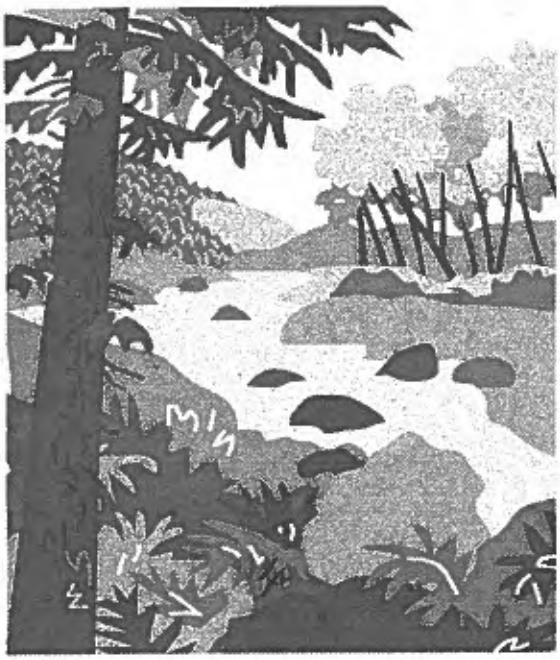
WASHINGTON FOREST PRACTICES BOARD



SUPPLEMENTAL DRAFT

ENVIRONMENTAL IMPACT STATEMENT and appendices

on

FOREST PRACTICES RULE PROPOSALS

for the

Northern Spotted Owl

Responsible Official:
Jennifer M. Belcher
Commissioner of Public Lands

Contact Person:
Judith Holter
FPB Rules Coordinator

Published:
Olympia, Washington
February 1996

Fact Sheet

Title: Forest Practices Rule Proposals

These proposed rules would apply to forest practices conducted on all nonfederal lands in Washington State that contain northern spotted owl habitat.

Proposed by:	Washington State Forest Practices Board
Lead Agency:	Washington State Forest Practices Board

Forest Practices Board Members:

Jennifer Belcher	Chair, Commissioner of Public Lands
Tom Campbell	Dept.of Community, Trade & Economic Development
Stu Trefry	Dept. of Agriculture
Terry Husseman	Dept. of Ecology
John Magnano	Clark County Commissioner
Jean Bolton	public member, small forest landowner
Harold Brunstad	public member, independent logging contractor
John Miles	public member
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Date of Issue: February 1, 1996

Comment Period Ending: March 1, 1996

Location and Date of Public Hearing:
Olympia February 13, 1996

Proposed Adoption Date: May 22, 1996

Draft EIS, Reference Material and Data Located at:

Department of Natural Resources
Forest Practices Division
1111 Washington Street S.E.
P.O. Box 47012
Olympia, WA 98504-7012

Cover Letter

Dear Reviewer:

The Washington Forest Practices Board proposed rule changes in 1994 that would apply to specific forest practices conducted within the habitat to two state and federally listed threatened species: the northern spotted owl and the marbled murrelet. The Board also has been considering whether to propose rules for the western gray squirrel, listed as a threatened species in Washington. A Draft Environmental Impact Statement (DEIS) was prepared and issued on January 31, 1995 for public review and comment. Public hearings for commenting on the DEIS and the proposed rules were held in March 1995; comments were due March 17, 1995.

Since then, substantial new information has become available on the northern spotted owl: (1) the Forest Practices Board accepted the offer of the Timber, Fish and Wildlife Agreement participants to develop a rule proposal for the northern spotted owl; (2) the federal 4(d) rule was proposed; and (3) more information was released on the federal Northwest Forest Plan's protection for northern spotted owl habitat. These developments, coupled with the large volume of complex comments received on the DEIS, resulted in the decision to prepare this Supplemental Draft EIS for the northern spotted owl proposed rules. The original DEIS has been completely rewritten, taking both new information and public comments into consideration.

Supplemental Draft EIS
This SDEIS discusses the proposed northern spotted owl rule alternatives, including the "no action" alternative, and associated impacts of each. It also discusses the federally proposed 4(d) rule alternative. It is intended to provide a comprehensive review of the alternatives in order to assist the Forest Practices Board in making rule adoption decisions. It is based on the most current information available as of December 1, 1995.

The comment period for this SDEIS continues until March 1, 1996. Written comments are encouraged. They will be reviewed and responded to in the Final EIS. The Board will take oral and written testimony at a public hearing on February 13, 1996. Please see the Notice of Public Hearing (next page) for details.

Final EIS
The Final EIS will respond to comments received on the owl alternatives in the SDEIS, as well as comments received earlier on marbled murrelet and western gray squirrel alternatives in the DEIS. It will be published at least seven days prior to rule adoption.

Rule Adoption
The Board may modify, adopt, or reject the proposed rules following the public hearing, comment on both the rules, the DEIS, and the SDEIS, and review of the responses in the Final EIS. The Board anticipates adopting rules in May 1996; the rules would become effective July 1, 1996.

Notice of Public Hearing on SDEIS and Proposed Rules

Date: February 13, 1996

Time: 3 p.m.

Location: Natural Resources Building, Room 172
1111 Washington Street S.E.
Olympia, Washington

Send Written Comments To:

Judith Holter, FPB Rules Coordinator
DNR-Forest Practices Division
P.O. Box 47012
Olympia WA 98504-7012

Phone: (360) 902-1412
Fax: (360) 902-1784

Comment Deadline: March 1, 1996

Assistance for persons with disabilities:

Contact Tami Grant at:
(360) 902-1413 by **Feb. 2, 1996**
TDD: (360) 902-1431

WASHINGTON FOREST PRACTICES BOARD

SUPPLEMENTAL DRAFT

ENVIRONMENTAL
IMPACT
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FOREST PRACTICES RULE PROPOSALS

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Forward

This publication contains two separate documents: the Supplemental Draft Environmental Impact Statement, and the related Appendices. For the purposes of efficiency and cost effectiveness, they have been printed and distributed as one publication.

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Summary

Purpose and Need for Action

Introduction

The Forest Practices Board (Board) proposes to adopt rules that address the impacts forest practices have on northern spotted owls and marbled murrelets. It is also evaluating the impacts of forest practices on western gray squirrels, although it is not proposing a rule for this species at this time. The need to examine the impacts forest practices have on these species was created by the listing of these species under the federal and/or state endangered species acts and the obligation of the Board as defined in the Forest Practices Act (76.09 RCW) to classify as Class IV all forest practices that have the potential for a substantial impact on the environment.

The rule proposals identify the "critical wildlife habitat (state)" for northern spotted owls and marbled murrelets and the specific forest practices that result in a Class IV-Special classification when proposed on these lands. Class IV-Special forest practices require review under the State Environmental Policy Act (SEPA, 43.21C RCW).

The Draft Environmental Impact Statement (DEIS) published by the Board in January 1995 evaluates three alternative rule proposals for northern spotted owls and two alternative rule proposals for marbled murrelets. The DEIS also evaluates the potential for forest practices to have a substantial impact on western gray squirrels and discusses two concepts for rule proposals. The No Action Alternative for each species is also evaluated.

There are no current permanent classification rules addressing the impacts of forest practices on these species. In June 1992, the Board adopted the "500 acre rule" for the northern spotted owl. This classification rule was designed to be interim and expired on February 9, 1994. Since then, the Board has adopted the 500 acre rule and certain disturbance avoidance requirements as emergency rules for the northern spotted owl while it develops a permanent rule. This was done to avoid having no classification rule for the northern spotted owl and to minimize confusion to landowners and the Washington Department of Natural Resources (DNR).

Emergency classification rules for forest practices that impact marbled murrelets have been in effect since November 1992. The Board has not adopted an emergency rule that addresses impacts of forest practices on western gray squirrels.

Public hearings on the proposed rules and the DEIS were held in March 1995. Nearly 300 individuals attended the hearings and 121 gave oral testimony. More than 1,200 written comments were received.

After analyzing the comments and because substantial new information became available on the northern spotted owl, the Board decided to prepare this Supplemental Draft EIS on the northern spotted owl proposed rules. The new information consists primarily of the proposed federal 4(d) rule published in February 1995, and the rule proposal developed by Timber, Fish and Wildlife (TFW) participants and accepted as a proposed rule by the Board on November 8, 1995. (This alternative replaces the three original owl alternatives.)

This Supplemental Draft EIS has been prepared by rewriting the Draft EIS, taking both new information and public comments into consideration.

The Final Environmental Impact Statement (FEIS) on proposed rules for the northern spotted owl and the marbled murrelet, as well as on the rule concepts for western gray squirrels, will be published and available at least seven days before the Board meets to adopt the rules.

Legal and Regulatory Framework

■ THE STATE FOREST PRACTICES ACT

Forest practices rules are developed pursuant to the Forest Practices Act (76.09 RCW) which requires: (1) the protection of public resources (water, fish, wildlife, and capital improvements of the state and its subdivisions) coincident with the maintenance of a viable forest products industry, and (2) the classification of forest practices into one of four classes depending upon their environmental significance. RCW 76.09.05 requires the Board to establish by rule which practices "have a potential for a substantial impact on the environment" and therefore require environmental review under the SEPA. This classification is referred to as Class IV-Special.

Class IV-Special Forest Practices

The Board has determined that certain forest practices on lands designated as "critical habitat (federal)" or "critical wildlife habitat (state)" of a federally or state-listed species are actions with the potential for a substantial impact on the environment. "Critical habitat" has a specific meaning under the Endangered Species Act (16 U.S.C. § 1531 et. seq.); therefore, to avoid confusion, critical habitat in state regulation is identified as "critical wildlife habitat (state)".

SEPA Review

Review under SEPA allows a more detailed assessment of whether a particular action will result in a significant adverse impact on the environment. This review consists of a checklist and is followed by a department determination of "significance" or "non-significance". If the determination is one of significance (a

"DS"), then an EIS must be prepared before DNR can act upon the forest practice application. A forest practice can be conditioned or denied under SEPA to mitigate specific adverse environmental impacts (WAC 197-11-660).

Proposed Classification Rules for the Northern Spotted Owl

The primary component of the current rule proposals is the classification of certain forest practices proposed within the critical wildlife habitat (state) of the northern spotted owl as Class IV-Special. The amount of habitat designated as critical wildlife habitat (state) varies by rule proposal. The current emergency rule is also a forest practice classification rule. It requires environmental review of any forest practice proposed within the best 500 acres of suitable spotted owl habitat around an owl site. This is not a prohibition on harvesting; it is a requirement to determine whether a forest practice will cause a significant adverse impact on the environment.

■ THE FEDERAL ENDANGERED SPECIES ACT

The ESA seeks to prevent the extinction of species by listing those species whose populations are perilously low as either "threatened" or "endangered". Action must then be taken to help the species recover. The U.S. Fish and Wildlife Service (USFWS) in the Department of the Interior and the National Marine Fisheries Service (NMFS) in the Department of Commerce are charged with listing species as threatened or endangered upon a finding that the species is subject to factors which affect its continued existence. A species is listed as "endangered" when it is in danger of extinction within the foreseeable future throughout all or a significant portion of its range. A "threatened" classification is provided to those animals and plants likely to become endangered within the foreseeable future throughout all or a significant portion of their ranges. A "species" includes any species or subspecies of fish, wildlife, or plant; any variety of plant; and any distinct population segment of any vertebrate species that interbreeds when mature.

The responsibility for implementation and enforcement of the ESA lies with federal agencies. However, the "take" prohibition, habitat conservation plans, and 4(d) rules directly affect nonfederal land. The consultation process for federal agencies can indirectly affect nonfederal land.

Federal Listing of the Northern Spotted Owl

The northern spotted owl (*Strix occidentalis caurina*) was federally listed as a threatened species in July 1990. The USFWS determined that the owl was likely to become endangered in the foreseeable future throughout all or a significant portion of its range (southern British Columbia to northern California). The primary threat to the northern spotted owl leading to its listing as a threatened species is the reduction and fragmentation of its habitat in forests in Washington, Oregon, and northern California (USDI 1992). Northern spotted owls use old-growth forests and other forests with similar characteristics for nesting, breeding, and rearing young. As timber harvesting has proceeded in the Pacific Northwest, the amount of habitat suitable for

spotted owls has declined, and remaining habitat areas have become smaller and more isolated from each other. As a result, the population of spotted owl has declined (USDI 1992).

The "Take" Prohibition

Nonfederal lands are primarily affected by the take prohibition in Section 9 of the ESA (16 U.S.C. § 1538). The ESA defines "take" in Section 3 as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" (16 U.S.C. § 1532(19)). U.S. Fish and Wildlife Service regulations (50 C.F.R. 17.3) interpret "harm" to mean "an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." The take prohibition applies to "any person subject to the jurisdiction of the United States". The ESA defines "person" as an individual, corporation, or government entity. Unauthorized take can be both a civil and criminal offense punishable by fines and/or imprisonment.

Habitat Conservation Plans

Section 10 of the ESA provides owners of nonfederal land with an alternative to the take prohibition (16 U.S.C. § 1539). It allows the USFWS to issue an incidental take permit to any applicant submitting a conservation plan for a listed species when the taking is "incidental to, and not the purpose of, carrying out of an otherwise lawful activity". To approve an incidental take permit, the USFWS must find:

- the taking will 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 plan will be provided;
- the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and
- any other measures deemed necessary by the USFWS will be met.

Many large commercial forest landowners are developing habitat conservation plans under Section 10 to achieve the long-term stability and certainty they need to successfully manage their businesses.

The 4(d) Rule

Section 4(d) of the ESA (16 U.S.C. § 1533(d)) allows the Secretary of the Interior or Commerce to develop regulations as necessary to conserve any species listed as threatened. In addition, this section authorizes the Secretary to apply to any threatened species the same protection provided to endangered species under Section 9. Rules under Section 4(d) have been developed in the past to prescribe the conditions under which take is allowed. By current

USFWS rule, the take prohibition applies to all threatened species. Development of regulations under this section could provide relief from the take prohibition where actions to conserve the species were not required.

The USFWS has proposed a 4(d) rule to replace the blanket prohibition against incidental take of northern spotted owls with a "narrower, more tailor-made set of standards that reduce prohibitions applicable to timber harvest and related activities on specified nonfederal forest lands in Washington and California." (60 Fed. Reg 9484 (1995), to be codified at 50 C.F.R. pt 17; proposed Feb. 17, 1995.)

For Washington State, incidental take restrictions would be retained in six designated zones called special emphasis areas (SEAs). Outside SEAs, the USFWS is proposing that the incidental take on nonfederal land of a northern spotted owl would no longer be prohibited unless it involves harvest activity within the 70 acres of habitat closest to an owl site center. The USFWS is also proposing an exemption for landowners owning 80 acres or less in an SEA and a local option conservation planning program which is envisioned as a short form habitat conservation planning (HCP) process for landowners who own between 80 and 5,000 acres.

The Consultation Process

Section 7 of the ESA, (16 U.S.C. § 1536(a)(2)) requires each federal agency, in consultation with the Secretary of the Interior or Commerce, to insure that any action authorized, funded, or carried out by such agency is "not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse-modification of habitat of such species" which is "critical" unless an exemption is granted. Activities on nonfederal land can be impacted by this requirement to the extent federal action is involved.

■ STATE LISTING OF THREATENED AND ENDANGERED SPECIES

Under state law (77.12.020 RCW), the Washington Fish and Wildlife Commission may classify a species as endangered if it is seriously threatened with extinction in the state of Washington. State law does not require recovery actions; however, regulations adopted by the Fish and Wildlife Commission (WAC 232-12-297) outline a process for listing, management, recovery, and de-listing of a species.

The northern spotted owl is listed by the state as endangered.

■ COMPLIANCE WITH FEDERAL AND STATE REQUIREMENTS

Forest landowners and operators are subject to both federal and state requirements. At present, a permittee can be in compliance with state forest practices rules, but in violation of the USFWS take prohibition.
WAC 222-50-020 expressly states that compliance with the Forest Practices Act or forest practices rules "does not ensure compliance with the Endangered Species Act or other federal laws".

Forest Practices Board's Goal and Objectives for a Permanent Owl Rule

In preparing to develop a permanent spotted owl rule, the Board adopted the following goal: "Prepare a rule that captures all forest practices that have potential for a substantial adverse impact on the environment. In the case of the owl, any forest practice that damages the long-term viability of populations of the northern spotted owl in Washington State." (FPB Minutes, March 10, 1994) The terms "long-term", "viability", and "populations" are key to understanding the standard these rules are intended to uphold.

The standard supported by these concepts is one that is intended to conserve spotted owl populations while providing the least restriction on human activities. "Viability" has been defined as "the long-term persistence and adaptation of a species or population in a given place" (Soule 1987). This standard represents a minimum level of protection consistent with the prevention of decline toward extinction.

The other key words, "long-term" and "populations", also lend support to this minimum standard of protection for spotted owls. "Long-term" recognizes that there will be fluctuations in population levels over time. Some will be induced by poor reproductive years, such as 1993, and others will be induced by the direct, indirect, or cumulative effects of habitat loss or degradation. Still others will be induced by catastrophic events such as wildfire. "Long-term" also recognizes that success means persistence of the population over an extended period of time, such as 100 years. It is not the Board's goal to enforce the take prohibition.

The term "population" also supports this interpretation. The Board's goal is to maintain owls where they can make a contribution to the species, not to maintain all individual owls where they currently exist. A well-accepted principle of conservation biology as it applies to spotted owls is that the maintenance of clusters or populations of owls is more beneficial to the recovery of the subspecies than the protection of scattered and isolated pairs. From a forest management standpoint, acceptance of this principle also allows the strategic allocation of habitat to those owls that have the potential to contribute to the viability of the species. This principle underlies the rule concept of designating "landscapes" and "special emphasis areas" for owl protection.

The Board's rule making goal, as it relates to spotted owls, also supports a conservation standard that is tied to actions on federal lands. As a matter of policy, the federal government has committed itself to providing the bulk of needed owl protection on federal public lands. Although the system of reserves established under the Northwest Forest Plan (USDA et al. 1993) assures protection for a significant portion of owl populations, it is not yet known to what extent federal actions will contribute to viability. Because the Board has adopted a biological standard (viability) as its goal, the state is committed to

providing a level of owl protection that complements federal protection in a way that achieves this goal and that may vary depending upon what the federal contribution actually turns out to be.

To support its rule making goal, the Board has also adopted five objectives (FPB Minutes, March 10, 1994):

- Define a level of [owl conservation] contribution from nonfederal lands that is essential to complement the federal recovery and conservation strategy for the northern spotted owl population in Washington State.
- Identify those landscapes that are essential to complement the federal conservation and recovery strategy. Identify whether their primary function is for dispersal or population maintenance.
- Maximize the use of local planning to promote flexibility. To do this, provide as specific criteria as possible for different levels of planning.
- Minimize conflicts between federal and state standards.
- Minimize economic impacts.

All of these elements provide a rationale for adopting a landscape approach to owl protection on nonfederal lands; in these lands, specific landscapes would be designated for maintenance of spotted owl habitat. Several management options are possible within these specified landscapes. In areas outside these important landscapes, owl protection around existing site centers would be reduced to a 70-acre core during the nesting season only. This landscape approach is thought to provide protection where it will most benefit the owl while reducing adverse impacts on landowners.

The Board's objective of complementing the federal conservation strategy was furthered in 1995 when USFWS representatives participated in the development of the TFW Proposal. The Board has the option of requesting the federal government to adopt the state rule by reference as the 4(d) rule for Washington State (FPB Minutes, November 8, 1995).

Scoping Summary

In April 1994, the Forest Practices Board issued "A Notice of Intent to Prepare an EIS/Determination of Significance" and requested public comment on the scope of the proposed environmental impact statement. Scoping was conducted to fully involve the public and to satisfy DNR's obligation under SEPA. Comments were solicited to address the alternatives described, mitigation measures, probable adverse impacts on the environment, and any other issues of concern. In particular, comments were invited in the following areas:

- the range and selection of proposed alternatives;
- the benefits and impacts of the proposed alternatives on the northern spotted owl, marbled murrelet, and western gray squirrel; and
- how these alternatives affected the commenter.

More than 800 scoping notices were mailed on April 8, 1994, to state agencies, counties, tribes, and members of the general public who have requested forest practices rule making information. Area daily and weekly newspapers were included in the mailing. The notice was published in the State SEPA Register on April 11, 1994.

The public comment period on the scoping notice lasted through April 29, 1994. Twenty-nine commenters responded. The range of alternatives presented in the scoping notice was upheld as fairly comprehensive. In general, the alternatives suggested by the public fall within those previously identified for analysis. Most of the comments addressed the content of the EIS and suggested useful issues for discussion.

Key issues of concern identified, but not listed in order of importance, were:

- exemptions for small landowners;
- recommendations of the Scientific Advisory Group (Hanson et al. 1993);
- environmental impacts of the rule alternatives; and
- economic and social consequences of rule alternatives.

SEPA emphasizes that an EIS analyzes environmental impacts (WAC 197-11-448). The intent is that the responsible agency and official will weigh the EIS as one of potentially several pieces of information necessary in the decision-making process. The EIS is not required to evaluate and document all possible effects and considerations, such as economic competition, personal income and wages, and social impacts. Therefore, the focus of this document is on the environmental impacts of alternatives under consideration.

Economic impacts related to northern spotted owl rule proposals were addressed in a recent study: "Economic Impacts of Alternative Forest Practices Rules to Protect Northern Spotted Owl Sites", by Bruce Lippke and Richard Conway, Jr., published August 1994 at the request of the Wildlife Committee of the Forest Practices Board. Copies of this report are available through the Washington State Library.

A "Small Business Economic Impact Statement" that analyzes potential economic impacts of the proposed rules has been prepared by the Department of Natural Resources to satisfy the requirements of the Regulatory Fairness Act (19.85 RCW). This report is available from the Department of Natural Resources, Forest Practices Division. For a copy, call (360) 902-1413.

Major Issues

Major issues facing decision makers in adopting forest practices regulations are:

- The level of protection the Forest Practices Board should provide the species under discussion.
- The degree of risk to the species that the Forest Practices Board is willing to accept.

Alternatives and Impact Matrix

Northern Spotted Owls

A summary of the environmental consequences of the three original alternatives, the TFW proposal, the proposed 4(d) rule alternative and the no action alternative is displayed in Table S.1. This table shows major points without explanation. The analysis supporting the summary can be found in Chapter 2, Section 2.3 Environmental Consequences.

Table S.1

Summary of the environmental consequences of the northern spotted owl alternatives according to the five biological criteria used to assess the options.

Criteria	Alternative 1 6 Landscapes	Alternative 2 10 Landscapes	Alternative 3 15 Landscapes	Alternative 4 TFW Proposal	Alternative 5 Proposed 4(d) Rule	Alternative 6 No Action
1. Numbers of known owl sites supported and unsupported	18% of nonfederal sites and 24% of most vulnerable sites supported. Support may be dropped at some sites. 27% of known territorial sites in WA could be seriously degraded or eliminated.	20% of nonfederal sites and 28% of most vulnerable sites supported. 25% of known territorial sites in WA could be seriously degraded or eliminated.	37% of nonfederal sites and 53% of most vulnerable sites supported. 16% of known territorial sites in WA could be seriously degraded or eliminated.	43% of nonfederal sites and 53% of most vulnerable sites supported. 17% of known territorial sites in WA could be seriously degraded or eliminated.	42% of nonfederal sites and 52% of most vulnerable sites supported. 17% of known territorial sites in WA could be seriously degraded or eliminated.	No sites supported. 35% of known territorial sites in WA could be seriously degraded or eliminated.
2. Habitat at supported sites	Habitat at most sites would not likely support owls at replacement demographic rates.	Better than Alt. 1 but habitat at most sites would not likely support owls at replacement demographic rates.	Habitat at many sites in Cascades would likely support owls at replacement demographic rates. Habitat at most sites in Olympics would not likely provide this support.	Habitat at most sites would not likely support owls at replacement demographic rates. Unknown whether sites in Olympics would support owls at replacement rates.	Habitat at most sites in the Cascades and Olympics would not likely support owls at replacement demographic rates.	No nonfederal habitat would be provided. Sites dependent on nonfederal habitat would likely be lost if not supported by an HCP.
3. Effectiveness of dispersal links	Would not provide for effective dispersal.	Would not provide for effective dispersal.	Criteria for dispersal landscapes not specified. Effectiveness unknown.	Standards incomplete. Would provide higher quality landscapes than Alts. 1 and 2 but effectiveness unknown.	Few criteria specified. Effectiveness of dispersal landscapes unknown.	No dispersal habitat provided.

4. Regional population viability support	Supports conservation functions in few landscapes. No functions supported in several important nonfederal areas.	Supports conservation functions in few landscapes. No functions supported in several important nonfederal areas.	Supports conservation functions in the most important landscapes. Only alternative that would designate a SOSEA in southwest WA and two SOSEAs on the Olympic Peninsula.	Extent of support for conservation functions in important landscapes unknown due to designation of several areas as combination support. Only alt. to provide combination support. Supports a greater range of planning options than Alts. 1, 2 and 3.	Supports conservation functions in most important landscapes. Supports a greater range of planning options than Alts. 1, 2 and 3.	No conservation functions supported; no SOSEAs designated.
5. Population risk reduction from catastrophic habitat loss	Provides little risk reduction in nonfederal areas most prone to catastrophic habitat loss.	Provides little risk reduction in nonfederal areas most prone to catastrophic habitat loss.	Provides some risk reduction in the most important nonfederal areas most prone to catastrophic habitat loss.	Provides some risk reduction in the most important nonfederal areas most prone to catastrophic habitat loss, except southwest WA.	Provides some risk reduction in some of the important nonfederal areas most prone to catastrophic habitat loss.	Provides no risk reduction.
6. Summary	Low probability of maintaining current distribution and viability of owls in WA.	Better than Alt. 1 but low probability of maintaining current distribution and viability of owls in WA.	Would likely provide for more viable owl populations than at present and support (for now) the current distribtuion of owls in WA.	Would provide greater support for well-distributed and viable populations in WA than Alts. 1 and 2; less support than Alt. 3.	Would provide greater support for well-distributed and viable populations in WA than Alts. 1 and 2; less support than Alt. 3. Between Alts. 4 and 5, unknown which would provide greater support.	Would provide not support for well-distributed and viable owl populations in WA.

Contents of this Supplemental Draft Environmental Impact Statement

SEPA Elements of the Environment

This document will address only the "(1)(d) Plants and animals" element of the environment (WAC 197-11-444), specifically, habitat for and numbers or diversity of species of plants, fish, or other wildlife; unique species; and fish or wildlife migration routes. Only those plants and animals that would be significantly affected will be described in detail. Those not significantly affected will be listed but not discussed in detail.

For a discussion of the elements that are not adversely affected by the proposed alternatives, see the Board's Final Environmental Impact Statement for the Proposed Forest Practices Rules and Regulations (June 1992). That FEIS contained a discussion of the following elements of the environment: earth, water, fish, wildlife, natural resources, land use, and economics.

Summary of Chapters in this Document

Chapter 1 covers that portion of Washington State shared by the northern spotted owl and the marbled murrelet. Included are a description of the terrestrial provinces and climate in the range of the two species and a discussion of terrestrial, aquatic, and riparian ecosystems within that range.

Chapter 2 covers the alternative rule proposals under consideration for the northern spotted owl. The chapter describes the northern spotted owl, its habitat requirements, and the environmental consequences to the owl and its habitat of implementing the alternatives.

There is no Chapter 3 in this document. Chapter 3 is reserved as a placeholder for the marbled murrelet section of the Final EIS.

Chapter 4 covers the other species within range of the northern spotted owl and the marbled murrelet in Washington State. The chapter contains a description of endangered species, threatened species, and species of concern and endemic species. The chapter goes on to discuss the environmental impact on these species of the alternative proposed rules for northern spotted owl and marbled murrelet.

There is no Chapter 5 in this document. Chapter 5 is reserved as a placeholder for the western gray squirrel section of the Final EIS.

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NOTE: References cited in this Summary are listed in Appendix E.

Chapter One

Shared Affected Environment within Range of the Northern Spotted Owl and the Marbled Murrelet

1.1 Introduction

This chapter provides a context of background information against which the animal elements of the environment are examined in later chapters. It includes descriptions of the physiographic provinces encompassing the range of the northern spotted owl and the marbled murrelet in Washington State. Land ownership in these provinces is shown, as is a general description of climate and geomorphic conditions.

The next major section of the chapter introduces and discusses the concepts of terrestrial ecosystems and aquatic and riparian ecosystems in the range of the northern spotted owl and the marbled murrelet.

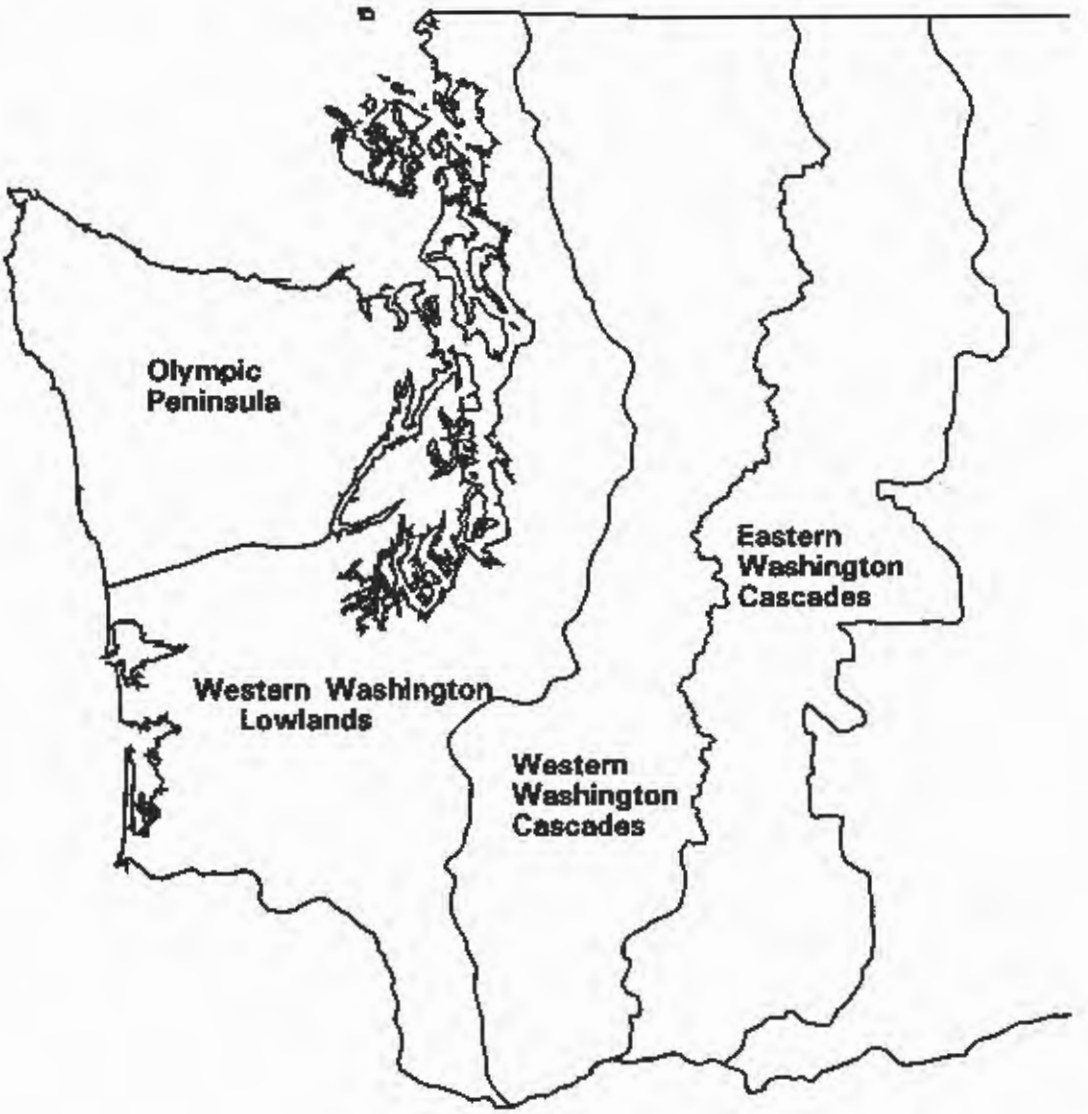
1.2 Terrestrial Provinces

The Spotted Owl Recovery Team 1 divided the range of the northern spotted owl in Washington State into four terrestrial provinces on the basis of differences in vegetation, soils, geologic history, climate, land ownership, and political boundaries (Figure 1.1) (Thomas et al. 1990). These provinces incorporate physical, biological, and environmental factors that shape broad-scale landscapes. Differences in geology resulted in broad-scale differences in soil development among provinces. These differences, combined with differences in climate, have brought about distinct plant and animal communities.

The Forest Ecosystem Management Assessment Team Report (USDA et al. 1993) used the province concept as the basis for its terrestrial and aquatic ecosystem analyses. The provinces were also used in the analysis for the Northern Spotted Owl Recovery Plan (USDI 1992). The range of the marbled

Figure 1.1

Terrestrial Provinces in Western Washington



murrelet is encompassed in that of the northern spotted owl. Therefore, unless otherwise specified, references in this EIS refer to the four terrestrial provinces.

Rates of harvest and natural disturbance have varied tremendously among the terrestrial provinces. As a result, various amounts of late-successional and old-growth forest are found from province to province. Franklin and Dyrness (1973), Thomas et al. (1990), Ruggerio et al. (1991), and USDI (1992) have described in detail the patterns of late-successional and old-growth forests. Therefore, the provinces will be described briefly here.

Olympic Peninsula Province

This province is bound by the Pacific Ocean on the west, the Strait of Juan de Fuca on the north, Puget Sound and Hood Canal on the east, and the western Washington lowlands on the south (Figure 1.1). The Olympic Peninsula is a very diverse province with strong maritime influences along the west and northwest sides graduating to a much more continental climatic regime in the northeast corner. Precipitation varies from over 200 inches at mid-elevations in the western regions to less than 20 inches near Sequim in the northeast. Vegetation, species distributions, fire and wind disturbance histories, growth, disease, soils, and nutrient regimes all vary along this moisture gradient.

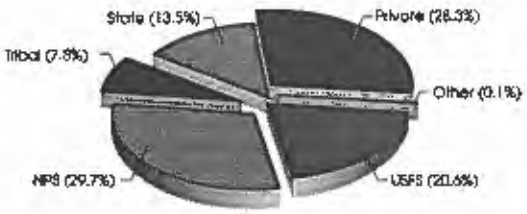
Forest vegetation dominates the landscape of the Olympic Peninsula up to about 4,500 feet in the west to over 5,000 feet in the northeast, where it is replaced by subalpine parkland, alpine meadows, snow, and rock. At lower elevations along the coast in the Sitka Spruce Zone, Sitka spruce and western hemlock predominate with small amounts of western red cedar, Douglas-fir, and red alder in young forests (Henderson et al. 1989). Away from the coast, the Western Hemlock Zone occupies the remaining lower elevations and is characterized by western hemlock and western red cedar. Outside the coastal area of the Sitka Spruce Zone and the wet part of the Western Hemlock Zone, Douglas-fir predominates in all ages of forests up to the middle Silver Fir Zone. Red alder occurs on wetter sites and in younger stands, while western hemlock and western red cedar may also occur, especially in older forests.

At mid-elevations, especially where a winter snowpack occurs, silver fir and western hemlock predominate in both young and old forests. Western red cedar may also occur in some stands. This area is known as the Silver Fir Zone (Henderson et al. 1989). It is first encountered at about 1,000 feet in the wetter parts of the western Olympics and extends up to about 4,000 feet in parts of the eastern Olympics. In the very dry northeast corner, the Silver Fir Zone is absent. The Mountain Hemlock Zone occurs above the Silver Fir Zone in most areas of the province. It begins about 2,800 feet in the west and about 4,500 feet in the east. It is absent in parts of the northeast Olympics where it is replaced by the Subalpine Fir Zone. Silver fir and mountain hemlock predominate in the Mountain Hemlock Zone, along with Alaska yellow cedar in some areas. Subalpine fir may be a seral species in parts of the Mountain Hemlock or Silver Fir Zones, or is a climax species in the dry rain-shadow area of the northeast.

There are two major federal land ownerships: the Olympic National Park occupying the peninsula interior and the surrounding Olympic National Forest. Outside the national forest are extensive areas of nonfederal land, including tribal reservations, lands managed by the state of Washington, and private industrial timberlands (Figure 1.2).

Figure 1.2

Olympic Peninsula Province Ownership



Acres	Ownership/Management
858,200	Private
409,000	State of Washington
626,200	U.S. Forest Service (USFS)
901,000	National Park Service (NPS)
235,700	Tribal Lands
3,800	Other
3,033,900	**Total**

Lowland valleys within the national park contain significant areas of late-successional and old-growth forests. Most private, state, and tribal reservation lands on the peninsula have been harvested within the last 80 years. Some of these areas are now being harvested for the second time.

Along the western coast of the peninsula and for as far as 30 miles inland, wind is the dominant natural disturbance factor. Fire is also a major disturbance factor, particularly in the eastern portion of the province. For a detailed discussion of fire effects, see the Natural Disturbances section of this chapter.

Forest structure and age-class distribution have varied greatly throughout history. Great fires have spread across much of the province several times in the last several hundred years (Henderson et al. 1989; Agee 1991a). In addition, several major windstorms have hit the province in the last century falling thousands of acres of forests and millions of board feet of timber, mostly along the far west side. This disturbance regime has created a continual renewal and regrowth of the forests of the province.

At the time of European settlement, the natural forest pattern of the province was a mix of age classes and structures from recently disturbed, early seral, to even-aged mature forests to very old and complex, near-climax forests. Patterns of young, mid- and old-aged forests have varied from century to century. But over the long run, the landscape has been a mix of forest ages and structures.

Seldom in the history of the province (last 1,000 years) was more than 65% in old and very old age classes ("old-growth") (Henderson 1990; Agee 1991a). Nor has the area seen more than 65% in young and very young forests, except for brief periods perhaps during the warm and dry period of the Medieval Climatic Optimum about 1,000 years ago (Henderson et al. 1989). Beyond these percentages, it is important to recognize that the distribution of ages and forest types has not been random, but repeatable and predictable. Forests in the western half of the province have been seldom disturbed by fire, if at all, during the last 1,000 years, while most of the forests of the eastern half of the province have been disturbed many times. Few forests in the drier eastern Olympics have grown beyond 300 years of age before being disturbed by fire. However, wind has been the main disturbance factor for the west side forests. Organisms of the forests (such as spotted owls and marbled murrelets) have had to adapt to this changing pattern of forest composition and structure caused by the natural disturbance regime. Soils and nutrient regimes have evolved and developed under this disturbance/climatic pattern, and continue to change as climate and disturbance patterns also change.

Current conditions reflect an intensive harvest pattern during the last 60 years or so. Timber harvesting activities in the province actually date back to early Spanish and English exploration in the 18th century. Early timber harvesting on the west side mostly focused around removing spruce for airplane construction. However, except in the far northeast corner near Port Gamble and Port Townsend and in the southwest corner of the peninsula in the vicinity of Aberdeen, most of the timber harvesting has occurred in the post-war period. The post-war expansion created an extensive road system that allowed easy access to many previously remote areas and increased erosion and sedimentation problems in rivers and creeks.

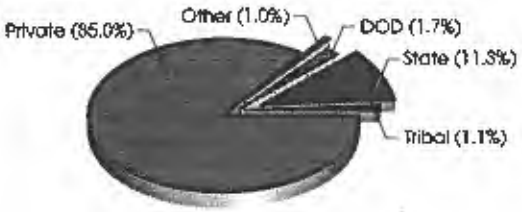
While timber harvest in the province has slowed considerably in the last decade, older second-growth forests are maturing, providing mid-seral habitat for many organisms. At the same time younger forests are developing and maturing, leaving the landscape with few acres of very young forests (currently <20 years). The resulting age-class distribution is not unlike historic patterns following the catastrophic fire episodes (Henderson 1990). However, the pattern and geographic distribution of different age classes does not reflect the likely pattern caused by wildfire, since harvest units are often small and widely scattered and occur commonly in wet areas and at high elevations, where historic fires were very uncommon. Currently, the landscape is mostly composed of three age classes: (1) very old old-growth, mostly in the western part of the province and at higher elevations; (2) young old-growth, mainly Douglas-fir in the eastern and northern part of the province; and (3) young forests, 10-60 years, scattered throughout state, private, and U. S. Forest Service ownerships.

Western Washington Lowlands Province

This province includes the area known as the Puget Sound basin plus the portion of the state south and west from the southern tip of Hood Canal to the Columbia River (Figure 1.1). Climate is temperate, and precipitation is moderate for western Washington. The northern part is somewhat drier, due to the rain-shadow effect from the Olympic Mountains, with precipitation averaging about 35-50 inches. The southwestern part is wetter, averaging over 70 inches. Most lands have been influenced by urbanization, especially north of Olympia. Forest vegetation dominates the landscape except where cleared for urban, industrial, or agricultural uses. Douglas-fir is the most common tree species. Western hemlock occurs throughout most of the area and is most common in the wetter areas, especially in the southwest part of the province. Western red cedar, while once more common, is usually scarce. Various other tree species, characteristic of drier or younger forests, such as madrone, Oregon oak, lodgepole pine, western white pine, dogwood, and Pacific yew may also occur. Red alder is a common seral species, especially in wetter areas and on wetter sites. The province is mostly Western Hemlock Zone (Henderson et al. 1989, 1992). Land ownership is mostly private. The province also includes state lands, U. S. Department of Defense lands, and tribal lands (Figure 1.3).

Figure 1.3

Western Washington Lowlands Province Ownership



Acres	Ownership/Management
5,235,000	Private
693,900	State
105,200	U.S. Dept. of Defense (DOD)
65,000	Tribal Lands
62,900	Other
6,162,000	**Total**

This province includes the heavily urbanized and industrialized population centers from Olympia to Everett, and Bellingham, where much of the landbase has been converted to nonindustrial forestry uses or is influenced by the population or pollution of the greater Seattle area. While there are remaining fragments of old-growth forests and significant acreage of young-growth forests, this province is the most heavily influenced by humans. Most forests are less than 80 years of age and some areas have been harvested more than once since settlement. Industrial, urban, and agricultural pollution sources are a concern in many waterways in this province, and air pollution from automobiles, factories, and fireplaces is a conspicuous feature of the Puget

Alternative 5 would support most of the important conservation functions in important nonfederal landscapes, although functions in the Entiat Ridge and southwest Washington landscapes and portions of the North Blewett and White Salmon landscapes would not be supported. Demographic support functions would be extended to sites centered on non-matrix federal lands outside but overlapping SOSEAs. A greater range of landscape planning options under this alternative than under Alternatives 1, 2, and 3 may provide additional benefit to owl populations in important nonfederal landscapes.

