety of habitats during their seasonal migrations.

Altman (1999) suggested habitat for the olive-sided flycatcher could be provided in managed forests by retaining four to 12 conifer trees per acre at least 40 feet tall at the time of even-aged harvest. He also recommended providing densely grown and/or suppressed understory trees, as these have been found to support olive-sided flycatcher nests.

Olive-sided flycatchers require uneven canopies or openings for hunting, and wet areas to produce abundant insect prey (Csuti et al. 1997; Marshall et al. 2003). Unlike many other flycatchers that attack prey by hovering and striking or by hunting from the ground, the olive-sided flycatcher forages from high prominent perches at the top of snags and or dead-topped trees. They swoop down to snatch flying insect prey (a hunting behavior referred to as hawking) and often return to the same or another prominent perch. Their diet includes bees, wasps, flying ants, moths, and bark beetles.

Management and Status in Western Oregon

Olive-sided flycatchers are listed as a sensitive/vulnerable species by ODFW. No Federal status has been assigned to this species. Population trends based upon breeding bird survey data indicate highly significant declines across all of North America, including Oregon (Marshall et al. 2003). In Oregon, populations declined an average of 5.1 percent per year between 1966 and 1996. Speculation on causes of population declines has focused on habitat alteration and loss on their South American wintering grounds (Altman and Sallabanks 2000). Factors potentially contributing to declines on the breeding grounds include habitat loss through logging, alteration of habitat from forest management practices (e.g.,

clearcutting, fire suppression), lack of food resources, and reproductive impacts from nest predation or parasitism.

Status in the Study Area

Olive-sided flycatchers were detected in nearly all management basins in the study area during bird surveys conducted in 2001 (Weikel and Vesely 2001). Researchers mapped the locations of 41 olive-sided flycatchers detected during these surveys. Because targeted surveys were not conducted, it is not known how many territories may exist in the study area. Likely habitats for olive-sided flycatchers include riparian areas, and high-contrast edges between early structure and advanced structure forest, particularly where early structure forest stands have retained green trees and snags.

3.6.2.6 Western Bluebird

Species Ecology

Distribution

The western bluebird breeds throughout much of western North America from southern British Columbia east to the mountains of Colorado and New Mexico, and south to southern Mexico (Csuti et al. 1997; Marshall et al. 2003). It is one of three bluebird species found only in North America. In Oregon, western bluebirds occupy a variety of open habitats with suitable nest structures in the forested mountains and wooded lowlands. The species is most abundant in low to moderate elevation foothills of the western part of the State (Marshall et al. 2003).

Behavior and Reproduction

In Oregon, pair bonding occurs as early as February, but nesting usually occurs from late March through August (Csuti et al. 1997; Marshall et al. 2003). The female lays four to six eggs in a suitable cavity or nestbox, and a pair may raise up to three broods a year. Incubation takes about two weeks. Although the female builds the nest, both parents feed the young. Fledging occurs in 20 to 21 days.

Habitat Requirements

The western bluebird seems partial to edge-type habitat and is most often found nesting along the edges of open fields (Marshall et al. 2003). It occurs in oak savannah, open oak-conifer woodlands, riparian woodlands, conifer stands adjacent to open grassy areas, and early successional clearcuts. In a recent Coast Range study, western bluebirds were found in 10 of 13 clearcuts less than 4 years old that contained suitable snags (Marshall et al. 2003). Western bluebirds nest in natural cavities, cavities excavated by woodpeckers and other birds, and human-made nest boxes.

Western bluebirds defend a territory from one to several acres during the breeding season. During winter, they move to lower elevations within their breeding range and occasionally form small flocks. Western bluebirds are largely insectivorous, feeding on grasshoppers, caterpillars, ants, beetles, flies, and other species (Csuti et al. 1997; Marshall et al. 2003). Fruits and berries are consumed in both summer and winter when available.

Management and Status in Western Oregon

The western bluebird breeds throughout Oregon in favorable habitat. Although previously abundant in the State, the species suffered a precipitous decline in the 1940s because of competition for available nesting cavities with English sparrows and European starlings (Marshall et al. 2003). Forest practices, particularly the widespread removal of snags, have also contributed to their declining numbers by reducing nesting habitat. As a result, the species is no longer found in many of the areas it formerly inhabited. Local population increases have been documented in areas where nest box programs have been implemented (Marshall et al. 2003). The western bluebird is classified as a sensitive/vulnerable species by ODFW. No Federal status has been assigned to this species.

Status in the Study Area

One systematic survey for the western bluebird has been conducted in the study area. In the summer of 2001, western bluebirds were detected in about half of the management basins in the study area, typically in recent clearcuts (less than 10 years old) that contained snags (Weikel and Vesely 2001). Other populations of western bluebirds are highly likely to exist in appropriate habitat in the study area.

3.6.2.7 Fisher

Species Ecology

Distribution

The fisher is a rare, medium-sized carnivore that inhabits conifer and mixed conifer forests across Canada and the northern United States (U.S. Fish and Wildlife Service 2004). Its range was dramatically reduced in the 1800s and early 1900s through over-trapping, predator control, and alterations of forested habitats.

Although probably never abundant in Oregon, fishers likely occupied most coniferous forest habitats in the State (Aubry and Lewis 2003). Most sightings over the last 50 years have been reported in the southern Cascades and Klamath Mountains, with small numbers in the Oregon Coast Range (Marshall et al.

1996). Two populations are currently known in the State—one in the northern Siskiyou Mountains and one in the southern Cascades (Aubry and Lewis 2003). The southern Cascade population originated from multiple fisher reintroductions into this area in the early 1960s through the early 1980s.

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

Behavior and Reproduction

The fisher is active year round and is very mobile, capable of traveling long distances over several days (Csuti et al. 1997; U.S. Fish and Wildlife Service 2004). It is a solitary animal except during the breeding season. Breeding generally occurs from February to April. A litter of one to four pups is born about 1 year after fertilization, due to delayed implantation of the embryo. Female fishers give birth in cavities of live trees or snags (natal dens). After the kits have become mobile, the mother moves her young to larger maternal dens in cavities, downed logs, and dwarf mistletoe brooms.

Habitat Requirements

In the Pacific Northwest, the fisher is associated with low to mid-elevation forests dominated by late-successional and old-growth Douglas-fir and western hemlock (U.S. Fish and Wildlife Service 2004; Powell and Zielinski 1994). Riparian areas are often an important habitat feature. Optimal habitat is associated with complex forest structure that supports dense prey populations, provides protection from predators, and furnishes denning and resting sites (Powell and Zielinski 1994). Complex structure is provided by a diversity of tree sizes and shapes, light gaps and associated understory vegetation, snags and large downed logs, and layers of overhead cover.

Although fishers are often associated with unmanaged forests (Aubry and Raley 2006), they also occupy some managed forest landscapes that provide habitat elements such as large trees, snags, large woody debris, and high canopy closure (U.S. Fish and Wildlife Service 2004). They appear to be restricted to areas with relatively low snow accumulation (U.S. Fish and Wildlife Service 2004; Powell and Zielinski 1994).

Fishers are opportunistic predators that typically consume small- to medium-sized mammals (mice, hare, squirrels, and porcupine) and birds, although they readily eat carrion, reptiles, insects, and fruits (U.S. Fish and Wildlife Service 2004; Powell and Zielinski 1994). Fishers, particularly males, have extremely large home ranges. Home range size for fishers in six areas in Northern California and the South Oregon Coast Range average 16,140 acres (Lewis and Hayes 2004). Consequently, extensive tracts of suitable habitat (i.e., late-successional conifer forest) may be necessary to maintain sufficient numbers of males to sustain a viable population (Powell and Zielinski 1994).

Management and Status in Western Oregon

In 2003, the FWS was petitioned to list the West Coast population of the fisher as endangered under the Federal ESA. The finding of the FWS in response to this petition was that listing of this population was warranted but precluded because of higher-priority actions. Currently the West Coast population of the fisher is classified as a candidate species for Federal listing. This species is classified as sensitive-critical by ODFW, meaning it may qualify for listing as threatened or endangered in the future.

Over-trapping and habitat loss by logging are believed to be the main causes of the species' decline throughout much of its historical range in the United States (Powell and Zielinski 1994). Trapping for fisher has been prohibited in Oregon since 1937 (Marshall et al. 1996). Strychnine poison baits, used to eliminate wolves and control coyotes in the early 1900s, may also have contributed to the species' decline in western Oregon (Marshall et al. 1996). Continuing threats to fisher include loss and fragmentation of mature and late-successional habitats across the landscape, incidental capture and injury in traps set for other species (e.g., bobcat (*Lynx rufus)* and coyote *(Canis latrans)*), and decreases in prey populations on lands of mixed ownership caused by shorter timber harvest rotations and stand-structure simplification.

Status in the Study Area

Although fishers likely occurred historically in the study area, it is doubtful that the species exists there now due to their limited distribution in the State. There are known populations located more than 100 miles away in the upper Rogue River Watershed of the southern Cascades and in the northern Siskiyou Mountains near the California border (Aubry and Lewis 2003). The closest known documented recent observation is over 75 miles from the study area.

3.6.2.8 Northern Red-Legged Frog

Species Ecology

Distribution

The northern red-legged frog ranges from Vancouver Island, British Columbia, south along the Pacific coast west of the Cascade Mountains to northern California. The species is found throughout western Oregon at elevations ranging from sea level to about 3,000 feet along the west slope of the Cascades (Corkran and Thoms 1996).

Behavior and Reproduction

The breeding period for the red-legged frog is short (1 to 2 weeks) and may begin as early as February at low elevations (Csuti et al. 1997). In general, breeding sites seem to have the following three characteristics (Nussbaum et al. 1983):

- little or no water flow,
- retention of water long enough for metamorphosis to occur, and
- sturdy underwater stems for egg mass attachment.

Between 750 and 4,000 fertilized eggs are attached as a gelatinous egg mass to underwater vegetation in slow-moving water. Early embryos are tolerant of temperatures only between 39.2 and 69.8 ºF (Nussbaum et al. 1983). Eggs hatch in about 4 weeks, and tadpoles are fully metamorphosed approximately 4 months later. Red-legged frogs reach sexual maturity and breed in 3 to 4 years.

Habitat Requirements

The northern red-legged frog inhabits moist coniferous and deciduous forests, breeding in cool, well-shaded ponds, lake edges, beaver ponds, and slow-moving streams (Leonard et al. 1993; Corkran and Thoms 1996; Csuti et al. 1997). Most of the year is spent in moist upland habitats before seeking water to breed. Adults breed in late winter and early spring, and usually attach their egg masses to submerged branches or stems of emergent vegetation. During summer, juveniles and adults use forests, brush, wetlands, and other habitats near water (Corkran and Thoms 1996).

Tadpoles eat aquatic algae and other organic debris, while adults consume invertebrates such as beetles, isopods, insect larvae, and other aquatic insects (Csuti et al. 1997). When conditions are wet, red-legged frogs may forage in moist forest habitats up to 1,000 feet from water (Nussbaum et al. 1983).

Management and Status in Western Oregon

The red-legged frog is classified as a sensitive species by ODFW and a species of concern by the FWS. Populations in Oregon are declining because of habitat loss and predation by introduced bullfrogs. Activities that alter the cool, moist microclimate of the riparian habitat or remove or disturb riparian cover may cause harm to individuals or populations. Such activities include ground-disturbing activities (e.g., operation of heavy machinery), removal of riparian vegetation for activities such as road building, and any activity that could potentially raise water temperatures in breeding areas.

Status in the Study Area

Two systematic surveys for red-legged frogs have been conducted in the study area (Oregon Department of Forestry 2008). Red-legged frog eggs, tadpoles, or adults were found in 6 of 13 ponds surveyed in 2001. There are also several records of this species occurring within 1 mile of the study area in Coos County.

3.6.2.9 Coastal Tailed Frog

Species Ecology

Distribution

Coastal tailed frogs occupy coldwater streams within forested habitats of the Pacific Northwest, from British Columbia to northern California (Csuti et al. 1997). In Oregon, the species occurs in the Coast Range and Cascade Mountains from sea level to near timberline.

Behavior and Reproduction

Courtship and mating take place in late September and early October (Csuti et al. 1997; Leonard et al. 1993). Fertilization is internal, considered an adaptation to their swift water environment. Egg laying is delayed until the following June or July. Each female produces from 30 to 98 white, pea-sized eggs in a gelatinous string attached to the underside of a rock. The larvae hatch in late August or September after about 6 weeks of development. The tadpoles can metamorphose into adult frogs in as little as 1 year, but in montane environments can take as much as 4 years to develop into adults (Nussbaum et al. 1983).

Habitat Requirements

Coastal tailed frogs are restricted to cold, fast-flowing permanent streams with boulder and cobble substrates (Csuti et al. 1997). They are closely associated with non-fish-bearing streams in older (mature and old-growth) forest, where they find cool, clear water free of predators. Logging appears to have a detrimental effect on coastal tailed frog populations, primarily by increasing the amount of fine sediments in streams (Corn and Bury 1989; Dupuis and Steventon 1999). Stream siltation degrades their habitat by filling in hiding cover and reducing the ability of tadpoles to attach themselves to rocks. Streamside habitat conditions required by coastal tailed frogs may be sustainable with RMAs, even if the surrounding habitat is not maintained as old-growth (Corn and Bury 1989; Dupuis and Steventon 1999).

Coastal tailed frogs are most active at night when they forage for insects and other small invertebrates (Csuti et al. 1997). Adults may forage in water, on the surface of emergent rocks and logs, or on land immediately adjacent to streams. Tadpoles feed on diatoms that they scrape from rocks using a specially adapted mouth that also allows them to anchor themselves to rocks in swift flowing waters.

When it is raining, adult tailed frogs may venture up to 82 feet from the stream, occasionally during the day (Nussbaum et al. 1983). Studies show that montane species usually stay within a 66-foot radius, but they also may travel up and downstream (Johnson and O'Neil 2001).

Management and Status in Western Oregon

The coastal tailed frog is listed as a sensitive species by ODFW because of an overall decline in population numbers throughout the State and its susceptibility to environmental changes. It is also classified as a species of concern by the FWS. Environmental changes caused by poor timber harvest practices are thought to cause local extirpation of populations and fragmentation of coastal tailed frog habitat by contributing to increased stream sedimentation and water temperatures (Csuti et al. 1997).

Status in the Study Area

In 2001, surveys for stream-dwelling amphibians were conducted in the study area (Vesely and Stamp 2001). Coastal tailed frogs were found in streams throughout the study area, including all three of the major watershed basins (the Umpqua, Tenmile Lakes and Coos). No further surveys have been conducted.

3.6.2.10 Southern Torrent Salamander

Species Ecology

Distribution

The southern torrent salamander occupies aquatic habitats in the coastal conifer belt from the central Coast Range of Oregon to northern California. Oregon populations occur in the coastal mountains south of Tillamook County (Csuti et al. 1997). An isolated population also occurs in eastern Douglas County on the west slope of the Cascades (Good and Wake 1992).

Behavior and Reproduction

Torrent salamanders are known for slow, extended development. Breeding takes place from March to June (Csuti et al. 1997). A clutch of 7 to 16 eggs is laid per year in deep, narrow cracks in or between rocks. The eggs must have cold water flowing over them at all times in order to complete development. Eggs take 7 to 10 months to hatch (Nussbaum et al. 1983). The young remain in the larval stage from 2 to 5 years and are strictly aquatic (Nussbaum and Tait 1977; Leonard et al. 1993). Sexual maturity typically occurs at around 4.5 years.

Habitat Requirements

Torrent salamanders are encountered in seeps, springs, small streams, and the margins of large streams, in water temperatures ranging from 41 to 61ºF (Nussbaum and Tait 1977; Diller and Wallace 1996; Welsh and Lind 1996; Blaustein et al. 1995; Hayes 1999). They are associated with high gradient streams (greater than 10 percent), presumably because the flow on these streams does not allow siltation of the gravel and cobble substrates that are the preferred hiding and feeding habitat (Diller and Wallace 1996).

The torrent salamander is most abundant in streamside rocks bathed in a constant flow of cold water or along cool rocky streams (Csuti et al. 1997; Leonard et al. 1993). Adults are usually found in the splash zone of streams and waterfalls within conifer or alder forests on north-facing slopes. They are generally associated with older forests that provide shade to keep streams cold and buffers to reduce sedimentation. Torrent salamanders are more likely to be found at sites having older geologic formations, higher stream gradients, and coarse gravel and cobble in the streams (Corn and Bury 1991b; Diller and Wallace 1996). They are not found in areas where timber harvest has resulted in decreases in cover and increases in water temperature and siltation (Csuti et al. 1997).

Both larvae and adult torrent salamanders feed on a variety of aquatic invertebrates including worms, snails, springtails, spiders, and amphipods (Nussbaum et al. 1983). Adults can move several yards from stream banks during wet weather, but are usually found very close to streams (Corn and Bury 1991b; Diller and Wallace 1996). Individual salamanders may move up to 164 feet per year from permanent water, although these larger movements are thought to be rare (Good and Wake 1992). Pacific giant salamanders (*Dicamptodon tenebrosus*) and garter snakes (*Thamnophis* spp.) are likely predators of this species, but the toxic skin secretions that torrent salamanders emit may assist them in avoiding heavy predation.

Management and Status in Western Oregon

The southern torrent salamander is listed as a sensitive species by ODFW and a species of concern by the FWS. Potential threats to this species include the loss, alteration, and fragmentation of its habitat, including actions that may contribute to stream siltation and warming. Clearcutting next to streams could lead to local extirpation of torrent salamander populations (Corn and Bury 1989). Recolonization may take decades because these salamanders have small home ranges, limited dispersal abilities, and low reproductive rates. Habitat fragmentation may lead to the further isolation of populations, making them more vulnerable to local extirpation.

Status in the Study Area

In 2001, surveys for stream-dwelling amphibians were conducted in the study area (Vesely and Stamp 2001). Southern torrent salamanders were found in suitable streams throughout the study area, including all three of the major watershed basins (the Umpqua, Tenmile Lakes, and Coos). No further surveys have been conducted.

3.6.2.11 Game Species

As many as 25 of the vertebrate wildlife species likely to be found in the study area are listed as State game animals or furbearers. These species may be hunted or trapped during open harvest seasons as regulated by the State. State game animals include big game species (mountain lion [*Felis concolor*], Roosevelt elk

[*Cervus elaphus roosevelti*], black-tailed deer [*Odocoileus hemionus columbianus*], and black bear [*Ursus americanus*]); upland game birds (mountain quail [*Oreortyx pictus*], California quail [*Callipepla californica*], ruffed grouse [*Bonasa umbellus*], and blue grouse [*Dendragapus obscurus*]); migratory game birds (Canada goose [*Branta canadensis*], various other waterfowl, band-tailed pigeon [*Columba fasciata*], mourning dove [*Zenaida macroura*], and common snipe [*Gallinago gallinago*]); and bullfrog (*Rana catesbeiana*). State furbearers that may occur in the study area include bobcat, gray fox (*Urocyon cinereoargenteus*), western gray squirrel (*Sciurus griseus*), common raccoon, northern river otter (*Lutra Canadensis*), American beaver (*Castor Canadensis*), American marten, mink (*Mustela vison*), and muskrat (*Ondatra zibethicus*).

Game animal populations in the study area range from fair to good (Love pers. comm. 2005). The ODFW currently reviews harvest plans in the study area to assess harvest effects on wildlife, including game species, and for opportunities to benefit wildlife. Roosevelt elk and black-tailed deer are the most abundant game species in the study area and are the species most frequently hunted (Love pers. comm. 2005). These species feed in clearcuts, early seral stands, and commercially thinned forests, while seeking closed forest stands for thermal and security cover. A mix of forage and cover types in close association provide optimal habitat for elk and deer. Black bear are common as well in the study area and forage opportunistically across most habitats and forest stands (Smith pers. comm. 2005).

Forage seeding projects have been implemented in the study area to benefit big game (Smith pers. comm. 2005). Two historic lowland pasture areas are currently managed cooperatively with ODFW, the Oregon Department of State Lands (DSL), and local ranchers to provide improved forage habitat for elk. These pasture areas include 90 acres along Big Creek and 40 acres along Dean Creek. In the past, 21 acres along Palouse Creek and 42 acres along Johnson Creek were managed for elk. Current management of these areas is now directed towards fishery and riparian restoration.

Ruffed grouse and mountain quail are the most abundant upland game birds in the study area, with populations rated moderate (Love pers. comm. 2005). Ruffed grouse prefer dense hardwood and mixed conifer-hardwood forest stands (especially riparian areas), while mountain quail favor shrubby habitats including early seral conifer plantations. Although the estuaries, wetlands, and agricultural lowlands of the southern Oregon Coast provide important wintering and migratory habitat for waterfowl of the Pacific Flyway, waterfowl abundance on the predominately forested study area is generally low (Love pers. comm. 2005). Significant waterfowl use in the study area is normally associated with the medium and large rivers that border or run through it (e.g., Umpqua River and West Fork Millicoma River) and the few large lakes present (e.g., Loon Lake). Common waterfowl observed in the study area include the western Canada goose, mallard, wood duck, and hooded merganser (Love pers. comm. 2005). Band-tailed pigeons are most common in areas containing both open shrubby habitats and conifer trees (Weikel and Vesely 2001).

Most furbearers in the study area are associated with aquatic and riparian habitats. However, the marten occurs in mature forest habitats, while the gray fox favors open woodlands. Beaver are the most abundant furbearer in the study area (Love pers. comm. 2005). They prefer smaller, low-gradient streams that meander through floodplains containing an abundance of hardwood trees (Verts and Carraway 1998). The propensity of beaver to modify streamside habitats through their dam building activities can be both beneficial and detrimental to other fish and wildlife species and ecosystem processes. Little furbearer trapping currently occurs in the study area, more a consequence of low fur prices, rather than poor furbearer populations (Love pers. comm. 2005).

3.6.2.12 Other Species

Non-game wildlife (animals that are not fished, trapped, or hunted) account for about 88 percent of all wildlife found in Oregon. Conservation and management of these species is provided for under the ODFW's *Wildlife Diversity Program*. Approximately 162 non-game species are likely to be found in the study area, including 40 mammals, 102 birds, and 20 reptiles and amphibians. More than 85 percent of these species utilize riparian habitats, although most are not obligate riparian species. Hardwoods, cliffs, talus, meadows, shrublands, seeps and streams, wetlands, snags, and downed wood provide elements of forest diversity important to many species. While most mammal, amphibian, and reptile populations in the study area would be considered resident, as much as 80 percent of the bird species involve individuals that may seasonally migrate to or through this region, including neotropical migrants (birds that winter in Central and South America). With the exception of threatened and endangered species, few studies of non-game wildlife have been conducted in the study area.

Small mammals (including shrews, voles, mice, moles, and squirrels) and bats comprise the majority of non-game mammalian species expected to occur in the study area. Common ground-dwelling mammals of mature forests in the Oregon Coast Range include Trowbridge's shrew (*Sorex trowbridgii*), western red-backed vole (*Clethrionomys californicus*), and Pacific shrew (*Sorex pacificus*), with the deer mouse (*Peromyscus maniculatus*), vagrant shrew (*Sorex vagrans*), and creeping vole (*Microtus oregoni*) common in clearcuts (Corn and Bury 1991a; Maser et al. 1981). Mountain beaver (*Aplodontia rufa*) are abundant throughout the study area, especially in young forest stands, and population control is often implemented to reduce tree seedling damage during reforestation (Smith pers. comm. 2005). Common canopy dwelling species that may also visit the forest floor include the red tree vole (*Arborimus longicaudus*), northern flying squirrel, Douglas squirrel, and bushy-tailed woodrat (*Neotoma cinerea*). Subterranean species include the Coast mole (*Scapanus orarius*) and shrew-mole (*Neurotrichus gibsii*).

Myotis bats account for most bat detections in forests of the Oregon Coast Range (Thomas and West 1991). Bats roost in caves, mine shafts, buildings, large snags, deformed trees, under bridges, and under loose tree bark, while feeding over ponds, streams, riparian areas, roads, meadows and forest edges

(Maser et al. 1981; Thomas and West 1991). Most bat roosting in the study area is believed to occur in large snags and under bark (Smith pers. comm. 2005).

The variety of habitat types and forest seral stages present in the study area is expected to support a very diverse assemblage of birds. The most commonly observed species detected during songbird breeding surveys conducted in 2001 were the Swainson's thrush (*Catharus ustaulatus*), chestnut-backed chickadee (*Parus rufescens*), hermit warbler (*Dendroica occidentalis*), Wilson's warbler (*Wilsonia pusilla*), and winter wren (*Troglodytes troglodytes*) (Weikel and Vesely 2001). All of these species are common to most age classes of conifer forest. Other common species expected in early seral stands where shrubs, grasses, and forbs predominate include the rufous hummingbird (*Selasphorus rufus*), song sparrow (*Melospiza melodia*), spotted towhee (*Pipilo maculates*), American goldfinch (*Carduelis tristis*), orange-crowned warbler (*Vermivora celata*), and American robin (*Turdus migratorius*), among numerous others (Marshall et al. 2003). Species such as the hairy woodpecker (*Picoides villosus*), red crossbill (*Loxia curvirostra*), and red-breasted nuthatch (*Sitta canadensis*) typically occur in older forest stands.

Snags are of special concern because they provide primary habitat for as many as 50 species of birds and mammals in the study area. Cavity-nesting birds feed on insects and play an important role in the control of forest insect pests. The Coos Bay Fire of 1868, the 1962 Columbus Day storm, and past harvest and salvage activities have significantly reduced snag numbers and the potential for snag recruitment from a large portion of the study area. Forest management prescriptions to increase the levels of snag and green tree retention within harvest units are currently being applied in the study area. These efforts will not immediately offset the deficit, but will result in a higher number of snags and wildlife trees over time.

Nine salamander and four frog species are known to occur in the study area (Biosystems et al. 2003). Their ideal habitat conditions include decomposing logs, springs, seeps, ponds, and streams. A major concern about the survival of terrestrial salamanders is the amount and condition of the large woody debris that is allowed to remain on the ground following a management activity. The protection of ponds, headwater streams, and riparian habitat is an important aspect in sustaining many aquatic breeding amphibian populations. The Western redback salamander (*Plethodon vehiculum*), ensatina (*Ensatina eschscholtzii*), rough-skinned newt (*Taricha granulose*), and Pacific chorus frog (*Pseudacris regilla*) are expected to be abundant in the study area (Corn and Bury 1991b). Common reptiles expected in the study area include the northern alligator lizard (*Elgaria coerulea*), northwestern garter snake (*Thamnophis ordinoides*), and common garter snake (*Thamnophis sirtalis*). Western pond turtles (*Clemmys marmorata*) have been sighted in lakes and ponds, including Gould and Loon Lakes, and may occupy some slow moving streams (Biosystems et al. 2003).

Section 3.7
Socioeconomics

This section describes the current population, employment, and economic condition of the forest products industry in the study area. For this section, the study area has been expanded to represent the six-county southwestern Oregon economic region that could be potentially affected by the alternatives. As such, the study area includes Coos and Douglas Counties (the two counties encompassing the action area described in Section 3.0, Action Area and Study Area), and the surrounding counties of Curry, Jackson, Josephine, and Lane. More focused analysis is directed at Coos County, which contains the largest portion of Elliott State Forest (ESF).