Alternative 5 would provide some population risk reduction in some of the important nonfederal areas most prone to catastrophic habitat loss. No risk reduction, however, would be provided in the Entiat Ridge and southwest Washington landscapes.

Alternative 5 would provide greater support for well-distributed and viable owl populations in Washington than either Alternatives 1 or 2. However, this alternative would likely provide less support than Alternative 3 because of the requirement for only 500 acres of habitat within 0.7 mile of site centers, the low total habitat amounts that would be provided at sites in the Cascades, the omission of support for the Entiat Ridge and southwest Washington landscapes, and the partial omission of support for portions of other landscapes.

Between Alternatives 4 and 5 it is uncertain which would provide greater support for well-distributed and viable owl populations in Washington. Alternative 5 would likely result in demographic support sites with less habitat near site centers and with greater habitat fragmentation relative to Alternative 4 and would not provide support for the Entiat Ridge landscape and a portion of the White Salmon landscape. Under Alternative 4, however, the uncertainty in the quality of support for owl sites in combination function areas and the exemption potentially allowing habitat at some sites with multiple nonfederal owners to be reduced below target amounts provides substantial uncertainty in the level of support Alternative 4 would provide to owl populations in Washington.

■ ALTERNATIVE 6 - NO ACTION

Alternative 6 would provide no protection to owls or owl habitat. Under this alternative, owl sites dependent on nonfederal habitat would likely be lost. The distribution of populations in all provinces would contract from that at present. And the demographic strength of the federal owl population network would be weakened.

Benefits and Disadvantages to the Environment of Reserving Implementation to Some Later Date

Reserving implementation of a rule package to protect the northern spotted owl and its habitat to some later date would have the disadvantages identified and discussed in Section 3.3 Environmental Consequences - No Action Alternative. Briefly, the disadvantages to the environment would be:

- the potential for destruction of northern spotted owl habitat on state and private lands by forest practices;
- a shrinking range of future conservation options; and
- increased potential for listing the species as endangered.

There are no benefits to the environment of reserving implementation of a rule package until some later date.

2.2 Affected Environment - Northern Spotted Owl and its Habitat

Introduction

This section describes the northern spotted owl and its habitat. The information presented here will be used as the baseline against which to measure the impacts of the alternatives. This section does not describe effects; that discussion of effects occurs in section 2.3, Environmental Consequences. This section focuses on the ecology and habitat requirements of the northern spotted owl and geographic areas of concern for spotted owls in Washington. Other plants and animals in the range of the northern spotted owl, including those that are threatened and endangered, are described in Chapter 4.

The northern spotted owl is one of the most studied owls in the world. This section provides discussion and summary of:

a. life history including reproductive biology, dispersal and survival,

b. range and numbers in Washington,

c. interspecific relationships including competition, hybridization and predation,

d. habitat including requirements for nesting, roosting, foraging and dispersal, amounts of habitats needed, and habitat fragmentation,

e. population dynamics and viability, and

f. federal management and areas of concern.

For additional discussion of these topics refer to "A Conservation Strategy for the Northern Spotted Owl" (Thomas et al. 1990), "Recovery Plan for the Northern Spotted Owl - Draft" (USDI 1992a), the FEMAT Report (USDA et al. 1993), or USDA and USDI (1994). Throughout this chapter, the term "owls" will refer to northern spotted owls.

Description

The northern spotted owl is a medium-sized bird with dark eyes, brown plumage and a round head with white spots extending down the nape. The breast and abdomen are mottled with white. The sexes look alike, although females are usually slightly larger and have higher pitched calls than males.

Life History

■ BEHAVIOR AND FOOD HABITS

Adult spotted owls defend territories, areas of exclusive use, against other spotted owls by vocalizing; both pair members will defend their territory. During the day owls spend most of their time sleeping at roost or nest sites. They forage primarily at night. Spotted owls are sit-and-wait predators, using perches at all heights in the forest canopy to look and listen for prey. In Washington they feed primarily on northern flying squirrels, deer mice, juvenile snowshoe hares, bushy-tailed woodrats, voles, and other small mammals (Thomas et al. 1990, Forsman et al. in prep.a).

Forsman et al. (in prep.a) analyzed remains from 6,293 prey items from the Olympic Peninsula, the northern and southern portions of the western Cascades, and the eastern Cascades. Twenty-one species or species groups of mammals, birds, insects, and frogs were found in the diet. Mammals comprised at least 95% of the total biomass consumed in each of the four regions. Five species (northern flying squirrels, snowshoe hares, bushy-tailed woodrats, deer mice and red-backed voles) comprised 65% to 88% of the biomass consumed. In all four regions, nocturnal prey comprised from 87% to 93% of the prey items; northern flying squirrels formed the largest portion of the diet, ranging from 28% to 54% of the diet by frequency of occurrence, and 45% to 55% by biomass.

■ REPRODUCTIVE BIOLOGY

Spotted owl pairs begin nesting in March or April. Nests are located in cavities in live trees or snags and in broken tops of large trees; in the eastern Cascades, northern goshawk nests and mistletoe brooms in the branches of trees are also used. One to three eggs are laid and incubated by the female for approximately 30 days. After hatching, juvenile owls remain in the nest for approximately 30 days before fledging. When they leave the nest, most fledglings cannot fly and all are completely dependent upon their parents for food. Fledglings remain with their parents through the summer, learning to fly and hunt; they eventually disperse in the early fall.

Most spotted owls first breed during their third year (Thomas et al. 1990) although some individuals may begin earlier (Barrowclough and Coats 1985, Barrows 1985, Miller 1989). Some owls may never breed. Not all pairs attempt

to reproduce each year. Of the pairs that attempt to nest in a season, zero to nearly 100% produce fledglings. Reproductive success can vary widely between sites, regions, and years. In Washington, the highest reproductive rates and the lowest year-to-year variability generally occur in the eastern Cascades (Irwin and Fleming 1995; Forsman et al. in prep.b), while the lower reproductive rates occur in southwest Washington, the northern Cascades, and the Olympic Peninsula (WDFW unpub. data; Holthausen et al. 1994).

Fecundity, the mean number of female offspring produced each year per territorial adult female, has been estimated on three demographic study areas in Washington (Irwin and Fleming 1995, Forsman et al. in prep.b). Fecundity of adult (three or more years old) females was 0.380 on the Olympic Peninsula and 0.565 on the Cle Elum study area. For subadult (one and two year old) females, fecundity was 0.206 on the Olympic study area and 0.306 on the Cle Elum study area (Forsman et al. in prep.b). On the Olympic and Cle Elum study areas, fecundity of adults varied significantly between years. Most of this variation resulted from the proportion of females that attempted to nest each year. Variation was also due to differing rates of nest failure between years (Forsman et al. in prep.b). For pair sites on the Wenatchee study area, overall fecundity averaged 0.49 over five years, and ranged from 0.10 to 0.74 (Irwin and Fleming 1995).

The number of young fledged per site per year within the Wenatchee study area was also found to vary among five fire management analysis zones (FMAZ) (Irwin and Fleming 1995). Annual reproductive rates for all pair and single sites combined ranged from 0.28 to 0.68 (Irwin pers. com.). For a more complete discussion of FMAZ characteristics and of the sites within the five FMAZ see "Amount of Nesting, Roosting, and Foraging Habitat within Owl Home Ranges" and "Other Methods for Estimating Habitat Amounts Used by Spotted Owls" below.

■ DISPERSAL

Dispersal by animals is the process of an individual leaving one area to establish a new home range elsewhere. In owl populations, dispersal plays a critical role by providing colonizers to reoccupy vacant habitat thereby contributing to population stability. (See Population Dynamics below.) Dispersal also results in genetic mixing important for long-term population health.

There are two sources of dispersers, young-of-the-year juveniles, and owls that were territorial but have abandoned their sites. Dispersing owls join the nonterritorial "floater" population until they settle into a territory. Dispersal among territorial owls is uncommon (Forsman et al. in prep.b). In most instances it is probably a result of habitat disturbance (e.g. logging, wind, or fire), although adults may infrequently change or abandon territories during years of low prey abundance (Forsman, unpub. data).

Juvenile owls leave their natal areas between late August and early November after having attained the body mass of adults (Forsman et al. 1984, Allen and Brewer 1985, Gutierrez et al. 1985a, Miller 1989). They appear to most often leave their natal ranges in random directions (Allen and Brewer 1985, Gutierrez et al. 1985a,b, Miller 1989). For the first few weeks dispersal is usually rapid. Daily movements of juveniles averaged one mile per day in Oregon (Miller 1989) and three to five miles per day in two seasons in California (Gutierrez et al. 1985a). Juveniles surviving this "active" period of dispersal typically settle into a temporary home range for the first winter (Gutierrez et al. 1985a, Miller 1989). In a study in Oregon, the size of these "settled" areas was larger for juveniles that survived this period (mean 1284, range 491 - 2076 ha) than juveniles that died (mean 378 ha, range 52 - 771 ha) (Miller 1989). Juveniles which survive the first winter often begin moving again in late winter or spring (Miller 1989). Dispersal may continue into the second year and beyond until the owl finds an unoccupied territory or dies (Miller 1989).

Survival of juvenile dispersers through their first year is low. Estimates of first year survival, including pre-dispersal mortality, range from 14% to 61% on 12 demographic study areas (Burnham et al. 1994, Irwin and Fleming 1995, Forsman et al. in prep.b). Predation and starvation are the main causes of disperser mortality (Gutierrez et al. 1985a, b, Miller 1989, Johnson 1992a). Great horned owls are thought to be the most significant predator of juvenile owls (Forsman et al. 1984, Miller 1989). In Oregon, peaks in disperser mortality occurred during September and November/December. Starvation was the major cause of mortality in September, coinciding with the time when adults quit feeding juveniles and dispersal was initiated (Miller 1989).

In Washington, radio telemetry studies of dispersal on the Olympic Peninsula (Forsman pers. com.), the eastern Cascades (Forsman pers. com.), and on the Yakama Indian Reservation (King pers. com.) have followed a total of 118 juvenile owls (Table 2.2-1). Mean straight-line dispersal distance for these three studies ranged from 15 to 22.2 miles, while maximum dispersal distances recorded by each study ranged from 36 to 76 miles.

Radio telemetry studies of 56 juvenile dispersers in Oregon and northern California found a mean straight-line dispersal distance of 20.1 miles. Approximately 20% of the owls dispersed more than 30 miles, while 25% dispersed less than 10 miles (Thomas et al. 1990). There is a tendency for female owls to disperse longer distances than males. For 14 juveniles identified as to sex, mean straight line dispersal distance averaged 20.5 miles for females and 16.3 miles for males; one male did not disperse (Miller 1989). Although a few juvenile owls in these studies dispersed distances greater than 30 miles from their natal areas, most owls dispersed much shorter distances and died in the process. For these reasons, emphasis should be placed on dispersal distances that the majority of owls are likely to be able to cover and survive, rather than on the maximum dispersal distances recorded in these studies when developing potential management actions.

Table 2.2-1

Maximum straight line dispersal distances (miles) of juvenile spotted owls in Washington State.

Study Area Dispersal Distance	Mean	Standard Error*	Maximum	Sample Size
Olympic Peninsula (Forsman pers. com.)	15.0	1.58	36	31
Eastern Cascades (Forsman pers. com.)	15.1	1.22	76	80
Yakama Indian Reservation (King pers. com.)	22.2	5.29	54	7

* Standard errors are a measure of the variability of the dispersal distances in each study. Greater standard errors indicate that the dispersal distances are more variable. Standard errors generally decrease with a larger sample size.

■ SURVIVAL

While spotted owls generally have low survival rates in their first year of life, adults are long-lived and have high annual survival rates. Survival rates may vary by age, sex, location and year (Burnham et al. 1994). Band recovery studies provide most of the available information on owl survival rates (Burnham et al. 1994).

On 11 band recovery study areas in California, Oregon, and Washington, annual adult survival rates ranged from 0.821 to 0.868, while juvenile survival ranged from 0.140 to 0.418 (Burnham et al. 1994). For three band recovery study areas in Washington, survival rates for adults (including subadults) and juveniles were highest on the Olympic Peninsula, and lower on the two study areas in the eastern Cascades (Table 2.2-2) (Burnham et al. 1994; Irwin and Fleming 1994). The major causes of adult and juvenile mortality are starvation and predation (Gutierrez et al. 1985ab, Miller 1989, Johnson 1992a). For the Cle Elum and Olympic study areas, however, estimates of juvenile survival rates were believed to be low due to emigration of dispersing juveniles (Burnham et al. 1994). Using radio telemetry data, Forsman et al. (in prep.b) calculated adjusted juvenile survival rates of 0.611 for the Olympic study area and 0.349 for the Cle Elum study area (Table 2.2-2). Bart (in press) concluded from simulation results that adult survival rates calculated using the techniques of Burnham et al. (1994) could also be biased low by as much as 0.02 to 0.03 due to undetected emigration of adults (but see further discussion in "Spotted Owl Demography" below). Forsman et al. (in prep.b) however, concluded that undetected adult emigration was rare on the Olympic and

Cle Elum study areas. Little is known of survival rates of dispersing subadult and adult owls although their survival rates are expected to be less than that of territorial adults.

Table 2.2-2

Annual survival rates for adults, subadults, and juveniles on three study areas in Washington.

Study Area	Adults[a]	Juveniles[b]	Emigr. Adj. Juv.[c]	Years Study	No. of Owls Banded
Olympic (Forsman et al. in prep.b)	0.862	0.245	0.611	7	548
Cle Elum (Forsman et al. in prep.b)	0.850	0.140	0.349	5	332
Wenatchee (Irwin and Fleming 1994)	0.824	0.200	NA	3	440

[a] Includes all owls greater than one year old.
[b] Juveniles are owls less than one year old.
[c] Juvenile survival rates adjusted for emigration using radio-telemetry data.

Range and Numbers

The current range of the northern spotted owl approximates the limits of its historic range: from southwestern British Columbia, south through the Cascade Range (east and west sides) and coastal ranges of Washington and Oregon, to northwestern California.

In Washington, the spotted owl occupies forested areas on both sides of the Cascade crest from the Canadian border south to Oregon. In the eastern Cascades, owls are found in the western portions of Okanogan, Kittitas, Yakima, and Klickitat Counties and throughout Chelan County. West of the Cascade crest, owls occur in the foothills and mountains, but have been extirpated from the Puget Sound lowlands. Spotted owls also occur on the Olympic Peninsula, and in southwestern Washington east and west of Interstate 5.

There is no estimate of the total number of owl sites, owl pairs, or owls in Washington. Nor do estimates exist for owl numbers in the eastern Cascades, western Cascades or western Washington lowlands provinces. However, little owl habitat and few owls remain in the latter province. For the Olympic Peninsula, sufficient information exists to provide an estimate of the number of owl pairs in the province. Holthausen et al. (1994) estimated the numbers of

owl pairs on the Olympic National Forest as either 97 or 117, and the numbers of pairs on state-owned lands as either 12 or 31 depending on the assumptions used. The lower estimates reflect the tally of known pairs for these areas. The upper estimates were based on the assumption that all known territorial sites actually harbored pairs. Seaman (pers. com.) estimates the number of owl pairs in the inland portion of Olympic National Park to be 229 $\pm$ 71 (90% confidence interval). The Queets corridor and coastal strip of Olympic National Park and the Quinault Indian Reservation likely harbor nine or fewer additional owl pairs; there are probably few additional pair sites on private lands. In summary, there are probably between 276-457 owl pairs currently on the Olympic Peninsula.

While there is no state-wide estimate of owl numbers, tallies of the number of owl sites known to exist in Washington are available from the Washington Department of Fish and Wildlife (WDFW) which recognizes 842 confirmed pair sites (status 1), 25 sites with two owls present whose pair status is unknown (status 2), 112 territorial single sites (status 3) and 164 non-territorial single sites (status 4), for a total of 1,143 sites as of October 9, 1995. (See Chapter 2 Addendum for current definitions of status 1, 2, 3.) Approximately 17% of the sites are centered on nonfederal lands (Hanson et al. 1993). 685 sites (60%) include nonfederal lands within a 1.8 or 2.7-mile radius (Table 2.2-3). The 685 sites that include nonfederal lands range from sites that encompass only a few acres of nonfederal land to sites that are completely supported by nonfederal lands. 105 of these sites are non-territorial owl sites (status 4) and are not subject to state regulation. 458 sites (40%) are entirely on federal lands. Of the 1,143 total owl sites, 979 are territorial sites (status 1, 2, 3), and 580 of these (59%) include some nonfederal lands (Table 2.2-4). It is the management of these 580 territorial sites involving nonfederal lands that the rule alternatives and this SDEIS seek to address. These tallies do not represent all spotted owls residing in Washington, since not all potential habitat in the state has been surveyed for owls.

Table 2.2-3

Numbers of known spotted owl sites (status 1, 2, 3, 4) in Washington including exclusively federal lands and sites involving some nonfederal lands.[a]

(Data from WDFW, October 9, 1995.)

Province	Some Nonfederal	Only Federal	Total
Eastern Cascades	228	129	357
Western Cascades	292	210	502
Western Washington Lowlands	20	0	20
Olympic Peninsula	145	119	264
Totals	685	458	1,143

[a] Sites are considered to involve nonfederal lands if the centers occur within 2.7 miles (west of I-5) or 1.8 miles (east of I-5) of any nonfederal lands.

Table 2.2-4

Numbers of known spotted owl sites in Washington involving nonfederal lands.[a]

(Data from WDFW, October 9, 1995.)

	Owl Site Center Status				
Province	1	2	3	4	Total
Eastern Cascades	176	5	12	35	228
Western Cascades	207	3	40	42	292
Western Washington Lowlands	6	3	5	6	20
Olympic Peninsula	97	6	20	22	145
Totals	486	17	77	105	685

[a] Sites are considered to involve nonfederal lands if the centers occur within 2.7 miles (west of I-5) or 1.8 miles (east of I-5) of any nonfederal lands.

Occupancy of territorial sites varies from year-to-year. Consequently not all of the "pair" sites (status 1, 2) recognized by WDFW will actually be occupied by a pair of spotted owls in any given year. The status assigned to a site reflects the highest status ever observed, i.e., if a pair is observed at a site in any year, it is listed as a "pair" site.

Interspecific Relationships

■ COMPETITION

Interspecific competition occurs when individuals of different species compete for the same resource. The spotted owl's primary competitor is the barred owl. Barred owls are recent colonists in the Pacific Northwest, first appearing in Washington within the last 50 years (Hamer et al. 1989). Barred owls are currently found throughout the range of the spotted owl in Washington. Spotted and barred owls use some of the same habitats, although there appear to be differences in habitat use between the two species (Hamer et al. 1989; Iverson 1993). Barred owls are larger and more aggressive in territorial interactions, use a wider variety of prey, occupy a wider variety of habitats and have smaller home ranges than spotted owls (Hamer et al. 1989). Where they co-occur, limited observational data suggest that barred owls are dominant to spotted owls (USDI 1992b).

■ HYBRIDIZATION

Hybridization occurs when individuals of different species breed and successfully produce offspring. At least eight spotted owl - barred owl hybrids have been observed in the wild in the Pacific Northwest as of August 1994 (Hamer et al. 1994, Thomas et al. 1993; WDFW unpub. data); six of these birds have been found in Washington. Hybrids have been found paired with spotted or barred owls at four sites; at one site, a hybrid paired with a barred owl produced offspring in at least two years (Hamer et al. 1994). However, hybridization is probably rare. Thousands of spotted owl pairs and hundreds of barred owl pairs have been observed in the last decade, with few instances of hybridization being detected. Extensive hybridization could threaten the genetic integrity of spotted owl populations and affect their identity as a species (Hamer et al. 1994; Thomas et al. 1993).

■ PREDATION

Predation is the killing of one animal by another for food. Great horned owls (Forsman et al. 1984, Miller 1989, Johnson 1992a,b) and northern goshawks (USDI 1992b) may prey on spotted owls. Great horned owls are larger and share some habitats with spotted owls. However, they tend to occupy areas that are more fragmented with less old forest than those used by spotted owls (Johnson 1992b, USDI 1992b). Johnson (1992b) found that great horned owls were most often detected in landscapes with 10-20% old forest, while the majority of spotted owls were detected in landscapes with at least 60% old forests. He also found less old forest at great horned owl sites than at spotted owl sites. Carey et al. (1992) noted that great horned owls were approximately five times more prevalent in an area of heavily fragmented Douglas-fir forest than in an area with more clumped Douglas-fir forest. Spotted owls will nest

within goshawk territories and will actively defend their young against goshawk attacks (USDI 1992b). It is unknown whether predation by goshawks is a significant mortality factor for owl populations. Red-tailed hawks and mammalian carnivores may also occasionally prey on spotted owls. At least 29% of dispersing juvenile owls were killed by avian predators within their first year in a four-year study in Oregon (Miller 1989). Johnson (1992a) compiled mortality data from radio telemetry studies in Washington, Oregon and California from 1975 through 1991 and found that at least 40% of documented adult mortalities and at least 25% of juvenile mortalities resulted from avian predation.

Habitat

■ NESTING, ROOSTING, AND FORAGING HABITAT

All radio-telemetry habitat-use studies conducted in Washington and Oregon to date indicate that stands with significant old-growth structural components are superior habitat for spotted owls. Thomas et al. (1990) reviewed ten studies of habitat selection that analyzed habitats used by 115 radio-tagged spotted owls in Washington and Oregon. The results of these studies were consistent. Throughout Washington and Oregon, old-growth was the only stand condition consistently used more than expected based on availability for roosting and foraging, and old-growth was never used less than expected. The majority of owls (65%) in these studies used mature forests in proportion to their availability, 21% used them significantly less than expected, while only 14% used mature forests greater than expected based on availability. Young forests were used significantly more than expected by only 3% of the owls in these studies, while more than 50% of the owls used these forests significantly less than expected. Very young forest plantations and clear-cuts were rarely used by all owls studied. All studies reviewed by Thomas et al. (1990) that reported separate data for roosting habitat found strong selection of old-growth forests.

Spotted owls have also been found to nest primarily in old-growth forests. Of 130 nests on the Olympic Peninsula and in western Oregon, 79% were located in old-growth stands and 16% were in stands where old-growth, mature and young trees were intermixed (Thomas et al. 1990). Only 4% of the nests were found in mature or young stands. On the Olympic Peninsula, all nests have been found in tree or snag cavities (Thomas et al. 1990). Stands used for nesting and roosting on the Olympic Peninsula typically had a higher degree of canopy layering than other stands and large mean diameter snags (Mills et al. 1993). In the northern Cascades and Olympic Peninsula, the intensity of stand use by spotted owls was found to increase with the volume of snags and diversity of tree height (North 1993).

Structural characteristics that distinguish old-growth forests include multi-layered, multi-species canopies with large (greater than 30 inches or 76 cm dbh) overstory trees, a high incidence of overstory trees with broken tops, cavities, mistletoe brooms or other deformities, presence of large-diameter snags and high volumes of large down logs (Thomas et al. 1990). Younger forests usually

lack or have reduced amounts of some or all of these components (Spies and Franklin 1991). Younger forests that are selected by spotted owls for nesting, roosting, or foraging typically have some of these features.

An exception to this pattern of reliance on old-growth forests occurs in the mixed conifer forests of the eastern Cascades of Washington where spotted owls have been found to regularly use younger forest stands. Buchanan et al. (1995) found that approximately 74% of 83 eastern Cascades nest sites were in fairly young (median age = 122 years) stands that were in intermediate stages of succession. Most of these nests were found in abandoned goshawk nests or dwarf mistletoe brooms (Buchanan et al. 1993). Among five spotted owl pairs radio-tracked on the Wenatchee National Forest, three of nine cover types were used by each individual owl in proportions greater than or equal to that expected based on availability (Forsman unpub. data). These cover types included old-forest, mixed aged stands with roughly an equal mix of trees greater than and less than 50 cm dbh, and younger forests. The younger forests were closed canopy stands dominated by trees 10-50 cm in diameter with few stems greater than 50 cm in diameter. Nine of ten owls used these younger forests in proportions equal to their availability while only one owl used these forests greater than expected based on their availability. The presence of scattered old trees and/or pockets of residual old trees were thought to be an important factor in affecting the level of owl use in these stands (Forsman pers. com.). Four other forest types were used in proportion to their availability by some owls but less than expected by other owls (Forsman unpub. data).

Hicks et al. (1995) studied habitat selection by eight owl pairs in an area of mixed ownership within the Wenatchee National Forest. Seven of the pairs used type A and B habitat in proportions greater than expected based on availability. The lack of selection for type A and B habitat by the remaining pair was thought to result from the owls having nested in a stand of type C habitat. Each of the eight owl pairs used type C habitat in proportions equal to or greater than expected based on availability, while non-habitat was avoided by each of the owl pairs. Type A and B habitat generally includes stands with older, larger diameter trees and higher canopy cover than type C habitat which typically include a preponderance of smaller, younger trees (Owl Memo #3, WDNR March 5, 1991). (Definitions of type A, B, and C habitat, as defined in Owl Memo #3, are in the Chapter 2 Addendum.)

At least six non-exclusive hypotheses have been proposed to account for the selection of older forests by spotted owls (Carey 1985): (1) prey are more abundant in older forest; (2) prey are more efficiently hunted in older forest; (3) multilayered canopies are needed for roosting microclimate selection; (4) predators are avoided; (5) nesting structures needed are most often found in older forests; and (6) spotted owls are behaviorally and physiologically adapted to older forests.

Carey (1995) found that flying squirrels, the most important prey species for owls in Washington, were more abundant in old-growth on the western Olympic Peninsula and in the southern coast range of Oregon than in young managed

forests lacking old forest legacies (residual large trees, snags, and downed logs). Additionally, diets were more diverse and squirrels moved shorter distances in the old forest than in the younger stands. In western hemlock stands on the western Olympic Peninsula, flying squirrels were two times more abundant in the old versus the young (44-67 years old) forests. In both areas, mixed age stands that had old-growth elements and a 66-100 year old age class of trees had flying squirrel densities similar to undisturbed old forests. One second growth stand on the Olympic Peninsula had flying squirrel densities similar to those of the old-growth stands. This stand had the largest mean tree diameter, number of large snags, shrub abundance, midstory abundance and course woody debris abundance of the younger stands.

Availability of cavities for dens and food (truffle) abundance are thought to limit flying squirrel densities in some second growth forests. Flying squirrels use cavities in live trees, snags, downed logs and old stumps as well as leaf nests in young forests in the Puget trough for denning (Carey in prep.). Cavities in logs and stumps were used only by females as maternal dens. In the two Puget trough stands studied by Carey (in prep.) flying squirrel densities and potential den sites were higher in an unthinned, 56-year-old stand which also included large residual trees, snags and downed logs than the larger and older (65-year-old) thinned stand. The older stand had been lightly thinned twice in the last 20 years and generally lacked large residual trees and snags, and had less coarse woody debris than the unthinned stand. However, availability of den sites may have limited flying squirrel numbers in both stands (Carey in prep.). Although large snags with cavities received heavy use by flying squirrels in all forests studied (Carey in prep., Carey pers. com.) and flying squirrel densities on the Olympic Peninsula were correlated with numbers of large snags (Carey 1995), the presence of large snags in the areas studied are thought to be more of an indicator of stand decadence than a direct measure of habitat quality (Carey pers. com.). Other habitat factors, such as the amount of coarse woody debris and degree of shrub cover within a stand, are also likely important in determining flying squirrel densities. Studies in other states have not reached similar conclusions (Rosenberg and Anthony 1991).

North (1993) examined managed mature stands, mature stands resulting from wind disturbance, and old-growth stands in relation to stand structure, intensity of spotted owl use, and truffle abundance. Managed stands used in this study were approximately 60 years old and unused by owls; wind disturbed stands were 70-80 years old. Equal numbers of stands on the Olympic Peninsula and in the northern Cascades were studied. Intensity of stand use by spotted owls was found to increase with increasing snag volume per acre. North noted that the level of owl use of wind-disturbed stands increased with an increase in the number of snags and complex canopy trees surviving the disturbance. The correlation of snag volume with owl use within stands was thought to be related to the owl's prey base and not directly to the owl. Biomass of truffles (the primary food of flying squirrels) in old-growth stands was 12 times higher than in managed mature stands. Mature stands originating from wind disturbance showed mixed results. Wind-disturbed

stands in the northern Cascades had higher biomasses of truffles than old-growth stands, while wind-disturbed stands in the Olympics had truffle biomasses similar to that of managed mature stands. North (1993) noted that truffle abundance within a stand appeared to be related to the depth of the soil organic layer; managed mature stands lacked this layer, while stands with thick organic layers had the highest truffle biomasses. Carey sampled flying squirrel densities in eight of the stands studied by North (1993). Flying squirrel densities in old-growth stands were 3.5 times higher than those in managed mature, while squirrel densities in wind-disturbed stands were two times higher than those in managed mature stands (North 1993).

In Washington, a wide variety of forest types are used for nesting, roosting or foraging habitat by spotted owls, including Douglas-fir, western hemlock, Sitka spruce, western red cedar, silver fir, grand fir and ponderosa pine. However, high-elevation forests are generally unused or lightly used for nesting, roosting, or foraging. On the Olympic Peninsula, nests have been found as high as 2,400 feet elevation on the west side and 3,900 feet elevation on the east side with 95% below 2,140 feet elevation and 3,500 feet elevation respectively (Holthausen et al. 1994). In the eastern Cascades, Irwin and Fleming (1994) noted that owl sites near the crest of the Cascades had lower reproductive rates than owl sites at lower elevations. Upper elevational limits in the Cascades range from approximately 3,600 to 5,000 feet elevation (Hays pers. com.). Bart and Forsman (1992) noted that forests in wilderness areas, which generally include the highest elevation forests, supported sparse populations of owls with reproductive rates about half that found among owls outside wilderness areas. This suggests that lower elevation owl sites are of greater demographic value to the population.

■ AMOUNT OF NESTING, ROOSTING AND FORAGING HABITAT WITHIN OWL HOME RANGES

Thomas et al. (1990:197) stated: "The amount of older forest within annual home ranges of owl pairs may be a good indicator of the amount of that type of habitat needed to sustain the pair." The issue of whether the amount of habitat an owl pair uses in its home range is reflective of its needs has been raised by some. To explore this question, the concept of "need" should be defined. Available evidence suggests that declines in habitat amount at individual owl sites results in reductions in adult survival and reproduction (Bart and Forsman 1990, Bart and Earnst 1992, Bart 1995). This suggests that the amount of habitat included within owl home ranges is indicative of the amount of habitat "needed" to sustain the current survival and reproductive rates of the residents. Alternatively, need could be defined as the amount of habitat required to sustain an owl pair at demographic rates sufficient for replacement. The amount of habitat required for this could change from year-to-year for any given pair. Given the likely declining trend of most owl populations studied to date (see Spotted Owl Demography below) it could be concluded that most owls may "need" more habitat than currently available within the landscape and included within their home ranges to support demographic rates sufficient for replacement. Reducing the amount of habitat at sites that currently have more

habitat than needed to sustain replacement rates could have adverse effects on the overall population if habitat at sites with amounts less than that needed to support replacement rates were not simultaneously increased (Bart 1995).

To get an indication of the amount and type of owl habitat included throughout the year by pairs in Washington, the Spotted Owl Scientific Advisory Group (SAG) opinion 1 (Hanson et al. 1993) reviewed data from every home range/ habitat use study conducted in the western Cascades and the Olympics. Because there were few data for pair home ranges in Washington spanning 12 months, the SAG used owl pairs in which both pair members had been tracked for at least eight months, including one winter, and each pair member had at least 80 relocations. Singles were not used in their analysis since their home ranges may be smaller and may not reflect the needs of pairs. Seven pairs in the Olympics and seven pairs in the western Cascades met the SAG criteria.

The maximum, minimum, mean and median amounts of habitat within owl pair home ranges using the 100% minimum convex polygon method (MCP) on the Olympic Peninsula and in the western Cascades are reported in Table 2.2-5 (from Hanson et al. 1993; Buchanan et al. 1994). The median amounts of habitat within pair home ranges were 4,681 acres on the Olympic Peninsula and 3,586 acres in the western Cascades.

Home range information meeting the SAG criteria is available from five owl pairs in the eastern Cascades (Forsman unpub. data). These ranges included seven forest types, three of which were used by all owls studied at levels greater than or equal to that expected based on availability. The other forest types were used at levels proportionate to availability by some owls, but less than expected by other owls in the study. Table 2.2-6 lists the maximum, minimum, mean and median amounts of the three "high-use" forest types using the 100% MCP method. The median amounts of these forest types within pair home ranges totalled 3,682 acres and ranged from 2,160 to 8,725 acres. The median home range size was 7,123 acres. Four of these owl pairs were within fire management analysis zone (FMAZ) 2 while the range of one pair overlapped FMAZ 2 and 3. (See "Other Methods for Estimating Habitat Amounts Used by Spotted Owls" below for discussion of FMAZ and map).

Hicks et al. (1995) reported home range information from nine additional owl pairs in the eastern Cascades; data meeting the SAG criteria were collected for five of these pairs. Using 95% MCP home ranges, the median and mean amounts of habitat at these sites were 1,992 and 1,990 acres respectively. Habitat amounts ranged from 369 - 3,115 acres. Information on 100% MCP home ranges were not reported, however Hicks et al. (1995) noted that habitat amounts and home range sizes within 100% MCP ranges were often twice that of 95% MCP ranges. The median 100% MCP home range size for all nine pairs studied by Hicks et al. (1995) totalled 6,567 acres, slightly more than the area of a 1.8 mile radius circle. Because the MCP technique tends to underestimate home range size when few animal locations are used, the median 100% MCP

home range size would have likely been larger if only the five owl pairs for which data meeting the SAG criteria were used. Each of the five intensively monitored owl pairs were within FMAZ 3.

Table 2.2-7 lists the maximum, minimum, mean and median percentages of habitat within the 100% MCP pair home ranges on the Olympic Peninsula, the western Cascades and the eastern Cascades. The median percentage of habitat within home ranges on the Olympic Peninsula was 47%, in the western Cascades 52% and in the eastern Cascades 55%.

Except for Hicks et al. (1995), each of the home range studies used the 100% minimum convex polygon technique (MCP) to estimate home range boundaries and size. Thomas et al. (1990) noted, however, that the amount and areas of habitat used by an owl pair may vary widely from year to year, thus multiyear home range needs may be greater than that reflected by the habitat used in one year. Of the nine owl pairs monitored by Hicks et al. (1995), five had one pair member which was monitored greater than 20 months. These pairs had a median 95% MCP home range size of 4,208 acres including a median of 2,186 acres of habitat. The four remaining pairs, which were each monitored for about one year, had a median home range size of 2,456 acres with a median of 1,156 acres of habitat. Carey et al. (1992) noted that the amount of habitat included within annual pair home ranges using the 100% MCP method closely approximated the amount of habitat used in two-year home ranges among the owl pairs they studied.

The SAG (Hanson et al. 1993) noted that their approach to quantifying habitat amounts would tend to underestimate the amount of habitat required by owls on an annual basis in at least two ways. First, for six of the pairs in their analysis, less than 12 months of data for both pair members were used to approximate annual home ranges. Second, narrow definitions of habitat were used to tally habitat amounts. In the Olympics and western Cascades only late successional habitats were included, not all habitats that were used by owls in proportion to their availability within the home ranges studied. Inclusion of these additional habitats would have increased the median amounts of habitat to 7,686 acres in the Olympics and 6,769 acres in the western Cascades. These medians would be 101% and 89% greater than those reported by the SAG in opinion 1. In the eastern Cascades, tallies include only habitats that were used in proportion to their availability or greater by all owls studied; each of the other four forest types within these ranges were used in proportion to their availability by at least half of the owls studied, but were not included within high-use forest type totals.

The median value is one measure of central tendency; it is simply the middle value from a sample. For example, the median of a list of five numbers would be the third largest number in the list. If there are an even number of values, the median is the mean of the two middle numbers. Using median values rather than mean values of home range size protects against undue bias resulting from extremely large or small home ranges, particularly in small samples (Sokal and Rohlf 1981, Thomas et al. 1990).

Table 2.2-5

Maximum, minimum, mean and median acres of habitat included in pair home ranges used by spotted owls in the Olympics and western Cascades.

(from Hanson et al. 1993.)

Province	Maximum	Minimum	Mean	Median
Olympic Peninsula[a]	11,690	2,395	6,031	4,681[b]
Western Cascades[a]	8,998	1,716	4,286	3,586

[a] These figures include only late-successional habitat, not all habitat that was used in proportion to its availability within each home range.
[b] This median is a correction to that reported in Hanson et al. (1993), see Buchanan et al. (1994:9).

Table 2.2-6

Maximum, minimum, mean and median acres of high use and other forests included in five pair home ranges used by spotted owls in the eastern Cascades.

(Forsman unpub. data).

Forest Type	Maximum	Minimum	Mean	Median
High-use forest[a]	8,725	2,160	4,386	3,682
Other forests[b]	6,141	1,078	3,448	2,770

[a] These figures include only three forest types used by all owls at a level greater than or equal to that expected based on availability. Other forest types were used by some owls at rates equal to that expected based on availability but are not included in these figures.
[b] Each of the forest types included in these totals was used at levels equal to their availability by at least half of the individual owls. However, each of these forest types was selected by one or more owls.

Table 2.2-7

Maximum, minimum, mean and median percentages of habitat within owl pair home ranges in the eastern Cascades, western Cascades and the Olympic Peninsula.

(Data for the Olympic Peninsula and the western Cascades are summarized in Hanson et al. (1993) and Buchanan et al. (1994); data for the eastern Cascades are from Forsman (pers. com.))

Province	Maximum	Minimum	Mean	Median
Olympic Peninsula[a]	71	27	45	47
Western Cascades[a]	70	21	46	52
Eastern Cascades[b]	60	40	52	55

[a] These figures include only late-successional habitat, not all habitat that was used in proportion to its availability within each home range.

[b] These figures include only those habitats used in proportions greater than or equal to their availability by all owls. Other habitats were used by some owls at levels equal to their availability.

Using median home range values for setting habitat protection levels at owl sites may not fully provide for owls at some sites. If the owl pairs studied used the amounts of forest that they needed to support themselves at demographic rates sufficient for replacement and the owl pairs sampled are representative of the overall population, then preserving median amounts of habitat within owl circles will provide adequate habitat at only half of the sites. However, if the owls at the sites studied had low survival and fecundity rates, then the amount of habitat within their home ranges would not be an accurate indication of the amount of habitat needed to sustain demographically healthy owl pairs, i.e. pairs able to replace themselves in the population. There is no indication available of the demographic health of the sites used in the home range studies.

Opinion 2 of the SAG (Hanson et al. 1993) underscored the importance of the habitat closest to owl site centers and recommended that all habitat within 0.7 miles of the center be retained. Opinion 2 illustrated the extent to which use by owl pairs is concentrated around the site center. Concentrated use of habitats nearest the site center, particularly during the reproductive season, has been observed in other studies (Forsman et al. 1984, Hamer et al. 1989, Hays et al. 1989, Solis and Gutierrez 1990). Opinion 2, however, did not provide specific recommendations or information on how much habitat is needed beyond 0.7 miles to meet all of the life requisites for a resident spotted owl pair.

■ OTHER METHODS FOR ESTIMATING HABITAT AMOUNTS USED BY SPOTTED OWLS

Irwin and Fleming (1994, 1995, Irwin pers. com.) investigated the amount of habitat around spotted owl pair sites at a variety of distances in the eastern Cascades of Washington. They found that pair sites in FMAZs 1 and 2 had significantly less habitat than sites in FMAZs 3, 4 and 5 while supporting generally higher reproductive rates (Table 2.2-8). While sites in FMAZ 4 had high reproductive rates, these sites on average included greater than 50% more habitat than sites in FMAZs 1 and 2. Sites in FMAZ 5 had the greatest amounts of habitat but the lowest reproductive rates. FMAZs are defined primarily by annual precipitation, topography, fire frequency and estimates of fuel loading (Keleman 1992). Figure 2.2-1 shows fire management analysis zones (FMAZ).

These data suggest that different amounts of habitat may be required to support owls at replacement rates in different areas of the eastern Cascades. The least amounts of habitat may be needed at owl sites in FMAZs 1 and 2, while more than 40% habitat within a regulatory circle may be needed to support owl pairs at replacement rates in FMAZ 5. However, caution should be used in interpreting these data because the accuracy and reliability of the habitat mapping used in this study (Wenatchee National Forest spotted owl habitat layer) is undetermined and likely varies between ranger districts and FMAZs (Irwin pers. com., Murphy pers. com.). It is also unknown to what extent habitat amounts and arrangements in these circles represent the amounts and arrangement of habitats actually used by the owls at these sites. Radio-telemetry data from owl pairs in FMAZ 2 suggest that pairs generally use substantially more habitat than that reported by Irwin and Fleming (1995, Irwin pers. com.) within 2.1 miles of owl sites. Four of the five owl pairs studied by Forsman (pers. com.) (Table 2.2-6) were located within FMAZ 2; 62% of the home range area of the fifth owl pair fell within FMAZ 2 with the remainder in FMAZ 3. Owl pairs at these sites used a median of at least 3,682 acres of habitat (Table 2.2-6).