3.7.1 Sources of Information

The socioeconomic information provided in this section was obtained from the following sources:

- The *Elliott State Forest Management Plan Revision – Connection to State and Local Economies* (Anderson et al. 2001), 2006 *Western Oregon Timber Harvest Report* (Oregon Department of Forestry 2007a), and *Oregon's Forest Products Industry and Timber Harvest, 2003* (U.S. Department of Agriculture 2006) provide information about current levels of timber harvest and economic conditions in the study area.
- *A Cost-Benefit Analysis of the Elliott State Forest Common School Fund Lands* (Mason, Bruce & Girard, Inc. 2005) and *The Common School Forest Lands Fiscal Year 2007 Annual Report* (Oregon Department of Forestry 2007b) provide additional information about economic conditions related to the ESF and timber harvest, and information about the social and recreational uses of some of the lands in the action area.
- Data from the Oregon Employment Department and the U.S. Census Bureau provide information on employment and population in the study area.

3.7.2 Affected Environment

The following provides a summary description of population and employment in the study area, as well as information specific to the timber industry, including the relative importance of wood products derived from ESF.

3.7.2.1 Population

Table 3.7-1 summarizes the population in the study area by county. As of 2006, the population in the six-county southwest region comprised approximately 22 percent of the statewide population (Oregon Employment Department 2007a).

Table 3.7-1 Population by County (Year 2006)

Geographic Area	Population	Percent of State Population (%)
State of Oregon	3,690,505	---
Coos County	62,905	1.7
Curry County	21,365	0.6
Douglas County	103,815	2.8
Jackson County	198,615	5.4
Josephine County	81,125	2.2
Lane County	339,740	9.2

Source: Oregon Employment Department 2007a

Population trends in the study area, as compared to the entire State, are summarized in Table 3.7-2. The table shows that since 1970, the rate of population growth in Coos County has been lower than the rate of growth statewide, or in the six-county study area. Prior to 1980, the rate of growth in the study area was higher than the statewide average. Since 1980, the rate of growth has been lower (Anderson et al. 2001, Oregon Employment Department 2007a).

Table 3.7-2 Population Sizes and Trends

	Population			Average Annual Growth over Previous Reported Period (percent) [2]		
Year	Coos County	Study Area[1]	Oregon State	Coos County	Study Area[1]	Oregon State
1950	42,265	316,633	1,521,341	2.6	5.4	3.3
1960	54,955	399,612	1,768,687	3.0	2.6	1.6
1970	56,515	481,880	2,091,385	0.3	2.0	1.8
1980	64,047	637,423	2,633,105	1.3	3.2	2.6
1990	60,273	660,983	2,842,321	-0.6	0.4	0.8
2000	62,779	762,269	3,421,399	0.4	1.5	2.0
2006	62,905	807,565	3,690,505	Less than 0.01 percent	0.6	0.8

Source: Anderson et al. 2001; Oregon Employment Department 2007a

[1] Includes Coos, Curry, Douglas, Jackson, Josephine, and Lane Counties

[2] Average annual growth based on previous 10-year period (1950 to 2000), or previous 6-year period (2000 to 2006).

Environmental Justice Populations

Title VI of the Civil Rights Act and Executive Order 12898 (regarding environmental justice populations) requires Federal agencies to identify minority and low income populations in areas where the effects of a proposed Federal action on human health and the environment would be disproportionately high or adverse. The following sections describe the ethnic composition and income characteristics of the study area.

Ethnic Composition

Table 3.7-3 summarizes the population composition by race and Hispanic origin for the State and for the study area. In 2005, about 82 percent of the population in the State identified themselves as white, non-Hispanic. This percentage is slightly less than those identifying themselves as white, non-Hispanic in the study area (88.5 percent) and in Coos County (89.8 percent) (Table 3.7-3). The percentage of those identifying themselves as a race other than Hispanic or white, non-Hispanic was comparable in Coos County and in the study area (around 6 percent), but less that of the State (8.5 percent). For the purposes of this Environmental Impact Statement (EIS), ethnic groups identified as "Hispanic" or "All Other Races" in Table 3.7-3 are considered minority populations.

Table 3.7-3 Population Composition by Race and Hispanic Origin

Ethnic Group	Coos County (percent)	Study Area[1] (percent)	State of Oregon (percent)
White, Non-Hispanic	89.8	88.5	81.6
Hispanic	4.3	5.8	9.9
All other races	5.9	5.7	8.5

Source: U.S. Census Bureau 2005
[1] Includes Coos, Curry, Douglas, Jackson, Josephine, and Lane Counties

Income

Table 3.7-4 summarizes the median household income and number of households in poverty in the study area and the State in 2003, as estimated by the Small Area Income and Poverty Estimates (SAIPE) program of the U.S. Census Bureau (U.S. Census Bureau 2006). Poverty status is determined by comparing an income threshold to specific characteristics of a given family (i.e., number of people, number of related children under 18, whether the primary householder is over age 65). If a family's income is below that threshold, the family is considered to be in poverty.

Table 3.7-4 Median Household Income and Population in Poverty in 2003[1]

Area	Median Household Income (dollars)	Population in Poverty	
		Individuals	Percent (%)
Coos County	32,015	9,390	15.0
Curry County	31,399	2,713	12.3
Douglas County	34,500	14,304	14.0
Jackson County	36,737	25,356	13.3
Josephine County	31,578	12,065	15.2
Lane County	36,685	44,958	13.8
State of Oregon	42,593	423,253	12.0

Source: U.S. Census Bureau 2006

[1] Small Area Income and Poverty Estimates are model based estimates. The limitations of model-based estimates are described in detail at www.census.gov/hhes/www/saipe.

The median household income of all counties in the study area is lower than that for the State. Similarly, the number of families in poverty in the study area ranges between 12.3 and 15.2 percent, which is greater than the overall number of families in poverty in State (12.0 percent).

Oregon's forest products industry has consistently been responsible for a higher portion of labor income than employment, indicating that the industry provides above-average wages and benefits. In 2003, Oregon's average worker earnings across all industries were $32,400, while average worker earnings in the forest products industry were $50,200 (U.S. Department of Agriculture 2006). Earnings at this level would exceed the median household income for all counties in the study are and the State as a whole (Table 3.7-4).

3.7.2.2 Employment Trends

Table 3.7-5 summarizes the percent of non-farm employment in major industry sectors for the study area. The table shows that the highest percentages of jobs in Coos, Curry, Douglas, and Lane Counties are in the government sector. In Jackson and Josephine Counties, the highest percentages of jobs are in the trade, transportation, and utilities sector. In all counties in the study area, natural resources and mining, which include private logging operations, represented between 0.6 and 2.9 percent of the employment within any given county.

Table 3.7-6 summarizes the unemployment trends from 2006 to 2007 for the study area, as compared to the statewide average. The table shows that the unemployment rates in the study area were higher than the statewide average. In addition, between August 2006 and August 2007, average unemployment increased in all of the counties in the study area, with the exception of Lane County. This is inconsistent with the overall statewide trend, which indicated a slight decrease (0.1 percent) in unemployment during the same period.

Table 3.7-5 Non-Farm Employment by Industry (Annual Average 2005)

	County											
	Coos		Curry		Douglas		Jackson		Josephine		Lane	
Industry	**Jobs**	**Percent**	**Jobs**	**Percent**	**Jobs**	**Percent**	**Jobs**	**Percent**	**Jobs**	**Percent**	**Jobs**	**Percent**
Natural Resources and Mining	690	2.9	140	1.9	1,120	2.8	630	0.8	360	1.4	900	0.6
Construction	870	3.7	640	9.0	1,880	4.8	5,230	6.4	1,730	6.8	7,300	4.9
Manufacturing	1590	6.8	610	8.5	6,320	16.1	7,060	8.6	3,300	12.9	20,100	13.4
Trade, Transportation, and Utilities	4,600	19.6	1,380	19.3	7,330	18.7	19,720	24.1	5,320	20.8	27,700	18.5
Information	290	1.2	100	1.4	400	1.0	1,780	2.2	340	1.3	3,500	2.3
Financial Activities	950	4.1	520	7.3	1,600	4.1	4,360	5.3	1,440	5.6	8,300	5.6
Professional and Business Services	2,800	11.9	380	5.3	2,880	7.3	7,760	9.5	1,640	6.4	15,600	10.4
Educational and Health Ser vices	2,060	8.8	620	8.7	4,390	11.2	11,530	14.1	3,740	14.6	19,200	12.9
Leisure and Hospitality	2,430	10.4	1,170	16.4	3,370	8.6	9,240	11.3	2,640	10.3	13,900	9.3
Other Services	670	2.9	190	2.7	1,120	2.9	2,840	3.5	940	3.7	4,900	3.3
Government	6,510	27.7	1,390	19.5	8,810	22.5	11,780	14.4	4,150	16.2	28,200	18.9
TOTAL	23,450	100.0	7,120	100.0	39,220	100.0	81,930	100.0	25,600	100.0	149,400	100.0

Source: Oregon Employment Department 2006

Table 3.7-6 Unemployment Trends

	Percent Unemployment (%)		
Geographic Area[1]	**August 2006**	**August 2007**	**Percent Change (%)**
State of Oregon	5.2	5.1	-0.1
Coos County	6.3	6.6	+0.4
Curry County	5.6	6.1	+0.5
Douglas County	6.9	7.4	+0.5
Jackson County	5.5	5.7	+0.2
Josephine County	6.1	6.8	+0.7
Lane County	5.5	5.3	-0.2

Source: Oregon Employment Department 2007b

[1] Unemployment data from Jackson and Lane Counties in the source data was based on data for the Medford Metropolitan Service Area and the Eugene-Springfield Metropolitan Service Area, respectively.

3.7.2.3 Timber Industry

The ESF covers about 93,000 acres within Coos and Douglas Counties in southwest Oregon. The majority of the forest, 84,000 acres, is owned by the Oregon State Land Board, and managed as a trust asset of the Common School Fund, which was established to benefit kindergarten through twelfth grade schools statewide. Revenues generated by timber harvest are deposited into the Common School Fund.

State Forest Lands

Table 3.7-7 summarizes the acres of land managed by the Oregon Department of Forestry (ODF) in the study area. The table shows the largest acreage of state-managed forestland is located in Coos County at 43 percent, while Douglas County has the second large acreage at 30 percent. Most of this acreage is in the ESF.

Table 3.7-7 Extent of State-Managed Forestland

County	Total Acreage	Percent of Study Area (%)
Coos	61,476	43
Curry	2,597	2
Douglas	43,192	30
Jackson	2,062	1
Josephine	7,303	5
Lane	26,497	19
Total	143,127	100

Source: Anderson et al. 2001

Table 3.7-8 shows the ownership of land in the study area. The table shows that State-managed forestland comprises a relatively small portion of the total forestland in study area, being approximately 5 percent of public land and 3 percent of total forestland. In Coos County, State-managed forests make up a larger proportion of the total: 26 percent of public forest and just over 9 percent of total forest.

Table 3.7-8 Ownership of Forestland in the Study Area

	Coos County		Study Area[1]	
	Acreage	**Percent (%)**	**Acreage**	**Percent (%)**
Public				
National Forests	73	8	3,737	40
Bureau of Land Management	155	18	1,782	19
State and Other Public Lands	81	9	289	3
Total Public	309	35	5,808	62
Private				
Forest Industry	403	46	2,417	26
Non-industrial Private	159	18	1,211	13
Total Private	562	65	3,628	38
Total (Public & Private)	871		9,436	

Source: Anderson et al. 2001
[1] Includes Coos, Curry, Douglas, Jackson, Josephine, and Lane Counties

Dependence on Lumber and Wood Products Industries

Employment and labor income are derived from both a primary and secondary forest products industry in Oregon. The primary forest products industry includes logging, processing logs into lumber and wood products, processing wood residues from timber-processing plants into outputs such as paper or electricity, and private sector forest management activities. The secondary forest products industry includes companies that process outputs from the products produced by the primary industry, such as prefabricated buildings, molding, millwork and cut stock, doors, windows, and laminated veneer lumber (U.S. Department of Agriculture 2006).

In combination, the primary and secondary forest products industry employed about 3 percent of Oregon's workers in 2003, and supplied about 5 percent of the total labor income. Southwest Oregon, which includes all of the counties in the study area, had a higher percentage of its workforce employed in wood processing than the statewide average, with approximately 10 percent of labor income derived from the forest industry (U.S. Department of Agriculture 2006).

3.7.2.4 Dependence on Elliott State Forest Timber Harvests

Traditionally, Oregon's forest industry has not been highly dependent on State-managed lands, although the economic conditions of local communities can be strongly affected by large changes in forest management. However, as harvests from Federal and private lands have decreased, the dependence on State harvests has grown, particularly in southwest Oregon (U.S. Department of Agriculture 2006).

In 2006, about 7.7 percent of western Oregon's timber harvest came from State-owned forestland (Oregon Department of Forestry 2007a). About 1.9 percent of the total timber harvest in the study area in 2006 was from State lands, which was substantially less than the State as a whole. Similarly, about 4 percent of the timber harvest in Coos County came from State lands in 2006, which represented a decline from the 10 percent estimated in 2000.

Almost all timber harvested from the ESF is processed in southwest Oregon, with the largest share processed in Douglas County (U.S. Department of Agriculture 2006).

Common School Forest Lands

The net present value of future timber-related income from the action area to Oregon's Common School Fund was estimated at $282 million in 2005 (Mason, Bruce & Girard, Inc. 2005)[1]. This value was based upon an estimated annual income of $14.2 million and an annual harvest of approximately 27.00 million board feet (MMBF).