Figure 2.2-1

Fire Management Analysis Zones

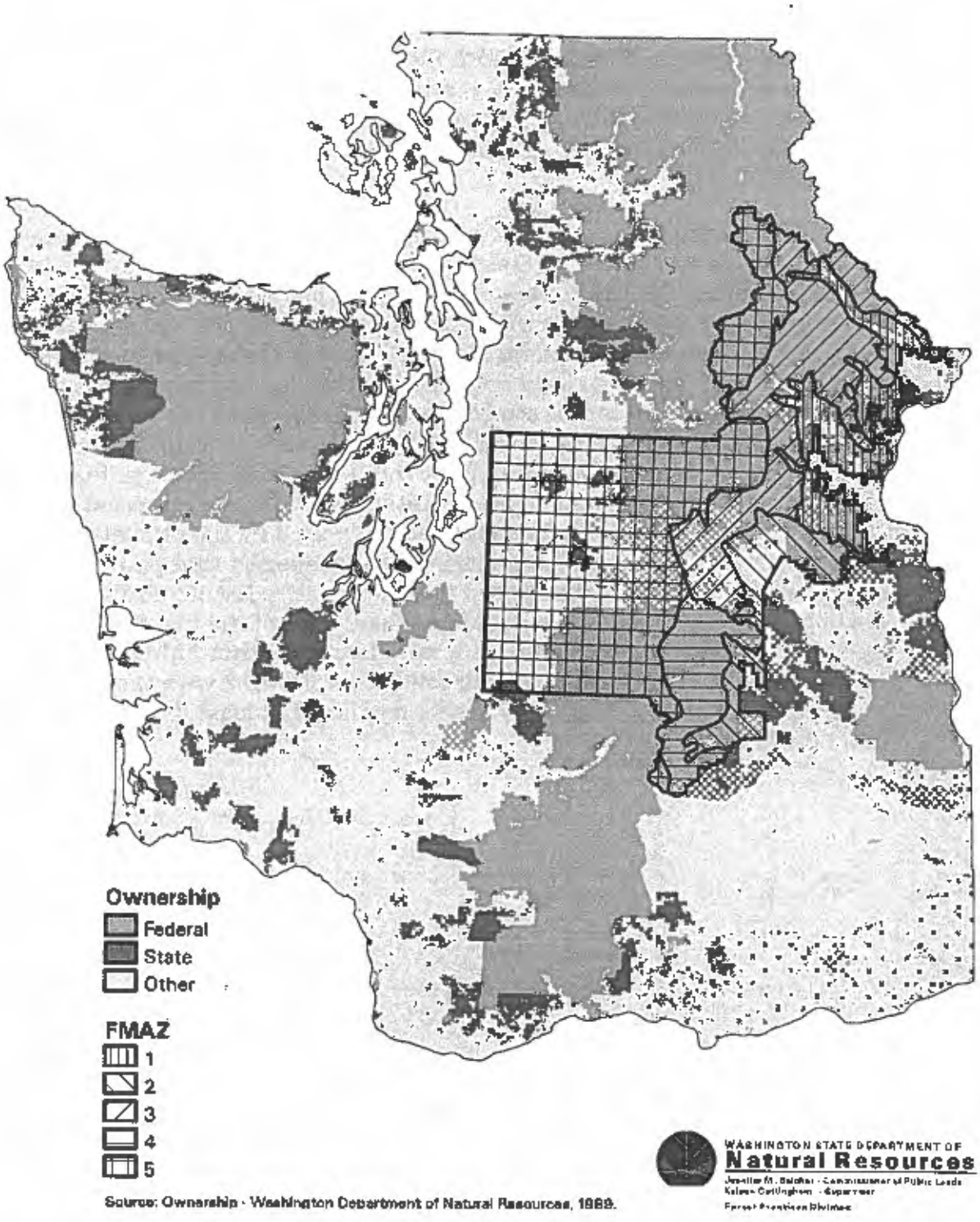


Table 2.2-8

Mean acres of habitat at owl sites occupied by a pair for at least two years and reproductive rates in the eastern Cascades of Washington by FMAZ.

(Irwin pers. com. Habitat amounts are based on mapping by the USDA Forest Service. See Figure 2.2-1, FMAZ map.)

	Acres of NRF Habitat		Fledgelings
FMAZ	1.5 mi.	2.1 mi.	per Site/Year
1 and 2	1,347	2,349	0.79
3	1,890	3,308	0.52
4	2,061	3,660	0.77
5	2,219	3,650	0.28

Several studies indicate that owls are more likely to occupy territories in areas with greater amounts of habitat present. Studies comparing habitat amount in owl home ranges and studies comparing habitat amount within 0.5- to 2.7-mile-radius circles around owl sites occupied by pairs or territorial singles to randomly placed circles of similar sizes have consistently found that areas occupied by owls contain a greater proportion of habitat than the surrounding landscape (Carey et al. 1990; 1992; Ripple et al. 1991; Lehmkuhl and Raphael 1993; Irwin and Fleming 1994; Hicks unpub. data cited in Hanson et al. 1993).

Anderson et al. (1990) compared survey detection rates at a random sample of 52 stations that had varied amounts of older forest within 2.1 miles of the station. They found that detection rates were significantly greater at stations with greater than 30% older forest than at those with less than 30% older forest.

Thomas et al. (1990) examined owl occupancy and habitat in more than 274 USFS random sample areas (RSAs). They found that spotted owl occupancy rates were significantly higher in Washington and Oregon RSAs with greater than 50% habitat than in RSAs with less than 50% habitat; occupancy rates for pairs and singles within RSAs with greater than 50% habitat were 1.5-2 times as high as occupancy rates in RSAs with less than 50% habitat. Additionally, occupied RSAs had significantly more habitat than unoccupied RSAs. They also found that the percentage of owl occupancy in spotted owl habitat areas (SOHAs) increased significantly with an increasing amount of habitat within 2.1 miles of SOHA centers in Washington and Oregon.

Bart and Forsman (1992), using three different data sets spanning most of the range of the owl, found that owls were significantly more abundant and fledged approximately 50 times more young owls in areas that had greater than 60% older forest than in areas with less than 20% older forest. Older forest was defined as forest greater than 80 years old.

Lehmkuhl and Raphael (1993) compared the amount of habitat within 1, 2 and 3 miles of 59 sites occupied by pairs, 19 sites occupied by singles and 100 random sites on the Olympic National Forest. Pair sites had more habitat at all three scales when compared to random sites. Statistical comparisons were made only at the intermediate circle size (8,038 acres) to avoid violating statistical assumptions; at this scale pair sites had significantly more habitat than random sites. Pair sites also had more habitat than single sites at all three scales, although the differences were not statistically significant.

Ripple et al. (1991) compared the proportion of older forest (greater than 80 years old) between 30 nest sites and 30 random sites using seven different plot sizes. The proportion of older forest was significantly greater at nest sites than random sites for all plot sizes.

Bart and Earnst (1992) re-analyzed data from 91 owl sites in two areas of Oregon and found that year-to-year persistence of owls at sites increased with the amount of older forest (greater than 120 years old) present. Additionally, Bart (1995) analyzed data from 102 owl sites and found that adult survival rate and pair reproductive rates increased with greater habitat amounts and concluded "that removing any suitable habitat within the vicinity of the nest tends to reduce the productivity and survivorship of the resident owls" (p. 943). These trends were significant. The suggestion that adult survival varies with the amount of older forest is important because owl population stability is very sensitive to adult survival rates (Burnham et al. 1994; Noon and Biles 1990).

■ HABITAT FRAGMENTATION

Few studies have explored the effects of habitat fragmentation on use by spotted owls. Lehmkuhl and Raphael (1993) contrasted landscape measures of owl habitat at 59 pair sites, 19 single owl sites and 100 random sites. Five measures relating to habitat fragmentation differed significantly between pair sites and random sites. Habitat at the pair sites tended to be more clumped and occurred in larger but fewer patches (see page 309, Table 1 in Lehmkuhl and Raphael 1993). Carey et al. (1990, 1992) noted increased home range sizes, overlap of home ranges among pairs and separation of pair members with increased fragmentation. In the most heavily fragmented areas, the authors noted that mate changes were frequent, the proportion of pairs with subadult members was high, and nomadism in adult females was observed.

Thomas et al. (1990) reviewed spotted owl radio-telemetry studies in Oregon and noted that pairs in areas with little late successional habitat remaining had larger home range sizes than pairs in areas with greater proportions of similar habitats. They also noted that the owl study with the smallest median home range size and habitat amount was in an area where the remaining old forests were clumped rather than fragmented.

On the western Olympic Peninsula, two independent studies are investigating owl pair densities: one centered on the Quinault Ranger District of Olympic National Forest and the other on less fragmented lands within Olympic National Park. After three of four planned years of study, the crude density of

owl pairs in low to mid elevation areas of the western portion of Olympic National Park is estimated to be 0.031 pairs per mi2 (Seaman pers. com.). The adjacent Quinault density study area is estimated to support a crude density of about 0.014 pairs per mi2 (Forsman pers. com.). Sampled areas within Olympic National Park have little human-caused or natural habitat fragmentation when contrasted with the Quinault density study area, which is thought to contain roughly 40% owl habitat (Forsman pers. com.).

Dispersal Habitat and Landscapes

Dispersal habitat can be defined as that which provides for foraging, roosting and protection from predators during the process. Forest habitats that provide cover from owl predators while also allowing efficient movement, but which provide few foraging and roosting opportunities will be of less value to dispersing owls. Additionally, these "travel" habitats are less well defined by research. Although every "dispersal" stand need not support roosting and foraging, areas that provide for foraging and roosting should be distributed throughout the dispersal landscape. Bart (1995) noted that juvenile survivorship depends in part on the amount of habitat through which juvenile dispersers pass. Miller (1989) noted that mature and old-growth forests were preferred for roosting by dispersing juveniles.

■ PLANS FOR PROVIDING DISPERSAL HABITAT

Previous plans for managing owls on federal lands relied on the "50-11-40" rule to provide dispersal habitat: outside of reserved areas, 50% of the federal lands capable of supporting forest should have stands with a mean tree diameter of at least 11 inches and canopy cover of at least 40% (Thomas et al. 1990; USDI 1992b). Because some of the federal lands that this 50-11-40 rule was designed for already had management standards for log and cavity dependent species, specific guidance on providing these habitat components was not incorporated. If this rule were to be applied to nonfederal lands, additional standards for providing snags, residual live trees, logs and shrubs, above and beyond existing forest practice standards, should be developed. This rule was meant to serve as a range-wide prescription.

The federal Northwest Forest Plan relies on riparian reserves to provide owl dispersal habitat in matrix and adaptive management landscapes (USDA 1994). In addition, this plan allows adaptive management, which includes research and monitoring to develop or protect dispersal habitat, to be incorporated into forest management where needed. Riparian reserves are reserved corridors along both sides of rivers, streams and intermittent streams, wetlands, lakes, ponds and unstable slopes ranging in width from one to two times the average maximum height of the tallest dominant tree. Matrix landscapes are unreserved areas in which substantial timber harvest may be allowed. Matrix lands are composed of areas where partial cutting, long rotation, general forest management, and adaptive management philosophies will occur. Adaptive management areas are landscapes in which experimental management is emphasized. In the long-term, riparian reserves have the advantages of providing travel corridors with high connectivity and allowing the development of higher quality habitat than would be required by the 50-11-

40 rule, as riparian forests regrow. However, one potential concern with this approach is that riparian reserves may become predation traps for dispersing owls by concentrating use by owl predators (e.g. goshawks and great horned owls) in riparian zones if adjacent upland forests don't contain suitable habitat. The extent and likelihood of this becoming a significant deterrent to successful dispersal is unknown. A second potential concern is that dispersing juvenile and adult owls may not follow habitat corridors for all their movements, thus it is important to provide dispersal habitat spread throughout the landscape. In some landscapes, riparian reserves alone may provide relatively low amounts of poorly-distributed habitat. In those landscapes, adaptive management areas and other matrix lands within federally owned landscapes will be important in supplying dispersal habitat.

An alternative plan for providing dispersal habitat developed by Beak Consultants, Inc. (1993) for the Murray Pacific Corporation Habitat Conservation Plan (HCP) would eventually provide dispersal habitat over 43% of Murray lands. Stands would range from five to 120 acres in size, with an average of 40 acres and be spaced a maximum of 0.25 mile apart. It also includes riparian habitats, leave tree requirements, older forest stands associated with steep and unstable slopes and other no-harvest zones, experimental pruning of stands to develop "canopy lift" for foraging owls sooner than would be expected in unmanaged stands, and thinning young stands to increase tree development and canopy closure while allowing increased shrub and understory development associated with increased sunlight on the forest floor.

Buchanan et al. (1994) recommend that in western Washington, at least 43% of the area within dispersal landscapes support dispersal habitat; for eastern Washington, in the absence of better information, they support the recommendation of Thomas et al. (1990) that at least 50% of the area within dispersal landscapes be dispersal habitat.

■ DISPERSAL LANDSCAPE SIMULATIONS

Anderson (pers. com.) simulated the development of dispersal habitat through time based on current Washington forest practices regulations. Starting conditions for the simulations were based on the current forest conditions of three landscapes, each approximately 90,000 acres in size, with a single owner. Each landscape was assigned one of three levels (passive, moderate, intensive) of silvicultural management intensity. Passive management included natural reseeding with no thinning, or planted stands with a commercial thinning at 30 years. Intensive management included planting with improved stock, precommercial thinning and application of fertilizer. Clear-cut harvest on each of the three landscapes was simulated using forest practices green-up rules in combination with maximum clear-cut sizes of 120 and 240 acres and a "sustainable" annual harvest rate of 1.7% of the landscape. The harvest rate used in these simulations was considered sustainable by a 1992 timber supply study (Adams et al. 1992). The intensive landscape was also simulated using the maximum annual harvest allowed by the green-up rules and a 240 acre maximum clear-cut size.

All simulations started with a relatively low percentage of the landscape covered by forests meeting the minimum definition of dispersal stands in the Forest Practices Board's proposed rule Alternative 4 (passive 38%, moderate 13%, intensive 37%). The proportion of the landscapes covered by "dispersal" stands showed a cyclical pattern, initially increasing followed by decreases in habitat amounts; maximum habitat amounts were reached in 20 to greater than 50 years from the present. The intensive and moderate landscapes harvested at "sustainable" rates reached maximum habitat amounts of 60% or greater before slowly declining to habitat levels near the starting conditions (Anderson pers. com.). The exact minimum habitat percentages are unknown because the cycle periods for these simulations exceeded the duration of the simulations. When the intensive landscape was simulated using the maximum harvest rate allowable under the green-up rules, the habitat amount decreased from the peak amount much more rapidly, returning to levels nearly as low as the starting conditions in 50 years, 20 years after the peak amount. Under the passive management scenario, habitat amounts increased from 38% to about 44% before declining to 27% by year 50.

These simulations suggest that current forest practice regulations do contribute to providing travel quality dispersal habitat, but alone are not enough to meet and sustain the proportions of dispersal habitat recommended above. Most of the simulations included harvest rates less than the maximum allowable by current regulations, implying that landowners would voluntarily forego harvesting at the maximum allowable rates. For many areas, however, the maximum harvest allowable or high rates of harvest in pulses may be more realistic scenarios due to operational or other considerations. Increased harvest rates shorten the length of time landscape conditions conducive to dispersal will be retained. In areas with multiple, inter-mixed ownerships, the contribution of green-up rules to maintaining dispersal habitat will be less. Forested areas with numerous intermingled small ownerships may have a broad range of size and age classes in various forested conditions, along with a variable management methodology.

Other concerns with the simulations indicate potential limitations; forest practices regulations alone may not provide effective dispersal landscapes over time. In some simulations, habitat connectivity was at times low in one direction. On a real landscape this could be a problem if the desired dispersal direction for owls was the same direction. The spatial distribution of dispersal habitat across the landscapes appeared to be highly dependent on starting conditions. The cycle length and magnitude of habitat fluctuations also appeared to be partially affected by starting conditions. Little or no habitat for roosting and foraging occurred in these simulated landscapes.

■ DESIGNING EFFECTIVE DISPERSAL LANDSCAPES

Despite the various plans and simulations, no research to date has investigated stand conditions and landscape configuration patterns that support high rates of successful dispersal. However, some important criteria for designing effective dispersal landscapes may be discerned from the present knowledge of spotted owls.

A dispersal landscape with habitat spread throughout will be more effective than one in which habitat is limited to owl sites or a small subset of the landscape (e.g., corridors) (Thomas et al. 1990). Because juvenile owls appear to often disperse in random directions across landscapes (Miller 1989), they are less likely to confine their movements to corridors. They are also unlikely to locate small clumps of habitat widely spaced through a landscape. Such spacing would result if habitat were retained only at owl sites. A landscape with either corridors or widely spaced small clumps of habitat would provide fewer opportunities for foraging, increased exposure to predators, and greater distances between suitable roosting sites than a landscape that had habitat spaced throughout. Miller (1989) and Gutierrez et al. (1985a,b) noted that dispersing juvenile spotted owls may be found in landscapes with little habitat (e.g. heavily clear-cut areas, urban and suburban areas), but both also noted that these episodes are often associated with the owl's death. Gutierrez et al. (1985b, p. 63) state that "although owlets frequently entered these areas, they often died there as well. Unsuitable habitats ... may be effective barriers to dispersal, but this does not seem to deter the birds from entering them."

Some level of dispersal habitat clumping may be advantageous to dispersing spotted owls. Areas of clumped habitat would provide increased connectivity and reduced predation risk in portions of the landscape. Additionally, larger areas (> 2000 acres) of relatively contiguous habitat may provide overwintering sites for juvenile owls before they continue dispersal in the spring (Miller 1989). Dispersal habitat clumping may be advantageous as long as large areas with low habitat amounts do not form a blockage to the directional movement of owls between areas of federal reserves, e.g. north-south movement in the I-90 West SOSEA or east-west movement in the Mineral Link SOSEA, and do not form "predator traps."

The Murray Pacific Corporation HCP has proposed a definition of dispersal habitat for their lands in western Washington (Beak Consultants Inc. 1993). This HCP requires that dispersal stands have 130-300 10-inch-diameter trees per acre or an equivalent basal area of larger trees. Stands must also have at least 70% canopy cover of which 70% is conifer. Two residual live trees and three snags per acre from the dominant-codominant size class of the previous stand would be retained. Residual live trees at least 18 inches in diameter are preferred. Two logs at least 12 inches in diameter and 20 feet in length would also be retained. The Murray Pacific HCP noted this definition reflected site specific habitat conditions occurring on their land and may not be applicable to other areas of western Washington.

In the past, snags and trees with cavities or defects were often targeted for elimination during silvicultural treatments or when stands were harvested. Downed logs and shrubs were often greatly reduced or eliminated during harvesting and site preparations for forest regeneration. Consequently, many younger-second growth forests today have low numbers of large snags and cavity trees, downed logs and little shrub cover. Carey (1995), Carey et al. (in prep.), and Carey and Johnson (1995) note that second growth stands with little or no structural characteristics of old-growth forest support reduced

populations of flying squirrels and forest floor dwelling small mammals when compared to old-growth stands and young stands with numerous large snags, cavity trees, downed logs and shrubs. It may take an extended period of time for second growth stands to redevelop the old-forest structural characteristics that were eliminated by intensive forest management practices. Management of second growth stands in the future may be able to provide for owl prey populations comparable to that found in old-growth forests.

Future stands within dispersal landscapes should focus on incorporating habitat components to support high small mammal populations. To provide for healthy small mammal populations in second growth forests of western Washington, Carey (1995), Carey et al. (in prep.) and Carey and Johnson (1995) recommend retaining all large snags (at least 20 inches dbh), up to eight snags per acre, and trees with defects that could have cavities when stands are harvested, as well as creating cavities in trees where there are less than two large snags per acre. Providing up to 15-20% cover of downed logs (log cover of 5-10% may limit populations of some small mammals), leaving some three to six foot tall stumps, and some consideration for retaining and providing shrub cover in harvested stands may also enhance owl prey populations. Numbers of green recruitment trees greater than that currently required by Washington State forest practices rules would also be needed to sustain levels of these habitat components through time. Green recruitment trees that were left through multiple harvest rotations would eventually grow large, develop cavities, provide additional canopy structure and become a large snag or log upon dying. These techniques simulate conditions found in older unmanaged forests. While they have been found to increase the numbers and distribution of small mammals consumed by northern spotted owls, the density of prey within a landscape needed to support effective dispersal is unknown.

Forest Practices and Disturbance to Spotted Owls

There has been little investigation of how forest management operations may affect nearby spotted owls. One school of thought is that activities such as timber falling, yarding and hauling, road building, blasting and repeated low level overflights in close proximity to roosting or nesting owls may be disruptive to those owls. If the disruptions are severe or chronic, the concern is that site use and/or reproduction could be affected. Available information provides conflicting implications from disturbance to owls.

A pilot study conducted during 1994 considered the potential disturbance effects of timber hauling on spotted owls by quantifying owl stress, as indicated by hormonal levels in owl fecal pellets (S. Wasser and E. Hanson pers. com.). The pilot study examined hormonal levels in fecal pellets collected from members of eight owl pairs that were at varying distances from roads heavily used by log trucks during the reproductive season. Wasser (pers. com.) and Hanson (pers. com.) tentatively concluded that owls within 0.25 mile of the roads had twice the hormone levels as owls that were more distant from the roads, and the effect was greater in male than female owls. Although Wasser

and Hanson (pers. com.) found higher hormone levels in owls within 0.25 mile of roads heavily used by log trucks, it is unknown how increases in owl hormones affect reproduction, survival, or site use.

Anecdotal information from the redwoods region in northwestern California suggests that owls may be little affected by nearby forest management operations (Diller pers. com. in comments from Washington Forest Protection Association on DEIS). It should be noted, however, that the redwoods region of California is perhaps the most productive portion of the owl's range supporting higher densities of owls (Thomas et al. 1993) and owl prey than are found in Washington (Thomas et al. 1990). Therefore, responses of owls to disturbance in this region may not be representative of owl responses to similar disturbance in Washington.

The timing of disturbance may also be important in avoiding disruption of reproduction. Pair bonding, courtship and nesting in spotted owls occur in the late winter and spring (February - May). Juvenile owls remain with their parents until dispersing in the fall. Disturbance during the late winter, spring and summer could have the greatest potential to affect reproduction. It must be remembered the effects of specific disturbance factors have not been directly studied.

Spotted Owl Population Dynamics

Several models exploring spotted owl population dynamics have been constructed in recent years (Lande 1988a, Doak 1989, Noon and Biles 1990, Anderson and Burnham 1992, Lamberson et al. 1992, McKelvey et al. 1993, Burnham et al. 1994, Holthausen et al. 1994, Lamberson et al. 1994, Raphael et al. 1994). These models have provided valuable general insights into owl population dynamics; however, each has been limited by assumptions made in model construction, by aspects of the owl's ecology and behavior included or excluded from the model, and by critical shortcomings in the current knowledge and understanding of spotted owl ecology, behavior, habitat or other factors. While the qualitative results and conclusions drawn from each model may add important insights to the functioning of owl populations, the accuracy of quantitative predictions and projections from these models is unknown (Thomas et al. 1990, Murphy and Noon 1992, Holthausen et al. 1994).

Historically, spotted owls had a more continuous distribution through the western Cascades and coastal ranges of Washington, Oregon and California, although both small and large-scale catastrophic events resulted in habitat in some geographic areas being eliminated or greatly reduced until forest regeneration could replenish it. Since settlement and statehood however, spotted owl habitat and thus owl populations have been increasingly fragmented by widespread timber cutting, development, and agriculture. Although the owl's range has not decreased, its distribution within the range has (Thomas et al. 1990). Spatially subdivided populations whose subpopulations (or local populations) are partially, but not wholly, isolated are called metapopulations. Dispersal between local populations may prevent or delay extinction of some local populations and re-establish extinct

subpopulations. Classically, metapopulations are thought to function as a balance between local colonization (by dispersers) and extinction of component subpopulations (Levins 1970), although they may more often occur in nature in the form of sources and sinks or patchy populations (Harrison 1991, 1994). Sources are local populations that are net producers of dispersers; sinks are areas unable to support a stable population without regular immigration of dispersers. A patchy population is one in which the separation of habitat patches is on a scale finer than that of the population, where the system of patches is "demographically united" (Harrison 1991 p. 81).

Although some recent authors (Doak and Mills 1994, Harrison 1991, 1994) have emphasized the differences between classical metapopulations, patchy populations and populations with source-sink dynamics, in some cases the distinction between these categories may blur (Harrison 1991). For example, it is plausible that an owl population may shift between source-sink, patchy population and classical metapopulation dynamics over time when habitat regrowth, timber harvest, catastrophic habitat loss, demographic and environmental stochasticity and planned federal management are considered on a regional scale. It should also be noted that none of these authors have questioned the validity of using the metapopulation concept to explore the potential dynamics and general conservation needs of spotted owl populations. Gutierrez and Harrison (in press) conclude that "...metapopulation models are essential for understanding how population viability depends on the number, sizes and spacing of habitat patches" for spotted owls. However, they warn against using metapopulation models to predict "safe" strategies for further reduction and fragmentation of spotted owl habitat because the model results are highly sensitive to details of demography and dispersal that are poorly known (Harrison pers. com., Harrison et al. 1993, Doak and Mills 1994, Gutierrez and Harrison in press).

Nevertheless, spotted owl populations have several of the hallmarks of classical metapopulations. The current distribution of owl territories is spatially subdivided as a result of natural and human-caused factors. Planned federal management will further partition the distribution of future owl territories and even-out the size of local populations. Disperser (would-be colonizers) survival and success is typically low, yet it appears that many new residents do not originate from the local-area in which they ultimately settle. Owl sites in many areas appear to be unable to maintain themselves demographically (due to habitat loss) thus making these areas more prone to extinction and underscoring the importance of immigration to local population persistence. Perhaps because of these factors, federal management strategies are based on the metapopulation concept. It would be difficult, however, to categorize with certainty the dominant population dynamics of a regional owl population at any moment in time (Doak and Mills 1994). Regardless, the metapopulation concept provides a useful framework for considering the functioning of spotted owl populations.

Several important conclusions have been drawn from mathematical models of metapopulations. The first is that metapopulations will maintain themselves only as long as the proportion of suitable habitat within the landscape is above a minimum threshold. If the proportion of habitat is reduced below this threshold, the metapopulation will decline to extinction even though some suitable habitat remains (Lamberson et al. 1992, Lande 1987, 1988). The underlying cause of these declines is that too few dispersers are able to find areas of suitable habitat in the landscape before they die. Lande (1988) estimated this threshold to be approximately 21% for spotted owls in a large region, but stated that this was likely an underestimate of the amount of habitat required to support a stable owl population because of the many assumptions in this metapopulation model. However, it may not be immediately apparent when habitat is decreased below threshold levels, because declines in owl occupancy rates, the percentage of owl sites occupied by pairs each year, and changes in other demographic characteristics may not become apparent until years after the logging has ended (Lamberson et al. 1992).

A second conclusion is that larger clusters of owl sites in the landscape will have higher occupancy rates than clusters with few or only one owl site (Lamberson et al. 1994). Lamberson et al. (1994) concluded that clusters of 20-25 owl sites would probably support reasonably stable local populations of spotted owls; further increases in cluster size brought diminishing increases in occupancy rates. For smaller clusters of five to 20 owl sites, occupancy rates are greatly increased if they are closer to other clusters, thereby increasing the likelihood of successful dispersal between them (Lamberson et al. 1994). If the population is actually functioning as a patchy population, smaller clusters would be expected to have higher occupancy rates and make greater contributions to long-term persistence than similar sized clusters in metapopulations.

Occupancy rates can also be increased by providing a higher quality dispersal landscape between clusters, thus decreasing dispersal risks. This is more important for smaller clusters and for larger clusters that currently have a low percentage of suitable habitat than for large clusters with a high percentage of habitat (Lamberson et al. 1994). Short-term occupancy rates of clusters that currently have little suitable habitat (and therefore fewer owl sites than carrying capacity) may be enhanced by increasing their effective size by preserving adjacent suitable habitat (Lamberson et al. 1994). McKelvey et al. (1993) also noted that cluster shape may affect occupancy rates; simulated clusters with a low edge-to-area ratio had greater occupancy rates than more irregular shaped clusters of the same area. These population and habitat simulations must be compared and contrasted to actual field conditions and tuned to measured habitat perturbations and population fluctuations to define expected responses in the actual forested environment to changes over time.

The greatest value of applying the metapopulation concept to spotted owls is heurism. Considering owl populations as classical metapopulations allows recognition of population processes which could, over time, lead to the

unravelling of a regional owl population. Identification of these potential pitfalls allows the implementation of management strategies that could prevent future crises.

■ CATASTROPHIC HABITAT LOSS

Catastrophic habitat loss may affect persistence of metapopulations by reducing or degrading habitat for individual local populations and by degrading dispersal landscapes between local populations. The amount and pattern of habitat loss, frequency of occurrence within a region and the degree of environmental correlation among local populations (Harrison and Quinn 1989; Goodman 1987) can affect the degree of impact on metapopulation persistence. Generally, the time to extinction (or likelihood of persistence) for metapopulations is greater in those that have more component subpopulations (Nisbet and Gurney 1982). This results from a greater spreading of risk (Den Boer 1981) among local populations; specifically, the degree of environmental correlation among subpopulations and the likelihood of simultaneous extinctions of subpopulations is reduced. However, if a metapopulation is already suffering from low habitat percentages near the extinction threshold in local populations or the landscape as a whole, the effects of catastrophes causing the loss or degradation of individual local populations may be magnified. Catastrophes may also produce dispersal barriers or increase dispersal risks by making the areas between local populations less conducive to disperser movement and survival.

Although spotted owls have evolved with natural disturbances within their habitat, humans have changed disturbance regimes or reduced the amount of habitat in all provinces such that natural disturbances resulting in habitat loss may cause significant declines in owl numbers and distribution. In Washington, catastrophic habitat loss may result from wind, fire, insects and disease. Of these, wind along the Pacific coast, and fire, insects and disease in the eastern Cascades have the greatest likelihoods of causing significant habitat loss or degradation within the next 100 years. Significant habitat loss on the east side of the Olympic Peninsula and in the western Cascades in the next 100 years is less probable (Henderson et al. 1989, Agee 1991a, b, Agee and Edmonds 1992, Agee 1993). Along the Pacific coast, at least three wind storms causing substantial blowdown have occurred this century with a return interval of approximately 30 years (Agee and Edmonds 1992).

For the eastern Cascades, Agee and Edmonds (1992 page 470 in USDI 1992b) state: "There is a very low probability that any [spotted owl management area] created in the East Cascades subregion will avoid catastrophic wildfire over a significant portion of its landscape over the next century." Fire suppression over the last 70-100 years has allowed the establishment of fire intolerant understories (most often grand fir or Douglas-fir) in areas which historically had frequent fires of low-to-moderate intensities. These types of forests were once largely limited to fire refugia, on moist north slopes, headwall basins, stream confluences, canyon bottoms and small pockets of dry forests surrounded by cooler moister forests (Agee 1993, Camp 1995). This has resulted in high fuel

conditions across broad landscapes, greatly elevating the risk of large-scale stand replacing fires. Additionally, these stands have become increasingly vulnerable to destruction or degradation from insects and disease.

In 1994, four major fires in the Wenatchee National Forest burned portions of 21 known spotted owl sites. At least four of these sites may have been rendered uninhabitable by owls. The Entiat valley, the site of the 1994 Tyee Creek fire, has had four other widespread, high-intensity fires since 1970. There were several other major fires during 1994 in the eastern Cascades (Klickitat County, the Yakama Indian Nation and the Okanogan region), but the impacts on spotted owl populations in these areas are unknown. To the extent that the risk of large-scale stand replacing fires can be reduced in landscapes harboring spotted owls, catastrophic reductions in the eastern Cascades owl population may be avoidable.

Existing knowledge of fire regimes, forest ecology, habitat requirements, and management methods suggest that landscapes can be managed to balance fire risk reduction with commercial timber production and the retention of spotted owls. Currently, the Wenatchee National Forest is preparing management plans for the Chihuahua and Boundary Butte late-successional reserves. Much of the lands in both reserves was historically subject to high frequency fire regimes. Plans for these reserves are focusing on providing owl habitat sustainably over the long-term, e.g. in potential fire refugia (Camp 1995), while reducing the risk of large-scale medium and high intensity fires in areas prone to frequent fires (Murphy pers. com., Stare pers. com.). These plans may serve as models from which future management plans may draw.

■ SPOTTED OWL DEMOGRAPHY

Burnham et al. (1994) analyzed data from 11 demographic study areas in Washington, Oregon and California. Collectively, the data from these study areas suggest that populations of spotted owls are declining throughout their range and that the decline is accelerating. Two of the study areas were in Washington: the Olympic and the Cle Elum study areas. Burnham et al. (1994) estimated the finite rate of population change (ë) to be 0.9472 (se = 0.0255) on the Olympic and 0.9240 (se = 0.0323) on the Cle Elum. A rate of population change equal to one indicates a stable population, and a rate less than one indicates a declining population. These estimates therefore suggested that the adult territorial populations were declining annually by 5.3% on the Olympic and 7.6% on the Cle Elum. Standard errors provide one measure of the certainty of the rate estimates; increases in standard errors suggest a decrease in certainty. In these analyses, the rate of population change is most sensitive to changes in adult survival rates.

For both areas, however, juvenile survival was thought to be underestimated since many juveniles dispersed from the study areas and were not encountered again. Data from radio-tagged juveniles in these areas provide some information on rates of emigration. Adjusting for juvenile emigration using the telemetry data, Forsman et al. (in prep.b) estimated λ to be 1.05815 (se = 0.06477) and 1.02449 (se = 0.05771) for the Olympic and Cle Elum study areas

respectively. The adjusted estimates of the rate of population change are not statistically different from 1.0 and suggest that in these two areas, the owl population is not declining. However, these adjustments assume that there is no balancing immigration to compensate for juveniles leaving the area. Additionally, the juvenile emigration adjustments for both areas were based on only two years of data involving relatively few juvenile owls; if emigration rates during these years were anomalous, the adjustments of λ could be very misleading.

Bart (in press) used computer simulations to explore the potential biases associated with the design and statistical techniques used in the on-going demographic studies first summarized by Anderson and Burnham (1992). Burnham et al. (1994) provided additional analysis of these studies after two more years of data had been collected; they also included analyses for six additional demographic studies for which data were insufficient in 1992. Bart (in press) concluded that the methods used by Anderson and Burnham (1992) provide unbiased trend estimates (λ) if unbiased survival and fecundity rates were used. However, he further concluded that estimates of λ by Anderson and Burnham (1992) were probably low, primarily due to under-estimation of adult and juvenile survival rates. Bart (in press) contends that adult and juvenile survival rates were likely underestimated by Anderson and Burnham (1992) because any emigration of adult and juvenile owls that may have occurred was treated as mortality.

Simulations by Bart (in press) suggest that Anderson and Burnham (1992) may have underestimated λ by as much as 0.11 (see Bart's table 6), primarily due to emigration of territorial adults. However, Bart's (in press) results are largely dependent on the rates of adult dispersal and the adult dispersal distances used in his simulations; there are, however, very few data on which to base these critical parameters. Bart (in press) bases his adult dispersal rates on results from three demographic study areas: the Roseburg and Eugene BLM areas in Oregon and the Willow Creek area in California. However, results from these areas may not be representative of owl populations in other areas, particularly those in Washington. Habitat in the Eugene study area is more highly fragmented and occurs in lower proportions than in either the Olympic or Cle Elum study areas (E. Forsman pers. com.), and in all three study areas spotted owls prey primarily on woodrats rather than flying squirrels (Forsman et al. 1984, Miller 1989, Thomas et al. 1990). Bart (in press) chose to set dispersal distances for territorial adults equal to those of male juveniles. There appear to be even fewer data on dispersal distances of territorial adults, but available data suggest that they generally move shorter distances than dispersing male juveniles (E. Forsman pers. com.). Burnham et al. (1994) consider adult emigration "a minor issue" in the demographic analyses (page 16), and Forsman et al. (in prep.b) believe that adult emigration on the Olympic and Cle Elum study areas is quite rare and point out that owls that emigrate and subsequently die would cause no bias in survival rate estimates. By assigning unrealistically high adult dispersal distances and potentially high adult

dispersal rates, Bart's (in press) simulations may overestimate adult emigration and therefore also overestimate the likely bias in estimates of λ by Anderson and Burnham (1992).

Additionally, Bart's (in press) simulation results may also stem in part from the high annual survival rate, 0.90, assigned to adult floaters and dispersers. Although there is little or no information on demographic rates of floaters, it seems likely that survival rates for floaters are less than that of territorial adults. By assigning such high survival rates to floaters, the number of owls emigrating and surviving in his simulations is further increased, thus further affecting his estimates of λ. In short, Bart (in press) illustrates the *potential* for adult emigration to affect estimates of λ, but the paucity of data currently available on adult dispersal make his choices of critical parameter values speculative. Consequently, there is little to indicate whether unaccounted for adult emigration may be a problem in the current demographic studies throughout the range of the owl. Bart (in press) notes that the potential for bias due to emigration could be reduced by increasing through time the proportion of habitat surveyed within a study area.

Although Burnham et al. (1994) and Forsman et al. (in prep.b) use the same approach as Anderson and Burnham (1992) to estimate λ, several factors in the more recent analyses ameliorate the concerns raised by Bart (in press) about the original demographic analysis by Anderson and Burnham (1992). Burnham et al. (1994) addresses the potential for bias in estimates of ë due to emigration in three ways. They address the potential for underestimating juvenile survival rates by calculating an adjusted ë using radio-telemetry data on juvenile emigration, and they calculate the level of juvenile survival and emigration needed in each study area for the population to be stable. The levels of emigration required on the study areas for populations to be stable ranged from 0 to 100% of juveniles. Concerns relating to adult emigration are ameliorated to some degree by using two additional years of data for the five study areas analyzed in Anderson and Burnham (1992) in which higher proportions of the study areas were surveyed than in earlier years. Estimates of λ (Burnham et al. 1994, unadjusted for juvenile emigration) for these study areas were up to 0.066 higher for four of the five study areas originally analyzed by Anderson and Burnham (1992). For these reasons, Bart's (in press) criticisms of the demographic analyses of Anderson and Burnham (1992), are not as applicable to the demographic analyses in Burnham et al. (1994). Furthermore, they do not invalidate the methods or conclusions of Burnham et al. (1994). Even if estimates of survival rates of territorial adults are biased low using the techniques of Anderson and Burnham (1992) and Burnham et al. (1994), this would not account for the decline in adult survival over time noted by Burnham et al. (1994) in long and short-term study areas.

Bart (in press) also attempts to explore the dynamics of the non-territorial owl population (the "floater" population). Holding the territorial population size constant and using optimistic survival rates in simulations, Bart (in press) concluded that the floater population has probably declined by about 50% over the last 20 to 30 years for an annual rate of about 3.0%. However, since

territorial populations have declined in size due to habitat loss over the last 20-30 years, these results suggest that the actual rate of decline of owls in the Pacific Northwest would be a combination of the decline in the territorial population and the decline in the floater population (Bart pers. com.). Simulations used in calculating this estimate also indicate the extreme sensitivity of Bart's model to relatively small changes in adult survival, suggesting that some aspects of the model may not be realistic (J. Bart pers. com.).

Several models exploring spotted owl population dynamics have been constructed in recent years (Lande 1988a, Doak 1989, Noon and Biles 1990, Anderson and Burnham 1992, Lamberson et al. 1992, McKelvey et al. 1993, Burnham et al. 1994, Holthausen et al. 1994, Lamberson et al. 1994, Raphael et al. 1994). Although these models have provided valuable general insights into owl population dynamics, each has been limited by assumptions made in model construction, aspects of the owl's ecology and behavior included or excluded from the model, and by critical shortcomings in the current knowledge and understanding of spotted owl ecology, behavior, habitat or other factors. Consequently, the results and conclusions drawn from each model are in part a reflection of its construction. For these reasons, the accuracy of quantitative predictions and projections from these models is unknown (Thomas et al. 1990, Murphy and Noon 1992, Holthausen et al. 1994).

■ POPULATION GENETICS CONCERNS

In recent decades spotted owl populations have been fragmented by human-caused elimination and degradation of their habitat state-wide. Current management direction for federal lands (Alternative 9, see Management of Habitat and Owls on Federal Lands below) will perpetuate a relatively fragmented spotted owl population in Washington. Because spotted owls probably formed an outbreeding population historically, planned federal management could result in a significant qualitative change in the population genetics of Washington spotted owls. The population genetics of an owl population comprised of many small (by population genetic standards) clusters of owls, or demes, may differ markedly from the dynamics of a population comprised of relatively few large demes, which likely existed earlier this century. Lande (1988b) emphasized the need to consider demography and population genetics and the interaction between the two when assessing requirements for species viability.

The functioning of small demes (those with a census size of approximately 200 or less (Mills pers. com.) differ from that of large demes. Small demes are much more susceptible than large demes to the effects of genetic drift (chance changes in allele frequencies as a result of random sampling among gametes from generation to generation) (Allendorf 1983). Genetic drift will tend to reduce heterozygosity in individuals and allelic diversity in the deme in the absence of natural selection for a particular allele or subset of alleles (Allendorf 1983). As a consequence of the increased susceptibility to genetic drift, natural selection is less effective in shaping the genetic profile of small demes than of large demes (Allendorf 1983). Additionally inbreeding is more likely to occur in small demes

than large demes. Inbreeding has been implicated in reduced demographic rates (e.g. survival and fecundity) in vertebrates and can have negative demographic consequences in small populations (Mills and Smouse 1994).

Mills and Smouse (1994) investigated the potential impacts of inbreeding on small populations vulnerable to stochastic extinction. They modelled populations of 5, 20 and 80 breeding females with high annual adult survival, slightly positive population trend (λ=1.05) and no immigration. They found that even minor inbreeding depression greatly increased the probability of extinction within five generations (approximately 40 years for spotted owls) for all three initial population sizes. Costs of inbreeding used in this model were based on results from mammalian studies, however available estimates of inbreeding costs in birds fall within the ranges of the mammal studies (Mills and Smouse 1994). These simulations demonstrate that inbreeding can affect population persistence even in the face of environmental fluctuation.

Weishampel (1990) explored the effects of relative population size and one-way immigration on heterozygosity and allelic diversity in the receiving population. Source and receiving population sizes were varied from four to 100; populations were modelled such that they could not increase. The amount of immigration from the source to the receiving population was also varied. These simulations suggest that immigration from source populations larger than the receiving populations will promote heterozygosity and allelic diversity and that more immigration is better. However, for source populations smaller than the receiving populations, increases in immigration lead to decreases in heterozygosity and allelic diversity. When source and receiving populations were of equal sizes, increases in immigration raised heterozygosity and allelic diversity for population sizes of 50 and 100, but reduced heterozygosity and allelic diversity slightly for populations of 20. Reductions in heterozygosity and allelic diversity due to increased immigration were most pronounced for the smallest population sizes (Weishampel 1990).

In the simulations by Mills and Smouse (1994), there were no upper limits to population size; however, owl demes in the Washington Cascades will be constrained to stay small (most less than 30 breeding females) due to planned federal management. Therefore, owl demes will remain continually vulnerable to the prospect of stochastic extinction due to the combined effects of inbreeding, demographic stochasticity and environmental variation. The simulations by Mills and Smouse (1994) also did not include any immigration; under most circumstances immigration would have reduced inbreeding depression and the vulnerability to extinction. In the simulations by Weishampel (1990), only one-way immigration from a single source was considered. However, most demes in Washington will likely receive immigrants from at least two sources. Allendorf (1983) considered how immigration affects heterozygosity and allelic diversity in individual demes. He concluded that one reproductively successful immigrant per generation (approximately 8 years for owls) is sufficient to maintain qualitative similarity among demes, but much greater immigration is needed to maintain quantitative similarity.

Given the low persistence rates and high genetic costs to small demes in these simulation studies and the evidence that owls likely formed an outbreeding population, management of owl populations in Washington should promote enough interchange among demes in the various subregions such that the collections of small demes act like single large demes. High levels of interchange would also be beneficial from a demographic viewpoint. This further underscores the importance of supplementing federal owl clusters with additional habitat and owl pairs where existing clusters are small and the importance of providing landscape conditions between owl clusters that are conducive to disperser survival and movement. Discretization of current local populations and of owl habitat distribution currently appears to be greater in the Cascades than in the Olympics.

Distribution of Habitat and Populations in Washington

■ MANAGEMENT OF HABITAT AND OWLS ON FEDERAL LANDS

Since development of the ISC plan (Thomas et al. 1990), management of owl habitat on federal lands has focused on providing a network of habitat reserves. Generally, each reserve is intended to support a cluster of spotted owl pairs and is set in a matrix of forest lands that will support dispersal between reserves. In response to the listing of the northern spotted owl as threatened under the Endangered Species Act in 1990, a Draft Recovery Plan was developed for the owl (USDI 1992a), followed by a Final Draft Recovery Plan (FDRP) (USDI 1992b). These plans proposed guidelines for managing federal forest lands designed to maintain the future viability of the owl in Washington, Oregon and California. The FDRP, however, was never formally implemented and as a management plan for spotted owls, was replaced by the adoption of Alternative 9, the federal Northwest Forest Plan. The Northwest Forest Plan is a forest management plan designed to provide to the extent possible for the conservation needs of all native species present on these federal lands, while allowing some resource extraction (e.g. timber cutting, mining, grazing etc.).

Both the FDRP and the Northwest Forest Plan rely on federal habitat reserves, dispersal between reserves, and regrowth of habitat to retain viable populations of spotted owls into the future. Although the Northwest Forest Plan and the FDRP differ in the location, size, shape and spacing of reserves designated in some areas, the amount of existing federal NRF habitat in Washington included within reserves of the two plans is similar (Table 2.2-9). Currently there are estimated to be approximately 2,273,000 acres of spotted owl nesting, roosting and foraging habitat on federal lands in Washington (Table 2.2-9) (USDA and USDI 1994). Approximately 90.6% of this total was targeted for protection under the FDRP (USDI 1992b), while approximately 92% is to be protected in reserves or areas withdrawn from timber harvest under the Northwest Forest Plan (Table 2.2-9) (USDA and USDI 1994). These figures are approximate; they are based on tables G-2 and G-3 of the FSEIS (USDA and USDI 1994). Discrepancies between tables in Appendix G of USDA and USDI (1994) result from employing different analysis methods (Ogden pers. com.).

Overall the Northwest Forest Plan includes 89% of federal lands within the Washington range of the owl in reserves, while the FDRP included 82.4% (Table 2.2-10). However, the Northwest Forest Plan is targeted towards a greater number of species than the FDRP and includes large areas within reserves that currently support few or no owls and have little potential for supporting owls in the future. For example, the Northwest Forest Plan includes as reserves 303,683 acres of Okanogan National Forest in which there are only six owl sites. As of Fall 1994, a total of 763 known territorial owl sites were centered on reserved federal lands, while 128 owl sites were centered on nonreserved federal lands (data from WDFW).

It is unknown at this time how the provisions of the recently passed federal salvage bill will be implemented in Washington. Consequently, it is unknown to what extent spotted owls and their habitat on federal lands in Washington will be affected and to what extent timber harvesting under the salvage rider will conflict with the management provisions of the Northwest Forest Plan.

■ AREAS OF CONCERN

Even though a high percentage of the current spotted owl habitat on federal lands is to be protected under the Northwest Forest Plan, there is still concern for spotted owl numbers and distribution in parts of its range in Washington. Currently existing habitat on federal lands comprises only about 11% of the lands within the historic range of the spotted owl in Washington. The Final Draft Recovery Plan for the Northern Spotted Owl (FDRP) (USDI 1992b), the Forest Ecosystem Management Assessment Team (FEMAT)(USDA et al.1993) and the Final Supplemental Environmental Impact Statement (FSEIS) (USDA and USDI 1994) considered nonfederal lands critical to the continued existence of the owl in some areas. In Washington, the FDRP identified several areas in which nonfederal lands were crucial to spotted owl recovery. The FEMAT (p. IV-150, 1993) and the FSEIS (p. 3&4-244, USDA and USDI 1994) concurred with the FDRP on the importance of these areas to spotted owl conservation. Additionally, the Spotted Owl Scientific Advisory Group (Hanson et al. 1993, Buchanan et al. 1994) identified 15 nonfederal landscapes in Washington important to spotted owls based on their current functions. These areas are described below.

Northern Cascades

In the northern Cascades, defined as the area north of Township 22, west of the Cascade crest and south of the Canadian border, there are no known large clusters of owl sites (20 or more) and relatively little habitat. Because of timber cutting and natural habitat breaks due to mountainous terrain, there is relatively little federal habitat in the region; only about 25% of the area comprises federally owned habitat. Although nonfederal lands in the region are generally at lower elevations, little habitat remains due to timber cutting. Additionally, owl reproduction in this region appears to be low. Of the 124 known pair sites (status 1 and 2) recorded by WDFW, reproduction has been documented at only 55 sites. Perhaps because of these concerns, matrix areas in

the northern Cascades include only six of the 155 known territorial sites on federal lands (three pairs and three singles). All other territorial sites are within reserved lands or administratively withdrawn areas.

Table 2.2-9

Amounts of NRF habitat on federal lands reserved under the FDRP and reserved and unreserved under the Northwest Forest Plan.

(Adapted from Tables G-2 and G-3 USDA and USDI 1994.)

Province	FDRP Reserved	Northwest Forest Plan Reserved[a]	Northwest Forest Plan Unreserved[b]
Olympic Peninsula	531,400	555,300	8,400
Washington Lowlands	0	0[c]	0
Western Cascades	923,900	919,401	124,499
Eastern Cascades	603,400	616,194	49,406
Totals	2,058,700	2,090,895	182,305

[a] Includes habitat in late-successional reserves, congressionally withdrawn areas, administratively withdrawn areas, managed late-successional areas and 73,895 acres of NRF habitat within the Snoqualimie Pass and Finney Adaptive Management Areas which are to be retained (Ogden pers. com.). These figures do not include NRF habitat in riparian reserves on unreserved lands since the value of these lands in supporting resident owls is unknown.

[b] Includes matrix areas and the Olympic and Cispus Adaptive Management Areas.

[c] The proposed late-successional reserve on Fort Lewis has approximately 36,000 acres of dispersal quality habitat of which approximately 20,000 acres are considered to be NRF habitat. Of the NRF habitat, 11,000 acres are marginally suitable while 9,000 are true NRF habitat (Bottorff pers. com.).

Table 2.2-10

Acreages of federal lands reserved under the FDRP and reserved and unreserved under the Northwest Forest Plan

(from Table G-1 USDA and USDI 1994.)

Province	FDRP Reserved	Alternative 9 Reserved[a]	Alternative 9 Unreserved[b]
Olympic Peninsula	1,367,400	1,466,800	63,200
Washington Lowlands	126,300[c]	126,300[c]	0
Western Cascades	3,118,200	3,331,500	387,800
Eastern Cascades	2,673,600	2,949,500[d]	520,800
Totals	**7,285,500**	**7,874,100**	**971,800**

[a] Includes acreage in late-successional reserves, congressionally withdrawn areas, administratively withdrawn areas, managed late-successional areas, riparian reserves and 124,541 acres of land within the Snoqualmie Pass and Finney Adaptive Management Areas.
[b] Includes matrix and adaptive management areas not included as reserved.
[c] Includes a proposed late-successional reserve on Fort Lewis of 90,580 acres.
[d] These totals include 303,683 acres of land in the Okanogan National Forest that supports only six owl sites.

The main area of concern identified by the FDRP for the northern Cascades is the Finney lowlands. This area of nonfederal lands surrounds on three sides the Finney Block of Mount Baker Snoqualmie National Forest and could potentially provide connectivity to habitat and owl clusters to the north, west and south. The Finney lowlands could also provide habitat to help support the owl sites on federal lands that border this area and that are centered on private lands. With 18 sites, the Finney Block harbors the largest cluster of territorial sites in the northern Cascades. A total of 19 territorial sites centered on reserved federal lands overlap the Finney lowlands; additionally, two pair sites are centered on nonfederal lands within the landscape. The FDRP recommends the nonfederal Finney lowlands be managed to provide dispersal habitat and supplemental pair areas.

I-90 Corridor and Chelan County

In the central Cascades, the I-90 corridor is a critical link between the northern and southern Cascades and with the Swauk Creek and Chelan County owl clusters. The main concerns in the I-90 corridor are the loss of habitat to clearcutting on federal and nonfederal lands and the poor north-south connectivity for dispersing owls. Federal lands are arranged in a checkerboard pattern among nonfederal lands, and federal habitat comprises only about 21% of the total area. Under the Northwest Forest Plan, some lands in the I-90 corridor are currently designated as matrix, although most federal lands in the corridor are to be part of reserves or included in the Snoqualmie Pass Adaptive Management Area. The emphasis for the adaptive management area is to

develop and implement a "scientifically credible, comprehensive plan for providing late-successional forest" (USDA 1994: B-62). Further, the plan "should recognize the area as a critical connective link in north-south movement of organisms in the Cascade Range" (USDA 1994: B-62). The FDRP recommends that NRF habitat be provided on nonfederal lands in the I-90 corridor to support existing owl sites and that dispersal habitat be provided throughout the area.

In Chelan County there are two areas of concern, Entiat Ridge and North Blewett. The Entiat Ridge area includes the northernmost large cluster of owl sites in the eastern Cascades. Modelling by Raphael et al. (1994) suggest that the Entiat Ridge area may constitute an important "source" population in the eastern Cascades. In their model runs, this area consistently had among the highest occupancy rates. Immediately south, the North Blewett landscape (as drawn by the SAG) encompasses a cluster of 12 territorial owl sites and most of the land capable of supporting suitable habitat north of Swauk Pass and south of the Entiat Ridge landscape. The Entiat and North Blewett landscapes are both within the portions of Wenatchee National Forest supporting the highest owl reproductive rates (Irwin and Fleming 1994). There is little NRF habitat on federal lands in either landscape: only 22% and 12% in the Entiat and North Blewett landscapes respectively (as drawn by the SAG) were in these areas before the 1994 fires. Both landscapes have intermingled ownerships; federal lands cover 68% of the Entiat landscape and 55% of the North Blewett landscape. Some of the land in these areas is incapable of supporting suitable habitat. Planned management of federal lands in these areas includes late successional reserves, administratively withdrawn areas, matrix and managed late successional reserves added out of concern for spotted owls. The FDRP states that nonfederal lands in both landscapes are needed to provide NRF habitat to support the existing owl sites in the Entiat and North Blewett areas and to provide dispersal habitat.

Within the Entiat landscape, 16 of the 18 territorial sites have nonfederal forest lands within 0.7 mile of the site center. This is important because habitat closest to the site center is generally used more heavily than more distant habitats (Hanson et al. 1993). Four of these site centers occur on nonfederal land. Although some of the federal lands within the SOSEA are designated as matrix, the federal habitats around territorial sites are included within reserves, with two exceptions. One of these exceptions is a single owl; the other is a pair site at which little habitat remains. Eight of the territorial sites were partially burned in the 1994 fires, although the amounts of habitat lost and the affects on future use of the sites by owls are unknown.

Nine of 11 pair sites in the North Blewett landscape are centered on federal land. Four of the federal pair sites are centered on lands to be reserved, and one of the nonfederal sites has all federal lands within 1.5 miles reserved. The remaining seven sites are in areas where federal lands are mostly designated as matrix or in an area with no federal lands. Of the 11 recognized pair sites in the North Blewett landscape, four were burned in the 1994 fires. An additional site was reclassified as historic after the Rat Creek fire burned the site center

and most of the habitat. Three of the four burned sites are centered on reserved federal lands, the fourth site is centered on nonfederal lands. It is unknown how the habitat reductions at these sites will affect their future use by owls.

Southern Cascades

The Mineral Block is a disjunct portion of the Gifford Pinchot National Forest in Lewis County that harbors several spotted owl sites. Loss of habitat on checkerboarded federal and nonfederal lands in a mixed ownership landscape is the major concern. Reproduction in the Mineral Block is low; only four of 19 pair sites are known to have produced offspring. The FDRP recommends providing enough NRF habitat in and around the Mineral Block to support at least 15 pairs of owls on all ownerships; for the Mineral Link, the area of nonfederal lands to the south and east, the FDRP recommendation is to provide dispersal habitat. The Murray Pacific HCP covers approximately 25% of the lands in the Mineral Link area.

The Siouxon area, south of Mount St. Helens National Volcanic Monument, offers the opportunity to retain owls in low elevation habitat and may contribute to population connectivity between the Washington Cascades and the Oregon Cascades. The habitat is fairly unfragmented and supports at least seven territorial sites, although one site has very little habitat remaining. Five sites on reserved federal lands overlap this area. The FDRP recommends providing NRF habitat for at least three or four territorial sites.

The Columbia Gorge landscape is important for sustaining the movement of owls and the flow of genes between Washington and Oregon, thus preventing the demographic and genetic isolation of the Washington Cascades from the Oregon Cascades. Additionally, this area provides demographic support to the southernmost Cascades of Washington. The FDRP recognized the key role of this landscape by recommending that all existing territorial sites be protected, that dispersal habitat be provided and that habitat be regrown to eventually support a density of four owl pairs per township.

Immediately northeast of the Columbia Gorge, the White Salmon area currently connects owls and habitat on the Yakama Indian Reservation, the southern portion of the Gifford Pinchot National Forest and the Columbia Gorge. The White Salmon area combined with western Klickitat County supports at least 20 territorial sites on nonfederal lands. Since some private lands in this area have had little survey effort (Buchanan pers. com.), there may well be more sites. Contiguous federal lands harbor 13 territorial sites, of which eight are to be protected on reserved lands under the Northwest Forest Plan. The FDRP recommends that the White Salmon area, as well as the area immediately north of the Yakama Indian Reservation, be managed for dispersal habitat. However, many of the currently known owl sites may have been undiscovered in 1992.

Olympic Peninsula

On the Olympic Peninsula, most known owl sites and most of the owl habitat are on federal lands. The main concerns in this province stem from habitat loss on national forest and nonfederal lands. Fairly low numbers of owls (Holthausen et al. 1994) and uncertain demographic trends (Burnham et al. 1994), in combination with the isolation of this province from demographic and genetic support from the Cascades population (USDI 1992a), have raised concerns for the viability of the Olympic owl population. The Reanalysis Team recently explored "the potential for and pattern of long-term persistence of the northern spotted owl on the Olympic Peninsula with varying levels of habitat contributions from nonfederal lands" (Holthausen et al. 1994, Appendix 1, p.1). They concluded that it "is likely but not assured, that a stable population of owls would be maintained" (Holthausen et al. 1994, p.1) on federal lands without a contribution of habitat from nonfederal lands. However, they also state that there is "significant uncertainty" in this conclusion and that protecting habitat on the west side of the peninsula would constitute a "biologically significant contribution" to owl population viability in the province (Holthausen et al. 1994 p.1).

Without nonfederal habitat on the west side of the peninsula, the team further concludes that it is unlikely that an owl population would persist in the coastal strip of Olympic National Park and that habitat on federal lands may have lower occupancy rates (Holthausen et al. 1994). Their analysis, however, does not adequately address the potential contribution of the North Olympic Coast landscape.

The Reanalysis Team used a spatially explicit population model (McKelvey et al. 1993) to simulate spotted owl population dynamics on the Olympic Peninsula. However, limitations of the model structure and questions in parameterizing the model creates uncertainty in the results and in conclusions based on the results. Available evidence suggests that owls are more dense and numerous on the east side of the peninsula than the west side (Seaman pers. com., Holthausen et al. 1994). The model, however, cannot include multiple territory cell sizes in a simulation. Additionally, the method used for linking demographic parameters with habitat amounts within territory cells may not have yielded a realistic portrayal of owl demography. If more realistic portrayals of demography and relative territory sizes on the Olympic Peninsula had been used in the simulations, a qualitatively different portrayal of the Olympic owl population may have emerged. This could have allowed better assessments of the potential affects of catastrophic fire on the peninsula owl population and of the contributions of the North Olympic Coast and Hoh-Clearwater landscapes to spotted owl conservation.

Raphael et al. (1995) expanded the analysis of Holthausen et al. (1994) to explore the question: "Can the contribution of non-Federal lands [on the Olympic Peninsula] be made more efficiently than through the current take guidelines (p. 2)." Although the simulation results suggest that some scenarios may provide higher owl occupancy rates using less nonfederal habitat than under the current take guidelines, these scenarios require that greater than

40% habitat be retained in some nonfederal areas; in some nonfederal areas, greater than 60% habitat would need to be retained. Perhaps for this reason, Raphael et al. (1994) caution that the most appropriate use of the results from this work "is in discussions of alternative approaches to non-Federal contributions, such as Habitat Conservation Plans (p. 2)." In general, Raphael et al. (1995) conclude that retaining sites with high habitat amounts that are close to the western boundary of Olympic National Park and Olympic National Forest contributed more to overall owl occupancy rates than sites with little habitat that are more distant from federal lands. It is noted, however, that these simulations do not consider any potential benefit of retaining habitat within the landscape to provide connectivity between inland and coastal owls on the peninsula. The potential concerns with the simulations by Holthausen et al. (1994) outlined above also apply to these simulations.

The FDRP recommended that nonfederal lands on the west side of the peninsula from Lake Ozette south to the Queets River and east to Olympic National Park be managed to provide demographic support for the owl population and to increase habitat connectivity between federal lands in the interior peninsula and the coastal strip of Olympic National Park. The FDRP recommends long-term provisions for 20-30 owl pairs in small clusters within this region. The North Olympic Coast landscape harbors six territorial sites within the landscape; 23 sites on reserved federal lands overlap the landscape.

Southwestern Washington

In southwestern Washington there are very few owls and very little habitat. Federal lands are limited to national wildlife refuge lands at Willapa Bay; these lands comprise less than one percent of the area. If owls are to be retained in this area, conservation measures will have to rely on nonfederal lands. This area comprises a large portion of the historic range of the owl in Washington and presents an opportunity to retain owls in low elevation managed landscapes (USDI 1992ab). The FDRP recommends providing for multiple clusters of at least 15 pair sites. Given the absence of federal forest lands, however, they recommend that currently existing owl sites be protected and that surveys continue in potential owl habitat.

Factors Influencing Population Viability

Population viability is the likelihood that a population will persist over a period of time within a given area (Schaffer 1981, 1987; Lande 1993). A wildlife population must be able to persist through and rebound from episodic declines in numbers. It should be widespread and numerous enough to preserve its genetic diversity. Subpopulations should be interconnected to ensure a continual source of dispersers to recolonize uninhabited areas of habitat and to allow for genetic interchange between regions. Habitat should be of sufficient quantity, quality and distribution to allow individuals to replace themselves in the population.

Federal conservation plans for the northern spotted owl (Thomas et al. 1990; USDI 1992b; USDA and USDI 1994) seek to preserve clusters of owl sites within reserved areas throughout the current range of the owl. Dispersal habitat will be provided between these areas. These plans have been based on several biological principles widely accepted by conservation biologists (Murphy and Noon 1992). The most important of these principles are that (1) species well distributed across their range are less prone to extinction than species confined to small portions of their range; (2) large blocks of habitat containing several or many pairs of the target species are better than blocks containing one or a few pairs; (3) blocks of habitat that are close together are better than blocks that are far apart; (4) within blocks, habitat that is contiguous is better than fragmented habitat; and (5) habitats between blocks will more efficiently permit dispersal the more closely they resemble habitat for the target species. These principles are also important in assessing the contributions from nonfederal lands necessary to insure a high likelihood of spotted owl persistence in Washington.

Factors influencing owl population viability operate on at least three scales: the individual site, the cluster or local population, and the geographic range. At individual sites, internal factors that directly influence site occupancy and reproduction are habitat quality, habitat amount (or percent), arrangement and the degree of contiguity. External factors that influence site occupancy directly and therefore influence reproduction are cluster size, proximity to other sites in the cluster and proximity of the cluster to other clusters.

Factors that influence dispersal success at all scales are the amount and quality of dispersal habitat between and within clusters, the configuration of dispersal habitat within the landscape, the distances between clusters, and the percent of the landscape that is roosting and foraging habitat.

Additional factors influencing range-wide viability include the distribution of clusters through the provinces and the ability of the metapopulation to absorb catastrophic habitat reductions. Any conservation strategy for spotted owls must consider these factors at all scales if it is to have a high probability of success.

2.3 Environmental Consequences to the Northern Spotted Owl and its Habitat

Introduction

This section presents the scientific and analytic basis for comparison of the alternatives presented by the Forest Practices Board. The section describes the probable consequences (impacts, effects) to the northern spotted owl and its habitat of implementing the alternatives.

This discussion covers the physical and biological consequences of each alternative. The discussion of the effects of the alternatives on the northern spotted owl is framed around assessment criteria that include: numbers of northern spotted owl sites supported by SOSEAs, provision of dispersal habitat, adequacy of habitat at demographic support sites, support of regional population viability, and protection against catastrophic habitat loss.

Adverse impacts that cannot or will not be mitigated by the alternatives are included in the discussion of the alternatives.

Criteria for Assessing Alternatives

The Forest Practices Board adopted the following goal: "Prepare a rule that captures all forest practices that have potential for a substantial adverse impact on the environment. In the case of the owl, any forest practice that damages the long-term viability of populations of the Northern Spotted Owl in Washington State". (See Purpose and Need for Action Section.) The assessment of five rule alternatives and a no action alternative considers to what extent each alternative would complement the federal strategy and contribute to well-distributed and viable populations of spotted owls in Washington. For the purposes of this environmental analysis, a well-distributed owl population is one whose geographic extent approximates that of the current owl population within each province.

These alternatives are assessed under the assumption that federal lands will be managed as stated under the Northwest Forest Plan (USDA and USDI 1994). This analysis does not consider deviations from the approved Northwest Forest Plan because the USFWS and the USFS have not assessed the potential impacts of recent legislation and court decisions on the salvage of timber. However, if these federal actions result in reduced protection for spotted owls and habitat on federal lands, greater support from nonfederal lands may be needed to meet specific conservation goals.

Any rule adopted by the state will affect the numbers of owls, their distribution, and the amounts of habitat on federal and nonfederal lands. Therefore, the criteria below consider each of these factors. The criteria are intended to provide a basis for assessing the relative changes in important population and habitat parameters that would likely result from each alternative. None of the criteria can be used independently to assess the adequacy of the alternatives.

Instead, the effects on habitat and owls described under each criteria should be considered collectively to assess the over-all contribution to owl conservation of each rule proposal.

To assist in assessing these alternatives, the owl habitat database was updated and modified in the DNR GIS using data from WDFW, DNR, USFS, industrial landowners and others. The data have differing levels of reliability depending on the methods used by the landowner to compile the data and the amount of ground truthing associated with development of the data. Much of the analyses of the rule alternatives are based on this database. Addendum C provides more information on the composition and use of this database.

Criterion 1: Numbers of known status 1, 2, and 3 owl sites involving nonfederal lands supported by demographic support, pair maintenance, species distribution or combination function SOSEAs.

The intent is to derive an indication of the numbers of known territorial owl sites that will be supported and the numbers of sites that may be degraded or lost due to timber harvesting under each alternative. This criterion considers the number of nonfederal owl sites that would be supported by SOSEAs under each alternative. It also considers the extent to which these sites are currently supported by habitat on federal lands and the percentage of federal lands at the sites. Conversely, it considers the number of sites that would not be supported by each alternative and the degree to which these sites are currently supported by federal habitat and lands. The discussion also considers site center status code definitions and provisions for dropping protection from status 1, 2, and 3 sites within SOSEAs.

Parameter: Numbers of owl sites involving nonfederal lands included within the regulatory scope of the rule alternative and the numbers of nonfederal sites that would likely be degraded or lost.

This criterion is used to provide a frame of reference for comparing the scope of each alternative and the degree to which each alternative would provide support to the sites most dependent on nonfederal lands.

Criterion 2: Dispersal habitat provided.

This criterion considers the definitions of dispersal habitat and the amounts, types, spacing, and distribution required in SOSEAs designated for dispersal. It also reviews portions of the landowner planning process, exemptions, and operations that may affect the provision of habitat in these SOSEAs.

Parameter: Effectiveness of dispersal links.

The basic premise of this criterion is that providing habitat between and within owl clusters facilitates the movement of owls between areas of suitable habitat. Successful dispersal between and within owl clusters is crucial for owl viability in Washington.

The intention is to assess the quality of dispersal landscapes that would be provided under each alternative. Dispersal landscapes must provide habitat conducive to owl movement while minimizing predation risk. They also must provide stopover places where owls can find foraging opportunities and suitable cover for roosting.

Criterion 3: Effects on habitat in SOSEAs designated for demographic support.

This criterion considers definitions of all types of owl habitat except dispersal. It also considers the amounts, type, selection, and spacing of habitats at owl sites. Additionally, it considers portions of the landowner planning process, exemptions, and operations that may affect the amount, quality, or spacing of habitat at owl sites.

Parameter: Effectiveness of habitat at demographic support sites.

The basic premise of this criterion is that sites supporting pairs which replace themselves in the population will contribute more to viable owl populations than sites which do not support owl pairs at demographic rates sufficient for replacement.

The intention is to assess whether the amount, type, and distribution of habitat that would likely result at demographic support sites under each alternative will support owl pairs capable of producing enough offspring to replace themselves in the population. The reproductive output of owl pairs is generally greater at sites with high habitat percentages, high habitat quality, and low habitat fragmentation.

Criterion 4: Regional population viability support.

This criterion considers the extent to which each alternative would contribute to well-distributed and viable populations of spotted owls in Washington. This criterion examines the locations, boundaries, and functions of SOSEAs provided by each alternative to see whether (1) adequate habitat connectivity for dispersal between critical areas of reserved federal land is provided; (2) the size, areal extent, and distribution of important federal owl clusters are supported; and (3) large and medium-size owl clusters (at least five sites) on nonfederal lands are retained and supported.

Parameter: Metapopulation support on the cluster and range scales.

This criterion combines elements of four basic premises (Thomas et al. 1990): (1) species well-distributed across their range are less prone to extinction than species confined to small portions of their range; (2) large blocks of habitat containing several or many pairs of the target species are better than blocks containing one or a few pairs; (3) blocks of habitat that are close together are better than blocks that are far apart; and (4) habitats between blocks will more efficiently allow dispersers to move through the more those habitats resemble habitat for the target species.

The intention of this criterion is to examine the degree of support provided by each alternative to weak links in the federal network of owl clusters. It considers support of Washington's owl population on the cluster and geographic range scales. There are several areas of concern in Washington. These areas correspond to gaps in the distribution of federal habitat and owls, clusters of owls on lands with checkerboard or intermingled ownerships, and regions with few owls and little habitat.

Criterion 5: Protection against catastrophic habitat loss.

This criterion considers the degree of support provided by each alternative to portions of the federal habitat network vulnerable to crippling habitat loss from wind and fire in the next 100 years. The likelihood of owl persistence in these areas could be increased by providing additional owl clusters to help spread the risk of extinction and by ensuring that existing owl clusters are demographically strong. Additionally, this criterion considers to what extent each alternative would encourage experimentation in the eastern Cascades to reduce the risk of large-scale catastrophic fires within a landscape while retaining demographically viable owl pairs.

Parameter: Population risk reduction on the cluster and geographic range scales.

The basic premises of this criterion are that (1) populations affected by periodic large-scale catastrophic habitat loss are less prone to extinction when the risk is spread among subpopulations and if the unaffected subpopulations are themselves demographically strong, and (2) the likelihood of local and regional extinction decreases with decreasing frequency, severity and extent of disturbance.

The intention of this criterion is to gauge the level of demographic safety against natural disturbances provided to the owl population by each alternative. Risk reduction may be accomplished by (1) spreading the risk - providing nonfederal habitat to support additional sites on nonfederal lands, (2) supporting owl populations that are resilient to disturbance by providing habitat for demographically strong owl sites; and (3) reducing the frequency, severity, and extent of losses of habitat and owls.

Assessing the Alternatives

Criterion 1: Number of known status 1, 2, and 3 owl sites involving nonfederal lands included in demographic support, pair maintenance, species distribution, or combination function SOSEAs.

Information Relative to All Alternatives

Using statewide and province-wide scopes, this criterion considers the numbers of nonfederal sites that would be supported by demographic support, pair maintenance, species distribution, or combination function SOSEAs under each rule alternative. It also considers the extent to which these sites are currently supported by habitat on federal lands and the percentage of federal lands at the

sites. Criterion 1 also considers the number of sites that **would not** be supported by each rule alternative and the degree to which these sites are supported by federal habitat and lands. The intent is to derive an indication of the numbers of known owl sites in Washington that could be degraded or lost due to timber harvesting under each rule alternative.

The percentages of federal habitat at owl sites are considered because: (1) the goal of the Forest Practices Board in adopting a rule is to complement management of owls and habitat on federal lands; (2) the amounts of federal habitat available at most sites will be relatively constant in the near future (little habitat is expected to regrow and, at most sites, little is expected to be harvested) while the level of support that would be provided from nonfederal lands varies with each rule alternative; (3) existing nonfederal habitat and young second-growth stands not yet suitable as habitat will likely be subject to variable harvest levels that are different from those expected on federal lands; and (4) reliable habitat information is not available for nonfederal lands at some owl sites. The percentage of federal lands surrounding a site is one indication of the extent to which federal habitat may be expected to support the site in the future; alternatively, the percentage of federal lands surrounding a site gives some indication of the potential for nonfederal lands to contribute to maintenance of the site.

Criterion 1 also considers site center status code definitions and provisions for dropping restrictions at territorial sites in SOSEAs designated for pair maintenance or demographic support. (See Criterion 3.)

Alternatives 1 through 5 designate SOSEAs in which owl sites are to be maintained in some fashion. The function of these SOSEAs are variously termed pair maintenance, demographic support, and species distribution by the alternatives. Additionally, Alternative 4 designates areas that are to support a combination of demographic support and dispersal functions; owl sites in these areas are included in the analysis for Alternative 4 even though there is some uncertainty about how many owl sites in these areas can be expected to be retained. (See Criteria 3 and 4 below.) Alternatives 1 through 4 also designate SOSEAs whose sole function is dispersal or demographic interchange; however, the low requirements for provision of NRF habitat in these SOSEAs make it unlikely that these areas will support resident owl pairs in the future.

Each of the alternatives includes only a subset of nonfederal sites within SOSEAs (Table 2.3-1). Therefore, all of the alternatives will result in a reduction in the numbers of owls from those existing at present. Outside SOSEAs, owl sites centered on nonfederal lands will require preservation of, at most, 70 acres of habitat around the site center. Owl sites centered on federal lands outside of SOSEA boundaries will require no contribution of habitat from nonfederal lands. Consequently, it can reasonably be expected that most owl sites heavily dependent on nonfederal lands outside of demographic support, pair maintenance, species distribution and combination function SOSEAs will be severely impacted or eliminated.

Table 2.3-2 lists the number of territorial nonfederal owl sites in each province by the percentage of federal habitat at the site. In the four provinces, 58-100% of nonfederal sites have less than 40% federal habitat. State-wide, 67% of nonfederal owl sites have less than 40% federal habitat. The 384 nonfederal owl sites with less than 40% federal habitat represent 39% of all known territorial sites in the state of Washington. There are 342 sites in Washington with less than 40% federal habitat and at least 5% nonfederal lands. These sites comprise 35% of all territorial sites in Washington and are likely the sites most vulnerable to degradation or elimination by further logging on nonfederal lands. Eighty-eight percent of these sites include more than 20% nonfederal land. These figures suggest that a substantial proportion of the known territorial owl sites in Washington are currently dependent on habitat on nonfederal lands.

The identification of sites with less than 40% habitat as "most vulnerable to serious degradation or elimination" from further timber harvesting is conservative. In most cases, sites with less than 40% habitat present probably do not support owls at demographic rates sufficient for replacement (see discussion in Affected Environment above and Criterion 3). Further reductions in habitat amount would likely reduce rates further making them below that needed for replacement and could make the site uninhabitable. It could be argued that sites with just enough habitat for replacement should be included in the "most vulnerable" category, since habitat reductions could make these sites unable to support owls at replacement rates. In most cases, this would be a higher standard than that chosen in this alternative. Even habitat reductions that reduced the net reproductive rate of "source" sites (sites with demographic rates greater than the needed for replacement in the population) but still left the site capable of functioning as a source might be considered a "serious degradation" depending on the landscape context of the site (e.g. if it was one of a few source sites present within a local population).

None of the alternatives would protect for the long-term the 70 acres of habitat around site centers in dispersal SOSEAs and outside of SOSEAs. Thomas et al. (1990) included a provision in their conservation strategy for the spotted owl requiring 100-acre-core areas to be left around owl site centers within areas that would be cut. These core habitats were to be maintained for the long-term and would allow a shorter restoration time if in the future it became apparent that additional owl sites were needed to meet conservation objectives. Under Alternatives 1, 2, 3 and 5, the 70 acres of habitat around site centers may be cut after three years of protocol surveys (consistent with the survey protocol endorsed by the USFWS) show no activity. Alternative 4 has limited prohibitions on logging site centers. Logging the 70 acres around site centers outside of SOSEAs would be prohibited from March 1 to August 31 only.

The total numbers of nonfederal sites listed in Tables 2.3-1 through 2.3-5 differ slightly from that reported in "Range and Numbers" of Section 2.2. Tallies used in this section result from GIS analyses done by WDNR using owl locations from WDFW. Tallies of nonfederal sites listed in "Range and Numbers" are from WDFW. The discrepancies result from the use of different provincial

boundaries, different ownership maps, different circle sizes for sites in the western Cascades, and the precision at which owl circles are mapped. The data for the analyses in Criterion 1 were developed by WDNR on a GIS using provincial boundaries from the Northwest Forest Plan (USDA and USDI 1994), a more up-to-date ownership map than that used by WDFW, and 2.0 mile radii for sites in the western Cascades province.

Small discrepancies in site tallies when comparing Alternatives 1, 4 or 5 with total nonfederal sites on Tables 2.3-3 and 2.3-5 result from differing circle sizes proposed by the alternatives for the western Cascades and small differences in area calculations between GIS runs. Nevertheless, percentages of sites are used in comparisons between alternatives and these are little affected by the differences.

Table 2.3-1

Numbers of recognized territorial (status 1, 2 and 3), nonfederal sites to be supported by the rule alternatives within demographic support, pair maintenance, combination function and species distribution SOSEAs, and the total numbers of sites including some nonfederal lands, by province.

Nonfederal sites include some nonfederal lands within their regulatory circles; see Section 2.1 or Criterian 3 for the radii proposed in each alternative. Alternatives 1, 2 and 3 would support only sites centered within SOSEAs; Alternatives 4 and 5 would also support some sites on federal lands that overlap the SOSEAs. Owl locational data from WDFW, July 1995. (Note: The total number of all nonfederal sites (592) differs from that (580) presented in the Range and Numbers in Section 2.2 above. The differences between these numbers reflect land exchanges and site center moves that have occurred.)

Province	Alt. 1	Alt. 2	Alt. 3	Alt. 4[a]	Alt.5[b]	Total Nonfederal[c]
Olympic Peninsula	0	0	34	52	53	142
Western WA Lowlands	0	0	12	0	0	20
Western Cascades	55	61	71	94	104	227
Eastern Cascades	50	58	101	108	89	203
Total no. of sites supported	**105**	**119**	**218**	**254**	**246**	**592**

[a] Includes 87 sites within areas that are to provide a combination of demographic support and dispersal support. If these sites are not included, the province tallies would be 48 sites for the Olympic Peninsula, 45 for the western Cascades, and 62 for the eastern Cascades for a total of 173 sites. See text for further discussion.

[b] These numbers are approximate. Some sites centered on nonfederal lands but including federal lands designated as matrix may not be included if this alternative was adopted. Additonally, an unknown number of "owl shadows" may be included if this alternative was implemented. See text for further discussion.

[c] Nonfederal sites include some nonfederal lands within 1.8 miles of an owl site center in the eastern Cascades, 2.0 miles in the western Cascades and Puget lowlands east of Interstate 5, or 2.7 miles on the Olympic Peninsula and southwest Washington.

Table 2.3-2

Numbers of territorial (status 1, 2 and 3), nonfederal owl sites in Washington by federal habitat percentage by province and total numbers of federal and nonfederal territorial sites in Washington.

Nonfederal sites include some nonfederal lands within 1.8 miles of the site center in the eastern Cascades, 2.0 miles in the western Cascades, 2.0 miles in the western Washington lowlands east of Interstate 5, 2.7 miles on the Olympic Peninsula and on western Washington lowlands west of Interstate 5.

Province	% Federal Habitat <1	1-19	20-39	40-59	≥60	Total No. NonFed. Sites[a]	Total No. Sites in WA[b]
Olympic Peninsula	10	34	40	31	27	142	230[c]
Western WA Lowlands	20	1	0	0	0	20	20
Western Cascades	19	26	87	77	18	227	431
Eastern Cascades	33	38	77	43	12	203	298
Total	**82**	**98**	**204**	**151**	**57**	**592**	**979**

[a] Includes 43 owl sites centered on federal lands designated as matrix. Twenty-six sites are centered on matrix lands in the western Cascades, and 17 sites are centered on matrix lands in the eastern Cascades. No owl sites in the Olympic Peninsula and Western Washington Lowlands Provinces are centered on matrix lands. These totals also include an unknown number of sites centered on nonfederal lands but dependent on habitat on federal lands designated as matrix.

[b] Data from WDFW October 9, 1995.

[c] Recent studies suggest there are 272-453 owl pairs on the Olympic Peninsula. See Range and Numbers in Section 2.2.

Table 2.3-3

Numbers of territorial (status 1, 2 and 3), nonfederal owl sites that would be supported under each rule alternative by federal habitat percentage.

Sites within demographic support, pair maintenance, combination function and species distribution SOSEAs are tallied. Nonfederal sites include some nonfederal land within 1.8 miles of the site center in the eastern Cascades, 2.0 miles in the western Cascades, 2.0 miles in the western Washington lowlands east of Interstate 5, 2.7 miles on the Olympic Peninsula and on western Washington lowlands west of Interstate 5.

	% Federal Habitat					
	<1	1-19	20-39	40-59	≥60	Totals
Alternative 1	4	17	64	20	0	105
Alternative 2	9	24	63	23	0	119
Alternative 3	43	56	86	28	5	218
Alternative 4[a]	33	45	105	50	22	254
Alternative 5	37	47	96	48	18	246
All nonfederal sites	82	98	204	151	57	592

[a] If sites in combination function areas are not included for Alternative 4, the column values from left to right would be 9, 29, 80, 30, 19 and 167.

Table 2.3-4

Numbers of territorial (status 1, 2 and 3), nonfederal owl sites that would be supported by each rule alternative by federal land percentage.

Sites that would be supported by demographic support, pair maintenance, combination function and species distribution SOSEAs are tallied. Nonfederal sites include some nonfederal land within 1.8 miles of the site center in the eastern Cascades, 2.0 miles in the western Cascades, 2.0 miles in the western Washington lowlands east of Interstate 5, 2.7 miles on the Olympic Peninsula and on western Washington lowlands west of Interstate 5.

	% Federal Land					
	0-19	20-39	40-59	60-79	80-100	Totals
Alternative 1	9	17	48	22	9	105
Alternative 2	21	12	52	24	10	119
Alternative 3	70	25	68	35	20	218
Alternative 4	50	33	64	49	58	254
Alternative 5	57	36	62	41	50	246
All nonfederal sites	113	42	99	101	237	592

Table 2.3-5

Numbers of territorial (status 1, 2, and 3), nonfederal owl sites that *would not be supported* by each rule alternative by federal habitat percentage.

Sites that would not be supported by demographic support, pair maintenance, combination function and species distribution SOSEAs are tallied. Nonfederal sites include some nonfederal land within 1.8 miles of the site center in the eastern Cascades, 2.0 miles in the western Cascades, 2.0 miles in the western Washington lowlands east of Interstate 5, 2.7 miles on the Olympic Peninsula and on western Washington lowlands west of Interstate 5.

	% Federal Habitat					
	<1	1-19	20-39	40-59	≥60	Total
Alternative 1	80	79	143	128	57	**487**
Alternative 2	73	74	141	128	57	**473**
Alternative 3	39	42	118	123	52	**374**
Alternative 4	51	49	100	101	37	**338**
Alternative 5	48	47	108	103	40	**346**
All nonfederal sites	82	98	204	151	57	**592**

■ ALTERNATIVE 1 - SIX LANDSCAPES

Of the 592 known territorial owl sites in Washington that involve nonfederal lands, Alternative 1 would include 105 (18%) sites within pair maintenance SOSEAs (Table 2.3-1). No sites on the Olympic Peninsula or in the Western Washington Lowlands Province would be included. Also, no sites in the eastern Cascades outside the I-90 corridor would be included. Most sites (58%) included in this alternative have 20-39% federal habitat (Table 2.3-3). Alternative 1 would support 12% of nonfederal sites that currently have less than 20% federal habitat and 22% of nonfederal sites that have less than 40% federal habitat (Table 2.3-3). While only 19% of the sites supported by Alternative 1 have 40% or more federal habitat (Table 2.3-3), 75% of sites supported have 40% or more federal land (Table 2.3-4). Most of the sites included by this alternative involve substantial amounts of federal lands (Table 2.3-4).

Alternative 1 also includes nine sites centered on or surrounded by federal lands designated as matrix. Although located in areas where programmed timber harvest is allowed on federal lands, the centers of some of these sites are located immediately adjacent to reserved federal lands. Federal lands may be managed consistent with owl retention at an unknown number of these sites.

Alternative 1 would offer no support to 487 (82% of) territorial owl sites in Washington involving nonfederal lands (Table 2.3-5). When sites with at least 5% nonfederal lands are considered, this alternative would provide no support

for 88% (154 of 175) of nonfederal sites in Washington with less than 20% federal habitat and 76% (261 of 342) of nonfederal sites with less than 40% federal habitat.

Alternative 1 would leave unchanged the current forest practices emergency rule (WAC 222-16-010) definition of a status 1 owl site as a reproductive pair. This definition does not currently correspond with the definition used by WDFW and the U.S. Fish and Wildlife Service. For status 1 owl sites, this definition would require that "reproductive activities" be documented at a site for it to be classified as status 1. Under current usage by the WDFW and U.S. Fish and Wildlife Service, status 1 refers to sites at which a resident pair has been confirmed. Under the definitions proposed by Alternative 1, pair sites at which "reproductive activities" had not been documented would not fit into any status category thereby receiving no protection. Additionally, there is no provision in the status 1 definition to include sites at which young-of-the-year birds identifiable as spotted owls are detected, but no adults are detected. Methods for identifying young as spotted owls include blood tests and may include body measurements and other techniques in the future.

The proposed definition for status 3 owl sites, territorial singles, would consider only responses detected during complete surveys. Spontaneous responses, accidental detections, detections during opportunistic visits, or detections on surveys that did not meet protocol would not count towards determining the status of the site. If adopted, this definition would result in the downgrading of some current sites from status 3 to status 4 and prevent recognition of territorial sites discovered in the future that did not receive protocol surveys. The proposed definition would also require that three detections of a single bird be made over one or two years. Current USFWS guidelines allow three detections be recorded in any number of years. This change in definition would result in some currently recognized sites being downgraded to status 4.