As described in Section 3.1.2.4, Timber Harvest, from fiscal year 1997 through 2006 (the current condition considered for estimating average harvest levels in this EIS), the average annual volume sold in the study area was 26.11 MMBF. This harvest equated to average gross revenue of $14.7 million; average net revenue averaged about $10.4 million. Approximately $14.2 million of this revenue was generated from Common School Forest Lands; approximately $442,500 was generated from Board of Forestry lands (Freedom Martinmass 2006).

During fiscal year 2007 (July 1, 2006 to June 30, 2007), a total volume of 27.10 MMBF, valued at $12.6 million, was removed from Common School Forest Lands in Oregon. About 91 percent of this total volume was generated from timber sales on the ESF (Oregon Department of Forestry 2007b).

[1] The cited report, *A Cost-Benefit Analysis of the Elliott State Forest Common School Fund Lands* (Mason, Bruce & Girard, Inc. 2005), only considered the portions of the action area (approximately 90 percent) managed as Common School Forest Lands.

3.7.2.5 Special Forest Products

Special forest products include plant products other than timber that are collected or harvested for personal or commercial purposes. In the action area, these products include sword fern, salal, red huckleberry, and firewood remaining on the landscape after harvest operations.

It is estimated that approximately 25 brush leases are issued each year for collection of sword fern, salal, and red huckleberry. Each brush lease covers about 320 acres. Approximately 500 free woodcutting permits are issued to the public for firewood collection (Oregon Department of Forestry 2006a).

3.7.2.6 Wood Products Sustainability

Growth-to-harvest ratios are an approximate measure of sustainable timber production (U.S. Department of Agriculture 2006). Ratios of less than 1 indicate that harvest is exceeding growth, which, if continued over time, would lead to a reduction in standing volume. Growth-to-harvest ratios greatly in excess of 1 indicate that growth is outpacing harvest. From a socioeconomic perspective, wood products sustainability can have a direct effect on employment opportunities and jobs in a given area. A growth-to-harvest ratio of less than 1 could indicate that employment opportunities, and resulting revenue, would decrease over time; a growth-to-harvest ratio of greater than 1 could indicate that employment opportunities would remain stable or increase over time.

At a State level, timber growth exceeded harvest in Oregon, with a 2:1 growth-to-harvest ratio across all ownerships (U.S. Department of Agriculture 2006).[2] For each ownership class in the State (non-industrial private forestry, tribal, State, and Federal) growth exceeded harvest, except for industrial and other public forestland ownerships, which had 0.8:1 and 0.7:1 growth-to-harvest ratios, respectively. Growth-to-harvest ratios for Federal lands were substantially higher than other ownerships, at 14:1 for the Bureau of Land Management (BLM) and 16:1 for National Forests (U.S. Department of Agriculture 2006).

[2] Ownerships considered included those in industrial, non-industrial private, tribal, State, National Forest, Bureau of Land Management, or other public ownerships (U.S. Department of Agriculture 2006).

3.7.2.7 Scenic Resources and Recreational Uses

The ESF is part of the scenic landscape of the Coos Bay area and provides recreation opportunities for the public, primarily local residents. Changes in these resources and uses may have economic implications. Recreational uses are described in Section 3.9, Recreation, and scenic resources are described in Section 3.11, Visual Resources.

3.7.2.8 Funds Generated from County Property Taxation

As a publicly owned forest, the ESF is exempt from levying of county property taxes (Mason, Bruce & Girard, Inc. 2005).

Section 3.8

Cultural Resources

This section describes the cultural resources in the study area. Cultural resources are districts, sites, buildings, structures, objects, and landscapes significant in American history, prehistory, architecture, archaeology, engineering, and culture. For the purposes of this Environmental Impact Statement (EIS), cultural resources include existing and/or potential historic and prehistoric archaeological sites, historic buildings and structures, Native American traditional cultural properties, and paleontological sites. As described below, cultural resources are divided into three primary groups: archaeological resources, ethnographic resources, and the historic built environment (also known as architectural resources).

For this section, the study area is the same as the action area described in Section 3.0, Action Area and Study Area.

3.8.1 Sources of Information

The information presented in this section is drawn from *A Cultural Resources Literature Search for Potential Sites on the Elliot State Forest, Oregon* (Stepp 1998) and from the 2006 *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a). Original sources for the excerpted text can be found in that reference.

3.8.2 Legal and Policy Requirements

3.8.2.1 Federal Regulations

The National Historic Preservation Act (NHPA) of 1966 (Section 16 United States Code [USC] 470), as amended, is the nation's central historic preservation law. Section 106 of the NHPA requires that a Federal agency consider the potential effects of a Federal undertaking on historic properties, and provide the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on those actions. Consideration of the Oregon Department of Forestry's (ODF) application for an incidental take permit (ITP) from the U.S. Fish and Wildlife Service (FWS) would require that the FWS meet the consultation requirements of

Section 106, if the proposed action could affect an historic resource. Section 106 requires six basic steps in the process:

1. Initiate consultation and public involvement.
2. Identify and evaluate historic properties.
3. Assess effects of the project on historic properties.
4. Consult with the State Historic Preservation Office (SHPO) regarding adverse effects on historic properties, as appropriate, and document consultation decisions in a Memorandum of Agreement (MOA).
5. Submit the MOA to the ACHP.
6. Proceed in accordance with the MOA.

For Federal projects, historic resource significance is evaluated in terms of eligibility for listing in the National Register of Historic Places (NRHP). Districts, sites, buildings, structures, and objects of State and local importance are considered to be significant in American history, architecture, archaeology, and culture when they possess integrity of location, design, setting, materials, workmanship, feeling and association, and they:

- are associated with events that have made a contribution to the broad pattern of our history;
- are associated with the lives of people significant in our past;
- embody the distinct characteristics of a type, period, or method of construction; represent the work of a master or possess high artistic values; or represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or are likely to yield, information important in prehistory or history (36 Code of Federal Regulations [CFR] 60.4).

Ethnographic resources can be eligible for listing in the NRHP if certain criteria are met (refer to the *National Register Bulletin 38 – Guidelines for Evaluating and Documenting Traditional Cultural Properties* [Parker and King 1990]).

3.8.2.2 State of Oregon and Oregon Department of Forestry

State of Oregon

The State of Oregon protects cultural resources, including Native American graves (Oregon Revised Statute [ORS] 97.740 – 97.760) and archaeological sites (ORS 358.905 – 358.955) on both private and public lands. The ORS (ORS 390.235) require State and local agencies to obtain a permit for any ground

disturbance on State lands and for disturbance of known cultural resource sites on private lands.

Oregon Department of Forestry

The ODF has goals specific to protecting cultural resources (Oregon Department of Forestry 2006a):

- protect any archaeological sites or archaeological objects found in the study area in accordance with State law (ORS 358.905 to 358.955);
- protect any real property of historic significance found in the study area in accordance with State law (ORS 358.653); and
- protect other important cultural resources found in the study area.

The *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a) also outlines management strategies for cultural resources that involve working with the Oregon SHPO to create plans for evaluating, developing, and/or protecting cultural resource sites.

3.8.3 Affected Environment

The following provides a description of cultural resources in the study area, including prehistoric and historic archaeological resources, ethnographic resources, and architectural resources. Prehistoric archaeological resources are physical properties that result from human activities that predate European contact with native peoples in America. Prehistoric archaeological sites may include villages, campsites, lithic or artifact scatters, fishing sites, roasting pits/hearths, milling features, rock art (e.g., petroglyphs/pictographs, intaglios), rock features, and burials.

Historical archaeological resources consist of the physical remains (unoccupied ruins) of structures or built objects that result from the work of EuroAmericans. These physical remains must be more than 50 years old and postdate contact between Europeans and Native Americans. Historic archaeological sites may include town sites, homesteads, agricultural or ranching features, mining-related features, and refuse concentration.

Ethnographic resources include sites, areas, and materials important to Native Americans for religious, spiritual, or traditional uses. These resources can encompass the sacred character of physical locations (e.g., mountain peaks, springs, and burial sites) or particular native plants, animals, or minerals that are gathered for use in traditional ritual activities. Also included are villages, burials, rock art, rock features, and traditional hunting, gathering, and fishing sites.

Ethnographic resources that meet the definition set forth in Executive Order 13007 can be considered sacred sites. Activities that might affect accessibility to,

or availability of, materials used in traditional practices are subject to Executive Order 13007. In some cases, ethnographic resources may overlap prehistoric or historic archaeological resources or they may be embedded within each other.

Architectural resources of the historic built environment can include houses, barns, stores, post offices, bridges, and community structures that are more than 50 years old. These resources are generally standing structures that are currently occupied or are being preserved from deterioration and rehabilitated to accommodate occupation and use.

3.8.3.1 Prehistoric Setting

The study area lies within Druker's Coast Salish-Chinook Province of the Northwest Coast Culture Area. Oregon coastal peoples—including the Siuslaw and Coosan peoples living in the coastal region near the study area—were a littoral culture, dependent on the seas for subsistence resources but without the technology to use the open seas as a hunting source. Instead, they accessed the diverse coastal microenvironments and terrestrial microenvironments adjacent to the coast. They exploited the edge of the seas, estuaries, shore rocks, near-shore rocks, islands, tide pools, and surf areas.

The littoral adaptation can be compared to other Northwest Coast adaptations such as the maritime coastal cultures of the whale hunting Makah and Quileute of northwestern Washington. Comparisons can also be made to the riverine/interior cultures of the Willamette Valley and the upper Umpqua and Rogue River basins. The Upper Umpqua Indians occupied territory immediately east of the study area and may have occasionally utilized lands on or near it.

3.8.3.2 Ethnography of Siuslaw and Coosan Peoples

A detailed ethnography of the Siuslaw (including Lower Umpqua) and Coosan peoples is given in Stepp (1998). Ethnographic data probably represent coastal Native American ways of life during the last half of the 19th century but not necessarily previous cultural systems. Disease had severely disrupted coastal populations by the time most ethnographic work was completed. Population estimates from Lewis and Clark in 1805 to 1806 reported about 900 Siuslawans, 500 to 1,700 Lower Umpqua, and 1,500 Coos.

The Siuslaw Indians inhabited the Siuslaw River valley and adjacent coastline from Siltcoos Lake north to about Tenmile Creek (not the Tenmile Creek associated with Tenmile Lake). The Lower Umpqua Indians inhabited the coast adjacent the Umpqua River from Tenmile Lake north to the Siltcoos Lake and upriver to the head of tidewater near the present-day town of Scottsburg. The Siuslaw and Lower Umpqua spoke the Siuslaw language in two dialects local to each territory.

The Coos also spoke two dialects. Hanis Coos was spoken by those living around Coos Bay, northward to Lower Umpqua territory and along the Coos River and tributaries. The Miluk Coos inhabited lands along the Lower Coquille River and north to Coos Bay including the South Slough on Coos Bay.

Strict boundaries between these peoples were probably only defined in the areas around closely related villages with shared right of access to local resources. Boundaries in the farther reaches of the territory, especially the interior uplands, were probably not well defined. Several Siuslaw, Lower Umpqua, and Coos villages have been reported. Most villages occurred along the coast, although upstream sites have been noted (but not located). Most of these upstream locations were probably seasonal use camps.

The study area straddles the line between the Lower Umpqua and Hanis Coos territories. Lower Umpqua territory within the study area lies along the south side of the Umpqua River to the north, the Scholfield Creek Watershed to the west, and Mill Creek and Lost Lake in the east. Hanis Coos territory extends along the West Fork of the Millicoma River Watershed in the southern portion of the study area. Territorial boundaries between the two groups were probably loosely defined by the divide between the Umpqua River and Millicoma River (a Coos River tributary). A study of cultural element distributions among coastal peoples shows a strong relationship between Siuslawan (including Lower Umpqua) and Coosan groups. Many cultural attributes are shared between the three groups.

3.8.3.3 Historical Setting

The earliest travel along the northwest coast by Europeans occurred sporadically for about 200 years from the mid-16th to the mid-18th centuries. Land-based exploration of the Oregon country began in the early nineteenth century. Lewis and Clark reached the mouth of the Columbia River in late 1805, and their expeditions opened an era of expansion in the northwest. The fur trade became the driving force behind much of the exploration of the region. Hudson's Bay Company saw great promise in the Umpqua and Coos territories and established Fort Umpqua near the present-day town of Elkton in 1836.

In general, relations between the fur traders and the Lower Umpqua and Coos were peaceful until the time of removal of the Native Americans to reservations. However, violent encounters between Native Americans and settlers occurred consistently in the years between 1850 and 1856. The U.S. Army established several forts in the region in attempts to keep peace between Native Americans and settlers but eventually was dragged into the conflicts.

Prior to 1850, only a handful of fur traders, missionaries, and explorers had settled and lived for any length of time in the lower Umpqua and Coos River Valleys. In 1850, passage of the Oregon Donation Land Act provided free land to any American willing to settle and improve the property. The prospect of free land brought many settlers to the Umpqua and Coos Rivers. The Homestead Act of 1862 also provided land for those willing to settle in the west.

Early settlers subsisted by gathering locally available resources, growing their own food, and maintaining the few possessions they brought with them. Settlers subsisted on vegetables from large, labor-intensive gardens; wild berries; livestock; deer; elk; and estuarine animals such as clams, crabs, and fish. Shelter was the first priority on any new land claim, and numerous small log cabins sprang up along the rivers and bottomlands. As these early families became more settled, larger houses and outbuildings were constructed. While local towns were important in trade and commerce, most residents lived in rural areas. Most of the early towns along the lower Umpqua had brief periods of prosperity before disappearing.

The towns of Empire City, Marshfield (now called Coos Bay), and North Bend were platted in 1853. Empire City (containing a sawmill, shipyard, post office, stores, hotels, and saloons) quickly became the center of commerce for the bay area. By the late 1860s, Marshfield, with sawmills, a shipyard, banking, railroads, and schools, became the leading community and the center of shipping between Coos County and San Francisco. North Bend contained a sawmill, shipyard, and store.

Settlement at the town of Allegany, located about 1 mile south of the study area, occurred in the 1870s. Several homesteads were created along the East Fork of the Millicoma River and Glenn Creek. A road was surveyed between Allegany and Scottsburg in 1900 and completed by 1909. Logging in this area began quickly with the first log drives on the East Fork Millicoma River in 1877. Several small logging and gyppo sawmill operations, as well as major logging by the Weyerhaeuser Company, developed in this area southeast of the forest.

The Elkhorn Ranch is located within the study area along the West Fork of the Millicoma River and was settled in 1886 by George Gould and his family. Gould raised sheep and cattle and sold elk meat and other elk products.

3.8.3.4 History of the Elliott State Forest

Most of the following history is excerpted from the *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a).

The Elliott State Forest (ESF) was the first State forest in Oregon and was established in 1930. It was created out of a land exchange with the Federal government in which the State of Oregon traded about 70,000 acres of scattered Common School Lands for a consolidated block of land south of the Umpqua River[1]. The Millicoma Tract, as the land was called, had originally been a part of the Umpqua Forest Reserve administered by the General Land Office. In 1905, the land was transferred to the Siuslaw National Forest. In 1930, the land exchange with the Federal government was completed and the 70,000 acres of land were transferred to the ODF.

[1] Common School Lands were a grant of lands from the Federal government of two sections in each township across the State, meant to provide funding for schools.

The forest was named in honor of Francis Elliott, the State forester most responsible for initiating and working out the details of the trade. Additional lands added to the forest included about 6,800 acres of Oregon and California Railroad lands adjacent to the forest. In 1940 Coos County deeded 6,500 acres of tax-delinquent adjacent forestlands to the State in return for a portion of the revenue generated from the lands. About 7,700 additional acres were obtained through school indemnity claims in the 1960s. More recently, about 7,000 acres of Common School Lands were added through land exchanges in an effort to make the forest a single contiguous block.

In the 1930s, the forest boundaries were surveyed and Civilian Conservation Corps (CCC) workers constructed about 30 miles of ridge-top access roads. Prior to the 1950s, funding for the forest was minimal and little activity took place (only two timber sales occurred in this period). In the 1950s, with demand for timber increasing, the Oregon Legislature set aside a fund for money collected from Common School Land timber sales on the forest. Intensive management of the forest began with an inventory of south coast State timberlands and the opening of the Coos Bay District Office of the ODF. Harvest levels on the forest reached 36.00 million board feet (MMBF) annually by the late 1950s. In the past 20 years, more than 1 billion board feet of timber have been harvested from nearly 36,000 acres.

3.8.3.5 Known or Potential Prehistoric Sites in the Study Area

Potential prehistoric sites in the study area would most likely be associated with river corridors. Tidewater along the Umpqua River extends above the town of Scottsburg; thus, the northern border of the study area lies along the river in an area defined as potentially suitable for riverine villages and camps occupied during the winter and/or summer-fall fishing seasons. Lands adjacent to larger tributaries suitable for salmonid migration may also have been utilized during fish runs. These tributaries include Scholfield Creek, Dean Creek, and Mill Creek flowing into the Umpqua River; Roberts Creek, Palouse Creek, Benson Creek, and Big Creek, which are tributary to Tenmile Lake; and the West Fork of the Millicoma River in the south and southeastern portion of the forest.

Upland environments characterize the remainder of the study area. Upland archaeological site types would be limited to seasonal, temporary hunting and gathering camps; lithic procurement sites; and possibly vision quest, petroglyph, or other ceremonial- or personal-use site types. Archaeological survey and site information suggest that these sites are typically found on lands of less than 20 percent slope, including stream terraces, benches, and ridgetops. Geomorphic features such as rock outcrops, rock shelters, caves, and other uncommon features may also contain sites.

Prehistoric archaeological sites in the study area have not previously been recorded, undoubtedly because no surveys have been performed on lands in the study area. Nevertheless, even with extensive survey, the likelihood of finding

significant numbers of sites is low. Numerous surveys on the Siuslaw National Forest lands to the north, and on Coos Bay District Bureau of Land Management (BLM) lands distributed around the study area, have revealed very little in the way of upland sites (Minor and Toepel 1982; Toepel 1986.). Most early surveys were pre-disturbance walkovers in response to timber sales in the Siuslaw National Forest; in the last 10 years two post-disturbance surveys have been conducted to view the land surface soils that have been exposed (Toepel 1986). Very few prehistoric sites have been discovered in upland environments, and most recorded prehistoric sites on the Siuslaw Forest and Coos District BLM lands are located along river corridors.

3.8.3.6 Known or Potential Historic Resources in the Study Area

Although historic sites may still be standing and visible in the study area, most remaining sites are expected to be preserved only as historic period archaeological sites.

Prior to 1850, very few people of European descent had entered the area of the lower Umpqua River and the uplands south of that stream. Activities of these early explorers were limited to fur trapping and mapping. Alexander McLeod's party trapped in the hills along the lower Umpqua in 1826. In 1834, the Hudson's Bay Company established a trading camp at the head of tidewater along the Umpqua River. Camps associated with these explorations are not likely to have left much trace, as they would have been very short term, and these early explorers would have left behind few artifacts likely to be preserved.

The settlement period (1850 to1900) gave rise to several communities near the study area, but it is unlikely that the steep terrain in the study area would have been conducive to active settlement or agriculture. Most donation land claims and homesteads were taken along the coast or flatter bottomlands along the major rivers and larger tributaries. Some of the later claimants were forced to take more marginal lands in steeper and more heavily vegetated areas. As agriculture became the most important early industry along the lower Umpqua River and the coast south of the Umpqua River, the forestlands in the study area were not likely utilized by these settlers.

Donation Land Claim and Homesteads

A listing of Homesteads, Indian Allotments, Cash Entries, Railroad Selections and other land claims is available from the Siuslaw National Forest Archaeologist (Roberts and Juntunen 1994). Some 112 different claims lie within the study area or at least within the same Public Land Survey section as some of the land in the study area.

Logging and Lumbering

Logging and lumbering became important in the region, as the Umpqua River was the only port in the region from which lumber could be easily exported. Log exports began with the earliest settlements at Umpqua City (1850 to 1851). A small sawmill was opened at the mouth of Mill Creek on the Umpqua River in 1850 at a site now located in the study area. Splash-dam technology allowed loggers to remove trees from locations higher up in the watershed. Splash dams were located on Mill Creek and Camp Creek below Loon Lake. Log chutes may also have been used in the area. Logging and log drives occurred along the Millicoma River as early as the 1870s.

The railroad reached the Umpqua Valley in the 1870s and Reedsport on the coast in 1912. Railroad logging became an important means of transporting logs to the mill from remote areas of the forest. At least one part of the study area is known to have been accessed by rail; the Buehner Lumber Company operated a logging camp and rail system along Marlow Creek in the southern end of the study area prior to World War I.

Shipbuilding

At least two ships were built near the mouth of Mill Creek and were launched into the Umpqua River in the 1850s.

Lookouts

Four lookouts were located within the study area on Elk Peak, Trail Butte, Dean Mountain, and Cougar Pass. These sites were established and maintained by the Siuslaw National Forest and/or Coos Forest Protection Association. Only the Cougar Pass Lookout is still standing.

Civilian Conservation Corps Camps and Activities

The CCC worked on the forest in the 1930s. The ODF was not well funded in this period, and the managing forester utilized the CCC in the construction of roads, lookouts, and other facilities. This system of roads provided some of the first access to the study area. Roads were constructed from Glenn Creek in the southeast to Scholfield Creek in the northwest, linking lookouts at Deans Mountain, Cougar Pass, and Elk Peak. Workers from the CCC may have left camps and temporary structures in the area they worked. A few possible CCC sites include the Mud Springs spike camp near the Dean Mountain Lookout, the Cougar Pass Lookout, and the Dry Lake CCC spike camp.

Telephones

Telephone lines were constructed by the CCC to link lookouts on Elk Peak, Deans Mountain, and Cougar Pass to the town of Allegany. The Elkhorn Ranch was also connected to the telephone system.

Travel Ways

Roads constructed by the CCC in the 1930s totaled about 30 miles and included the 7000 Road in current use. After the 1962 Columbus Day Storm, over 150 miles of road were built to access the fallen timber. Currently, over 500 miles of roads are located in the study area (Biosystems et al. 2003).

Various individuals and groups constructed trails for access to the forest. Trails from Elkhorn Ranch lead to Allegany, Scottsburg, and Goulds Lake. Trails also probably connected the lookouts to external points of access, prior to road construction. A trail has been reported that connected cabins on Elk Creek and the West Fork of the Millicoma River. Several trappers maintained traplines and associated trails within the forest. Most trails have been destroyed by road construction, but remnants of some can still be found.

Native American trails are also likely to have occurred in the forest, and early explorers likely used these routes. The Umpqua River corridor would have provided access between the coast and interior valleys, both on the river and through adjacent bottomlands. A Native American trail has been reported in the southeast portion of the forest. The early explorers, Alexander McLeod and Jedediah Smith, both traveled along the Umpqua River.

Section 3.9
Recreation

This section describes recreational use and opportunities in the study area. Regional, State, and national recreation trends are also discussed to infer future recreation demands in the study area. For this section, the study area is the same as the action area described in Section 3.0, Action Area and Study Area.

3.9.1 Sources of Information

The information in this section was drawn primarily from a report commissioned by the Oregon Department of Forestry (ODF) to assess the short- and long-term economic consequences of the 1994 *Elliott State Forest Management Plan* (Oregon Department of Forestry 1994) on State and local economies (Anderson et al. 2001). Additional information was taken from the 2006 *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a) and local, State, and national recreation surveys, as cited below.

3.9.2 Affected Environment

3.9.2.1 Current Recreational Use in the Study Area

Most of the people who visit the study area are from local communities such as Coos Bay, North Bend, Reedsport, and Lakeside. These local residents are attracted to the recreational opportunities in the study area in large part because they are undeveloped, relatively unregulated, and lightly used, resulting in low competition for favorite sites. The study area has few transitory visitors (on their way to another destination), or destination visitors (specifically traveling to the Elliott State Forest [ESF]) from outside local areas. Recreation use within the study area is concentrated in several small areas, including Loon Lake and the corridors of Elk Creek and West Fork Millicoma River. The remainder of the study area has little recreation use. Heaviest use is made on long holiday weekends in the summer, and during deer and elk hunting seasons in the fall (Anderson et al. 2001).

A recreational survey was conducted for the study area by ODF during the fall/winter of 2000 and summer of 2001. During the fall and winter survey period, 90 percent of those people contacted cited hunting as one of the purposes of their trip, and 87 percent cited hunting as the primary purpose of their trip (Ehlen and Lord 2005). Other uses cited included wildlife viewing (42 percent),

sightseeing (39 percent), camping (24 percent), off-highway vehicle (OHV) riding (20 percent), and hiking (17 percent) (Ehlen and Lord 2005).

The most popular activities cited by respondents during the summer survey period were sightseeing (65 percent), camping (62 percent), wildlife viewing (60 percent), fishing (43 percent), OHV riding (38 percent), and hiking (35 percent). Camping was most often cited as the primary purpose of summer visitors (51 percent) (Ehlen and Lord 2005).

Based on these surveys and typical duration of stays for these types of uses, it is estimated that about 8,000 recreational visits are made to the study area each year. This equates to about 24,000 recreational visitor days (Mason, Bruce & Girard, Inc. 2005). The major recreation uses in the study area are described below.

Camping

The study area provides numerous areas for dispersed camping along roads and streams. Popular areas include Elk Creek and West Fork Millicoma River. Other sites spread throughout the forest experience varying levels of camping.

The Bureau of Land Management (BLM) operates and maintains the Loon Lake Recreation Area near the northeast border of the study area. This recreation area is one of the more popular destination sites in the Reedsport vicinity, drawing an average of 70,000 to 80,000 visitors each year. The parcel of BLM land containing the Loon Lake Recreation Area is surrounded by State forestland. These State forestlands provide an important viewshed for visitors, and provide opportunities for hikers to explore an undeveloped forest environment. Some of the recreation facilities associated with the Loon Lake Recreation Area are located in the study area and are managed by BLM under an agreement with ODF. These facilities include approximately 14 picnic sites, an amphitheater, one flush restroom, a portion of the beach and swimming area, a portion of a shop building and water storage facilities, and several developed and undeveloped trails. Recreation use at Loon Lake Campground has remained fairly constant (Anderson et al. 2001).

Hunting and Shooting Sports

Hunting is the main recreational use in the study area during fall and winter. Most recreational hunting in the study area occurs during the big game hunting seasons for deer, elk, and bear beginning in late August and continuing through November. The Oregon Department of Fish and Wildlife (ODFW) estimates that, on average, about 12,100 hunter days were spent annually in the study area between 1992 and 1999, with about 27 percent of the total composed of out-of-area residents (Anderson et al. 2001). Recreational shooting also occurs throughout the study area, but few people participate in this activity because of public safety concerns.

Fishing

Winter steelhead fishing is popular in the West Fork Millicoma River, and occasional trout fishing takes place in the study area. The ODFW's Salmon Trout Enhancement Program has created an increase in steelhead fishing opportunities as a result of activities at a salmon and steelhead hatchery located at the Millicoma Interpretive Center. Salmon fishing is not permitted in any streams within the study area.