Alternative 1 includes two means for reducing restrictions over time at territorial owl sites. The first would allow dropping all restrictions other than maintaining 70 acres around the site center of sites occupied by resident single owls with less than 1,500 acres of suitable habitat, if three years of surveys failed to find evidence that the owl had mated. This would result in the elimination of territorial single (status 3) sites within pair maintenance SOSEAs. The second means would eliminate recognition of a site center if three consecutive years of survey failed to reveal any status 1, 2, or 3 owls "at the site center." Current USFWS guidelines allow that a site be petitioned to be listed as status 5, or historic, if there are no spotted owl or unknown *Strix* species responses within the "take" circle after three years of protocol survey. Because the status definitions under Alternative 1 require multiple responses, Alternative 1 would allow many sites to become historic that would be considered active under U.S. Fish and Wildlife Service guidelines. Under this proposed rule, sites no longer recognized would also no longer require any consideration as spotted owl sites for future logging, road building, or other forest practices.

Analysis: Of the five principal alternatives, Alternative 1 would retain the fewest currently recognized owl sites within SOSEAs and would provide new standards for their elimination. Of the nonfederal sites most vulnerable to degradation or elimination by further logging in Washington (sites with less than 40% federal habitat and at least 5% nonfederal lands) 24% would be supported by this alternative. As a result, potentially 27% of all known territorial spotted owl sites in Washington and 44% of known nonfederal sites could be seriously degraded or eliminated under Alternative 1. The provision for reclassifying status 1, 2, and 3 sites to historic status is less strict than the current standard for "downlisting" territorial sites. This, along with the provision for dropping restrictions at sites occupied by single owls, would additionally result in the loss of protection for some sites within pair maintenance SOSEAs. The omission of owl sites on the Olympic Peninsula, southwest Washington, the Columbia Gorge and the eastern Cascades outside of the I-90 corridor would reduce the viability and distribution of the owl populations in these provinces (see Criterion 4 for further discussion).

■ ALTERNATIVE 2 - TEN LANDSCAPES

Of the 592 known territorial owl sites in Washington that involve nonfederal lands , Alternative 2 would include 119 (20%) sites within demographic support SOSEAs (Table 2.3-1). No sites on the Olympic Peninsula or in the Western Washington Lowlands Province would be included. Also, no sites in the eastern Cascades outside the I-90 corridor would be included. Most sites (53%) included in this alternative have 20-39% federal habitat (Table 2.3-3). Alternative 2 would support 18% of nonfederal sites that currently have less than 20% federal habitat and 25% of nonfederal sites that have less than 40% federal habitat (Table 2.3-3). While only 19% of the sites supported by Alternative 2 have 40% or more federal habitat (Table 2.3-3), 72% of sites supported have 40% or more federal land (Table 2.3-4). Most of the sites included by this alternative involve substantial amounts of federal lands (Table 2.3-4).

Alternative 2 also includes ten sites centered on or surrounded by federal lands designated as matrix. Although located in areas where programmed timber harvest is allowed on federal lands, the centers of some of these sites are located immediately adjacent to reserved federal lands. Federal lands may be managed consistent with owl retention at an unknown number of these sites.

Alternative 2 would offer no support to 473 (80% of) territorial owl sites in Washington involving nonfederal lands (Table 2.3-5). When sites with at least 5% nonfederal lands are considered, this alternative would provide no support for 81% (142 of 175) of nonfederal sites in Washington with less than 20% federal habitat and 72% (247 of 342) of nonfederal sites with less than 40% federal habitat.

Alternative 2 would leave unchanged the current forest practices emergency rule (WAC 222-16-010) definition of a status 1 owl site as a reproductive pair. This definition does not currently correspond with the definition used by WDFW and the U.S. Fish and Wildlife Service. For status 1 owl sites, this definition would require that "reproductive activities" be documented at a site

for it to be classified as status 1. Under current usage by the WDFW and U.S. Fish and Wildlife, status 1 refers to sites at which a resident pair has been confirmed. Under the definitions proposed by Alternative 2, pair sites at which "reproductive activities" had not been documented would not fit into any status category thereby receiving no protection. Additionally, there is no provision in the status 1 definition to include sites at which young-of-the-year birds identifiable as spotted owls are detected, but no adults are detected. Methods for identifying young as spotted owls include blood tests and may include body measurements and other techniques in the future.

Analysis: Alternative 2 would include within demographic support SOSEAs 14 more owl sites than Alternative 1. Of the nonfederal sites most vulnerable to degradation or elimination by further logging in Washington (sites with less than 40% federal habitat and at least 5% nonfederal lands) 28% would be supported by this alternative. As a result, potentially 25% of all known territorial spotted owl sites in Washington and 42% of known nonfederal sites could be seriously degraded or eliminated under Alternative 2. Not including owl sites on the Olympic Peninsula, southwest Washington, the Columbia Gorge, and the eastern Cascades outside of the I-90 corridor would reduce the viability and distribution of the owl populations in these provinces. (See Criterion 4 for further discussion.)

■ ALTERNATIVE 3 - FIFTEEN LANDSCAPES

Of the 592 known territorial owl sites in Washington involving nonfederal lands, Alternative 3 would include 218 (37%) sites within demographic support and species distribution SOSEAs (Table 2.3-1). This total includes 34 sites on the Olympic Peninsula, nearly all of which are centered on and include predominantly nonfederal lands. Twelve sites in southwest Washington would be included within a single SOSEA. In the eastern Cascades, 101 (50%) sites would be included in demographic support SOSEAs; approximately one-third of these sites would be within Chelan County.

Most sites (84%) included in this alternative have less than 40% federal habitat (Table 2.3-3). Alternative 3 would support 55% of nonfederal sites that currently have less than 20% federal habitat and 48% of nonfederal sites that have less than 40% federal habitat (Table 2.3-3). While only 15% of the sites supported by Alternative 3 have 40% or more federal habitat (Table 2.3-3), 56% of sites supported have 40% or more federal land (Table 2.3-4). Many sites included by this alternative involve largely nonfederal lands (Table 2.3-4).

Alternative 3 also includes 18 sites centered on or surrounded by federal lands designated as matrix. Although located in areas where programmed timber harvest is allowed on federal lands, the centers of some of these sites are located immediately adjacent to reserved federal lands. Federal lands may be managed consistent with owl retention at an unknown number of these sites.

Alternative 3 would offer no support to 374 (63%) territorial owl sites outside SOSEAs in Washington involving nonfederal lands (Table 2.3-5). When sites with at least 5% nonfederal lands are considered, this alternative would provide

no support for 43% (76 of 175) of nonfederal sites in Washington with less than 20% federal habitat and 47% (160 of 342) of nonfederal sites with less than 40% federal habitat.

Alternative 3 would leave unchanged the current forest practices emergency rule (WAC 222-16-010) definition of a status 1 owl site as a reproductive pair. This definition does not currently correspond with the definition used by WDFW and the U.S. Fish and Wildlife Service. For status 1 owl sites, this definition would require that "reproductive activities" be documented at a site for it to be classified as status 1. Under current usage by the WDFW and U.S. Fish and Wildlife Service, status 1 refers to sites at which a resident pair has been confirmed. Under the definitions proposed by Alternative 1, pair sites at which "reproductive activities" had not been documented would not fit into any status category thereby receiving no protection. Additionally, there is no provision in the status 1 definition to include sites at which young-of-the-year birds identifiable as spotted owls are detected, but no adults are detected. Methods for identifying young as spotted owls include blood tests and may include body measurements and other techniques in the future.

Analysis: Alternative 3 would include approximately twice as many sites within demographic support SOSEAs as would be included by Alternative 1 or 2. It would include owl sites on the Olympic Peninsula and in the eastern Cascades outside the I-90 corridor; Alternatives 1 and 2 do not include any sites in these areas. It is the only alternative that would include owl sites in the Western Washington Lowlands Province. The inclusion of owl sites in these areas may help prevent further reductions in the viability and distribution of the owl populations in these provinces. (See Criterion 4 for further discussion.) Despite the high numbers of owl sites included within SOSEAs, the effectiveness of this alternative would be significantly enhanced if sites overlapping SOSEAs but centered on reserved federal lands outside SOSEAs were also supported. Of the nonfederal sites most vulnerable to degradation or elimination by further logging in Washington (sites with less than 40% federal habitat and at least 5% nonfederal lands) 53% would be supported by this alternative. As a result, potentially 16% of all known territorial spotted owl sites in Washington and 27% of known nonfederal sites could be seriously degraded or eliminated under Alternative 3.

■ ALTERNATIVE 4 - TFW PROPOSAL

Of the 592 known territorial owl sites in Washington involving nonfederal lands, Alternative 4 would include 254 (43%) sites within demographic support and combination function SOSEAs (Table 2.3-1). This total includes 52 sites on the Olympic Peninsula, many of which are centered on and include predominantly nonfederal lands. In the eastern Cascades, 108 (56%) sites would be included in demographic support or combination function SOSEAs. Alternative 4 would protect greater numbers of owl sites than Alternative 3 due to the protection of sites centered on federal lands outside of SOSEAs but whose circles overlap nonfederal lands within the SOSEAs.

Most sites (72%) included in this alternative have less than 40% federal habitat (Table 2.3-3). Alternative 4 would support 43% of nonfederal sites that currently have less than 20% federal habitat and 48% of nonfederal sites that have less than 40% federal habitat (Table 2.3-3). While only 28% of the sites supported by Alternative 4 have 40% or more federal habitat (Table 2.3-3), 67% of sites supported have 40% or more federal land (Table 2.3-4). Many sites included by this alternative involve largely nonfederal lands.

Alternative 4 includes 87 sites within areas that are to provide a "combination of dispersal support and demographic support." In these areas "a variety of habitat conditions should be provided which in total are more than dispersal support and less than demographic support." These areas are also to provide "some opportunities for nesting," but it is unclear whether the current numbers of existing sites will be supported and to what extent they will be supported. These areas include all sites in the Columbia Gorge, White Salmon and Mineral Block/Link SOSEAs and some sites within the I-90 East, Finney Block and Hoh-Clearwater SOSEAs. Consequently, it is unclear how many of these sites would be retained as functional owl sites in the future. If the 87 sites in combination function areas would not be supported as territorial sites, a total of 167 sites (28%) would remain within demographic support SOSEAs. Twenty-one percent of nonfederal sites that currently have less than 20% federal habitat and 31% of nonfederal sites that have less than 40% federal habitat would be supported. If sites within combination function areas were allowed to be eliminated without replacement by other sites in the landscape, the conservation contribution of this alternative would be substantially reduced.

Alternative 4 also includes 15 sites centered on or surrounded by federal lands designated as matrix. Although located in areas where programmed timber harvest is allowed on federal lands, the centers of some of these sites are located immediately adjacent to reserved federal lands. Federal lands may be managed consistent with owl retention at an unknown number of these sites.

Alternative 4 would offer no support to 338 territorial owl sites outside of SOSEAs in Washington involving nonfederal lands, comprising 57% of nonfederal sites (Table 2.3-5). When sites with at least 5% nonfederal lands are considered, this alternative would provide no support for 54% (95 of 175) of nonfederal sites in Washington with less than 20% federal habitat and 47% (162 of 342) of nonfederal sites with less than 40% federal habitat.

Alternative 4 proposes a status 1 definition consistent with that currently in use by the WDFW and the U.S. Fish and Wildlife Service. However, there is no provision in the status 1 definition to include sites at which young identifiable as spotted owls, but no adults are detected. Methods for identifying young-of-the-year birds as spotted owls include blood tests and may include body measurements and other techniques in the future.

Analysis: Alternative 4 would protect from 35 to 149 more sites than Alternatives 1, 2 and 3. It would include owl sites on the Olympic Peninsula and in the eastern Cascades outside the I-90 corridor. The inclusion of

additional owl sites in these areas may help prevent further reductions in the viability and distribution of the owl populations in these provinces. (See Criterion 4 for further discussion.) No sites, however, would be protected within southwest Washington. Of the nonfederal sites most vulnerable to degradation or elimination by further logging in Washington (sites with less than 40% federal habitat and at least 5% nonfederal lands) 53% would be supported by this alternative. As a result, potentially 17% of all known territorial spotted owl sites in Washington and 27% of known nonfederal sites could be seriously degraded or eliminated under Alternative 4. This alternative, however, would support 12% fewer sites with less than 20% habitat than Alternative 3. The conservation value of this alternative would be greatly reduced if sites within combination function areas were not maintained as functioning territorial sites. Combination function areas include all owl sites within the Columbia Gorge, White Salmon and Mineral Block/Link SOSEAs.

■ ALTERNATIVE 5 - PROPOSED 4(d) RULE

Of the 592 known territorial owl sites in Washington involving nonfederal lands, Alternative 5 would include 246 (42%) sites within demographic support SEAs (Table 2.3-1). This total includes 53 sites on the Olympic Peninsula, many of which are centered on and include predominantly nonfederal lands. In the eastern Cascades, 89 (44%) sites would be included in demographic support SEAs. Alternative 5 would protect greater numbers of owl sites with fewer special emphasis areas (SEAs) than Alternative 3 due to the protection of sites centered on federal lands outside of SEAs but whose circles overlap nonfederal lands within the SEAs. Alternative 5 would offer no protection to owl sites centered on federal lands designated as matrix or owl sites centered on nonfederal lands surrounded by matrix. This alternative may also protect some owl sites centered on reserved federal lands but whose "shadow" or circle extends onto nonfederal lands outside of designated SEAs. These "shadow" sites are to be reviewed on a case-by-case basis over the next two years. Consequently, the actual number of sites this alternative would support is unknown.

Of the sites that would be supported by SEAs, most (73%) have less than 40% federal habitat (Table 2.3-3). Alternative 4 would support 47% of nonfederal sites that currently have less than 20% federal habitat and 47% of nonfederal sites that have less than 40% federal habitat (Table 2.3-3). While only 27% of the sites supported by Alternative 4 have 40% or more federal habitat (Table 2.3-3), 62% of sites supported have 40% or more federal land (Table 2.3-4). Many sites included by this alternative involve largely nonfederal lands.

If no shadow sites were supported, Alternative 5 would offer no support to 346 (58%) territorial owl sites outside SEAs in Washington involving nonfederal lands (Table 2.3-5). When sites with at least 5% nonfederal lands are considered, this alternative would provide no support for 51% (90 of 175) of nonfederal sites in Washington with less than 20% federal habitat and 48% (165 of 342) of nonfederal sites with less than 40% federal habitat.

Alternative 5 does not propose definitions for owl site center status categories.

Analysis: Alternative 5 would protect from 27 to 141 more sites than Alternatives 1, 2 and 3, and similar numbers of sites as Alternative 4. It would include owl sites on the Olympic Peninsula and in the eastern Cascades outside the I-90 corridor. The inclusion of owl sites in these areas may help prevent further reductions in the viability and distribution of the owl populations in these provinces. (See Criterion 4 for further discussion.) Additionally, some shadow owls may also be supported outside of SEAs. Owl sites in southwest Washington, however, would not be protected. Of the nonfederal sites most vulnerable to degradation or elimination by further logging in Washington (sites with less than 40% federal habitat and at least 5% nonfederal lands) 52% would be supported by this alternative. As a result, potentially 17% of all known territorial spotted owl sites in Washington and 28% of known nonfederal sites could be seriously degraded or eliminated under Alternative 4. This alternative, however, would support 8% fewer sites with less than 20% habitat than Alternative 3.

■ ALTERNATIVE 6 - NO ACTION

None of the 592 known territorial owl sites in Washington involving nonfederal lands would be supported under this alternative. Owl sites with little federal habitat would be particularly vulnerable to significant degradation or elimination. It is likely that nearly all nonfederal owl sites heavily dependent on nonfederal lands would be eliminated.

Analysis: Alternative 6 would provide no further contribution to spotted owl viability in the state of Washington. The reduction of owl numbers under this alternative could reduce the viability of the Washington owl population from that at present.

Synopsis of Criterion 1

Alternatives 3, 4 and 5 would support roughly twice as many or more owl sites as Alternatives 1 and 2 (Table 2.3-1). Alternatives 4 and 5 would support the greatest number of sites; these alternatives would support many of the same owl sites and roughly the same number of sites. Only Alternatives 4 and 5 would support owl sites centered on federal lands that overlap SOSEAs.

Approximately a quarter of the nonfederal sites most vulnerable to degradation or elimination by further logging (those sites with less than 40% federal habitat and at least 5% nonfederal land) would be supported by Alternatives 1 and 2 (Table 2.3-6). Alternatives 3, 4 and 5 would support about half of the nonfederal sites with less than 40% federal habitat. Alternative 3 would support the greatest percentage of nonfederal sites with less than 20% federal habitat (57%), while Alternatives 1 and 2 would support 12% and 19% of these sites respectively (Table 2.3-6). When the percentage of federal habitat is examined at the sites that would not be supported by each alternative, potentially 42-44% of all nonfederal sites in Washington could be seriously degraded or eliminated under Alternatives 1 and 2. Potentially a little more than a quarter of all nonfederal sites could be seriously degraded or eliminated under Alternatives 3, 4 and 5.

Alternatives 1 and 2 would support no owl sites on the Olympic Peninsula, southwest Washington, Columbia Gorge, Finney, Entiat Ridge, North Blewett and White Salmon areas. Alternative 3 would include sites in all these areas, while Alternative 4 would include sites in all these areas except southwest Washington. Alternative 5 would omit owl sites in the Entiat Ridge area and southwest Washington.

Alternatives 1, 2, 3 and 4 each propose owl site status definitions. Status 1 definitions in Alternatives 1, 2 and 3 and the status 3 definition in Alternative 1 would require DNR to classify owl sites differently than how they are currently classified by WDFW and the U.S. Fish and Wildlife Service. This would lead to dropping protection on many current pair sites and the reclassifying of some currently recognized territorial sites to non-territorial sites. Alternative 4 proposes language that is the same as the language currently being used by the USFWS and WDFW. Alternative 5 does not propose status definitions. Alternative 1 would also provide new mechanisms for downlisting territorial owl sites that would result in elimination of some current owl sites.

Table 2.3-6

Percentages of nonfederal owl sites with less than 20% and 40% federal habitat and at least 5% nonfederal lands that are supported and not included by each rule alternative.

	Percentage of Sites Supported		Percentage of Sites Not Included	
	<20% Fed. Hab.	<40% Fed. Hab.	<20% Fed. Hab.	<40% Fed. Hab.
Alternative 1	12	24	88	76
Alternative 2	19	28	81	72
Alternative 3	57	53	43	47
Alternative 4	46	53	54	47
Alternative 5	49	52	51	48

Criterion 2: Dispersal habitat provided.

Information Relative to All Alternatives

The discussion for each principal alternative covers three topics. The first is the definition of dispersal habitat, the second is the amount and distribution of habitat required in dispersal landscapes. The third is the landowner management activities permitted, including site-specific management plans developed by landowners, exemptions for timber harvest, and restrictions on operations, and how these activities may affect the provision of dispersal habitat. The analysis of each alternative is based heavily on material within the "Dispersal" and "Dispersal Habitat" sections of the Affected Environment.

To evaluate whether landscapes would have a reasonable likelihood of providing for effective dispersal, five criteria should be considered: (1) the extent to which dispersal habitat is spread throughout the landscape and not limited to owl sites, corridors, or a small subset of the landscape; (2) the proportion of the landscape in roosting and foraging habitat; (3) the presence or absence of directional passage barriers resulting from large areas with little or no habitat; (4) the degree to which definitions for future habitat stands focus on providing components important to supporting small mammal populations; and (5) the proportion of the landscape covered by roosting and foraging and dispersal quality habitat.

Dispersal habitat can be defined as that which provides for foraging, roosting and protection from predators during disperal by owls. Forest habitats that provide cover from owls predators while also allowing efficient movement, but which provide few foraging and roosting opportunities will be of less value to dispersing owls. Additionally, these "travel" habitats are less well defined by research. Although every "dispersal" stand need not support roosting and foraging, areas that provide for foraging and roosting should be distributed throughout the dispersal landscape.

The proportion of the landscape covered by dispersal stands in two recent dispersal plans would provide at least 43% and 50% of the forest land area within dispersal landscapes in western Washington and the eastern Cascades respectively (Beak Consultants Inc. 1993, Thomas et al. 1990). The proportion of dispersal habitat in dispersal landscapes under the rule alternatives will be evaluated against these standards.

■ ALTERNATIVE 1 - SIX LANDSCAPES

Alternative 1 does not provide minimum stand definitions of dispersal habitat; instead, average stand conditions are presented. Under Alternative 1, the average dispersal stand in western Washington must have at least 70 square feet of basal area of trees that are at least 10 inches diameter at breast height (dbh); at least 70% of these trees must be conifers. This approximates the tree size and density standards of the Murray Pacific HCP. Inclusion of a minimum basal area standard without including a standard for total canopy cover could allow the dominant-codominant trees to be thinned to lower densities as the trees grow larger. Without a total canopy cover standard some stands may be thinned to levels that provide little protection for travelling owls.

In the eastern Cascades, stands under Alternative 1 would average between 50 - 200 dominant and codominant trees per acre with an average size of 6 inches dbh in even-aged stands. In uneven-aged stands, these standards would apply to all trees at least 4 inches dbh. At least 70% of the trees must be conifers. Again, without a standard for total canopy cover, this definition could allow open, poorly developed stands of small trees to be labeled dispersal habitat.

Alternative 1 includes standards for dispersal habitat in the eastern Cascades but no dispersal landscapes are proposed for this province.

The dispersal habitat definitions in this alternative also include no provisions for retaining and developing snags, residual live trees, coarse woody debris, and shrubs. Snags, live cavity trees, coarse woody debris and shrubs are important indicators of conditions that may support high densities of owl prey (Carey 1995, Carey et al. in prep., Carey and Johnson 1995, USDI 1992). The habitat definitions proposed in this alternative could result in widespread development and maintenance of low quality dispersal habitat ("travel" habitat) with low prey populations for the future. Since the standards proposed by this alternative are average definitions, any single stand of "dispersal habitat" may be of substantially lower quality than the average. Alternative 1 does not establish a lower limit to what can be labeled dispersal habitat.

Alternative 1 requires that dispersal habitat be provided only within 1.8 miles of status 1, 2, and 3 site centers that occur within dispersal SOSEAs. Dispersal habitat need not be provided throughout the SOSEA. Within each owl circle, dispersal habitat must be provided only on those lands that fall within the same watershed administrative unit (WAU) as the site center and within the SOSEA. Since WAUs generally range from about 5,000 to 50,000 acres, portions of an unknown number of owl circles extend beyond the WAU border. At the site center, 70 acres of suitable habitat must be retained.

Alternative 1 provides incomplete descriptions of the amount and distribution of dispersal habitat at owl sites for the western and eastern Cascades. For the eastern Cascades, dispersal stands would average at least 40 acres (5 acres minimum stand size), and "a minimum of 25% of the landowner's forest land with a site index of 80 or greater (base age 50) shall be in stands of dispersal habitat". The proportion of an area that meets the site index standard will be variable. If all lands within an owl circle have a site index of at least 80, this rule would require a maximum of 25% of the lands within the owl circle to be retained as dispersal habitat. However, if only 25% of the lands in the owl circle have a site index of at least 80, then only 6% of the lands within the circle would be retained as dispersal habitat. Under this alternative, if all lands within an owl circle met the site index standard, the provision of dispersal habitat would not meet the recommendations for dispersal habitat; if little of the land met the site index standard, the habitat contribution would be even further reduced. No spacing criteria for individual stands are provided.

For the western Cascades, the criteria for the amount and distribution of dispersal habitat to be provided are that stands would average at least 40 acres (5 acres minimum stand size) and that the average distance between dispersal stands not exceed 0.5 mile. No criterion for the minimum proportion of the area to be retained as dispersal habitat is provided. But if square 40 acre stands were spaced 0.5 mile apart on a grid across the owl circle, the proportion of the owl circle occupied by dispersal habitat would be 11%. However, there is no language requiring that dispersal stands be spread throughout an ownership or owl circle. Therefore, if stands were irregularly spaced, the proportion of the owl circle covered by dispersal stands could be less than 11%.

Individual landowners whose lands fall within the portion of an owl circle that is to provide dispersal habitat would be encouraged to develop a local option plan (LOP). LOPs are intended to benefit the landowner by allowing flexibility in management actions and by facilitating the forest practice application process. The LOP may include either a "dispersal habitat plan", which generally follows the provisions outlined above, or the landowner may submit "site center management plans", which are more stringent and discussed below under Criterion 3. A LOP may "provide for harvesting to continue prior to and after achieving the goal set forth above" because dispersal habitat may be developed over time. No limit is specified for the amount of habitat that may be in transition at any time while additional harvesting is occurring. With this provision, it is possible that a full complement of dispersal habitat may never exist at one time at some owl sites.

With a LOP, a landowner would also be allowed to develop a plan "tailored to the specific circumstances" of the particular site. Plans may also include "elements of operational research and adaptive management opportunities". However, no further elaboration on these topics is provided in the rule language. If research is being proposed, there is no provision for qualified scientists to review the proposed plans; however, DNR would have final review and approval authority. Given the lack of guidance provided, it is impossible to gauge how often these provisions would result in effective dispersal landscapes, experimentation, and adaptive management.

Without regard to a LOP, all individual landowners may clearcut annually up to ten acres of any forest beyond 0.7 mile of an owl site center. There is no limit to the number of years this can be repeated.

Table 2.3-7 presents the number of existing status 1, 2, and 3 sites and the total area in each of the three SOSEAs whose sole function is dispersal. Using these numbers and the percentages given above, the proportion of each SOSEA that would be retained as dispersal habitat can be approximated. As presented, this alternative would require a maximum of between 0.2% and 3.0% of the three dispersal SOSEAs be retained as dispersal habitat (Table 2.3-7). If this alternative is implemented, the actual proportion of each landscape covered by dispersal habitat could be less due to ambiguity in distribution criteria for the western Cascades, language requiring habitat be provided only in the portion an owl circle which is within the WAU containing the site center, and the unlimited allowance for existing dispersal habitat to be cut before other habitat is regrown. Additional undiscovered owl sites would likely have little effect on the habitat proportions in Table 2.3-7, since territorial sites discovered after a LOP has been approved will not be considered in future management. The only restrictions for such sites is that the 70 acres around the center of activity cannot be cut during the breeding season (March 1 to July 31).

Table 2.3-7

Numbers of status 1, 2, and 3 owl sites, total area, and the maximum proportion of each dispersal SOSEA likely to be retained as dispersal habitat under Alternative 1.

SOSEA	Number of Owl Sites	Total Area of SOSEA (acres)	% of Area as Dispersal Habitat[a]
Columbia Gorge	8	83,987[b]	3.0[c]
Mineral Link	3	190,202	0.7
Finney Block	2	259,910[b]	0.2[c]

[a] These proportions should be considered theoretical maximums. If implemented, the actual proportions would likely be less; see text for explanation.
[b] Includes only nonfederal lands; does not include federal lands in SOSEA boundaries.
[c] These percentages represent the proportion of nonfederal lands that would be required to meet dispersal habitat targets.

Analysis: This alternative would allow the loss of owls within and overlapping dispersal SOSEAs in exchange for providing small amounts of low-quality dispersal habitat within 1.8 miles of owl site centers. This alternative would allow low proportions of travel quality dispersal habitat be maintained in small areas of the dispersal landscapes. There are no provisions for retaining suitable habitat in dispersal landscapes. Under worst case conditions, the standards could result in forest landscapes with little potential to support small mammal prey for owls. It is possible that most of the area of the SOSEAs could be largely devoid of dispersal habitat and meet the stated requirements. This alternative would provide less favorable habitat conditions for dispersing owls than the 50-11-40 rule of the ISC plan (Thomas et al. 1990), the riparian reserve strategy of the Northwest Forest Plan (USDA 1994), or the Murray Pacific HCP (Beak Consultants, Inc. 1993). It is unlikely that this rule would allow for consistent successful dispersal through the three dispersal landscapes.

■ ALTERNATIVE 2 - TEN LANDSCAPES

The minimum definition of dispersal habitat for the western Cascades approximates the Murray Pacific definition except that the requirement for snags is replaced by three wildlife reserve trees per acre and there is no size specification for leave trees, snags and canopy lift. For the eastern Cascades, the minimum definition of dispersal habitat would require 50 to 200 trees per acre with an average of at least 6 inches dbh (or 4 inches dbh in uneven-aged stands) and at least 50% canopy cover. Dominant and codominant trees must average at least 65 feet in height. The definition also would provide for two residual live trees that are dominant or codominant and two wildlife reserve trees per acre that are at least 10 feet high and 10 inches dbh.

The inclusion of canopy cover and tree height provisions in these definitions adds certainty that stands meeting the definitions will provide at least a minimum level of utility as travel quality habitat. However, the low densities

and qualities of snags, residual trees, and coarse woody debris included in these definitions may result in low quality dispersal stands ("travel" habitat) with low small mammal densities. Shrubs are important components of dispersal habitat; however, shrubs are not included in the definitions included in this alternative.

This alternative would require that dispersal habitat be provided only within 2.0 miles in the western Cascades (1.8 miles in eastern Cascades) of status 1, 2, and 3 site centers that occur within dispersal SOSEAs. Dispersal habitat need not be provided throughout the SOSEA. Within each owl circle, dispersal habitat must be provided only on those lands that fall in the same WAU as the site center and within the SOSEA. Since WAUs generally range from 5,000 to 50,000 acres, portions of an unknown number of owl circles extend beyond the WAU border. At the site center, 70 acres of the best habitat must be retained. This alternative provides incomplete descriptions, identical to those of Alternative 1, for the amount and distribution of dispersal habitat at owl sites for the western and eastern Cascades. (See the discussion for Alternative 1 above.)

Individual landowners whose lands fall within the portion of an owl circle that is to provide dispersal habitat may develop a landowner option plan (LOP). LOPs are intended to benefit the landowner by allowing flexibility in management actions and by facilitating the forest practice application process. With a LOP, landowners would be allowed to continue harvesting habitat beyond the amount and spacing criteria outlined above if the plan has some provision to "develop [dispersal] habitat over time". No limit is specified for the amount of habitat that could be in transition at any time. With this provision, it is possible that a full complement of dispersal habitat may never exist at one time at some owl sites.

With LOPs, landowners could follow the prescriptions outlined above or develop site-specific habitat definitions and carry out management actions that do not meet the criteria outlined above. If the potential risk of these management actions is "relatively high", landowners may treat the actions as "designed experimentation". The language of Alternative 2 would give landowners unspecified latitude in providing alternative habitat definitions, in "experimentation", and in the level of risk to owls that may be taken in management plans. Additionally, it is unspecified whether qualified scientists, outside of the DNR, would review the proposed experimentation. Given the lack of guidance provided, it is impossible to gauge how often these provisions would result in effective dispersal landscapes, experimentation and adaptive management.

Table 2.3-8 presents the number of existing status 1, 2, and 3 sites and the total area of each of the five SOSEAs whose sole function is dispersal. Using the numbers and the percentages given above, the maximum proportion of each SOSEA that would be retained as dispersal habitat can be approximated. As presented, this alternative would require a maximum of between 0.3% and 12.3% of the five dispersal SOSEAs be retained as dispersal habitat.

If this alternative were implemented, the actual proportion of each landscape covered by dispersal habitat could be less than the values presented in Table 2.3-8 due to the ambiguity in distribution criteria for the western Cascades, uncertainty in the eastern Cascades SOSEAs as to how much land within owl circles would meet the site index standard, and the unlimited allowance for existing dispersal habitat to be cut before other habitat is regrown. If additional owl sites are discovered in the future, providing dispersal habitat for these sites would increase the proportion of habitat within the SOSEAs. However, it is unlikely that this would result in a substantial increase for any of the SOSEAs because there will probably be relatively few additional sites discovered, at least in the near term because most of the habitat within the most of the SOSEAs has been surveyed.

Table 2.3-8

Numbers of status 1, 2, and 3 owl sites, total area, and the proportion of each dispersal SOSEA likely to be retained as dispersal habitat under Alternative 2.

SOSEA	Number of Owl Sites	Total Area of SOSEA (acres)	% of Area as Dispersal Habitat[a]
Columbia Gorge	8	185,327	1.4
White Salmon	7	73,180	8.0[b]
Mineral Link	3	190,202	0.7
Easton	5	44,797	12.3[b]
Finney Block	2	231,613	0.3

[a] These proportions should be considered maximums. If implemented, the actual proportions permissible would likely be less; see text for explanation.
[b] These numbers assume that all land within owl circles have a site index of at least 80. If some lands within these circles had lower site indices, the percentage of the landscape retained as dispersal habitat would be less.

Analysis: This alternative would allow the loss of owl sites within and overlapping dispersal SOSEAs in exchange for providing small amounts of low-quality dispersal habitat within 1.8 miles of owl site centers. This alternative would allow low proportions of travel quality dispersal habitat to be maintained only in owl circles within dispersal SOSEAs. Although the habitat definitions are more likely than those of Alternative 1 to provide functional travel habitat, the standards could result in forest landscapes with little potential to support small mammal prey for owls. Additionally, there are no provisions for retaining NRF habitat in dispersal landscapes. It is possible that most of the area of the SOSEAs could be largely devoid of dispersal habitat and meet the stated requirements. This alternative would provide less favorable habitat conditions for dispersing owls than the 50-11-40 rule of the ISC plan (Thomas et al. 1990), the riparian reserve strategy of the Northwest Forest Plan (USDA 1994), or the Murray Pacific HCP (Beak Consultants, Inc. 1993). It is unlikely that this rule would allow for consistent successful dispersal through the six dispersal landscapes.

■ ALTERNATIVE 3 - FIFTEEN LANDSCAPES

Dispersal habitat is left undefined in this alternative. The amounts and arrangement required within dispersal SOSEAs are also unspecified. These are left to future decisions by the Forest Practices Board. Because these are unspecified, it is impossible to determine the effects this alternative would have on owl dispersal.

■ ALTERNATIVE 4 - TFW PROPOSAL

In western Washington, dispersal stands would be at least five acres in size and have at least 70% canopy cover with 70% of the canopy in conifer species greater than 6 inches dbh. At least 130 trees per acre that are at least 10 inches dbh or a basal area of 100 square feet per acre of 10 inch dbh or larger trees would be required. Stands must also have a total tree density of 300 trees per acre or less, and at least 20 feet between the top of the understory vegetation and the bottom of the canopy that is relatively clear of dead limbs. This is similar to the Murray Pacific HCP standard, except the basal area is greater and there are no provisions for snags, green recruitment trees, or logs in this definition.

In eastern Washington, dispersal stands would be at least five acres in size with at least 50% canopy closure. At least 50 conifer trees per acre that average 65 feet tall with a dbh of 6 inches or more in even-aged stands or 4 inches dbh in uneven-aged stands would be required. Stands must have a total tree density of 200 trees per acre or less, and at least 20 feet between the top of the understory vegetation and the bottom of the canopy that is relatively clear of dead limbs. Alternatively, stands could have a quadratic mean diameter of 9 inches or more with a relative density of 33 or at least 55% canopy closure.

The inclusion of canopy cover and tree height provisions in these definitions adds certainty that stands meeting the definitions will at least provide travel quality dispersal habitat. For western Washington stands, the alternative requirement of a basal area of 100 square feet per acre will prevent stands from having their dominant/codominant trees thinned to marginal densities as they grow larger. However, these definitions provide no criteria for snags, residual live trees, coarse woody debris and shrubs. These stands would still need to meet current forest practice regulations that will retain some snags, residual live trees and coarse woody debris. This, however, may still result in relatively low densities and qualities of snags, residual trees, and coarse woody debris and thus, low small mammal densities.

Alternative 4 provides no discussion of the amount or distribution of dispersal habitat that would be required. It does, however, state that dispersal landscapes will have dispersal quality habitat as defined above, interspersed with areas of higher quality habitat, such as suitable spotted owl habitat, although the amounts and distribution of suitable spotted owl habitat required are not discussed.

Landowners with lands in a dispersal SOSEA may support current and future territorial owl sites that overlap or are centered on their lands, or they may develop a LOP. To be approved, LOPs must contribute to meeting the goals of the SOSEA. Landowners in a dispersal SOSEA not impacted by a current owl site may do a cooperative habitat enhancement agreement (CHEA). CHEAs apply only to lands within SOSEAs that are outside of territorial owl circles. CHEAs may meet a lower standard than LOPs; they will be approved if they provide some benefit to spotted owl habitat over what would occur without the plan. CHEAs are not required to contribute to meeting the goals of the SOSEA; it is not clear if a CHEA may be used as mitigation for a LOP.

Analysis: This alternative lacks standards for the amount and distribution of dispersal habitat required within SOSEAs. Although this alternative calls for suitable spotted owl habitat to be interspersed through the landscapes with dispersal quality habitat, no criteria for the amount, distribution, and quality are provided. Lacking these standards it is impossible to assess whether this alternative would provide effective dispersal landscapes. Habitat definitions in this alternative provide the greatest certainty among the six alternatives that forest stands meeting the definitions would consistently provide travel quality dispersal habitat. However, no standards are provided for snags, residual trees, coarse woody debris and shrubs. This could result in forests with little potential to support small mammal prey populations for owls. Ambiguity in the language for CHEAs and LOPs may undercut SOSEA goals if CHEAs are allowed to be used as mitigation in LOPs.

■ ALTERNATIVE 5 - PROPOSED 4(d) RULE

In western Washington, dispersal habitat would include coniferous or mixed coniferous/hardwood stands with total canopy cover greater than 60%. Stands should also have multiple canopy layers and multiple overstory conifers greater than 10 inches dbh. In eastern Washington, dispersal habitat would include coniferous stands with greater than 20% fir trees and total canopy trees greater than 11 inches dbh. Because tree height and density standards are not provided in either definition, it is unknown how often these definitions would result in functional travel quality habitat. Additionally, there are no criteria for providing snags, residual live trees, coarse woody debris, and shrubs. Consequently, these definitions could result in forests with little potential to support small mammal prey for owls.

Alternative 5 does not propose landscape prescriptions for dispersal habitat, nor does it identify areas where dispersal habitat is needed to meet conservation objectives. In areas where dispersal habitat is needed, this alternative would rely on protection against incidental take, large-scale habitat conservation planning, local option conservation plans (LOCPs) or voluntary conservation contributions by nonfederal landowners to provide habitat over time. LOCPs could allow incidental take of spotted owls in exchange for growing or maintaining dispersal habitat within the SEA, except in portions of the SEA required for demographic support of federal owl reserves. However, the portions of SEAs in which demographic support would be required are not

identified. Therefore, it is unknown as to what areas dispersal habitat would be provided. LOCPs would be limited to landowners with 80-5,000 acres of forest land within a SEA. Presumably, HCPs and LOCPs would provide dispersal habitat on lands throughout the SEA, not just within owl circles.

Analysis: Alternative 5 provides few standards for providing effective dispersal landscapes other than acknowledging that dispersal habitat is needed in some areas to meet conservation objectives. These areas, however, are unspecified. It is unknown how often the proposed habitat definitions would lead to stands suitable for travel by spotted owls because tree height and density standards are unspecified. The omission of standards for snags, residual trees, coarse woody debris and shrubs could result in forests with little potential to support small mammal populations and little potential to provide anything but the lowest quality dispersal habitat. Because so little guidance is provided, it is impossible to determine if Alternative 5 would provide any assurance that necessary habitat required for consistent, successful dispersal is maintained.

■ ALTERNATIVE 6 - NO ACTION

Under Alternative 6 no dispersal habitat would be required on nonfederal lands in Washington outside of areas identified in approved HCPs. Any dispersal habitat that did occur would result from current state forest practice regulations, federal HCPs, or voluntary contributions. The amount, location and quality of dispersal habitat that might result from these mechanisms is unknown.

Analysis: Alternative 6 would provide no additional contribution to spotted owl viability in the state of Washington. Alternative 6 would provide no assurance that current levels of dispersal habitat would be maintained or increased where needed, thus there is no certainty that effective dispersal landscapes would be provided.

Criterion 3: Affects on habitat in SOSEAs designated for demographic support or pair maintenance.

Information Relative to All Alternatives

In this section, the likelihood that habitat adequate to support reproductively viable pairs at owl sites within SOSEAs is assessed for each alternative. To be reproductively viable, sites should be capable of supporting pair occupancy rates and reproductive rates high enough for owls to replace themselves in the population.

The SAG report (Hanson et al. 1993) includes the most comprehensive synthesis of owl habitat use studies in Washington. The SAG synthesized data to produce qualitative and quantitative descriptions of habitats used by spotted owls for nesting, roosting, and foraging. This report provides the best existing

definitions of suitable habitat for western and eastern Washington. Consequently, it is used as the standard against which habitat descriptions in the alternatives are compared.

Opinions 1 and 2 of the SAG (Hanson et al. 1993) agreed that habitat closest to the site center is the most heavily used and therefore the most important. Both opinions recommended protecting all nesting, roosting, and foraging habitat within 0.7 mile of the site center.

The Federal Draft Recover Plan (FDRP) (USDI 1992b) and opinion 1 of the SAG (Hanson et al. 1993) recommend that supplemental pair areas on nonfederal lands provide amounts of owl habitat equal to the median amount of habitat found in annual home ranges of pairs within the province. The habitat should be provided within an area equal to the median home range size of pairs in the province. However, it is unknown whether habitat conditions at the owl sites studied in Washington were sufficient to support resident owls at demographic rates that allowed replacement. If all sites studied supported owls at replacement demographic rates (net reproductive rate R_0=1) then providing median amounts of habitat at owl sites may be adequate for half of the sites, assuming the sites studied were representative of the sites to be managed in the population. If however, some sites studied supported net reproductive rates of less than one, while the others had net reproductive rates equal to one, then providing median amounts of habitat at all sites may not be sufficient to support a stable population at the existing population level. Whether the population would stabilize at a lower level prior to regrowth of habitat is unknown.

Because demographic information for the owl pairs studied is lacking, and because relatively few owl pair home ranges have been studied in Washington (see "Amount of Nesting, Roosting and Foraging Habitat within Owl Home Ranges" in Section 2.2 above) it is unknown how closely the median amount of habitat found in these home ranges corresponds to the median amount of habitat needed to support owls at replacement demographic rates. Although the information available from home range studies is the most direct measure of the amount of habitat used by spotted owl pairs, the reliability of using the median amounts of habitat found in these studies to gauge whether proposed management actions will support owls at replacement rates is unknown.