Motorized Off-Highway Vehicle Use

Some visitors to the study area use old skid roads and trails for preseason scouting and hunting in OHV and four-wheel drive vehicles. In addition, some use of motorcycles and all-terrain vehicles takes place in summer. Because of the well-established road network and steep topography of the areas without roads, most people use existing roads, many of which have been blocked off to exclude regular vehicles.

Non-Motorized Use

Horseback riding, hiking, picnicking, and mountain biking occur in the study area, but at low to moderate levels relative to the other uses described above. Hiking and mountain biking trails have not been developed because of infrequent use.

Other Uses

A small number of people use the study area for sightseeing, wildlife viewing, and other specialized activities. For example, kayakers use the West Fork Millicoma River and sightseers drive backcountry roads in the study area. School groups, universities, and forestry organizations also use the study area for various educational tours. The ODFW operates the Millicoma Interpretive Center located on the West Fork Millicoma River, which is also located in the study area. This educational "hands-on" fish hatchery facility produces coho, chinook, and steelhead. Each year hundreds of Oregon schoolchildren visit the center to learn about salmon lifecycles and stream habitat and to clip the fins of hatchery fish.

3.9.2.2 Current Approach to Recreation Management in the Study Area

The study area is open to yearlong recreational use with the exception of uses that require compliance with fire season restrictions. Restrictions on recreation use during fire season are based on the degree of fire hazard, and range from prohibitions on smoking and campfires to regulated closures of the entire study area (limited access is allowed for industrial operators during these periods by permit only). Notices regarding use restrictions are posted on forest roads. Restrictions may differ between the northwestern portion of the study area, which

is located in the fog belt and generally has a lower fire hazard than the middle, eastern, and southern sections of the study area. There is also a 21-day limit on camping in the study area.

3.9.2.3 State and Regional Recreation Trends

The results of the 2003 -2007 *Oregon Statewide Comprehensive Outdoor Recreation Plan* (SCORP) (Oregon Parks and Recreation Department 2003) show that Oregonians are actively engaged in all types of outdoor recreation activities. Data presented in the SCORP indicate that about 73 percent of Oregon households participated in outdoor recreation activities between February 2001 and January 2002. The highest use activities in the State are running/walking for exercise and walking for pleasure. The next most popular activities are bird watching and nature/wildlife observation (Oregon Parks and Recreation Department 2003). The report attributes the popularity of these activities to the demographics of the State's population, which is aging, more concerned about fitness, and increasingly metropolitan. Hiking, dispersed camping, off-road driving, sightseeing, fishing, and hunting are the other top activities noted in the State.

The ESF is located in Region 4 of the SCORP, which includes Douglas, Coos, and Curry Counties. Recreation in this region also reflects the statewide trends. In the most recent statewide survey, Region 4 had the highest percentage of respondents over the age of 65 (21 percent), the highest percentage of respondents in the State participating in bird watching and nature/wildlife observation (27.9 percent percent), and the second highest percentage of respondents walking for pleasure (35.4 percent) (Oregon Parks and Recreation Department 2003). The most popular activities in Region 4 were picnicking, sightseeing, fishing, collecting (e.g., rocks, plants, mushrooms, berries), and ocean beach activities. Demand for outdoor recreational experiences, particularly those listed above, is predicted to increase as Oregon's population continues to grow.

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation also reports results from interviews with U.S. residents about their fishing, hunting, and other wildlife-related recreational activities. The survey has been conducted about every 5 years since 1995, with the last set of preliminary findings published in 2007 (U.S. Department of the Interior et al.2007a). In addition to the national findings presented in Section 3.9.2.4, National Recreation Trends, below, the report provides an overview of wildlife-related recreational use at a State and regional level. In the Pacific region, which includes Alaska, California, Hawaii, Oregon, and Washington, it is estimated that about 9 percent of the residents of the region fished or hunted in 2006, and 26 percent closely observed, fed, and/or photographed wildlife. However, there was an estimated 26 percent drop between 2001 and 2006 in the number of anglers in the region, and a slight decrease (about 2 percent) in the number of hunters in the region. The number of away-from-home wildlife watching participants increased during between 2001 and 2006 by about 2 to 3 percent (U.S. Department of the Interior et al. 2007b).

3.9.2.4 National Recreation Trends

Recreation trends in Oregon are similar to national trends. Nationally, outdoor recreation is increasing. Between 1983 and 1995, the greatest increase in outdoor recreation was in the number of bird watching participants (Cordell et al. 1999 in Beltz et al.). Results of the National Survey on Recreation and the Environment published in 1999 noted significant increases in the number of participants in hiking, dispersed camping, off-road driving, and sightseeing; all growing at rates ranging from 40 to 94 percent in the 12-year period (Cordell et al. 1999 in Beltz et al.). The survey also noted declines in fishing and hunting during the same period. It predicted that hunting would continue to decline nationally as the population became increasingly urbanized but that fishing would not experience a similar decline. The survey predicted that as the population of the Pacific Coast Region (which includes Oregon) grows, with an expected increase of 20.7 percent by 2010, the number of participants seeking activities including bird watching, hiking, dispersed camping, off-road driving, sightseeing, and fishing would increase.

According to the *2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* report, nationally, fishing continues to be a favorite pastime of recreationalists, although the number of anglers declined 12 percent between 2001 and 2006 (U.S. Department of the Interior et al. 2007a). Five percent of the U.S. population 16 years old and older hunted in 2006, which represented a 4 percent decline from the number that hunted in 2001. Although the number of hunters declined from 2001 to 2006, the number of big game hunters remained steady. About 31 percent of the U.S. population 16 years old or older fed, observed, or photographed wildlife in 2006. This represented an 8 percent increase over those who reported enjoying wildlife watching in 2001 (U.S. Department of the Interior et al. 2007a).

Section 3.10
Air Quality

This section describes the air quality in the study area. For this section, the study area consists of two categories:

- the coastal region of southern Oregon including Lane, Douglas, Coos, Curry, and Josephine Counties, (each could be affected by cumulative prescribed burning emissions including those from the action area); and
- the local vicinity within 500 feet of major unpaved logging roads serving the action area, which could be affected by fugitive dust from logging trucks, support vehicles, and recreationists.

3.10.1 Sources of Information

Air quality information was obtained from the following sources:

- Climatological data for the region were obtained from the Western Regional Climate Center (WRCC) website (Western Regional Climate Center 2007).
- Air quality monitoring data were obtained from the U.S. Environmental Protection Agency (EPA) AirData web site (U.S. Environmental Protection Agency 2007).
- Regulatory information on the Oregon Department of Environmental Quality (DEQ) Visibility Protection Plan was obtained from the regulations (Oregon Administrative Rules [OAR] 340-200-040, Section 5.2).
- Information on the Oregon Department of Forestry (ODF) procedures for regulating prescribed burning operations was obtained from the Oregon Smoke Management Rules (OAR 629-48) and the latest *Oregon Smoke Management Annual Report* (Oregon Department of Forestry 2001).

3.10.2 Affected Environment

3.10.2.1 Climate

Climate within the study area is affected mainly by weather fronts coming from the Pacific Ocean. The region experiences cool, wet winters and dry, mild summers. Most precipitation occurs between October and March. Due to the rugged terrain within the study area, the amount of rainfall varies considerably

throughout the region depending on the elevation. Annual precipitation at the North Bend weather station averages 63 inches, with a highest monthly average maximum temperate of 67ºF (occurring in September) and a lowest monthly average minimum temperature of 39ºF (occurring in January) (Western Regional Climate Center 2007).

3.10.2.2 Air Quality Regulatory Constraints

Clean Air Act

The Clean Air Act, as amended in 1990, is designed to reduce air pollution, protect health, and protect visibility. It requires each state to develop a State Implementation Plan to ensure that National Ambient Air Quality Standards (NAAQS) are attained and maintained for expected pollutants. A State Implementation Plan must schedule development and implementation of State air quality programs, and must contain regulations for "nonattainment areas" where the NAAQS have been exceeded for one or more pollutants. Based on air quality monitors operated throughout the State by DEQ, there have been no recent (1997 to 2007) exceedances of the NAAQS within the study area (Lane, Douglas, Coos, Curry, and Josephine Counties) (U.S. Environmental Protection Agency 2007). Based on these monitoring results, and monitoring results for the larger coastal area, EPA and DEQ have designated all of coastal Oregon as an attainment area.

Non-Road Emission Rule

In addition to the NAAQS, EPA has established a list of air toxics (64 Federal Register [FR] 38706). Air toxics are pollutants that may cause cancer or other serious health effects or adverse environmental effects. The primary sources of air toxics are industrial activities and motor vehicle emissions. Most air toxics originate from human-made sources, including non-road mobiles sources, such as construction equipment.

In 2004, EPA adopted a comprehensive national program to reduce emissions from future non-road diesel engines, including those associated with construction equipment. These regulations, referred to as the "Non-Road Emission Rule," require all new construction equipment to comply with stringent emission standards (U.S. Environmental Protection Agency 2004). As old construction equipment is gradually replaced with new equipment, the overall emissions from construction equipment (nationwide) are expected to steadily improve.

New construction equipment used for forest management activities on the Elliott State Forest (ESF) would be required to meet the Non-road Emission Rule requirements.

Regional Haze Programs

The Regional Haze Rule, enacted by the EPA in 1999, requires that states, in coordination with the EPA, National Park Service, U.S. Fish and Wildlife Service (FWS), and the U.S. Forest Service (USFS), develop and implement air

quality protection plans to reduce the pollution that causes visibility impairment in identified national parks and wilderness areas. Each state is required to develop a Visibility Protection Plan to reduce regional haze impacts at specified "Class I" areas. Oregon's Visibility Protection Plan (OAR 340-200-040, Section 5.2) specifies Class I visibility protection areas, including the following areas relevant to prescribed burning activity within the study area:

- Crater Lake National Park
- Mt. Washington Wilderness
- Mt. Jefferson Wilderness
- Three Sisters Wilderness
- Diamond Peak Wilderness

The visibility rule defines the "visibility protection period" as the period from July 1 to September 15 each year, during which time restrictions on prescribed burning apply.

Prescribed Burning Regulations

The *Oregon Smoke Management Rules* (OAR 629-48), updated in November 2007, ensure that forest activities comply with the Clean Air Act. Prescribed burning is regulated through these rules and associated fuels program. The ODF and the Environmental Quality Commission set the requirements, with assistance from DEQ.

Prescribed burning in the study area is regulated by ODF. District employees collect data on each unit proposed for burning, including tons of fuels, location, elevation, tree species, and fuel moisture. They register the unit with the Coos Forest Protection Association, which regulates prescribed burning and issues burning permits. Meteorologists with ODF in Salem study the unit data along with the weather, forecast atmospheric dispersion and temperature information, and use this information to issue daily burning instructions that are designed to protect air quality. The instructions control the amount and location of prescribed burning on any particular day. For prescribed burning activities in the study area, the goal is to protect air quality and visibility of Coos Bay, Roseburg, the Willamette Valley, the Rogue Valley, and the Class I protected wilderness areas in western Oregon (see Regional Haze Programs above).

The Coos Forest Protection Association is a private, nonprofit corporation that provides protection from fires to its corporate members and other private, State, and Federal lands. The Coos Forest Protection Association's objectives are to minimize the cost of fire suppression and the damage caused by wildfire to forests and watersheds, and to respond to all fires. As a result of aggressive efforts to suppress wildfires, impacts on regional air quality are minimized and less particulate air pollutants are released into the airshed.

3.10.2.3 Air Quality Trends

According to EPA's AirData County Air Quality Report (Environmental Protection Agency 2007), there were no exceedances of the NAAQS limits for particulate matter (PM) (diameter less than 2.5 micrometers [PM2.5] and diameter less than 10 micrometers [PM10]) between 1997 and 2007 at any of DEQ's monitoring stations in the study area. According to the most recent *Oregon Smoke Management Annual Report* (Oregon Department of Forestry 2001), visibility impairment (caused by all regional sources, not limited to prescribed burning) at the combined Class I areas in western and central Oregon occurred less than 5 percent of the time during the July to September visibility protection period in 2001.

Section 3.11
Visual Resources

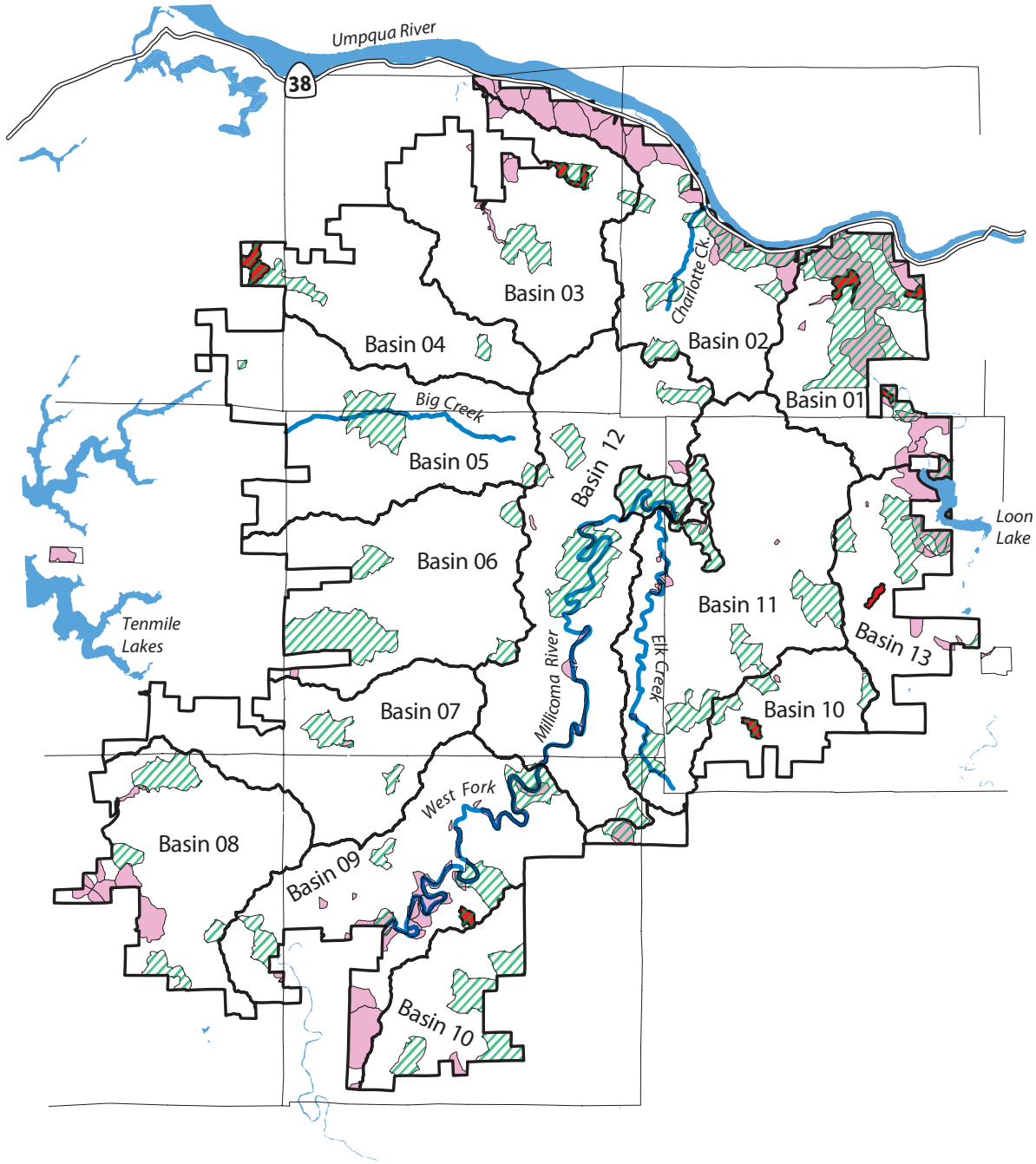
This section describes visual resources in the study area. For this section, the study area encompasses the action area described in Section 3.0, Action Area and Study Area, and adjacent areas with viewsheds of the action area.

3.11.1 Sources of Information

The information presented in this section was based on review of the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008), the *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a), and the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003).

3.11.2 Elliott State Forest Land Management Classifications

Land management classification in the action area dictate how sensitive visual resources should be managed by the Oregon Department of Forestry (ODF). All State lands within a forest management planning area are classified as General Stewardship, Focused Stewardship, or Special Stewardship lands (Oregon Administrative Rules [OAR] 629-035-0050 through 0060). These classifications describe the types of management that ODF will apply, the appropriate range of management activities, and the forest resources the classification is intended to address. Portions of the study area have been designated Special Stewardship and Focused Stewardship lands to provide protection and consideration of sensitive visual resources, as described in Section 3.11.3, Affected Environment. The locations of these lands are best approximated by the scenic, unique, and visual (SUV) designation illustrated on Figure 3.11-1. These lands encompass about 4,000 acres.



N

0 1 2 3 4

Miles

Legend

- Management Basins
- Major Streams
- Stands Aged >180 Years
- Steep, Unique, Visual (SUV)
- T & E Core Areas

Source: Oregon Department of Forestry 1996 [FMP]

04718.04 EIS (11-06)

Jones & Stokes

Figure 3.11-1
Visual Resources in the Action Area

3.11.2.1 Special Stewardship-Visual

Special Stewardship lands are lands where:

- a legal or contractual constraint dominates the management of the lands and precludes the integrated management of all forest resources;
- one or more forest resource is present which requires a level of protection that precludes the integrated management of all forest resources; or
- lands are committed to a specific use and management activities are limited to those that are compatible with that use (OAR 629-035-0055).

Special Stewardship lands are further classified according to subclasses. The Special Stewardship-Visual subclass designation applies to 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 (OAR 629-035-0055).

3.11.2.2 Focused Stewardship-Visual

Focused Stewardship lands are lands that are managed using integrated management practices to accomplish forest management planning goals, but for which a forest management plan, habitat conservation plan (HCP), or other legal requirement identifies the need for supplemental planning, modified management practices, or compliance with legal or contractual requirements above those required on lands classified as General Stewardship (OAR 629-035-0055).

Similar to Special Stewardship lands, Focused Stewardship lands are further classified according to subclasses. The Focused Stewardship-Visual subclass designation includes lands that have been identified as having high or moderate visual sensitivity according to criteria in the applicable forest management plan and where those visual resources are the focus of the supplemental planning, modified management practices, or other legal requirements (OAR 629-035-0055).

3.11.3 Affected Environment

The action area is located on the remote southern Oregon Coast. The closest major metropolitan area to the study area is Eugene/Springfield, which is about 76 miles away, and is not likely to be affected.

Areas sensitive to visual impacts from forest management activities include areas that are adjacent to, or seen from major highway corridors designated as visually sensitive by the Oregon Forest Practices Act (FPA), or areas with established, high public use vistas (Oregon Department of Forest 2006a). As described below, views of the action area from Highway 38, and views from within the action area in higher use recreational areas constitute the most sensitive viewsheds within the study area. Figure 3.11-1 illustrates where important visual resources in the study area are located.

3.11.3.1 Visual Character of Elliott State Forest

Oregon Highway 38

Oregon Highway 38 (Highway 38) runs along the northwestern portion of the study area adjacent to the lower Umpqua River. On private lands between the study area and the lower Umpqua River, Highway 38 and its immediate visual foreground are protected either by Oregon Department of Transportation-owned scenic buffers, or by scenic statutes and the FPA. The visually sensitive corridors are defined as the areas within 150 feet of the outermost right-of-way boundary along both sides of the highway (Oregon Department of Forestry 2006a). Special rules apply to timber harvest in this corridor.

Some areas further back from the highway, but still visible from the road, are considered mid-ground scenic areas and are designated as Special Stewardship-Visual. Harvesting in these areas is only allowed to enhance the visual characteristics of the forested landscape and/or viewshed. The background areas adjacent to these lands are classified as Focused Stewardship-Visual. Management activities for these areas are adjusted for visual considerations (Oregon Department of Forestry 2006a).

Big Creek

Big Creek is one of the larger streams in the forest, and its size and older timber makes it one of the most scenic. A high quality hiking opportunity potentially exists in the action area along Big Creek, which is a tributary to North Tenmile Lake. Most of the lower slopes of Big Creek are older timber and a decommissioned road along the stream provides a level surface for establishing a trail (Biosystems et al. 2003).

Charlotte Creek

Hiking opportunities providing views of older trees and rocky outcrops are also available along Charlotte Creek, a tributary to the Umpqua River. Noise from Highway 38 could distract from its otherwise scenic qualities (Biosystems et al. 2003).

Elk Creek

Elk Creek is one of the most popular camping areas in the vicinity of the study area (Biosystems et al. 2003). Currently, a 100-foot-wide timber harvest exclusion zone is maintained along this perennial, fish-bearing stream. A road parallels Elk Creek, and a mix of early, intermediate, and advanced structure forest exists along the stream. Forests in the stream's watershed are currently managed for long rotations (240 years).

West Fork Millicoma River

The West Fork Millicoma River is a large, perennial, fish-bearing stream, which is accessible by road in several reaches. Much of the river canyon is managed for its visual resources, rather than timber production. Along with Elk Creek, the West Fork Millicoma River is one of the most popular areas for camping in the study area (Oregon Department of Forestry 2006a). An upland interpretive trail is planned for the Millicoma Interpretive Center on the West Fork Millicoma River. This would provide additional scenic and recreational opportunities within the action area (Oregon Department of Forestry 2006a).

Loon Lake Recreation Area

The Bureau of Land Management (BLM) operates and maintains the Loon Lake Recreation Area near the northeast border of the study area. This recreation area is one of the more popular destination sites in the Reedsport vicinity, drawing an average of 70,000 to 80,000 visitors each year (Biosystems et al. 2003).

The parcel of BLM land containing the Loon Lake Recreation Area is surrounded by State forestlands, which provide an important viewshed for visitors, and opportunities for hikers to explore an undeveloped forest environment. As described in Section 3.9, Recreation, some of the recreation facilities associated with the Loon Lake Recreation Area are located in the study area and are managed by BLM under an agreement with ODF.

Loon Lake is accessed from the north via Highway 28 (Douglas County Road #3). Both the recreation area and the access road provide a high quality scenic backdrop and scenic hiking opportunities.

Tenmile Lakes

Tenmile Lakes (collectively North Tenmile Lake and South Tenmile Lake) is located on the west side of the study area, which provides a scenic backdrop to the upper arms of the waterbody. Some of the viewshed forests are currently managed for long timber production rotations (200 and 240 years).

Forest Stands Over 175 Years Old

Small patches of forest stands over 175 years of age and scattered individual trees can be found throughout the action area, with the majority of the larger identified older stands found in the northern and eastern portions of the action area (Figure 3.11-1). Many of the stands located in the northeastern portion of the action area are accessible by vehicle or foot. These types of stands are visually unique in the study area, given their large size and the structural diversity that they add to the landscape. The majority of these stands (in particular the large groupings located in the northeastern portion of the action area) are not available for timber harvest.

Oregon Myrtlewood Stand

An Oregon myrtlewood stand is located in the Big Creek Basin (located in Basin 5 on Figure 3.11-1) and encompasses less than 25 acres. This stand is not accessible by road, but can be reached by foot. The Oregon myrtlewood stand is not available for timber harvest.

Bottomland Hardwoods

These hardwoods are located in the Ash Valley Basin (located in Basin 13 on Figure 3.11-1) approximately 2 miles south of Loon Lake on the east side of the action area. They encompass about 17 acres of land and are accessible by a short drive and walk along a portion of a gated road. These hardwoods may be visible from Douglas County Road #3, but it is a short-term view that does not stand out from the vantage point of the road. These hardwoods are not available for timber harvest.

Section 3.12
Land Use

This section describes existing land ownership and use in the study area, and uses adjacent to the study area, and Federal, State, and local laws, regulations, or policies governing land use and/or protection of the environment. For this section, the study area is the same as the action area described in Section 3.0, Action Area and Study Area.

3.12.1 Sources of Information

Information in this section regarding the ownership of land adjacent to the study area was derived from the *Elliott State Forest Watershed Analysis* (Biosystems et al. 2003). Land use and management of the study area was obtained from the *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a) and the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008). Other sources of information are cited in the text.

3.12.2 Affected Environment

3.12.2.1 Elliott State Forest Land Ownership and Use

The study area encompasses 93,000 acres of forested land in Oregon's Coast Range. This land is owned by the State as either Common School Forested Lands (91 percent) or Board of Forestry Lands (9 percent). Historically, the cultivation and sale of forest products (i.e., timber) on these lands have been used to produce income for the Common School Fund (see Section 3.7, Socioeconomics, for a discussion of how funds derived from the Common School Fund influence population and employment in the study area). The Elliott State Forest (ESF) has also historically provided dispersed recreation opportunities for the public (see Section 3.9, Recreation, for a discussion of recreation opportunities in the study area).

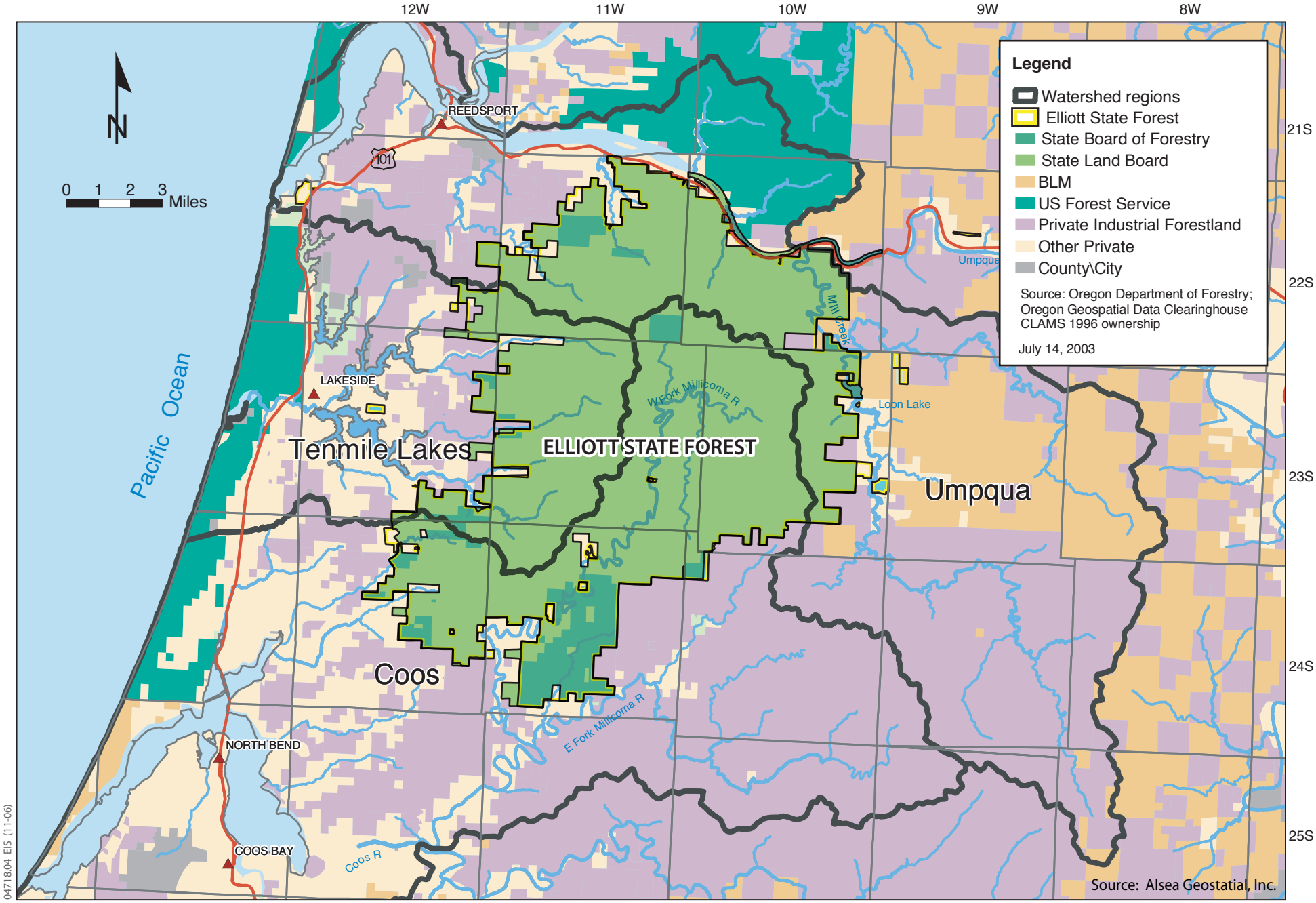
3.12.2.2 Adjacent Land Ownership and Uses

The study area is primarily surrounded by other forested lands in a variety of ownerships (Figure 3.12-1). It is bordered largely by private industrial forestland. The U.S. Forest Service (USFS), the Bureau of Land Management (BLM), and other private landowners own other lands adjacent to the study area.