Because of the uncertainty in how well available studies of habitat amounts within home ranges characterize the amount of habitat needed to support owl pairs at replacement rates, the amounts of habitat within various radii of owl site centers (status 1-4) were investigated in relation to the annual reproductive output (juveniles per year) at each site. Annual reproductive output rates were used as an index to the finite rate of population change (λ, see Addendum C). For the western Cascades, the eastern Cascades, and the western Olympic Peninsula, sites at which habitat had been reliably typed and entered into a GIS data coverage and at which two or more years of surveys during reproductive years from 1991 to present could be documented by the WDFW were included in the analyses (see Addendum C). To be included, sites

must have been surveyed for occupancy and reproduction using at least a three-visit annual survey protocol. Since most nonfederal sites that would be supported under the proposed rule alternatives in the western Cascades and the western Olympic Peninsula are at relatively low elevations, only sites including predominantly low and middle elevation lands were used. High elevation sites, such as many of those on exclusively federal lands, were not used in the analyses; most sites used in the analyses included nonfederal lands within their provincial median home range radii.

Because not all sites used in the analyses were surveyed each year, reproductive data from the years surveyed (from 1991 through 1995) were used to extrapolate an annual reproductive rate for each site covering a four, five or eight year period for the western Cascades, the eastern Cascades, and the western Olympic Peninsula respectively (Table 2.3-9). Also, habitat amounts within various distances of the site center were tallied using a GIS. Table 2.3-9 lists the period from which surveys and reproductive data were drawn, the period covered by rate calculations, the number of sites used and the habitat analysis circle sizes used for each province or area. Amounts of type A, B, and type C habitat (WDNR Owl Memo #3; See Addendum B) were considered in analyses for the eastern Cascades (Figures 2.3-5, 2.3-6, 2.3-7 and 2.3-8), but habitat quality was not considered in the western Cascades and western Olympic Peninsula analyses because some lands were typed as suitable / nonsuitable habitat while others used the type A, B, C designation.

Various measures of habitat fragmentation, overlap of circles with neighbors, and proportions of high-elevation habitat were also calculated for each site using a GIS. These data along with the habitat amount data were used in exploratory regression analyses reported in Addendum D. These analyses examined the factors correlated with annual reproductive output.

Table 2.3-9

Period from which surveys and reproductive data were drawn, the period covered by rate calculations, the number of sites used and the habitat analysis circle sizes used in habitat capability analyses for each province or area.

(See text and Addendum C for further information.)

Province/Area	Years of Surveys	Years Covered by Repro. Rate Calcs.	No. of Sites[a]	Analysis Circle Sizes (miles)
Western Cascades	1991-1994	1991-1994	48	0.7, 2.0
Eastern Cascades	1991-1995	1991-1995	43	0.7,1.8
Western Olympic Peninsula	1991-1995	1988-1995	41	0.7, 2.7

[a] Includes only the number of sites surveyed during two or more "good" reproduction years. See Addendum C for further discussion.

For each province or area, the amount of habitat within analysis circles were graphed against the annual reproductive output (mean number of juveniles produced over time) for each site (Figures 2.3-1 to 2.3-10). A life table simulator and survival rates from demographic studies in progress (Forsman et al. in prep., Irwin and Fleming 1995) were used to identify the ranges of mean annual reproductive output that would lead to owl pairs that supported demographic rates below, at and above that necessary for replacement in the population (see Addendum C). These ranges roughly correspond to levels of annual reproductive output that would lead to declining, stable and increasing populations and are marked by isoclines (horizontal lines) which partition some of the graphs developed for this analysis. Because a range of survival rate estimates are used to calculate the values of the isoclines, the "stable" zone of each graph should be interpreted as the range of values which likely include the actual annual reproductive output needed for stable populations. Portions of the stable range may actually lead to declining or increasing owl populations. The width of the "stable" zone in each graph is a reflection of the degree of uncertainty in the survival rate estimates resulting from the demographic studies. Vertical lines in the graphs indicate the amounts of habitat that would be provided at owl sites by each alternative.

Generally, Figures 2.3-1 to 2.3-10 suggest that the likelihood of a site supporting owls at replacement rates increases with increasing habitat amounts at all analysis circle sizes, although this trend was not apparent for sites in FMAZ 2 of the eastern Cascades (see Addendum C). In FMAZ 3 and 4 of the eastern Cascades annual reproductive output increased with increasing amounts of types A and B habitat at the site, and tended to decrease with the increasing amounts of type C habitat. This suggests that types A and B habitat

are of greater value for pair occupancy and reproduction than type C habitat (Figures 2.3-5 to 2.3-8). It should not be concluded, however, that type C habitat does not contribute to sustaining owls; a more appropriate conclusion is that sites with a higher proportion of types A and B habitat tend to have higher reproductive rates in the eastern Cascades.

A second observation apparent from Figures 2.3-3, 2.3-4, and 2.3-9 is that most stable and increasing sites in the analyses have more habitat within their provincial median home range radius than the median amounts of habitat found in studies of owl pair home ranges in Washington. This second observation could result from using sites in home range studies that were unable to demographically replace themselves in the population or from using too small of a sample size of owl pairs or a sample that did not represent the overall owl population. Alternatively, circles, in some cases, may be poor approximations of owl home ranges, excluding and/or including some habitat areas used and/or unused by resident owls. Consequently, habitat amounts within circles may not accurately reflect the habitats or habitat amounts that would actually be used by owls if they were present. Additionally, these analyses are only as good as the habitat maps on which they are based. Factors other than habitat amount may be important in determining site occupancy and reproduction. These factors could include habitat quality, fragmentation and proximity and the presence of other territorial owls or other resource competitors. Analyses in Addendum D suggest that increases in habitat fragmentation are correlated with declines in annual reproductive output. It should also be noted that many declining sites have habitat amounts in excess of the median amounts found in studies of owl pair home ranges in each area (Table 2.3-11, Figures 2.3-3, 2.3-4, and 2.3-9).

Habitat amounts at stable or increasing sites used in the habitat capability analysis for the western Olympic Peninsula were high (Figure 2.3-10). Few sites with less than 7,000 acres of habitat were included because most of these sites were not surveyed to protocol during two reproductive years. Also, due to recent timber harvesting, few sites with 4,000 to 7,000 acres of habitat remain in this area. On the western Olympic Peninsula, sites centered on federal lands tend to have higher habitat amounts, while sites centered on nonfederal lands tend to have relatively little habitat. Consequently, it is unknown how well the habitat capability analysis for the western Olympic Peninsula addresses sites with 4,000 to 7,000 acres of habitat within a 2.7 mile radius (see Addendum C).

Given the uncertainty in the habitat capability analyses and in the median amounts of habitat found in studies of owl pair home ranges in Washington, owl site habitat amounts proposed by each alternative on the western Olympic Peninsula and the western Cascades will be compared against the results from both types of investigation. For the eastern Cascades, owl site habitat amounts proposed by each alternative will be compared against the median amounts of habitat found within owl pair home ranges, the results of the habitat capability analyses for FMAZ 3 and 4, and the mean habitat amounts found in analysis circles within FMAZ 2 (2,946 acres) and FMAZ 5 (3,732 acres) (see Addendum C). Habitat capability analyses were inconclusive for owl sites in FMAZ 2, and

were not done for sites in FMAZ 5 due to a small sample size. Sites in FMAZ 5 used in the habitat capability analysis had very low annual reproductive output; Irwin and Fleming (1995) using a larger sample of sites also noted very low reproductive rates for sites in FMAZ 5. Although no sites in FMAZ 1 were included in the analyses, Irwin (pers. com.) has noted that owl sites in FMAZ 1 have similar reproductive rates but a little more habitat on average than sites in FMAZ 2, when all sites regardless of occupancy history are considered. Therefore, the mean amount of habitat at sites in FMAZ 2 may underestimate the mean amount of habitat found at sites in FMAZ 1. Rates of annual reproductive output for sites used in the current analyses are listed in Table 2.3-10.

Table 2.3-10

Mean annual reproductive output (juveniles per year) for eastern Cascades sites included in the habitat capability analysis by FMAZ. Only sites durveyed during two or more "good" years included.

(See Addendum C.)

FMAZ	No. of Sites	Annual Reproductive Output
2	27	0.84
3	35	0.72
4	8	0.68
5	4	0.13

Figure 2.3-1

Amounts of habitat within 0.7 mile of site centers and annual reproductive output at 48 sites in the western Cascades of Washington. Triangles represent sites for which two or more years of reproductive information were available during "good" reproductive years; crosses represent sites for which only one year of reproductive information during "good" reproductive years was available. One-year sites are not used in the analysis and are presented here for illustration only. Horizontal lines identify portions of the graph in which sites are likely to have demographic rates below, above, or approximately at those needed for replacement in the population (Declining, Increasing, and Stable respectively). Vertical lines identify habitat amounts proposed by each rule alternative. See text and Addendum C for further discussion.

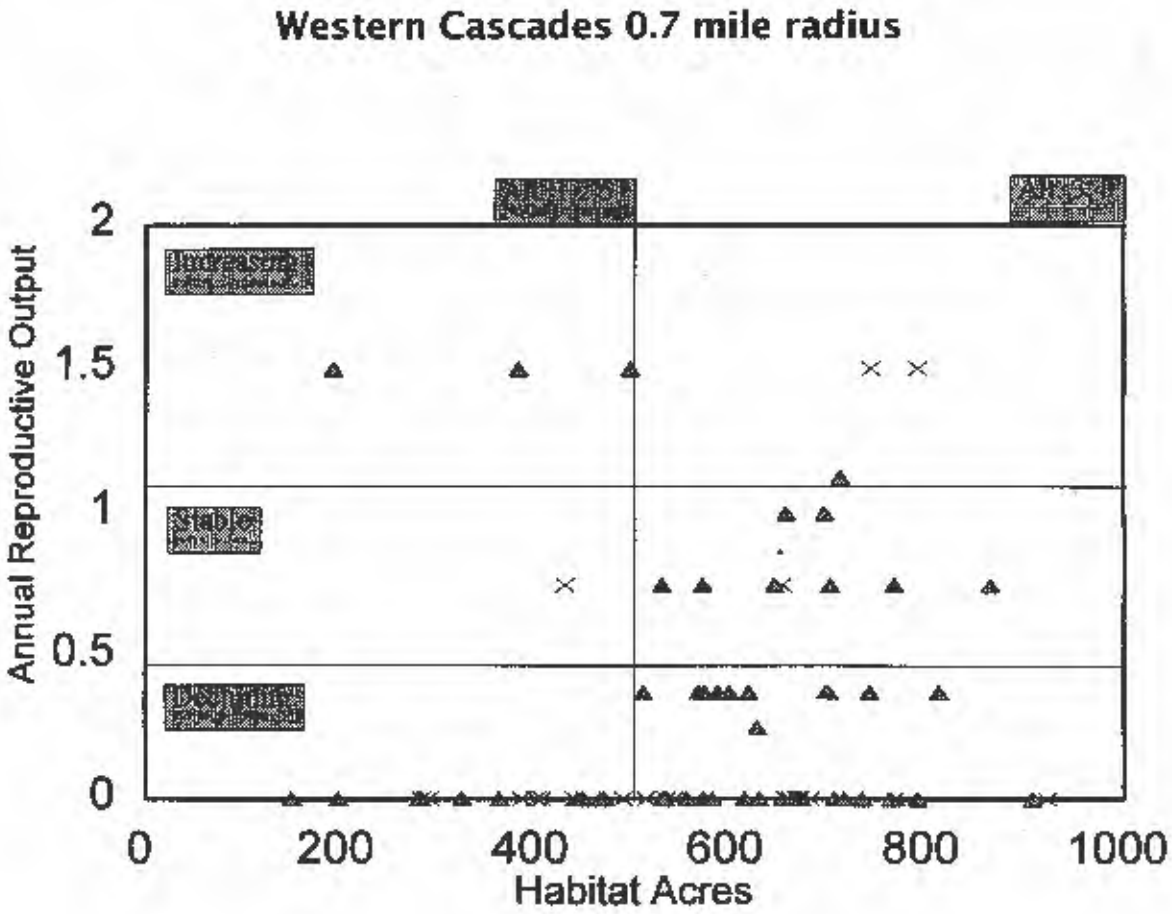


Figure 2.3-2

Amounts of habitat within 2.0 miles of site centers and annual reproductive output at 48 sites in the western Cascades of Washington. Triangles represent sites for which two or more years of reproductive information were available during "good" reproductive years; crosses represent sites for which only one year of reproductive information during "good" reproductive years was available. One-year sites are not used in the analysis and are presented here for illustration only. Horizontal lines identify portions of the graph in which sites are likely to have demographic rates below, above, or approximately at those needed for replacement in the population (Declining, Increasing, and Stable respectively). Vertical lines identify habitat amounts proposed by each rule alternative. See text and Addendum C for further discussion.

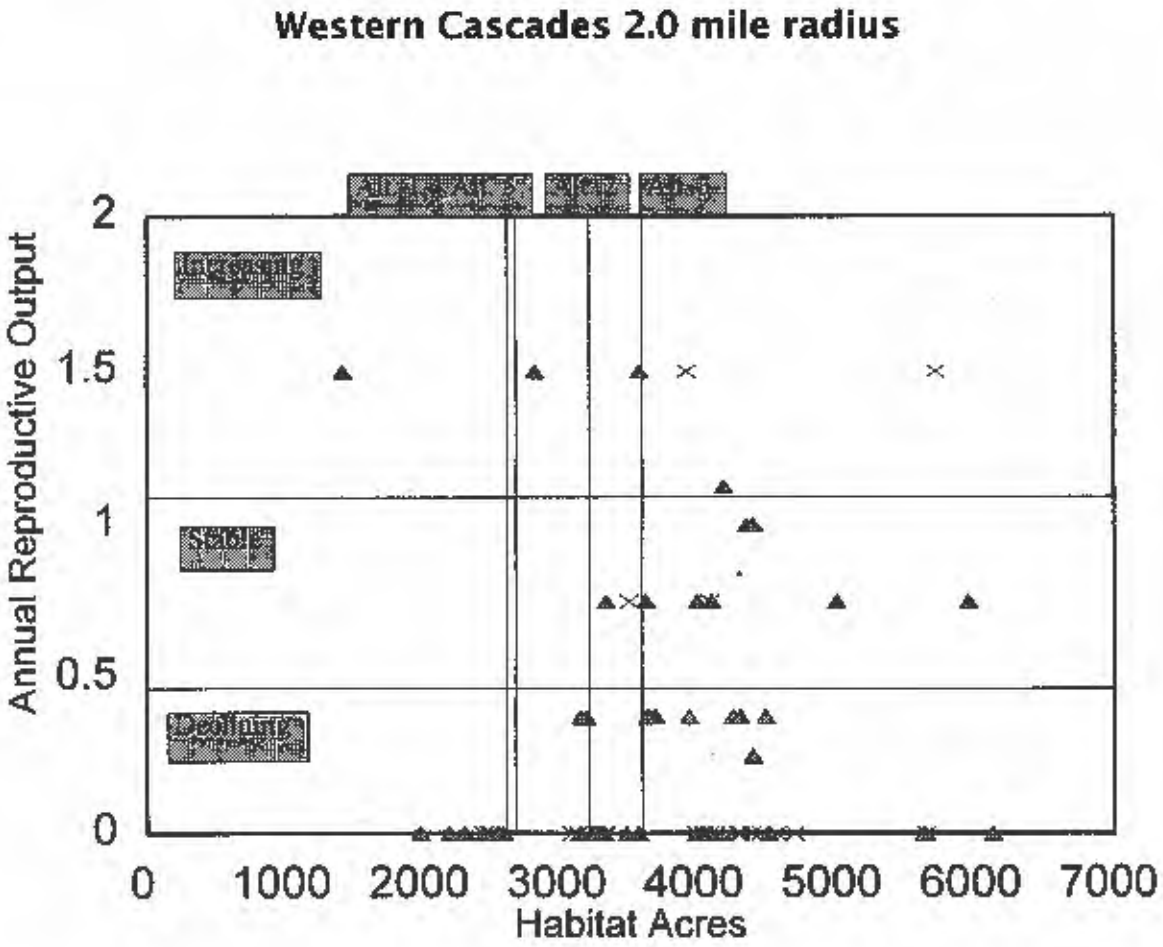


Figure 2.3-3

Amounts of habitat within 0.7 mile of site centers and annual reproductive output at 43 sites in FMAZ 3 and 4 of the eastern Cascades of Washington. Triangles represent sites in FMAZ 3; crosses represent sites in FMAZ 4. All sites are based on two or more years of reproductive information "good" reproductive years. Horizontal lines identify portions of the graph in which sites are likely to have demographic rates below, above, or approximately at those needed for replacement in the population (Declining, Increasing, and Stable respectively). Vertical lines identify habitat amounts proposed by each rule alternative. See text and Addendum C for further discussion.

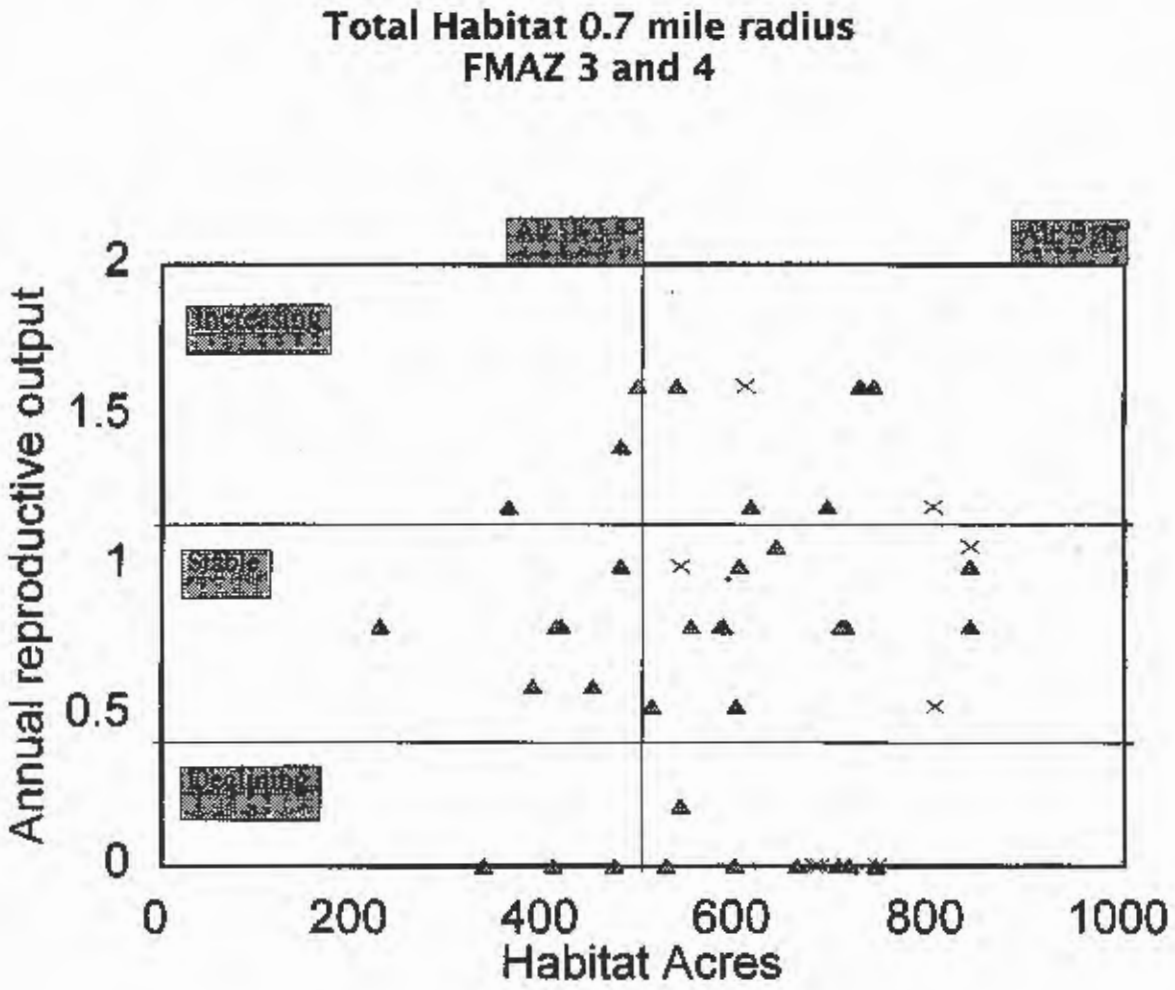


Figure 2.3-4

Amounts of habitat within 1.8 miles of site centers and annual reproductive output at 43 sites in FMAZ 3 and 4 of the eastern Cascades of Washington. Triangles represent sites in FMAZ 3; crosses represent sites in FMAZ 4. All sites are based on two or more years of reproductive information "good" reproductive years. Horizontal lines identify portions of the graph in which sites are likely to have demographic rates below, above, or approximately at those needed for replacement in the population (Declining, Increasing, and Stable respectively). Vertical lines identify habitat amounts proposed by each rule alternative. See text and Addendum C for further discussion.

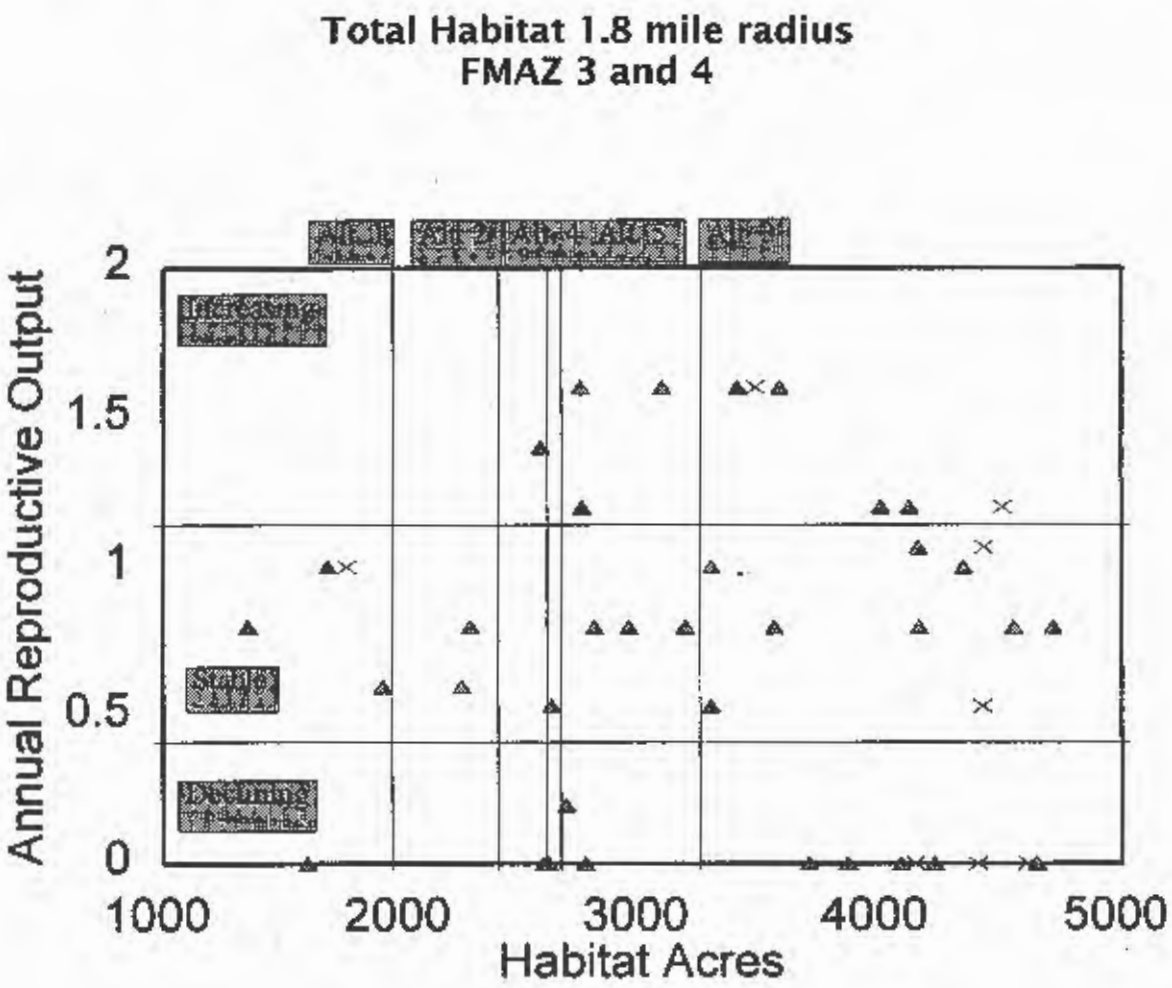


Figure 2.3-5

Amounts of type A and B habitats within 1.8 miles of site centers and annual reproductive output at 43 sites in FMAZ 3 and 4 of the eastern Cascades of Washington. Triangles represent sites in FMAZ 3; crosses represent sites in FMAZ 4. All sites are based on two or more years of reproductive information "good" reproductive years. Horizontal lines identify portions of the graph in which sites are likely to have demographic rates below, above, or approximately at those needed for replacement in the population (Declining, Increasing, and Stable respectively). Vertical lines identify habitat amounts proposed by each rule alternative. See text and Addendum C for further discussion.

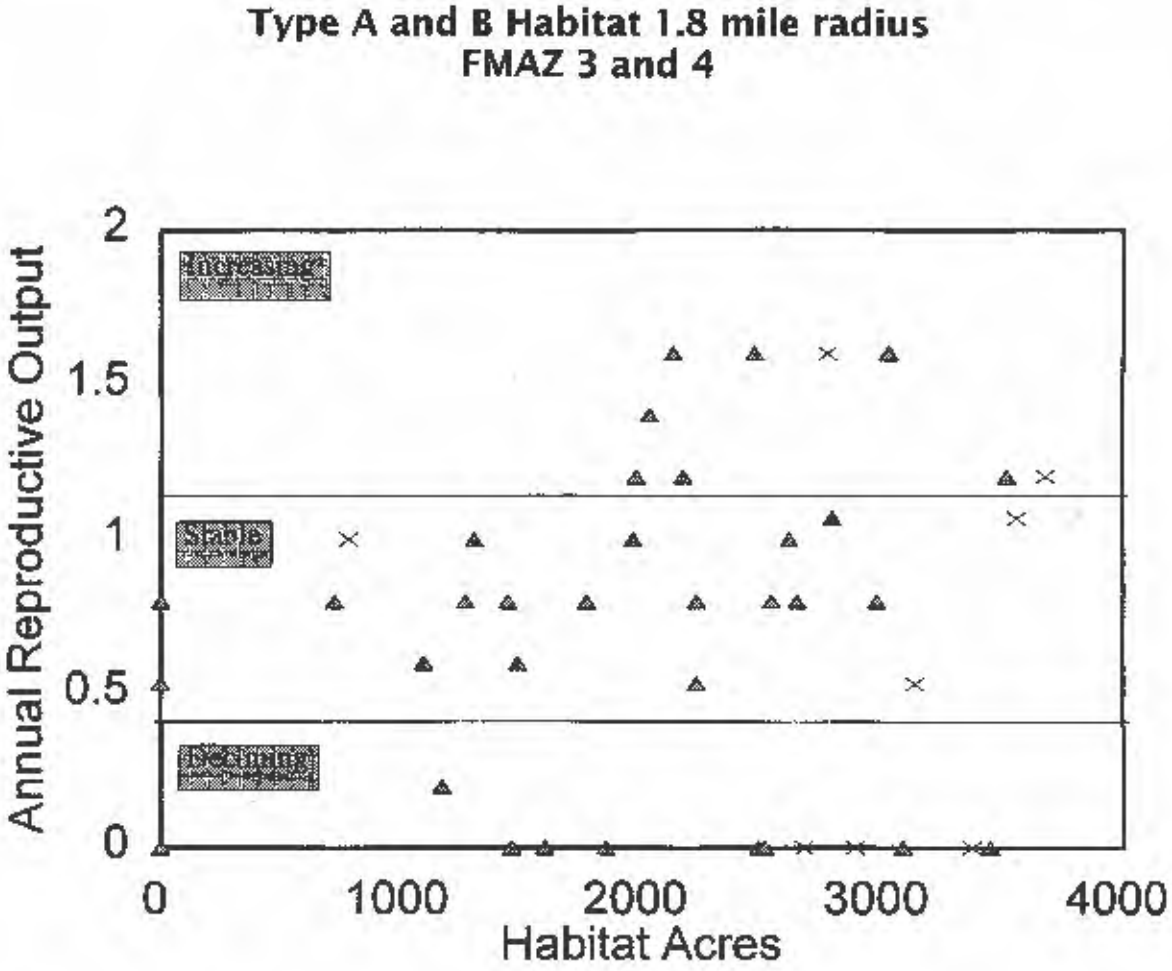


Figure 2.3-6

Amounts of type C habitat within 1.8 miles of site centers and annual reproductive output at 43 sites in FMAZ 3 and 4 of the eastern Cascades of Washington. Triangles represent sites in FMAZ 3; crosses represent sites in FMAZ 4. All sites are based on two or more years of reproductive information "good" reproductive years. Horizontal lines identify portions of the graph in which sites are likely to have demographic rates below, above, or approximately at those needed for replacement in the population (Declining, Increasing, and Stable respectively). Vertical lines identify habitat amounts proposed by each rule alternative. See text and Addendum C for further discussion.

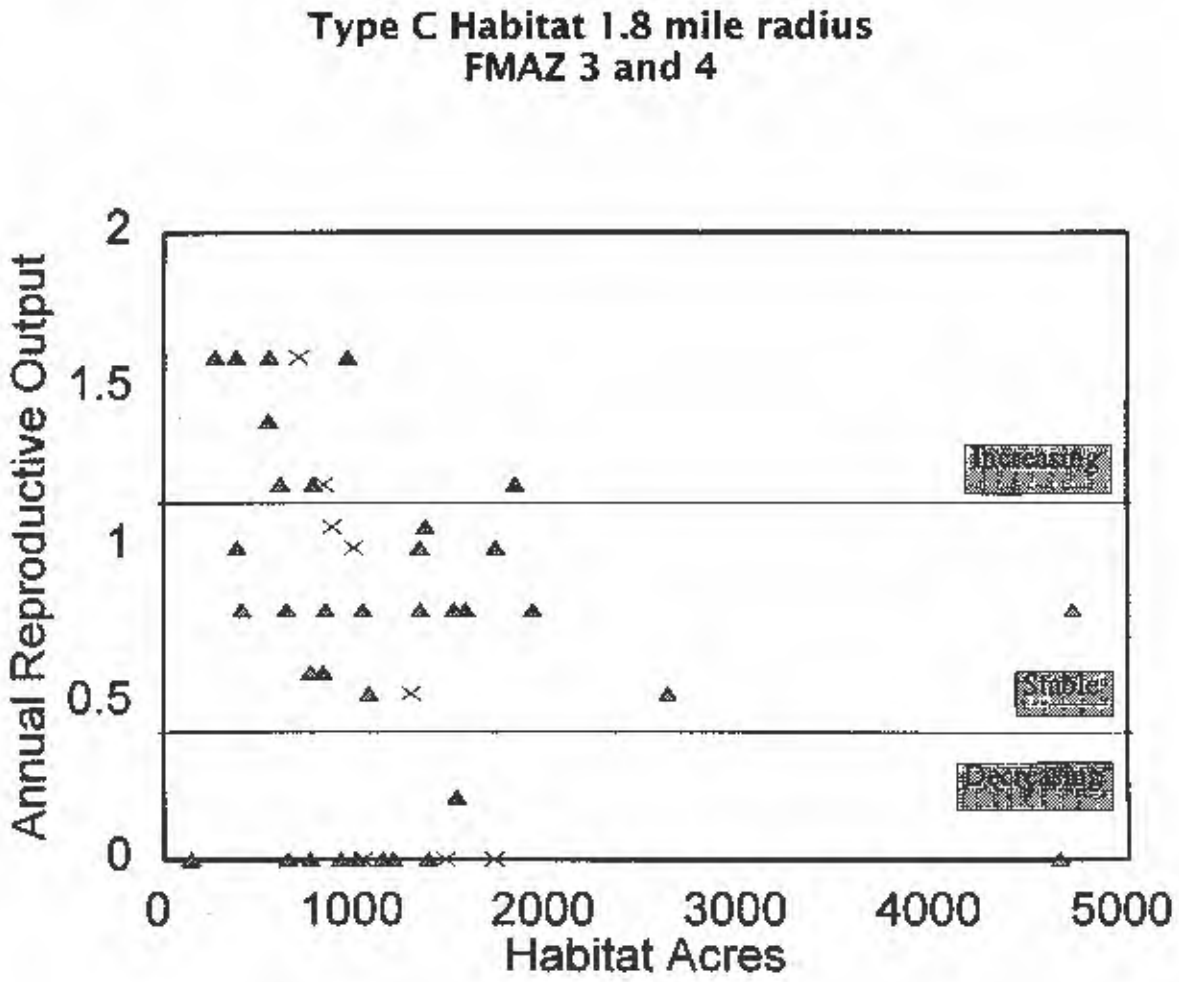


Figure 2.3-8

Amounts of type C habitat within 0.7 mile of site centers and annual reproductive output at 43 sites in FMAZ 3 and 4 of the eastern Cascades of Washington. Triangles represent sites in FMAZ 3; crosses represent sites in FMAZ 4. All sites are based on two or more years of reproductive information "good" reproductive years. Horizontal lines identify portions of the graph in which sites are likely to have demographic rates below, above, or approximately at those needed for replacement in the population (Declining, Increasing, and Stable respectively). Vertical lines identify habitat amounts proposed by each rule alternative. See text and Addendum C for further discussion.

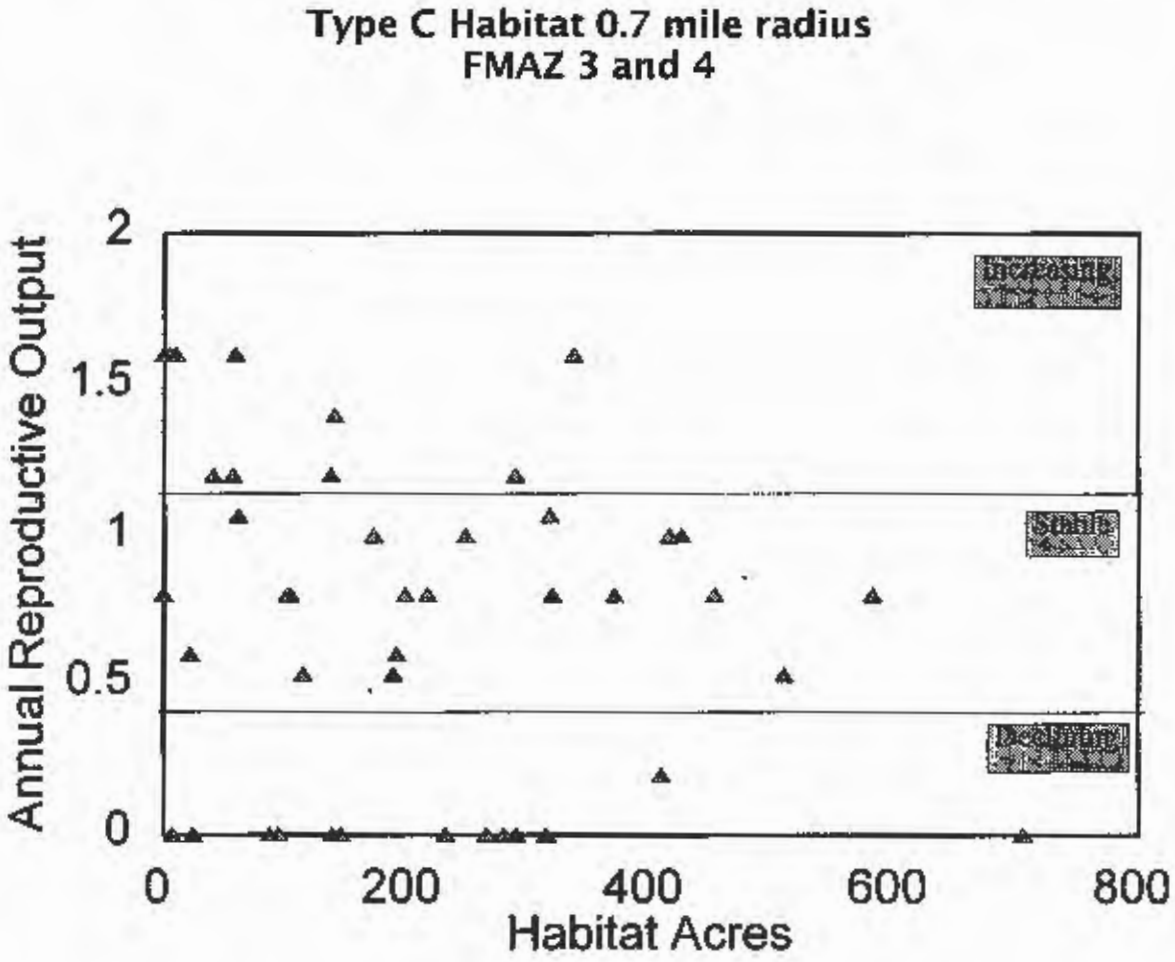


Figure 2.3-9

Amounts of habitat within 0.7 mile of site centers and annual reproductive output at 41 sites on the western Olympic Peninsula of Washington. Triangles represent sites for which two or more years of reproductive information were available during "good" reproductive years; crosses represent sites for which only one year of reproductive information during "good" reproductive years was available. One-year sites are not used in the analysis and are presented here for illustration only. Horizontal lines identify portions of the graph in which sites are likely to have demographic rates below, above, or approximately at those needed for replacement in the population (Declining, Increasing, and Stable respectively). Vertical lines identify habitat amounts proposed by each rule alternative. See text and Addendum C for further discussion.

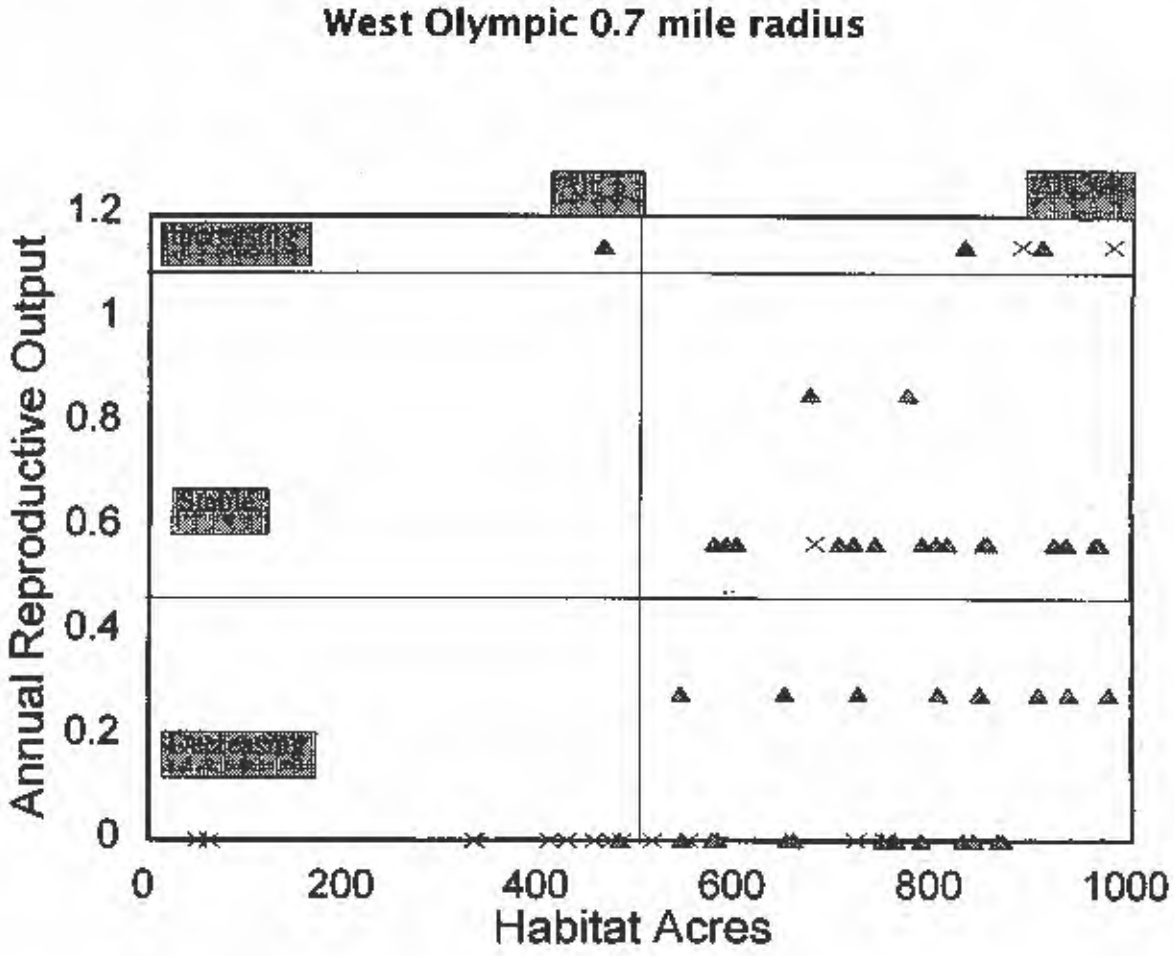


Figure 2.3-10

Amounts of habitat within 2.7 mile of site centers and annual reproductive output at 41 sites on the western Olympic Peninsula of Washington. Triangles represent sites for which two or more years of reproductive information were available during "good" reproductive years; crosses represent sites for which only one year of reproductive information during "good" reproductive years was available. One-year sites are not used in the analysis and are presented here for illustration only. Horizontal lines identify portions of the graph in which sites are likely to have demographic rates below, above, or approximately at those needed for replacement in the population (Declining, Increasing, and Stable respectively). Vertical lines identify habitat amounts proposed by each rule alternative. See text and Addendum C for further discussion.