Private forest lands account for 53 percent of the forest land in western Oregon, with 26 percent of total private forest land in industrial ownership and 27 percent in non-industrial ownership (Oregon Department of Forestry 2006a). Few acres of private land have forest stands older than 65 years. The Millicoma Tree Farm, owned by Weyerhaeuser, is located near the eastern and southern border of the study area. It encompasses 209,000 acres of private industrial timberland in Coos and Douglas Counties and is managed for commercial timber (Weyerhaeuser 1995). A discussion of management requirements for the Millicoma-Tree Farm is provided in Section 3.12.2.4, Management Requirements for Adjacent Private Lands.

Federal lands lie north, east, and southeast of the study area. The Siuslaw National Forest (managed by the USFS) is located to the north, across the Umpqua River. To the east and southeast are BLM-managed lands, most of which are intermixed with private lands in a checkerboard pattern of alternating square-mile sections (Oregon Department of Forestry 2006a). The BLM-managed land includes Loon Lake Recreation Area near the northeast border of the study area.

Much of the Federal land near the action area is currently designated as late successional reserves (LSRs). Late successional reserves are designated in the Northwest Forest Plan (NWFP) specifically for habitat connectivity, and threatened and endangered species conservation. A summary of management requirements under the NWFP is provided in Section 3.12.2.5, Management Requirements for Adjacent Federal Lands.



04718.04 EIS (11-06)

Jones & Stokes

Figure 3.12-1
Land Ownership in Vicinity of the Action Area

3.12.2.1 Management Requirements for State-Owned Lands

Elliott State Forest Management Planning

The ESF is managed in accordance with the Oregon State Constitution, the 1859 Admissions Act, Oregon Revised Statutes (ORS), and State Land Board and Board of Forestry Policies. The State Forester is authorized to manage Common School Forest Lands on the ESF in accordance with ORS 530.500 (See Chapter 1, Purpose and Need, for a discussion of Common School Forest Lands). A Common School Forest Land agreement between the State Lands Board, Oregon Department of Forestry (ODF), and Oregon Department of State Lands (DSL) sets forth the requirements for developing long-range management plans, which are then approved by the State Land Board.

The ODF is seeking a revision to their incidental take permit (ITP) issued by the U.S. Fish and Wildlife Service (FWS) in 1995 so that activities associated with implementation of the revised *Elliott State Forest Management Plan* (Oregon Department of Forestry 2006a) comply with the Federal Endangered Species Act (ESA). The revised forest management plan (FMP) provides management direction for all Common School Forest Lands and Board of Forestry Lands managed by the Coos District of ODF. This includes the study area, as well as scattered tracts of State forestlands in Coos, Curry, and Douglas Counties, totaling 97,022 acres. Currently, the ESF is managed under the 1995 *Elliott State Forest Management Plan* (Oregon Department of Forestry 1995) and the 1995 ITP for northern spotted owls (See Chapter 1, Purpose and Need).

As described in the 2006 FMP, management planning for Oregon State forests involves five main elements:

- long-range planning,
- intermediate level planning,
- district Implementation Plan development,
- Annual Operations Plan development, and
- annual and biennial budgeting.

Planning begins with broad-scale, long-range planning; for the study area, this long-range planning effort included preparation of the *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008), which is the subject of this Environmental Impact Statement (EIS). Intermediate-level planning is done at the ODF district level, and is documented through district Implementation Plans. Annual Operations Plans and budgets (both biennial and annual) are designed to achieve the Implementation Plan objectives for shorter periods of time (1 or 2 years).

The 2006 *Elliott State Forest Management Plan* provides overall direction for managing resources in the study area and is guided by legal and policy mandates

and administrative rules, including the Oregon Forest Practices Act (FPA) and provisions of the 1995 ITP. The resource management goals for land base and access in the *Elliott State Forest Management Plan* state that ODF should manage the action area to:

- conserve the State forestland base to maintain resource values,
- maintain compatibility with all Oregon Statewide Planning Goals and the Oregon Coastal Management Program,
- maintain a land ownership pattern that can be efficiently managed,
- identify and accomplish land exchanges and/or purchases that will enhance management efficiency,
- develop and maintain a cost-efficient access system suitable for fire protection and management activities,
- minimize potential adverse environmental and biological effects of roads and other components of the access system, and
- provide for public access where it is compatible with resource development protection and management activities.

Forest Practices Act and Administrative Rules

The FPA sets minimum standards for reforestation, road construction and maintenance, timber harvesting, chemical application, and slash disposal, among other things, on all private and State-owned forestlands in Oregon. The FPA encourages economically efficient forest management and seeks to balance the growth and harvest of trees with the protection of forest resources, including soil, air, water, fish, and wildlife resources. It also seeks to preserve scenic resources along visually sensitive corridors and reduces the risk of serious bodily injury or death caused by shallow, rapidly moving landslides directly related to forest practices. FPA standards apply to all timber harvest and forest management activities within the study area.

Federal Endangered Species Act

The Federal Endangered Species Act (ESA) was enacted in 1973, and is intended to conserve endangered species habitat, provide a program for the conservation of endangered and threatened species, and to act on specified relevant treaties and conventions. The U.S. Secretary of the Interior and U.S. Secretary of Commerce administer the Federal ESA, and FWS and National Marine Fisheries Services (NMFS) act on the Secretaries' behalf.

Section 10 of the Federal ESA authorizes the taking of federally listed wildlife or fish by a non-federal entity if such taking occurs incidentally during otherwise legal activities. The provisions of Section 10 require that an applicant for an ITP prepare a "conservation plan" that specifies, among other things, the impacts that are likely to result from the taking, and measures the permit applicant will

undertake to minimize and mitigate such impacts. A more detailed description of the Federal ESA is provided in Chapter 1, Purpose and Need.

The *Elliott State Forest Habitat Conservation Plan* (Oregon Department of Forestry 2008), which is the subject of this EIS, has been prepared to meet the conservation plan requirements of Section 10.

State of Oregon Endangered Species Act

The Oregon ESA was adopted in 1987 to establish a process for identifying threatened and endangered species for conservation and protection on State-owned land. The Oregon ESA is much more limited in scope than the Federal ESA and applies only to State agencies taking actions on State-owned or leased lands. Oregon administrative rules also allow for a Federal ITP issued pursuant to the Federal ESA to meet State ESA compliance requirements. Oregon's ESA is administered by the Oregon Department of Fish and Wildlife (ODFW), DSL, and the Oregon Department of Agriculture (ODA). A more detailed description of the Oregon ESA is provided in Chapter 1, Purpose and Need.

Given that lands within the study area are owned by ODF, the provisions of the Oregon ESA apply to proposed land management activities.

3.12.2.2 Management Requirements for Adjacent Private Lands

The provisions of the FPA and Federal ESA, as described in Section 3.12.2.3, apply to management of all private lands, including those adjacent to the study area. On the Millicoma Tree Farm, which is located near the eastern and southern border of the study area, compliance with the Federal ESA is met through administration of a habitat conservation plan (HCP) approved by FWS. As described below, this HCP only addresses wildlife species under the jurisdiction of the FWS.

Habitat Conservation Plan for the Northern Spotted Owl, Millicoma Tree Farm

The Millicoma Tree Farm encompasses about 208,000 acres and is managed by Weyerhaeuser, a private timber company. Forest management activities on the Millicoma Tree Farm are implemented in compliance with the *Millicoma Tree Farm Habitat Conservation Plan*, which was approved by the FWS in 1995 (Weyerhaeuser 1995). Conservation strategies associated with the Millicoma HCP are designed to minimize and mitigate the effects of incidental take on spotted owls, and include retention of nesting-roosting-foraging (NRF) lands near known spotted owl activity centers, protection of occupied owl site centers, seasonal protection of active nests, and an active monitoring program. A more detailed description of the Millicoma Tree Farm HCP prescriptions is provided in Chapter 5, Cumulative Effects.

3.12.2.3 Management Requirements for Adjacent Federal Lands

The provisions of the Federal ESA, as described in Section 3.12.2.3, apply to management of all Federal lands, including those adjacent to the study area. The following additional land management requirements also apply to Federal lands adjacent to the study area.

Northwest Forest Plan

In 1994, the comprehensive NWFP went into effect in the Pacific Northwest within the range of the northern spotted owl. This plan outlined current management direction for Federal forest lands in western Oregon, Washington, and northern California and developed long-term management alternatives that maintain or restore the following:

- habitat conditions for the northern spotted owl and marbled murrelet that provide for the viability of each species;
- habitat conditions to support viable populations, well-distributed across their current range, of species known to be associated with old-growth forests; and
- rearing habitat on USFS, BLM, National Park Service, and other Federal lands to support the recovery and maintenance of viable populations of anadromous fish species and other fish species considered “sensitive” or “at risk” (U.S. Forest Service and Bureau of Land Management 1994).

As noted above, the NWFP provides specific protection for threatened and endangered species on Federal lands through designation of LSRs. A more detailed description of the NWFP prescriptions is provided in Chapter 5, Cumulative Effects.

Coos Bay District Record of Decision and Resource Management Plan

The *Coos Bay District Resource Management Plan* (RMP) (Bureau of Land Management 1995) describes management of approximately 329,700 acres of land in Oregon administered by the BLM, Coos Bay District. The goals of this RMP include maintaining late successional and old-growth species habitat and ecosystems on Federal lands, as well as maintaining biological diversity associated with native species and ecosystems in accordance with laws and regulations.

As described in detail in Chapter 5, Cumulative Effects, the BLM is proposing to replace the NWFP land use allocations and management direction in the Coos District RMP, as well as the five other western Oregon RMPs, through a Western Oregon Plan Revision planning effort. The stated purpose of these revisions is three-fold: (1) BLM plan evaluations found that the BLM has not been achieving the timber harvest levels directed by the existing RMPs; (2) there is an opportunity to coordinate the BLM management plans with new recovery plans

and redesignation of critical habitat currently under development; and (3) the BLM has refocused the goal for management on the objectives of its statutory mandate to utilize the principles of sustained yield management on the timber lands covered under the Oregon and California revested railroad lands (O&C) Lands Act (Bureau of Land Management 2007).

The *Draft Environmental Impact Statement for the Revision of the Resource Management Plans of the Western Oregon Bureau of Land Management Districts* (Bureau of Land Management 2007) was released for public comment in August 2007. Three action alternatives and a No-Action Alternative are evaluated in that document. The No-Action Alternative would continue the management of the current RMPs approved in 1995, as described above. The three action alternatives consist of a range of management objectives, management actions, and land use allocations on RMP lands, with key differences focused on the width and management of riparian areas; the retention of green trees, snags, and down wood; the extent of salvage allowed after disturbance events; and management of habitat for the northern spotted owl and the marbled murrelet. Refer to Chapter 5, Cumulative Effects, for additional information on the proposed revisions to the Coos District RMP.

3.12.2.4 Use of Elliott State Forest Roads for Adjacent Land Management

Some roads in the study area are used for hauling materials harvested from adjacent or nearby timberlands. Currently, ODF does not seasonally restrict road use for nesting pairs of northern spotted owls. However, on roads not commonly used, seasonal restrictions on road use are implemented between April 1 and September 15 to protect nesting populations of marbled murrelets.

To avoid seasonal disturbance to nesting marbled murrelet adults and chicks, between April 1 and August 5, timber harvest activities (including the hauling of logs, rock, and heavy equipment) and the use of heavy equipment are not allowed on roads not commonly used when the road is within 330 feet of likely nesting habitat. From August 6 to September 15, heavy equipment use is allowed on roads not commonly used within 330 feet of the likely murrelet nesting habitat from 2 hours after sunrise to 2 hours before sunset. There are no hauling restrictions on roads within the study area outside of the murrelet nesting season. These disturbance policies are not applied to adjacent or nearby landowners hauling on roads in the study area if those landowners hold permanent easements for those roads.

In addition, during the “wet season” (typically October 1 to April 30), ODF may limit access to roads in the study area to prevent road damage and sediment yield to adjacent stream systems. These closures are contingent on weather conditions, and are typically made at the discretion of the ODF District Forester.