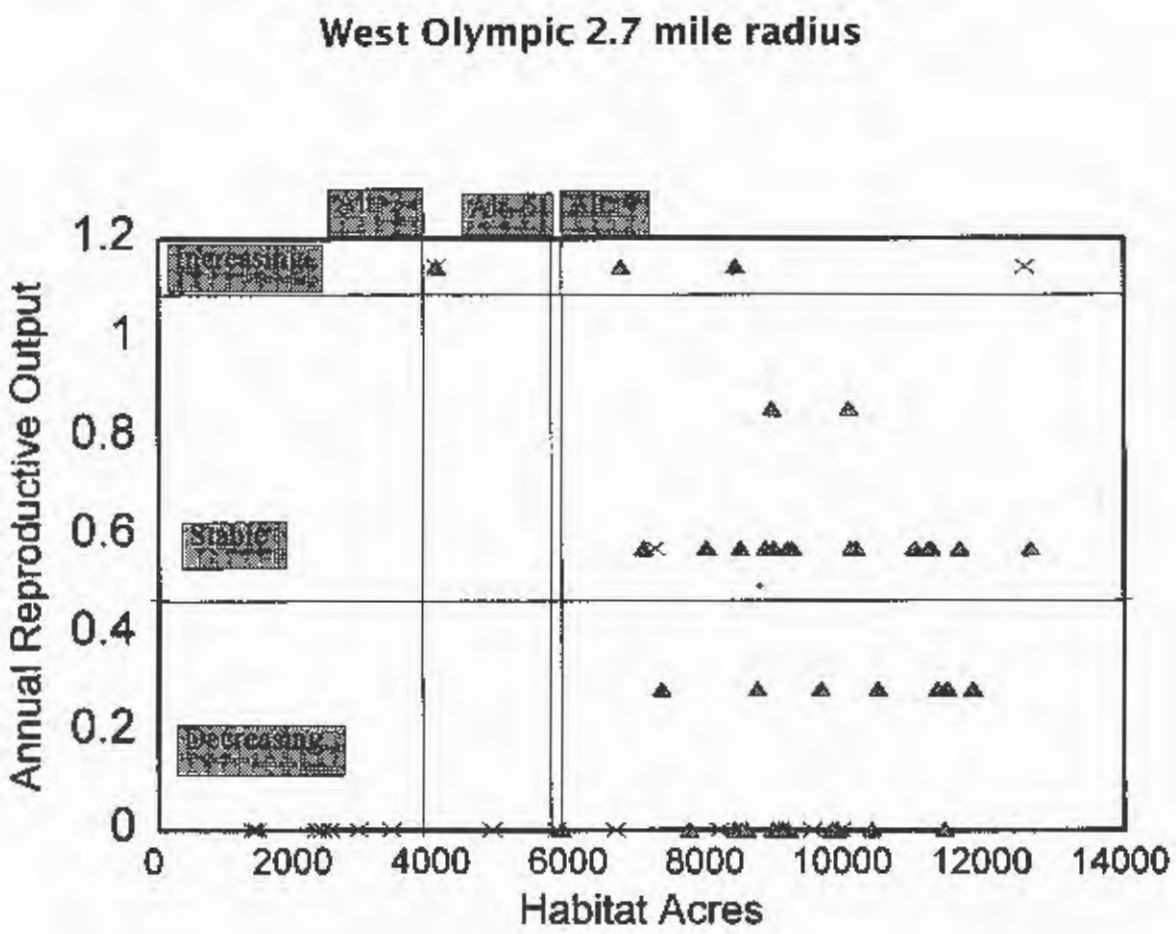


Table 2.3-11

Amount of habitat proposed by each alternative for owl sites in demographic support, pair maintenance and species distribution SOSEAs, provincial median amounts of habitat found within pair home ranges, numbers of stable/increasing sites analyzed with less than and greater than the habitat amounts proposed by each alternative, and the number of declining sites with less than and greater than habitat amounts proposed by each alternative.

			No. Stable/Increasing Sites With		No. Declining Sites with	
	Proposed Hab. Amt.	Provincial Med. Hab. Amt.	Proposed <Hab. Amt.	Proposed >Hab. Amt.	Proposed <Hab. Amt.	Proposed >Hab. Amt.
Western Cascades						
2.0 mile radius						
Alternative 1	2,608	3,586	1	11	6	30
Alternative 2	3,200		2	10	9	27
Alternative 3	3,586		4	8	19	17
Alternative 4	2,605		1	11	6	30
Alternative 5	2,663		1	11	6	30
Eastern Cascades						
1.8 mile radius*			FMAZ 3 and 4			
Alternative 1	1,956	3,682	4	26	1	12
Alternative 2	2,400		6	24	1	12
Alternative 3	3,249		14	16	5	8
Alternative 4	2,605		7	23	2	11
Alternative 5	2,663		8	22	3	10
Western Olympic Peninsula						
2.7 mile radius						
Alternative 1	NA	4,681	-	-	-	-
Alternative 2	NA		-	-	-	-
Alternative 3	3,827		0	20	0	21
Alternative 4	5,863		1	19	1	20
Alternative 5	5,708		1	19	0	21

*Mean habitat amount at 27 owl sites analyzed in FMAZ 2 totalled 2,946 acres within 1.8 miles of the site center. Mean habitat amount at six owl sites analyzed in FMAZ 5 totalled 3,732 acres within 1.8 miles of the site center.

Table 2.3-12

Numbers of stable/increasing sites analyzed with less than and greater than 500 acres of habitat within 0.7 miles of the site center by province/area.

Province/Area	No. Stable/Increasing Sites with <500 Acres Hab. within 0.7 mi	No. Stable/Increasing Sites with >500 Acres Hab. within 0.7 mi.
Western Cascades	3	9
Eastern Cascades*		
FMAZ 3 and 4	9	21
FMAZ 2	9	9
Western Olympic Peninsula	1	19

* Of six sites sampled in FMAZ 5, five had greater than 500 acres of habitat within 0.7 miles of the site centers. Only one of the six sites was stable or increasing; this site had more than 500 acres of habitat within 0.7 miles of the site center.

■ ALTERNATIVE 1 - SIX LANDSCAPES

Alternative 1 identifies two types of "pair maintenance" habitat: roosting and foraging, and foraging habitat. Throughout the rule, there is no mention of providing habitat for nesting. The implication is that this alternative would provide for non-reproducing pairs of spotted owls. By not including provisions for reproductively viable sites, much of the potential conservation value of these sites, and of this alternative, is lost. As discussed under Criterion 1, protections at sites with single owls may be dropped if there are less than 1,500 acres of habitat and the owl has not mated in three years of surveys. Requiring reproductive activities by owls in order to maintain their protection when there are no provisions for nesting habitat indicates that there is a very low likelihood that Alternative 1 would "maintain", conserve, or provide for viable owl populations.

Definitions for roosting and foraging habitat are not provided; definitions are provided only for foraging habitat. Foraging habitat definitions under this alternative are similar to the dispersal habitat definitions in Alternative 2, except that Alternative 1 foraging habitat does not require green recruitment trees in either the western or eastern Cascades. In the eastern Cascades, it also lacks provisions for heights of dominant and codominant trees, total canopy cover, and mistletoe, but it calls for one more wildlife reserve tree per acre and a greater minimum conifer component. The definitions of foraging habitat under Alternative 1 are also nearly identical to dispersal habitat in Alternative 1, the only difference being that foraging stands require the retention of three wildlife reserve trees per acre.

center, while 21 of 30 sites in FMAZ 3 and 4 of the eastern Cascades have more than 500 acres of habitat within 0.7 miles (Table 2.3-12, Figures 2.3-1, 2.3-3).

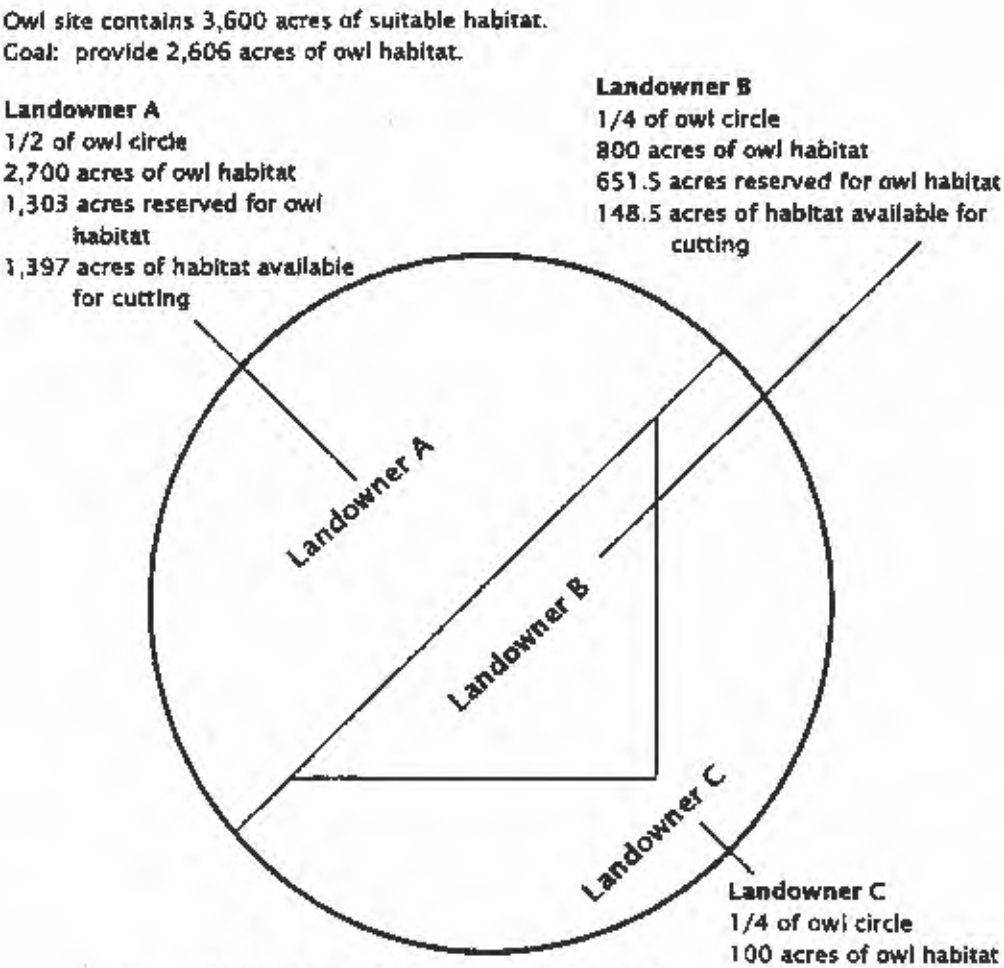
Habitat on federal, state and other public lands within the owl circle would be counted first towards the required totals; habitat on private lands would comprise the rest. Using ownership as the primary selection criterion for habitats to be provided at an owl site disregards the importance of proximity, quality and contiguity of habitat. Analyses in Addendum D suggest that habitat fragmentation may reduce the annual reproductive output of owl sites. At sites that include state, federal lands or other public lands, this could result in protecting habitats that are farther from the site center than privately owned habitats closer to the site center.

Individual landowners would be required to protect only an amount of habitat proportional to the percentage of the total area of the owl circle they own. Habitat acreage above this target may be declared "excess" and cut by the landowner. In circles that have multiple landowners, this could have three effects. The first is that this may tend to decrease the quality of habitat protected because high-quality habitat declared excess by one landowner may be cut, even though a second landowner may have only lower quality habitat or no habitat at all to contribute to the habitat targets. The second is that it may prevent habitat acreage targets from being met. Landowners can harvest "excess" habitat on their property based on their proportional share even if the habitat amount at the owl site is below the acreage target. The third effect would be a tendency to increase fragmentation of the habitat protected because there is no provision to maintain habitat closest to the site center. This is counter to the majority and minority opinions of the SAG; both recommended protecting all habitat within 0.7 mile of the site center.

Figure 2.3-11 illustrates the second and third effects of the proportional allocation concept in Alternative 1 using a hypothetical owl circle in the western Cascades. Assume there are 3,600 acres of suitable habitat (landowner A 2,700 acres, landowner B 800 acres and landowner C 100 acres) within the owl site. In addition, assume landowner A owns 50% of the circle and landowners B and C each own 25% of the circle. The goal is to maintain 2,606 acres of owl habitat (40% of the area in a 1.8-mile-radius circle). If landowners are required to provide a proportion of the required total habitat (2,606 acres) equal to the proportion of the owl circle they own, landowners A and B combined would provide 1,954.5 acres (75%) of the required habitat. Under the proportional rule landowners A and B would be allowed to cut 1,545.5 acres of habitat. Landowner C, who has only 100 acres of habitat, would not be able to harvest any habitat until their lands supported more than 651.5 acres of habitat. The result would be that the required amount of habitat is not met, despite starting off with nearly 1,000 acres of habitat more than the targeted amount. Another result is that landowner B is allowed to cut habitat close to the site center in favor of landowner C providing more distant habitat. The proportional rule would provide the targeted amounts of habitat only when the percentage of habitat on each ownership is greater than or equal to the proportion of the owl circle comprised by the ownership.

Figure 2.3-11

Hypothetical spotted owl circle illustrating the potential effects of the proportionate rule on the provision of owl habitat.



Acres of habitat needed to meet proportionate share: 651.5

	Total Acres of Owl Habitat	Acres Available for Cutting	Acres of Owl Habitat Provided
A	2700	1397	1303
B	800	148.5	651.5
C	100	0	100
Total	3600	1545.5	2054.5

Result = 551.5 acres below goal

Under Alternative 1, habitat quality on private lands may also be reduced in two ways. First, younger habitat that meets the minimum definitions for foraging habitat may be substituted for older, higher quality habitat outside 0.7 mile, which may then be logged. Second, any habitat may be harvested to the minimum standards of foraging habitat; this effectively allows substituting foraging habitat for higher quality habitat, if it occurs, within 0.7 mile of the site center. There are no restrictions on how much habitat may be partially harvested in a time period, nor are there any provisions for checking partially logged stands after operations are completed to see if they still meet foraging habitat standards.

Alternative 1 includes a small harvest exemption that would allow each landowner to clearcut 10 acres per year beyond 0.7 mile of the site center; regardless of the amount of land they own. There is no limit on the number of years that this may be repeated or the number of landowners that can harvest. Available information on ownership patterns, sizes, and habitat indicates that six sites included within pair maintenance SOSEAs have at least one percent of the circle area in habitat owned by small landowners with less than 500 acres within a SOSEA. If all of this habitat were removed, two of the sites would have less than 40% habitat remaining. Based on limited information small landowners (those with less than 500 acres) would have little impact on owl sites supported by Alternative 1. However, the total impact by landowners of all sizes is unknown.

Alternative 1 allows LOPs to include "site specific owl management plans." These plans would be "tailored to the specific circumstances" of site centers. Under this alternative, owl sites discovered after approval of a LOP would receive no recognition or protection. For owl sites with multiple landowners, these plans "may include elements of operational research and adaptive management opportunities." If research or experimentation is being proposed, there are no definitions for these terms nor are there criteria for approving the proposed plans. The language of Alternative 1 gives landowners unspecified latitude in providing alternative habitat definitions and in experimentation. Although the LOP concept is worthwhile, the lack of direction provided in the rule language makes it impossible to gauge how often these provisions would result in effective management, experimentation and adaptive management. Additionally, there is no provision for monitoring to determine whether site-specific owl management plans, operational research, and adaptive management are meeting their owl conservation objectives.

Restrictions on harvesting, road construction, and "concentrated helicopter use" within the 70 acres of habitat surrounding site centers are included, but not in adjacent areas. However, concentrated helicopter use is undefined, and there are no restrictions on yarding, hauling, burning, skidding systems, and the use of fertilizers and pesticides within the 70 acres.

Analysis: If implemented, this alternative would allow for major reductions in habitat quality, quantity, and contiguity at owl sites within pair maintenance SOSEAs compared to existing conditions and the other alternatives. Due to the

many allowances and exemptions for harvest and degradation of habitat, it is likely that the acreage totals set by the rule would not be met at many sites, further compromising the marginal protection afforded owl sites under this rule. Coupled with the allowances for removing protection from owl sites (discussed in Criterion 1), many sites could be harvested. If implemented, Alternative 1 could result in the elimination of many and perhaps most of the owl sites that currently occur within pair maintenance SOSEAs.

Alternative 1 would provide lower minimum standards for habitat quality than Alternatives 2, 3, and 4. Alternative 1 would also provide lower habitat amounts than Alternatives 2, 3, 4 and 5 except in the western Cascades where Alternatives 4 and 5 would provide similar amounts.

■ ALTERNATIVE 2 - TEN LANDSCAPES

Alternative 2 defines three types of suitable owl habitat on the basis of the SAG definitions (Hanson et al. 1993): old-forest, submature, and young forest marginal (YFM). Old-forest is the highest quality habitat, and YFM is the lowest quality. The definitions are generally consistent with those of Hanson et al. (1993), although the minimum standards for submature and YFM would be a little lower than that of the SAG. The result would be that some stands considered by the SAG to be YFM would be included in the higher quality category of submature, and some stands that would be considered unsuitable by the SAG would be included as YFM. Although the definition of old-forest habitat is qualitatively good, it may be unimplementable in its current form because the sizes and amounts of the required vegetative components are not specified.

Within 2.0 miles of a status 1, 2, or 3 site center, this alternative would require that 3,200 acres of suitable habitat be protected in the western Cascades and 2,400 acres be protected in the eastern Cascades. These acreage totals are 386 acres and 849 acres respectively below the median amounts of habitat included in annual home ranges of owl pairs in these provinces (Hanson et al. 1993). The proposed acreage total for the eastern Cascades represent 30% of a 2.0 mile radius circle. The proposed habitat total for sites in the western Cascades is less than that found at ten of 12 stable or increasing sites and 27 of 36 declining sites included in the habitat capability analysis (Table 2.3-11, Figure 2.3-2). The proposed habitat total for sites in the eastern Cascades is less than that found at 24 of 30 stable or increasing and 12 of 13 declining sites in FMAZ 3 and 4, 546 acres less than the mean amount of habitat found within 1.8 miles of 27 sites in FMAZ 2 and 1,332 acres less than the mean amount of habitat found at six sites in FMAZ 5 (Table 2.3-11, Figure 2.3-4).

Of the total acreage, 500 acres are required to be within 0.7 mile of the site center. This is counter to the majority and minority opinions of the SAG, both of which recommended protecting all available habitat within 0.7 mile of the site center (Hanson et al. 1993). In the western Cascades, nine of 12 stable or increasing sites have more than 500 acres of habitat within 0.7 miles of the site center, while 21 of 30 sites in FMAZ 3 and 4 of the eastern Cascades have more than 500 acres of habitat within 0.7 miles (Table 2.3-12, Figures 2.3-1, 2.3-3).

Within 0.7 mile, the highest quality and closest habitats would be selected first for protection. Outside 0.7 mile, YFM or submature can be substituted for old-forest, and protection of the closest habitat is "preferred" but not required; this could over time lead to degradation of habitat quality at sites.

Individual landowners would be required to protect only the amount of habitat proportional to the percentage of the total area of the owl circle they own. Habitat acreage above this target would be declared "excess" and could be cut by the landowner. This could result in protecting lower quality and less contiguous habitat in amounts less than the provincial acreage minimums at owl sites with multiple owners. (See the discussion of this topic in Alternative 1 above.) The proportional rule would provide the targeted amounts of habitat only when the percentage of habitat on each ownership is greater than or equal to the proportion of the owl circle comprised by the ownership.

A small harvest exemption for ownerships whose entire harvestable acreage falls within a status 1, 2, or 3 site center in a SOSEA would allow 2% of the land to be harvested every 10 years. Information is not available on the numbers of ownerships that fall completely within an owl circle, but if all landowners with 500 acres of land or less within a SOSEA are considered, available information indicates that eight sites included within demographic support SOSEAs have at least one percent of the circle area in habitat owned by small landowners. If all of this habitat were removed, two of the sites would have less than 40% habitat remaining. Given the conservative rate of cutting allowed, however, it may take several decades for all this habitat to be cut. The small harvest exemption would have little impact on owl sites to be included in demographic support SOSEAs.

Individual landowners would be required to meet the rules described above or they could submit a LOP describing proposed alternative management. If additional owl sites are discovered after approval of a LOP, the plan must be revised to include planning for these "new" sites. Under LOPs, landowners may develop site-specific habitat definitions and carry out management actions that do not meet the criteria outlined above. If the potential risk of these management actions is "relatively high", landowners may treat the actions as "designed experimentation". The language of Alternative 2 gives landowners unspecified latitude in providing alternative habitat definitions and in experimentation. Although the necessary elements of a LOP are listed, the rule language does not discuss who and what criteria would be used to review LOPs and to what standards LOPs would be held. Given the lack of direction provided in the rule language, it is impossible to gauge how often these provisions would result in effective management, experimentation and adaptive management. LOPs under this alternative would be required to include provisions for monitoring the biological effectiveness of the plan and revision of the plan if conditions change or if the original conservation objectives are not met. Overall, the requirement for biological monitoring of LOP success, the more clear listing of the required elements of LOPs, and the higher standards

of this alternative increase the likelihood that LOPs under this alternative would provide some significant conservation contribution to owls when compared with Alternative 1.

Restrictions would be placed on harvesting, road construction, felling and bucking, cable yarding, helicopter yarding, skidding systems, timber and rock hauling, slash disposal and prescribed burning, and aerial application of pesticides and fertilizers within 0.25 mile of owl site centers inside and outside SOSEAs, from March 1 through July 31. However, the potential exists for operations to adversely affect reproduction at site centers because the timing restriction does not extend through August 31 when juvenile owls are capable flyers.

Analysis: Alternative 2 partially follows the recommendations of the SAG for providing habitat at demographic support sites. However, the cumulative effects of small amounts of habitat provided within 0.7- and 2.0-mile circles, the proportional rule for sites with multiple landowners, and the substitution of low-quality for high-quality habitat would seriously degrade the ability of many owl sites to support reproductively viable owl pairs. Although habitat quality and amounts would likely be higher than under Alternative 1, most demographic support sites may not support owl pairs at demographic rates sufficient for replacement.

■ ALTERNATIVE 3 - FIFTEEN LANDSCAPES

Alternative 3 attempts to put into rule language the recommendations of the SAG (Hanson et al. 1993). This alternative identifies three types of habitat "essential" to support nesting, roosting, and foraging based on the SAG report (Hanson et al. 1993): old-forest, submature, and young forest marginal habitats. The habitat definitions in this alternative cannot be assessed because they are not quantitatively described. If these definitions follow those proposed by the SAG (on which this alternative is based), the alternative would provide higher standards for habitat quality than Alternatives 1 or 2.

This alternative requires providing at least 3,827 acres of suitable habitat within 2.7 miles of site centers in the Olympic province, 3,586 acres within 2.0 miles of site centers in the western Cascades, and 3,249 acres within 1.8 miles of site centers in the eastern Cascades. For the western and eastern Cascades provinces, these requirements follow recommendations of the FDRP (USDI 1992b) by providing amounts of suitable habitat equal to the median amount of habitat within annual pair home ranges. For the Olympic province, it requires 854 acres less than the median (Hanson et al. 1993); this likely results from an error in the original data supplied to the SAG by the principal investigator of the home range study. The proposed habitat total for sites in the Olympic Peninsula is less than all 20 stable or increasing sites and all 21 declining sites on the western Olympic Peninsula included in the habitat capability analysis. The proposed habitat total for sites in the western Cascades is less than that found at eight of 12 stable or increasing sites and 17 of 36 declining sites (Table 2.3-11, Figures 2.3-2, 2.3-10). The proposed habitat total for sites in the eastern Cascades is less than that found at 16 of 30 stable or increasing sites and eight

of 13 declining sites in FMAZ 3 and 4, 303 acres more than the mean amount of habitat found within 1.8 miles of 27 sites in FMAZ 2 but 483 acres less than the mean amount of habitat found at six sites in FMAZ 5 (Table 2.3-10, Figure 2.3-4).

To meet acreage requirements, all suitable habitat within 0.7 mile of the site center would be selected first. This is in agreement with the majority and minority opinions of the SAG, both of which recommended protecting all available habitat within 0.7 mile of the site center (Hanson et al. 1993), and with the results of the habitat capability analysis which suggested that sites with more habitat within 0.7 miles of the site center tend to have higher annual reproductive outputs (Table 2.3-12, Figures 2.3-1, 2.3-3, 2.3-9). Beyond 0.7 mile, priority would be given to old-forest habitat first, followed by submature and young forest marginal. Priority would also be given to the stands closest to the site center. This method of selection would retain the highest quality habitats with the least amount of fragmentation at the sites.

Within 0.7 mile of the site center, no cutting of suitable habitat would be allowed. Beyond 0.7 mile, partial cutting would be allowed first in submature and then young forest marginal habitats as long as the cutting did not degrade the habitat quality such that it dropped to a lower class. Partially cut habitat would be inspected after a two-year transition period to determine whether it had been degraded. If the habitat had been degraded, no further cutting would be allowed until the same amount of habitat had been restored. No more than 5% of a landowner's habitat could be in transition at a time. No cutting would be allowed in old-forest habitats within the owl site. Lack of a quantitative definition for old-forest, however, may pose a problem with this provision. These provisions would apply only if a landscape plan had not been approved for the area.

"Site-specific special wildlife management plans" would allow the landowner greater flexibility in meeting conservation targets. However, the details of these plans are not provided; they would be "developed and placed in the Board Manual" at a later date. Therefore, the potential affects these might have on the provision of habitat at owl sites cannot be determined. Similarly, it is unspecified what role owl surveys and monitoring would play under this alternative.

Road construction, felling and bucking, cable yarding, hauling, burning, the use of helicopters, skidding systems, fertilizers, and pesticides are restricted during the reproductive season (March 1 - July 31) within 0.25 mile of the site center. However, the potential for operations to adversely affect reproduction at site centers extends through August 31 when juvenile owls are capable flyers. The restrictions on operations are extended to 0.5 mile if the current year's site center is not known; this could provide important protection against disturbance at sites where the center of owl activity has moved from the previous site center, but the current location is unknown. The other alternatives lack this provision.

Analysis: The lack of habitat definitions and of details regarding site-specific special wildlife management plans adds uncertainty to any appraisal of the effectiveness of habitat provided under this alternative. If habitat definitions of Hanson et al. (1993) are adopted, and if opportunities for reducing the amount, quality, and contiguity of habitat through management plans are minimal, then this alternative would provide considerably better habitat conditions than the other alternatives. In the western and eastern Cascades, this alternative would result in a greater proportion of sites within demographic support SOSEAs being occupied by reproductively viable pairs than Alternatives 1 and 2. On the Olympic Peninsula, however, nonfederal owl sites heavily dependent on nonfederal habitat would probably support few owl pairs at demographic rates sufficient for replacement.

■ ALTERNATIVE 4 - TFW PROPOSAL

Alternative 4 defines three types of suitable owl habitat on the basis of the SAG definitions (Hanson et al. 1993): old-forest, submature, and young forest marginal (YFM). Proposed definitions for submature and YFM habitats in eastern and western Washington follow those recommended by the SAG. Additional descriptors of vertical diversity and alternate standards for canopy closure and tree density expressed in relative density and quadratic mean diameter have been added. The added requirement for 25-50% intermediate trees as part of the vertical diversity requirement appears to be an attempt to define what constitutes a canopy layer. It is not clear, however, how these values were derived. Field verification of this and all other components of the habitat definitions may prove helpful in setting effective standards.

The SAG did not provide quantitative definitions for old-forest habitat. Alternative 4 proposes some quantitative measures to define these forests. This alternative would require that old-forest stands have "... a layered multi-species canopy where 50% or more of the canopy closure is provided by large overstory trees (typically, there should be at least 75 trees greater than 20 inches dbh per acre, or at least 35 trees 30 inches dbh or larger per acre)." This standard, however, would exclude many stands classified as "old-growth" by recent definitions (Franklin and Spies 1991, Spies and Franklin 1991, Fierst et al. 1992a,b,c, Hopkins et al. 1992, Williams et al. 1992). Field verification may be useful in developing effective habitat definitions. Additionally, separate definitions for the eastern Cascades and western Washington may be more effective.

On the western Olympic Peninsula, this alternative would require the 5,863 acres of habitat be provided within 2.7 miles of status 1, 2 or 3 owl site centers. This would be 1,182 acres more than the median amount of habitat found in home range studies of pairs in this province (Buchanan et al. 1994). However, the proposed habitat total is less than that provided at 19 of 20 stable or increasing and 20 of 21 declining sites included in the habitat capability analysis (Table 2.3-11, Figure 2.3-10).

In the eastern and western Cascades, this alternative would require that 2,605 acres of suitable habitat be protected within 1.8 miles of a status 1, 2, or 3 site center. These acreage totals are 981 and 1,077 acres less than the median amounts found within home range studies of pairs in the western and eastern Cascades respectively (Hanson et al. 1993). The required total acreage of habitat in the western Cascades is less than that documented at five of seven territorial spotted site centers in the province for which home range information is available (Hanson et al. 1993). Similarly, the required total acreage of habitat in the eastern Cascades (2,605 acres) is less than that documented at four of five territorial spotted owl site centers in the province for which home range information is available (Hanson et al. 1993). The proposed habitat total for sites in the western Cascades is less than that found at 11 of 12 stable or increasing sites and 30 of 36 declining sites included in the habitat capability analysis (Table 2.3-11, Figure 2.3-2). The proposed habitat total for sites in the eastern Cascades is less than that found at 23 of 30 stable or increasing sites and 11 of 13 sites in FMAZ 3 and 4, 341 acres less than the mean amount of habitat found within 1.8 miles of 27 sites in FMAZ 2, and 1,127 acres less than the mean amount of habitat found at six sites in FMAZ 5 (Table 2.3-11, Figure 2.3-4). Within the provincial median home range radius the highest quality, closest and most contiguous habitats are to be selected first for protection.

All habitat within 0.7 miles of the site center would be retained. This is in agreement with the majority and minority opinions of the SAG, both of which recommended protecting all available habitat within 0.7 mile of the site center (Hanson et al. 1993), and with the results of the habitat capability analysis which suggested that sites with more habitat within 0.7 miles of the site center tend to have higher annual reproductive outputs (Table 2.3-12, Figures 2.3-1, 2.3-3, 2.3-9).

Alternative 4 includes a small parcel harvest exemption. Forest practices proposed by landowners who own or control less than or equal to 500 acres within a SOSEA and where the forest practice is not within 0.7 miles of the site center would be exempt from the provisions relating to spotted owls. Available information on ownership patterns, sizes, and habitat indicates that of sites included within or overlapping demographic support or combination function areas of SOSEAs, 17 sites with at least one percent of the circle area in habitat owned by small landowners would be left with less than 40% habitat if all the habitat were cut. Nine of these sites would have less than 30% habitat. Overall, the impacts from the small parcel exemption would be low. However, a few owl sites may be severely impacted if a high percentage of small landowners opted to harvest before habitat would regrow.

Individual landowners would be required to meet the rules described above or they could submit a LOP describing proposed alternative management. The required elements of LOPs are well listed; however, the goals and objectives for LOPs and the acceptance criteria for LOPs are stated in general terms which could potentially be widely interpreted. It is impossible to assess whether LOPs under this alternative would contribute to meeting SOSEAs goals or to "...the

likelihood of the survival and recovery" of the owl in the wild. Additionally, it is unclear whether monitoring under LOPs would be simply compliance monitoring, or whether LOPs would also include monitoring to determine whether the LOP was achieving its biological goals. If the WDNR approved a LOP over the objections of the WDFW, WDNR would be required to put its reasons in writing. After approval of each LOP, the WDNR, in consultation with WDFW, would be required to review whether the applicable SOSEA should be deleted or modified. There are no standards for evaluating potential deletions or modifications of SOSEAs.

Alternative 4 would also allow landowners with lands within SOSEAs but outside of owl circles to submit a cooperative habitat enhancement agreement (CHEA). CHEAs could provide significant benefit to owl populations in and around SOSEAs. Under a CHEA landowners could manage their lands in ways that would benefit owls but would not be prevented from further management or harvesting of forests in the future if owls were to take up residence on the lands covered by the agreement. CHEAs are not required to contribute to meeting the goals of the SOSEA; it is not clear if a CHEA may be used as mitigation for a LOP. Alternatives 1, 2 and 3 do not include provisions for CHEAs or similar plans.

Under this alternative, habitat that is cut at an owl site under the small parcel exemption, an HCP, a LOP, a federal rule, a "no take letter," an unlisted species agreement or other agreement entered into by a state or federal wildlife agency would continue to be counted towards the total acres necessary at the site. Approval of multiple plans could lead to the elimination or serious degradation of some sites because there is no assurance that mitigation for these plans will be complementary.

Restrictions would be placed on road construction, blasting, operation of heavy equipment, felling and bucking, cable yarding, helicopter yarding, skidding systems, slash disposal and prescribed burning within 0.25 mile of owl site centers inside SOSEAs, from March 1 through August 31 unless the landowner could demonstrate that owls were not nesting during the current nesting season. At sites outside of SOSEAs, however, harvesting, road construction and aerial application of pesticides would be restricted only in the 70 acres of highest quality habitat at the site center.

Analysis: Alternative 4 provides habitat definitions for submature and YFM consistent with that recommended by the SAG (Hanson et al. 1993); the proposed definition for old-forest, however, would exclude many stands currently considered "old-growth" by recent definitions. All habitat within 0.7 miles of owl site centers would be retained. It is uncertain whether the proposed habitat amounts for the Olympic Peninsula would, on average, provide sites at which owls could replace themselves in the population. In the western and eastern Cascades, it is likely that the proposed habitat amounts would not, in most cases, provide sites at which owls could replace themselves in the population. It is unknown to what extent LOPs would contribute to

viable owl populations within SOSEAs. It is not clear in the alternative how the biological contributions of proposed plans will be considered in relation to existing plans.

On the Olympic Peninsula, owl sites under Alternative 4 would have a considerably greater likelihood of supporting owl pairs at replacement rates than under Alternative 3; Alternatives 1 and 2 would not provide any habitat at Olympic Peninsula owl sites. In the western Cascades, Alternative 4 would provide higher quality sites than Alternative 1 by including all habitat within 0.7 miles of the site center and by retaining the closest, most contiguous and best habitat available, but would provide lower quality sites than Alternative 3. Although Alternative 2 would require nearly 600 acres of habitat more than Alternative 4, it would not necessarily retain all habitat within 0.7 miles of the site center. Consequently, it is unknown which of these alternatives would better provide for owl sites in the western Cascades. In the eastern Cascades, Alternative 4 would provide higher quality sites than Alternatives 1 and 2, but lower quality owl sites than Alternative 3. Required elements of LOPs under Alternative 4 are more clearly presented than in Alternatives 1, 2 and 3; however, there is still uncertainty under Alternative 4 concerning the goals and objectives of LOPs, the acceptance criteria, and on monitoring requirements. These could reduce the effectiveness of resulting LOPs. Under this alternative, CHEAs could provide significant contributions to owl populations in and around SOSEAs; Alternatives 1, 2 and 3 do not have similar provisions.

■ ALTERNATIVE 5 PROPOSED 4(d) RULE

Alternative 5 provides only general definitions for nesting, roosting and foraging habitat. These definitions include criteria only for species composition, canopy cover, multiple layers, and would require an unspecified number of large overstory trees. These definitions would likely not be implementable without further elaboration because quantitative values are not provided for most stand descriptors. In western Washington, these definitions may exclude some stands classified as YFM by the SAG definitions (Hanson et al. 1993) in western Washington; in the eastern Cascades, these definitions may include stands that would not meet the standards for YFM. Additionally, these definitions include no standards for snags, cavity trees, logs, shrubs or mistletoe.

Alternative 5 would "...generally retain the existing incidental take protection for owls located within [SEAs]." On the western Olympic Peninsula, this would require that 5,708 acres of habitat be provided within 2.7 miles of status 1, 2 or 3 owl site centers (Table 2.3-11). This would be 1,027 acres more than the median amount of habitat found in home range studies of pairs in this province (Buchanan et al. 1994). However, the proposed habitat total is less than that provided at 19 of 20 stable or increasing sites and all 21 declining sites included in the habitat capability analysis (Table 2.3-11, Figure 2.3-10).

In the eastern and western Cascades, this alternative would require that 2,663 acres of suitable habitat be protected within 1.8 miles of a status 1, 2, or 3 site center (Table 2.3-11). These acreage totals are 923 and 1,019 acres less than the

median amounts found within home range studies of pairs in the western and eastern Cascades respectively (Hanson et al. 1993). The required total acreage of habitat in the western Cascades is less than that documented at five of seven territorial spotted site centers in the province for which home range information is available (Hanson et al. 1993). Similarly, the required total acreage of habitat in the eastern Cascades (2,400 acres) is less than that documented at four of five territorial spotted owl site centers in the province for which home range information is available (Hanson et al. 1993). The proposed habitat total for sites in the western Cascades is less than that found at 11 of 12 stable or increasing sites and 30 of 36 declining sites included in the habitat capability analysis (Table 2.3-11, Figure 2.3-2). The proposed habitat total for sites in the eastern Cascades is less than that found at 22 of 30 stable or increasing sites and 10 of 13 declining sites in FMAZ 3 and 4, 283 acres less than the mean amount of habitat found within 1.8 miles of 27 sites in FMAZ 2, and 1,069 acres less than the mean amount of habitat found at six sites in FMAZ 5 (Table 2.3-11, Figure 2.3-4). There is apparently no requirement that the closest, most contiguous or best quality habitat be retained at a site.

Of the total acreage, 500 acres are required to be within 0.7 mile of the site center. This is counter to the majority and minority opinions of the SAG, both of which recommended protecting all available habitat within 0.7 mile of the site center (Hanson et al. 1993). Nineteen of 20 stable or increasing sites on the Olympic Peninsula, nine of 12 stable or increasing sites in the western Cascades and 21 of 30 sites in FMAZ 3 and 4 of the eastern Cascades have more than 500 acres of habitat within 0.7 miles (Table 2.3-12, Figures 2.3-1, 2.3-3, 2.3-9).

Alternative 5 includes a harvest exemption for landowners with less than or equal to 80 acres of forest lands within an SEA or within the "shadows" of owl sites centered on reserved federal lands outside of SEAs. Landowners could cut without regard to this rule as long as the forest practices did not include the 70 acres of habitat closest to the site center. Available information on ownership patterns, sizes, and habitat indicates that of sites included within or overlapping demographic support SEAs, 21 sites with at least one percent of the circle area in habitat owned by landowners with less than 100 acres would be left with less than 40% habitat if all the habitat were cut. Nine of these sites would have less than 30% habitat remaining. Eight sites have at least 50 acres of habitat within 0.7 miles of the site center which could be cut, and 14 sites have at least 20 acres of habitat within 0.7 miles that could be cut. It is unknown to what extent this exemption could affect owl sites centered on reserved federal lands whose "shadows" extend onto nonfederal lands, because the "shadow" sites that will be protected under this alternative are not known. Although the definition of a small landowner is much more restrictive in Alternative 5 (80 acres) than in Alternative 4 (500 acres), Alternative 5 may have a more significant negative impact on sites to be included in demographic support SEAs than Alternative 4 due to its allowance of cutting within 0.7 miles of site centers.

Landowners with between 80 and 5,000 acres of land within a SEA may follow the incidental take restrictions or complete a local option conservation plan (LOCP). An LOCP may involve multiple landowners and multiple species and habitats. The reporting requirements for LOCPs are less than that required of HCPs. The approval criteria for LOCPs are stated in general terms which could potentially be widely interpreted. Therefore it is difficult to assess to what extent LOCPs under this alternative would contribute to meeting SEAs goals or to "...the likelihood of the survival and recovery" of the owl in the wild. Additionally, there is no mention of whether monitoring to see whether the LOCP was achieving its biological goals would be required. Landowners with more than 5,000 acres of land within a SEA may follow the incidental take restrictions or complete an HCP. Again it is difficult to assess the extent to which HCPs would contribute to viable owl populations in Washington.

Alternative 5 would also allow landowners with lands within SEAs but outside of owl circles to submit a cooperative habitat enhancement agreement (CHEA). CHEAs could provide significant benefit to owl populations in and around SEAs. Under a CHEA landowners could manage their lands in ways that would benefit owls but would not be prevented from further management or harvesting of forests in the future if owls were to take up residence on the lands covered by the agreement. There is nothing in the language of Alternative 5 that would prevent those with lands at owl sites and elsewhere in the SEA from doing a CHEA for lands outside of owl sites, and an LOCP for lands at owl sites. Alternatives 1, 2 and 3 do not include provisions for CHEAs or similar plans.

Alternative 5 does not propose specific restrictions on operations, but notes that some activities related to timber harvesting have the potential to disturb the breeding and nesting of spotted owls during the reproductive season and may constitute "harassment." These activities include but are not limited to felling, bucking, yarding, road construction and blasting in the 70 acres of habitat closest to the site center.

Analysis: Alternative 5 is similar to Alternative 4 in terms of habitat amounts required at owl sites, the criteria guiding LOCPs, and the provisions for CHEAs. Alternative 5, however, would not require the retention of all habitat within 0.7 miles of the site center, nor retention of the closest, most contiguous and highest quality habitat at the site center as required by Alternative 4. Additionally, habitat definitions under Alternative 5 do not provide quantitative descriptions of suitable habitat and do not consider snags, cavity trees, logs or shrubs. Forest stands labelled as habitat or non-habitat under these definitions would at times be in disagreement with habitat classifications under the SAG definitions (Hanson et al. 1993). For these reasons, Alternative 5 is less likely to provide sites that would support owl pairs at replacement rates throughout the Washington range of the owl than Alternative 4. Because of the common elements of Alternatives 4 and 5, these alternatives are similar in comparisons with Alternatives 1, 2 and 3 (see discussion above in Alternative 4).

■ **ALTERNATIVE 6 - NO ACTION**

Under this alternative, no SOSEAs would be designated, and no protection of habitat on nonfederal lands would be required.

Analysis: Under this alternative, nearly all owl sites in Washington that are heavily dependent on nonfederal habitat and not protected by an HCP may be lost.

Criterion 4: Regional population viability support.

Information Relative to All Alternatives

This criterion considers whether conservation functions within important nonfederal landscapes would be provided where needed to support a high likelihood that a well-distributed and viable owl population would be maintained in Washington. Specifically, it considers whether (1) adequate habitat connectivity for dispersal between important areas of reserved federal land is provided; (2) the size, areal extent, distribution and demographic vigor of important federal clusters are supported; and (3) large and medium-size owl clusters (at least five sites) on nonfederal lands are retained and supported in the SOSEAs that would be designated under each alternative. The discussion relies heavily on the needs assessment information provided in "Areas of Concern" under the Affected Environment.

Table 2.3-13 lists the numbers of territorial owl sites affected by important nonfederal landscape areas identified by the SAG (Hanson et al. 1993) and the FDRP (USDI 1992b). These tallies include sites centered within landscape boundaries and sites centered on federal lands but whose provincial median home range radius overlaps nonfederal lands within the landscapes. Overall, 10% of these sites are centered on or surrounded by federal lands designated as matrix (Table 2.3-13), while 90% of these sites are associated with reserved federal lands or no federal lands. Of the 307 non-matrix sites, 87% have less federal habitat than the median amounts of habitat found at stable or increasing sites included in the habitat capability analyses (discussed in Criterion 3 and Addendum C), while 54% of sites have less than 30% federal habitat within their provincial median home range radii (Table 2.3-13). Seventy-three percent of the non-matrix sites have at least 10% nonfederal land within 0.7 miles of the site centers. Clearly, nonfederal lands are important to many of the sites in these landscapes.

Table 2.3-14 lists the numbers of known territorial sites that would be included within pair maintenance, demographic support, species distribution or combination function SOSEAs for each alternative. Figures 2.3-1 to 2.3-5 portray the proposed SOSEA boundaries for each alternative. Alternatives 1, 2 and 3 would support only sites that fall within SOSEA boundaries. In addition to sites within SOSEAs, Alternative 4 would support sites that are centered on federal lands outside of SOSEAs but whose provincial median home range radius overlaps SOSEA boundaries; Alternative 5 would include sites within SOSEAs and sites centered outside of SOSEAs on non-matrix federal lands but whose provincial median home range radius overlaps SOSEA boundaries.

Alternatives 4 and 5 would support the greatest number of sites. All the alternatives propose to protect only a subset of the owl sites currently including nonfederal lands in the various provinces. Alternative 5 is the only rule alternative which states that demographic support will not be provided for owl sites centered on federal lands designated as matrix or on nonfederal lands surrounded by federal matrix lands even when they occur within or overlap a SEA.

Table 2.3-13

Important nonfederal landscapes in Washington, total number of owl sites included within or overlapping from federal lands, numbers of non-matrix sites, numbers of non-matrix sites with less than median amounts of federal habitat, numbers of non-matrix sites with less than 30% federal habitat, and numbers of non-matrix sites with at least 100 acres of nonfederal land within 0.7 miles of the site center.

Landscape boundaries are those of the SAG (Hanson et al. 1993) except that I-90 East extends west to the Cascades crest. Lands within 1.8 miles of owl sites within eastern Cascades, 2.0 miles of the western Cascades, and 2.7 miles west of Interstate 5 are considered.

			Reserved and Non-Matrix[a] Sites with		
Landscape	Total NonFed Sites[a]	Non-Matrix Sites	<Median St./Incr. Fed. Hab. Amt.[b]	<30% Fed. Hab.[c]	>10% NonFed. Land within 0.7 miles
North Olympic Coast	36	36	31	15	19
Hoh-Clearwater	52	52	43	30	36
Southwest Washington	12	12	12	12	12
Finney	26	22	14	5	9
I-90 West	37	28	27	13	25
I-90 East Complex	72	67	61	36	57
Entiat Ridge	17	15	13[d]	7[d]	12
North Blewett	14	9[d]	7[d]	7[d]	6
Mineral Block/Link	24	24	23	13	19
Siouxon	14	11	9	6	7
Columbia Gorge/White Salmon Complex	37	31	26	22	23
Total	341	307	267	166	225

[a] Does not include sites centered on federal lands designated as matrix and sites centered on nonfederal lands surrounded by federal lands designated as matrix.
[b] Median amounts of habitat found at stable or increasing sites included in habitat capability analysis (discussed in Criterion 3) are: 4,043 acres in the western Cascades, 3,294 acres in the eastern Cascades and 9,044 acres on the Olympic Peninsula.
[c] Habitat amounts less than or equal to 2,413 acres in the western Cascades, 1,954 acres in the eastern Cascades and 4,397 acres on the Olympic Peninsula.
[d] Does not consider habitat losses at eight sites in the Entiat Ridge landscape and four sites in the North Blewett landscape resulting from the 1994 fires.

Table 2.3-14

Numbers of status 1, 2, and 3 owl sites in landscapes designated for pair maintenance, demographic support, species distribution or combination function.

Boundaries for some SOSEAs vary between alternatives. (Owl location data from WDFW, October 1995.)

Landscape	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
North Olympic Coast	0	0	6	0	0
Hoh-Clearwater	0	0	28	52	53
Southwest Washington	0	0	12	0	0
Finney	0	0	2	22	21
I-90 West	31	31	31	24	32
I-90 East Complex	50	58	58	69	77
Entiat Ridge	0	0	18	15	0
North Blewett	0	0	11	6	0[a]
Mineral Block/Link	24	24	24	24	28
Siouxon	0	6	6	9	11
White Salmon	0	0	15	19	13
Columbia Gorge	0	0	8	14	12
Total	105	119	219	254[b]	247

[a] Some sites in this area are included in the I-90 East Complex in this alternative.
[b] Total includes 87 sites within areas that are to provide a combination of demographic support and dispersal support.

■ ALTERNATIVE 1 - SIX LANDSCAPES

Alternative 1 provides for six SOSEAs in the western and eastern Cascades; no SOSEAs are provided on the Olympic Peninsula or in southwest Washington (Figure 2.1-1). Three SOSEAs (I-90 West, I-90 East, and Mineral Block) are to provide for pair maintenance, while three SOSEAs (Finney, Mineral Link, and Columbia Gorge) are to provide for dispersal.

In the northern Cascades, Alternative 1 would provide only for dispersal in the Finney Block SOSEA. Currently two pair sites are known to exist in the proposed SOSEA, and 20 non-matrix sites overlap the SOSEA (Table 2.3-13). Not including the demographic support function may result in the elimination of sites within the SOSEA and would not support overlapping sites on federal land; five of these sites have less than 30% federal habitat. One of the pair sites within the SOSEA is a part of the Finney Block cluster. Supporting territorial

In the I-90 corridor, two SOSEAs are planned; the function of both would be pair maintenance. The proposed I-90 East SOSEA includes most of the Taneum and Easton landscapes delineated by the SAG (Hanson et al. 1993) as well as some lands near the Cascades crest not included in the SAG landscapes. The I-90 East SOSEA does not include the Teanaway basin. A total of 109 territorial owl sites are known in the I-90 corridor; 81 of these sites would be included within the two pair maintenance SOSEAs (Tables 2.3-13, 14). Alternative 1 would protect fewer sites in the I-90 corridor than Alternatives 2, 3, 4 or 5 (Table 2.3-14).

The difference stems primarily from the exclusion of the Teanaway basin by Alternative 1. This area harbors 14 territorial sites, all of which include nonfederal lands. Seven of the sites are centered on nonfederal lands. The Teanaway basin provides habitat important for east-west connectivity between the I-90 corridor and owl clusters in the Swauk Creek area of Wenatchee National Forest and Chelan County. Federal lands capable of supporting NRF or dispersal habitat in the Teanaway basin comprise only a thin strip. Not including the Teanaway basin may result in the loss of seven sites on nonfederal lands and the degradation of seven overlapping federal sites. It could also result in weakening the east-west dispersal link in this area.

Although providing NRF habitat at territorial sites in the I-90 West and East landscapes would help ensure the connectivity of dispersal habitat in the I-90 corridor, there are no known sites in some parts of the corridor. Examples include the northern portion of I-90 West and the central part of the I-90 East SOSEA (corresponding to part of the Easton landscape under Alternatives 2, 3 and 4). Not including the dispersal function from the I-90 East and I-90 West SOSEAs may reduce the ability of owls to move through parts of these landscapes. Additionally there appears to be a gap between the southwestern portion of the I-90 West SOSEA and reserved federal land to the south. This alternative does not provide a mechanism for providing dispersal habitat between owl sites in the two areas.

Although the Mineral Link is designated dispersal, this function is not included in the Mineral Block. Providing habitat for demographic support would likely support dispersal through much of the area; however, where sites are not present, not including the dispersal function could lead to dispersal barriers within the block.

The designation of the Columbia Gorge as a dispersal landscape weakens the demographic connection between the Washington and Oregon spotted owl populations. The proposed boundaries of the Columbia Gorge SOSEA under this alternative includes only 45% of the area of nonfederal lands proposed under Alternatives 2 and 3 (Figures 2.3-1 to 2.3-3). While there are no territorial owl sites in the western portion of the Columbia Gorge or on the federal lands immediately north, dispersing owls attempting to travel through this area, given the often random nature of their movements, will be less likely to survive. By not including the western portion of the Columbia Gorge the likelihood that

dispersing owls that venture into this area would survive is reduced, thereby reducing the effectiveness of the dispersal connection between the Washington and Oregon Cascades.

There are eight known territorial sites on nonfederal lands in the Columbia Gorge SOSEA. Although these sites are contiguous with a large cluster of protected sites on national forest lands to the north, the federal sites are farther from the nearest owl cluster in Oregon. The nonfederal sites extend the distribution of this owl cluster more than five miles south of the nearest federal sites. Extending the distribution of pair sites may increase successful dispersal thus improving opportunities for demographic interchange across the Columbia River by providing high quality dispersal conditions in this part of the landscape and by providing a source of colonizers closer to the Columbia River. Designating the Columbia Gorge as solely a dispersal SOSEA may result in the loss of these eight owl sites, a reduction in the distribution of this southernmost owl cluster, and a reduction in the rate of interchange between the Washington and Oregon Cascades.

Alternative 1 would exclude nonfederal habitats in the Entiat Ridge, North Blewett, Siouxon, and White Salmon areas, the Olympic Peninsula, and southwest Washington from providing pair maintenance or dispersal functions. In these areas, sites centered on or heavily dependent on nonfederal lands may be lost, landscape conditions conducive to dispersal may not be provided and current conservation functions may be lost.

In the Entiat Ridge and North Blewett landscapes, NRF habitat on federal lands is currently limited (see "Areas of Concern" in Affected Environment) and cannot provide all habitat needs. In the Entiat Ridge landscape, 15 of 17 territorial sites are centered on or adjacent to reserved federal lands within the SOSEA (Table 2.3-13); six of 11 territorial sites within the North Blewett landscape are centered on or among reserved federal lands or nonfederal lands unassociated with federal lands. Twenty of these 21 "non-matrix" sites include nonfederal lands within 0.7 mile of their site centers. Before the 1994 fires in these areas, 14 of the non-matrix sites had less than 30% federal habitat and 20 non-matrix sites had less federal habitat than the median amount of habitat found at the stable or increasing sites analyzed in the habitat capability analysis. (Table 2.3-13; See Criterion 3). Not including the demographic support function in these landscapes could result in the loss of nonfederal habitat at most of these sites, thus weakening the demographic strength of the owl clusters in these areas. It is unknown how habitat reductions from the 1994 fires will affect future use of the affected sites by owls. Effective cluster size in the North Blewett landscape has been reduced by fire, and likely will be reduced by the designation of lands supporting some owl sites as matrix; this alternative would allow further reductions in the size and demographic vigor of this cluster and of the Entiat Ridge cluster. This could in turn affect the small and medium-sized owl clusters in the northeastern Cascades. Not including the dispersal function in the North Blewett landscape could result in a reduction in the ability of owls to move between the Swauk Creek and Entiat Ridge owl clusters.

Excluding the Siouxon area could result in the loss of the only medium-size cluster of owls in low-elevation habitat on the west slope of the Cascades. Low-elevation habitats may be among the most productive for spotted owls (Thomas et al. 1990, Bart and Forsman 1992). Additionally, if these sites were harvested, the areal extent of size of a large federal and nonfederal owl cluster would be reduced.

Excluding the White Salmon area would leave all nonfederal sites in Klickitat County (at least 20 territorial sites) unprotected and could result in their loss. Most owl sites in this landscape include little or no federal land. It would also weaken dispersal links between owls and habitat on the Yakama Indian Reservation, the southern portion of the Gifford Pinchot National Forest, and the Columbia Gorge. This would allow loss or reduction in size of a possibly large cluster of territorial owl sites on nonfederal lands in the While Salmon area.

On the Olympic Peninsula, 52 non-matrix sites are centered in or overlap the Hoh-Clearwater landscape and 36 non-matrix sites are centered in or overlap the North Olympic Coast landscape (Table 2.3-13). For the Hoh-Clearwater landscape, 30 of these sites have less than 30% habitat on federal lands, and 36 of these sites have more than 10% nonfederal land within 0.7 mile of the site centers. For the North Olympic Coast landscape, 15 of these sites include less than 30% federal habitat, and 19 of these sites have more than 10% nonfederal lands within 0.7 mile of the site centers (Table 2.3-13). Not including the demographic support function in these landscapes would likely result in the elimination of some sites and the maintenance of others at habitat amounts supporting low demographic vigor. Not including the dispersal function in the Hoh-Clearwater landscape could reduce the survival of dispersing owls moving through this landscape and reduce the rate of demographic interchange with owls on the coastal strip of the Olympic National Park. The Reanalysis Team (Holthausen et al. 1994) concluded that nonfederal owl sites on the west side of the Olympic Peninsula provided "...a biologically significant contribution to the maintenance of a stable population of spotted owls..." by increasing occupancy rates on federal lands and that..."retention of this habitat would likely increase the chances of maintaining a population on the coastal strip of the Olympic National Park."

Not including this landscape would reduce the likelihood of owl persistence. Simulations by Holthausen et al. (1994) did not reliably address the potential contribution of the North Olympic Coast landscape to owl population persistence on the Olympic Peninsula.

Excluding owl sites in southwest Washington from protection under forest practices rules could leave the few remaining sites with no regulatory protection. Only voluntary protection by the landowners would prevent elimination of the owl from this portion of its range.

Analysis: Under Alternative 1, little or no protection would be provided for owl sites, owl clusters and dispersal connections in several important landscapes. Dispersal functions in the White Salmon, Hoh-Clearwater and North Blewett landscapes would not be provided for on nonfederal lands. In the Columbia Gorge, Mineral Block, I-90 East and I-90 West landscapes, dispersal functions would only partially be provided. Not including the White Salmon and Hoh-Clearwater landscapes would likely result in the elimination or reduction of the nonfederal owl clusters in these areas. Not including demographic support functions in the Columbia Gorge and Siouxon landscapes and the Teanaway portion of the I-90 East landscape would likely result in the elimination or reduction of the nonfederal portions of large federal owl clusters, reducing their sizes and areal extents. In the Columbia Gorge, this could reduce the rate of demographic interchange with owl clusters in Oregon. Elimination of owl sites in the Teanaway Basin could reduce east-west connectivity between the I-90 corridor and owl clusters in the Swauk Creek area of Wenatchee National Forest and Chelan County. Not including the demographic support functions in the Entiat Ridge, North Blewett, Hoh-Clearwater, North Olympic Coast and Finney Block landscapes would likely result in many sites in these landscapes being eliminated or maintained at habitat levels that would support low demographic vigor. Omission of these functions would reduce the likelihood that a well-distributed and viable owl population would be maintained in the Washington Cascades and on the Olympic Peninsula.

Omission of the southwest Washington landscape from this alternative would likely result in further reduction or extirpation of owls from this portion of their range. The extirpation of owls from southwest Washington would contract the present range of the species in Washington reducing future conservation options for this area.

■ ALTERNATIVE 2 - TEN LANDSCAPES

Alternative 2 would provide for ten SOSEAs in the western and eastern Cascades; no SOSEAs would be provided on the Olympic Peninsula or in southwest Washington (Figure 2.1-2). Five SOSEAs (I-90 West, I-90 East, Taneum, Mineral Block, and Siouxon) would provide demographic support, while six SOSEAs (Finney, Easton, Mineral Block, Mineral Link, White Salmon, and Columbia Gorge) would provide dispersal support. Mineral Block would support both functions.

In the northern Cascades, Alternative 2 would provide only for dispersal in the Finney Block SOSEA. Currently, two pair sites are known to exist in the proposed SOSEA, and 20 non-matrix sites overlap the SOSEA. Omission of the demographic support function would likely result in the elimination of the sites within the SOSEA and would provide no support to overlapping sites on federal land; five of these sites have less than 30% federal habitat. One of the pair sites within the SOSEA is a part of the Finney Block cluster. Supporting territorial sites in and around the SOSEA would enhance dispersal through the landscape because NRF provides high quality dispersal habitat.

In the I-90 corridor, four SOSEAs are proposed: three for demographic support and one for dispersal. A total of 109 territorial owl sites are known in the I-90 corridor; 89 of these sites would be included within the three demographic support SOSEAs. Although the Teanaway Basin is included within the I-90 East SOSEA, five territorial sites within the checkerboard ownership area east of the Cascades crest would not be supported.

The single dispersal SOSEA, Easton, would provide a needed dispersal link between north and south, but other needed dispersal links within the I-90 West and East SOSEAs may not be adequate. The I-90 East and West SOSEAs have high densities of known owl sites, which, if protected, would maintain or enhance the connectivity of dispersal habitat within the corridor. However, in some portions of these SOSEAs owls are not now known to exist. Consequently, no dispersal habitat would be provided in these areas. Examples include the northern portion of I-90 West and parts of the Teanaway basin in I-90 East. Not including the dispersal function from the I-90 East and I-90 West SOSEAs may reduce the ability of owls to move through parts of these landscapes. Additionally, there appears to be a gap between the southwestern portion of the I-90 West SOSEA and reserved federal land to the south. This alternative does not provide a mechanism for providing dispersal habitat between owl sites in the two areas.

Demographic support functions would be provided in the Mineral Block and Siouxon landscapes, while dispersal functions would be provided in the Mineral Link and Block landscapes.

The designations of the Columbia Gorge and the White Salmon SOSEAs as solely dispersal landscapes could have adverse effects on the Cascades owl population. The effects of omitting the demographic support functions from these SOSEAs are discussed under Alternative 1.

The size of the White Salmon SOSEA, under Alternative 2, would be smaller than that proposed by Alternatives 3, 4 and 5. The small size of this SOSEA would likely reduce the ability of dispersing owls to move between the Yakama Indian Reservation, the southern portion of the Gifford Pinchot National Forest, and the Columbia Gorge.

Alternative 2 would exclude nonfederal habitats in the Entiat Ridge and North Blewett landscapes, the Olympic Peninsula, and southwest Washington from providing demographic support, dispersal or species distribution functions. The effects of omitting conservation functions in these areas are discussed under Alternative 1.

Analysis: Under Alternative 2, little or no protection would be provided for owl sites, owl clusters and dispersal connections in several important landscapes. Dispersal functions in the Hoh-Clearwater and North Blewett landscapes would not be provided for on nonfederal lands, and in the Columbia Gorge, White Salmon, I-90 East and I-90 West landscapes dispersal functions would only partially be provided. Omission of the demographic support

functions in the White Salmon and Hoh-Clearwater landscapes would likely result in the reduction or elimination of the nonfederal owl clusters in these areas and the maintenance of some sites in the Hoh-Clearwater landscape at habitat levels supporting low demographic vigor. Not including the demographic support functions in the Columbia Gorge and in the Teanaway portion of the I-90 East landscape would likely result in the elimination or reduction of the nonfederal portions of large federal owl clusters, reducing their areal extents. In the Columbia Gorge, this could reduce the rate of demographic interchange with owl clusters in Oregon; elimination of owl sites in the Teanaway Basin could reduce east-west connectivity between the I-90 corridor and owl clusters in the Swauk Creek area of Wenatchee National Forest and Chelan County. Not including the demographic support functions in the Entiat Ridge, North Blewett, North Olympic Coast and Finney Block landscapes would likely result in many sites in these landscapes being eliminated (reducing cluster sizes) or maintained at habitat levels that would support low demographic vigor. (The first three of these landscapes are not included in Alternative 2). Not including these functions would reduce the likelihood that a well-distributed and viable owl population would be maintained in the Washington Cascades and on the Olympic Peninsula.

Not including the southwest Washington landscape from this alternative would likely result in the further reduction or extirpation of owls from this portion of their range. The extirpation of owls from southwest Washington would contract the present range of the species in Washington reducing future conservation options for this area.

Inclusion of demographic support functions in the Siouxon landscape and the Teanaway Basin and the dispersal function for the Mineral Block by Alternative 2 would likely provide increased benefit to spotted owl populations in Washington over that proposed by Alternative 1.

■ ALTERNATIVE 3 - FIFTEEN LANDSCAPES

Alternative 3 would designate a total of 15 SOSEAs: 12 SOSEAs in the Cascades, two SOSEAs on the Olympic Peninsula, and one SOSEA covering much of southwest Washington (Figure 2.1-3). Most SOSEAs would be designated to provide two or more of the three functions proposed in this alternative.

All of the important nonfederal landscape functions identified by the SAG (Hanson et al. 1993) would be provided under this alternative. However, demographic support would not be provided for owl sites centered on reserved federal lands outside of SOSEA boundaries but whose provincial median home range radii overlap demographic support SOSEAs. For some SOSEAs, there are likely many overlapping sites centered on reserved federal lands with federal habitat amounts below that needed to support demographic replacement rates. For example, the Hoh-Clearwater and North Olympic Coast SOSEAs are overlapped by 11 and nine sites centered on reserved federal land, respectively, with less than 30% federal habitat. The Finney Block SOSEA is overlapped by 12 non-matrix sites with less federal habitat than the median

amount found at stable or increasing sites in the habitat capability analysis (discussed in Criterion 3 and Addendum C); four of these sites include less than 30% federal habitat. Most of the other demographic support and dispersal SOSEAs proposed in this alternative are overlapped by sites centered on reserved federal land with low federal habitat amounts.

The SOSEA boundaries proposed by Alternative 3 would leave out a portion of the checkerboard ownership area immediately east of the Cascades crest. Currently, there are five territorial sites within this area. Additionally there appears to be a gap between the southwestern portion of the I-90 West SOSEA and reserved federal land to the south. This alternative does not provide a mechanism for providing dispersal habitat between owl sites in the two areas.

In southwest Washington, one large SOSEA covering most of the region would be established. Its functions would provide for dispersal and the maintenance of the species' distribution. Preserving these sites now would keep open a wider range of conservation options for the future and prevent, for now, a contraction in the range of the spotted owl in Washington. If spotted owls are to be maintained beyond the next few decades in this landscape, proactive management involving regrowing suitable habitat to create new owl sites will be necessary.

Analysis: In the Cascades and Olympics, SOSEA distributions, functions, and sizes would probably support the weak links in the federal owl population network and provide a reasonable likelihood of persistence throughout the owl's current range until substantial amounts of habitat on federal lands are regrown. Existing medium and large nonfederal owl clusters and the sizes and areal extent of federal owl clusters would be preserved. Not including demographic support for sites centered on reserved federal lands overlapping SOSEAs, however, could result in low habitat amounts and low demographic vigor at some of these sites.

This alternative would provide stronger support than Alternatives 1 and 2 for the conservation functions needed in important nonfederal landscapes to provide a high likelihood that a well-distributed and viable owl population would be maintained in Washington. While the measures proposed for the Cascades and the Olympics are probably adequate to ensure persistence of well-distributed populations, those proposed for southwest Washington may not be. In southwest Washington, implementing Alternative 3 would prevent for now the extirpation of the owl from this portion of its range. However, additional actions would be necessary to ensure the long-term security of the owl population in this area. Alternative 3 is the only alternative that proposes a SOSEA for southwest Washington and the only alternative that would seek to support existing owl sites in this area.

■ ALTERNATIVE 4 - TFW PROPOSAL

Alternative 4 would provide for nine SOSEAs in the western and eastern Cascades and one SOSEA on the Olympic Peninsula; southwest Washington would not be included in a SOSEA (Figure 2.1-4). SOSEAs under this

alternative may provide demographic support, dispersal support or combination support. Some of the proposed SOSEAs would support all three types of functions on different lands within the SOSEAs. In combination support areas "...either suitable spotted owl habitat should be maintained to protect the viability of the owl(s) associated with each northern spotted owl site center or a variety of habitat conditions should be provided which in total are more than dispersal support and less than demographic support." Combination support areas should "...contain some opportunities for nesting" but the level of support that would be given to owl sites in these areas and the proportion of existing owl sites that will be retained within these areas are unspecified. Additionally, combination function areas are to provide dispersal support and "connectivity" between demographic support areas or federally reserved lands, although the differences between dispersal support and connectivity are not specified. Demographic, dispersal and combination support would be extended to owl sites overlapping SOSEAs but centered on federal lands outside of SOSEAs under this alternative. This is the only alternative that proposes combination functions.

In the northern Cascades, the Finney Block SOSEA would provide demographic, dispersal and combination support in different areas. Two sites are centered within the SOSEA; one would be within a demographic support area, the other in a combination support area. The 12 reserved sites overlapping the SOSEA with less federal habitat than the median amount of habitat found at stable or increasing sites included in the habitat capability analysis all overlap either demographic support or combination support areas. Three of the four sites with less than 30% federal habitat would receive demographic support.

In the I-90 corridor, two SOSEAs, I-90 West and East, would be provided covering the entire corridor, Taneum, Easton and Teanaway Basin areas and including 94 sites within demographic or combination support areas. In both SOSEAs, nonfederal lands intermingled with federal matrix lands are designated for dispersal support. Additionally, the Easton area and portions of the I-90 West SOSEA with no federal lands or owl sites are designated for dispersal support. The Teanaway Basin is designated for combination function; 14 sites are centered within or overlap only this portion of the SOSEA. The remaining portions of both SOSEAs are designated for demographic support. Additionally, there appears to be a gap between the southwestern portion of the I-90 West SOSEA and reserved federal land to the south. This alternative does not provide a mechanism for providing dispersal habitat between owl sites in the two areas.

Demographic and dispersal support would be designated for different portions of the Entiat and North Blewett SOSEAs. Of the 17 sites within the Entiat landscape, 15 would receive some demographic support, and two sites centered on nonfederal lands would receive only dispersal support. Of the 15 sites that would receive some degree of demographic support, nonfederal lands potentially important to five sites are excluded from demographic support areas. For at least three of these sites, nonfederal habitat within 0.7 mile of the

site centers are excluded. The two sites centered on nonfederal lands are adjacent to reserved federal lands but are within areas designated for dispersal support. These two sites would likely be lost under this alternative.

In the North Blewett landscape, six sites centered on federal lands would receive demographic support, although the amount of support for two of these sites would be minimal. Both of these sites suffered habitat loss in the 1994 fires. It is unknown how habitat reductions from the 1994 fires will affect future use of the affected sites by owls. Three sites in matrix areas would be included in areas designated for dispersal support. Two sites centered on nonfederal lands and including predominantly nonfederal lands are excluded from this SOSEA; these sites would likely be lost under this alternative. One of these sites suffered some habitat loss in the 1994 fires. Cluster size in the North Blewett landscape has been reduced by fire, and likely will be reduced by the designation of lands supporting some owl sites as matrix; this alternative would allow further reductions in the size and demographic vigor of this cluster and of the Entiat Ridge cluster. Not including the dispersal function in the North Blewett landscape would likely result in a reduction in the ability of owls to move between the Swauk Creek and Entiat Ridge owl clusters.

Three landscapes, the Mineral Block, White Salmon, and the Columbia Gorge would be included in combination function SOSEAs. These landscapes support important owl clusters or portions of clusters dependent to a large degree on nonfederal lands. Successful owl dispersal through these landscapes is important for the local and regional functioning of the owl population in these areas and in the southern Cascades of Washington. Providing demographic support and dispersal support would best provide for the conservation functions needed in these landscapes to support well-distributed and viable populations. Designating these areas as combination support (something less than demographic support but more than dispersal support) suggests that the size of these clusters would be reduced, or that the existing owl sites would be maintained but at habitat amounts and configurations that may result in low demographic vigor for some sites or that both of these outcomes may occur.

The areal extent of the White Salmon and the Columbia Gorge SOSEAs would be less under this alternative than under Alternative 3. For the White Salmon SOSEA, two territorial sites included by Alternative 3 would not be included under this alternative. Habitat for two other sites would be left out under this alternative. These four sites may be lost under Alternative 4. A portion of the Columbia Gorge landscape would not be included under this alternative. Although there are no territorial owl sites in the western portion of the Columbia Gorge or on the federal lands immediately north, dispersing owls attempting to travel through this area, given the often random nature of their movements, will be less likely to survive. This has the potential to reduce the effectiveness of the dispersal connection between the Washington and Oregon Cascades.

The Siouxon landscape would be included within a demographic support SOSEA, although the eastern "panhandle" of this landscape would not be included. It is possible that this area could be important for dispersing owls. Nonfederal habitat within 0.7 mile of the center of one site would be omitted under Alternative 4; this site is centered on the border between federal and nonfederal lands.

On the Olympic Peninsula, Alternative 4 would provide one SOSEA, the Hoh-Clearwater; this SOSEA would include areas of demographic, dispersal and combination support. Generally, demographic support would be provided in areas bordering federal lands and in the eastern portion of the Hoh-Clearwater Block. All sites in and along the coastal strip of the Olympic National Park but one would be included in demographic support areas; this remaining site would receive only dispersal support. Four sites centered on and including almost exclusively nonfederal lands are in areas that would be designated for combination support. These four sites currently have little habitat remaining (less than 20% at each site). The remaining portions of the SOSEA would provide dispersal support. The configuration of landscape functions assembled in this SOSEA would likely support demographically the most important portions of the western Olympic Peninsula owl population while maintaining strong dispersal connections between the coastal strip and interior federal lands, as well as north-south connectivity in the landscape. Alternative 4 would not provide a SOSEA encompassing the North Olympic Coast landscape; the consequences of this are discussed above under Alternative 1.

Excluding owl sites in southwest Washington from protection under forest practices rules could leave the few remaining sites with no regulatory protection. Only voluntary protection by the landowners would prevent elimination of the owl from this portion of its range.

Under Alternative 4, WDNR in consultation with WDFW would be required to review whether the goals of a SOSEA had been met by approval of each landscape plan. There are no standards in the rule language on how SOSEAs would be reviewed or under what conditions deletion, modification or reinstatement of SOSEAs would be recommended to the Forest Practices Board.

Analysis: In the Cascades, Alternative 4 would support dispersal functions in most of the important nonfederal areas with three exceptions: the western Columbia Gorge, the northern portion of the North Blewett landscape, and between the southwest portion of the I-90 West SOSEA and owl sites on reserved federal lands to the south. There are concerns that the size, demographic vigor, and/or areal extent of owl clusters within the Mineral Block, White Salmon and Columbia Gorge landscapes would have reduced support due to their inclusion in combination support SOSEAs. The size of the North Blewett and Entiat owl clusters would likely be reduced due to omission of owl sites, while demographic vigor at some sites may be reduced due to not including important habitats from demographic support areas.

On the Olympic Peninsula, the proposed Hoh-Clearwater SOSEA would likely provide for dispersal connections and demographic support to the most important portions of the western Olympic Peninsula. No support would be provided for owl sites in or overlapping the North Olympic Coast landscape.

Not including the southwest Washington landscape in this alternative would likely result in the further reduction or extirpation of owls from this portion of their range. The extirpation of owls from southwest Washington would contract the present range of the species in Washington reducing future conservation options for this area.

Alternative 4 would provide greater support than Alternatives 1 and 2 for the conservation functions needed in important nonfederal landscapes to provide a high likelihood that a well-distributed and viable owl population would be maintained in Washington. The concerns listed above for the Cascades and the lack of support for sites along the North Olympic Coast and southwest Washington by this alternative suggest support for important conservation functions by this alternative would be less than under Alternative 3.

■ ALTERNATIVE 5 - PROPOSED 4(d) RULE

Alternative 5 would provide seven SEAs within the Cascades and Olympics (Figure 2.1-5). The functions of these SEAs would be demographic support except in areas where federal lands designated as matrix were intermingled with nonfederal lands; in these areas dispersal would be supported. It is unclear whether portions of SEAs lacking federal lands and territorial owl sites would provide dispersal support under this alternative. If this is to be the case, it appears that the main mechanism for this would be through LOCPs or HCPs. Alternative 5 may also provide demographic support to some owl sites centered on reserved federal lands not associated with the seven SEAs. These "shadow" sites are to be identified over the next two years.

In the northern Cascades, the Finney SEA would provide demographic support to owls centered within and overlapping the SEA from non-matrix federal lands. It is unclear, whether nonfederal lands in this landscape would also provide dispersal support.

In the I-90 corridor and North Blewett areas, this alternative would provide one SEA incorporating all known owl sites in the I-90 region and four non-matrix owl sites in the North Blewett landscape. Two non-matrix owl sites in the North Blewett landscape, one centered on reserved federal lands and one on adjacent nonfederal lands would not be included within the SEA boundaries; the latter of these sites would likely be lost. Nonfederal lands between owl sites on the White River Ranger District of Mount Baker-Snoqualmie National Forest on the northern flank of Mount Rainier and the checkerboard area of the I-90 West landscape would be included in the SEA. In total, 108 non-matrix owl sites within or overlapping this SEA would be supported (Table 2.13, 14). Although providing NRF habitat at territorial sites in this SEA would help ensure the connectivity of dispersal habitat in the I-90 corridor and North Blewett landscape, there are no known sites and little federal land in some

parts of the corridor. Examples include the northwestern portion of the SEA and the central part of the I-90 East landscape (corresponding to part of the Easton landscape under Alternatives 1, 2 and 3). It is unclear whether dispersal would be provided for in these areas.

No support would be given to sites in the Entiat Ridge landscape; the consequences of this are discussed above under Alternative 1.

One SEA would cover the Mineral Block and Link landscapes. Again it is unclear whether dispersal support would be provided in addition to demographic support for the owl population in federally reserved areas.

SEAs would also be provided in the Siouxon, Columbia Gorge and White Salmon landscapes. The areal extent of the White Salmon SEA would be less under this alternative than under Alternatives 3 and 4. Four territorial sites included by Alternative 3 would not be included under this alternative. Additionally, potentially important habitat for three other sites would not be included under this alternative. Some and perhaps all of these sites may be lost under Alternative 5. Again, it is unclear whether dispersal support would be provided in portions of these SEAs lacking owl territorial owl sites.

On the western Olympic Peninsula, the Hoh-Clearwater SEA would provide demographic support for 53 owl sites centered within or overlapping the SEA from federal lands. Sites in the North Olympic Coast landscape would not be supported; the consequences of this are discussed under Alternative 1.

Excluding owl sites in southwest Washington from protection under forest practices rules could leave the few remaining sites with no regulatory protection. Only voluntary protection by the landowners would prevent elimination of the owl from this portion of its range.

Analysis: It is unclear to what extent dispersal in important nonfederal landscapes would be supported by this alternative. Owl sites in the I-90 corridor, Mineral Block, Siouxon, Columbia Gorge and Hoh-Clearwater landscapes would be supported. Although some owl sites would be supported in the North Blewett and White Salmon landscapes, the size of these clusters would likely decrease under Alternative 5. No support would be provided in the Entiat Ridge, North Olympic Coast and southwest Washington landscapes.

Not including the southwest Washington landscape in this alternative would likely result in the further reduction or extirpation of owls from this portion of their range. The extirpation of owls from southwest Washington would contract the present range of the species in Washington reducing future conservation options for this area.

Alternative 5 would provide stronger support than Alternatives 1 and 2 for the conservation functions needed in important nonfederal landscapes to provide a high likelihood that a well-distributed and viable owl population would be maintained in Washington. The uncertainty that this alternative would provide effective dispersal links, the reduced cluster sizes supported in the North

Blewett and White Salmon landscapes and the lack of support for owl sites in the North Olympic Coast and southwest Washington landscapes suggest that support for important conservation functions by this alternative would not be as strong as that under Alternative 3. Between Alternatives 4 and 5, it is unknown which would provide greater support for important conservation functions contributing to a well-distributed and viable owl population in Washington.

■ ALTERNATIVE 6 - NO ACTION

Under Alternative 6, no SOSEAs would be designated and no landscapes would be required to provide owl conservation functions.

Analysis: Alternative 6 would provide no support to the federal owl population, or to spotted owl viability in Washington. It would allow the degradation and elimination of all owl conservation functions currently supported by nonfederal lands.

Criterion 5: Protection against catastrophic habitat loss.

Information Relative to All Alternatives

This criterion considers the extent to which each alternative will contribute to owl populations that are resilient to and protected against catastrophic habitat loss. The likelihood of owl persistence in portions of the federal habitat network vulnerable to crippling habitat loss from wind and fire, exacerbated by drought, insects, and disease, could be increased by providing additional owl clusters to help spread the risk of extinction and by ensuring that existing owl clusters are demographically strong. To accomplish this, owl clusters throughout the region must be protected, and habitat adequate to support high pair occupancy and reproductive rates at individual sites must be provided. Wind along the Pacific coast and fire in the eastern Cascades have the greatest potential for destroying or degrading habitat on a large-scale in important areas over the next 100 years (Agee and Edmonds 1992). In the eastern Cascades, risk reduction for the regional owl population and for owl habitat may be possible by managing landscapes to reduce the severity of fires while retaining owl sites, thereby reducing the frequency of large-scale habitat loss or degradation at owl sites. Such an approach would require a combination of site-specific and landscape risk-reduction strategies.

The basic premises of this criterion are that (1) populations affected by periodic large-scale catastrophic habitat loss are less prone to extinction when the risk is spread among subpopulations and if the unaffected subpopulations are themselves demographically strong, and (2) the likelihood of local and regional extinction decreases with decreasing frequency, severity and extent of catastrophic disturbance (Thomas et al. 1990).

Although fire and wind have the potential for large-scale disturbance in many regions inhabited by spotted owls, the discussion of each alternative assesses the support provided for owl sites in important nonfederal landscapes in eastern Washington, the western Olympic Peninsula, and southwest

Washington, where large-scale catastrophic habitat losses are most likely. This criterion specifically considers the degree to which existing owl clusters would be supported, the quality, amount and distribution of habitat that would be provided at individual sites, and the extent to which each alternative would encourage meaningful experimentation in the eastern Cascades to reduce the risk of large-scale catastrophic fires within a landscape while retaining demographically viable owl pairs.

The best available opportunities for meaningful experimentation in the eastern Cascades to reduce the risk of large-scale catastrophic fires within a landscape while retaining demographically viable owl pairs would be through LOPs or HCPs. Each of the five action alternatives provides a landscape planning process. Alternative 4, however, is the only one directing landowners to consider fire risk reduction in landscape plans for the eastern Cascades. This alternative would require that LOPs "...consider the need to protect the forests from catastrophic loss from wildfire, insects, and diseases" in the eastern Cascades. To the extent that this consideration focused on proactive landscape management to reduce high intensity fire risk while supporting owl sites, it would represent a positive contribution to the likelihood of spotted owl population persistence in the eastern Cascades. Fire risk reduction in the eastern Cascades could also be incorporated into landscape plans under the other alternatives.

■ ALTERNATIVE 1 - SIX LANDSCAPES

In the eastern Cascades, Alternative 1 would provide a single pair maintenance SOSEA, I-90 East. No protection would be provided for other important nonfederal landscapes (Entiat Ridge and North Blewett) that are highly susceptible to large-scale destructive fires. The I-90 East SOSEA would not include the Teanaway Basin leaving a narrow east-west corridor of habitat on protected federal lands to connect the Swauk Creek and Chelan County owl clusters to the I-90 corridor. If the nonfederal east-west connection were lost or degraded, isolation of these northeastern owl clusters would be increased.

Under Alternative 1, the portion of the owl population reliant on nonfederal lands would not be resilient to catastrophic habitat loss. At territorial sites in the I-90 corridor, Alternative 1 would not provide for demographically strong owl sites (discussed under Criterion 3). Alternative 1 would require habitat amounts that total only 53% of the median amount of habitat found in studies of pair home ranges, less habitat than 87% of stable or increasing sites analyzed in FMAZs 3 and 4 and 990 acres less than the mean amount of habitat found in a sample of owl circles in FMAZ 2 (discussed under Criterion 3). Accordingly, most sites reliant on nonfederal lands may be expected to have low reproductive rates. Nonfederal habitat would likely be located adjacent to federal reserves and provide some benefit to sites in these areas.

Alternative 1 would provide no SOSEAs on the Olympic Peninsula or southwest Washington. Risk reduction to those populations against widespread habitat loss or degradation due to windthrow would not be supplied.

Analysis: Alternative 1 would provide no reduction of risk against catastrophic habitat loss on the Olympic Peninsula or southwest Washington. By not including the Teanaway Basin, and the Entiat Ridge and North Blewett landscapes, and by providing low habitat amounts at sites within the I-90 East SOSEA, this alternative would provide little contribution to risk reduction in the eastern Cascades.

■ ALTERNATIVE 2 - TEN LANDSCAPES

In the eastern Cascades, Alternative 2 would provide two demographic support SOSEAs in the I-90 corridor: I-90 East and Taneum. In contrast to Alternative 1, the I-90 East SOSEA would include the Teanaway Basin. No reduction of risk would be provided for owl populations in the Entiat Ridge and North Blewett landscapes, both of which are highly susceptible to large-scale destructive fires.

Under Alternative 2, the portion of the owl population reliant on nonfederal lands would not be as resilient to catastrophic habitat loss. At territorial sites in the I-90 East and Taneum SOSEAs, Alternative 2 would require habitat amounts that total 65% of the median amount of habitat found in studies of pair home ranges, less habitat than 80% of the stable or increasing sites analyzed in FMAZs 3 and 4, and 546 acres less than the mean amount of habitat found in a sample of owl circles in FMAZ 2 (discussed under Criterion 3). Thus most sites reliant on nonfederal lands may have low reproductive rates. Nonfederal habitat would likely be located adjacent to federal reserves and provide some benefit to sites in these areas.

Alternative 2 would provide no SOSEAs on the Olympic Peninsula and southwest Washington, and therefore, no risk reduction to these owl populations against widespread habitat loss or degradation due to windthrow.

Analysis: Alternative 2 would provide no reduction of risk against catastrophic habitat loss on the Olympic Peninsula and southwest Washington. Not including the Entiat Ridge and North Blewett landscapes and by providing low habitat amounts at sites within the I-90 East and Taneum SOSEAs, this alternative would provide little contribution to risk reduction in the eastern Cascades. However, this alternative would provide slightly more protection than Alternative 1 by providing demographic support for the Teanaway Basin and by providing more habitat at owl sites in the I-90 East and Taneum SOSEAs.

■ ALTERNATIVE 3 - FIFTEEN LANDSCAPES

Alternative 3 would provide four demographic support SOSEAs in the eastern Cascades covering the most important nonfederal landscapes. The amount of habitat that would be provided at demographic support sites would be 433 acres less than the median amount found in studies of pair home ranges, less than 53% of the stable or increasing sites in FMAZ 3 and 4, and 303 acres more than the mean amount of habitat found within a sample of owl sites in FMAZ 2. Additionally, priority for protection would be given to the highest quality and closest habitats (discussed under Criterion 3). Thus many of these sites would

be expected to have greater reproductive rates and survival rates than under Alternatives 1 and 2. Nonfederal habitat would likely be located adjacent to federal reserves and provide some additional benefit to sites in these areas.

Along the Pacific coast, Alternative 3 would provide one SOSEA encompassing virtually all known territorial sites centered on nonfederal lands on the western Olympic Peninsula. However, the amount of habitat that would be provided is only 82% of the median amount of habitat found in studies of pair home ranges and less than that found within 2.7 miles of all stable and increasing sites analyzed (discussed in Criterion 3). This alternative would prioritize protection of habitats closest to the site center, which may ameliorate to some extent the low habitat amounts. One SOSEA encompassing all known owl sites in southwest Washington would also be provided; it is unclear how much habitat would be provided at these sites. It is not known whether sites in southwest Washington and the western Olympic Peninsula would, on average, support demographic rates sufficient for replacement of the resident owls.

Analysis: In the areas where catastrophic habitat losses are most likely, Alternative 3 provides substantially greater risk reduction to owl populations than either Alternatives 1 or 2. In the eastern Cascades, territorial owl sites in all of the most important nonfederal landscapes would be provided with greater amounts of more contiguous and higher quality habitat than under Alternatives 1 and 2. This would likely provide for an owl population in the eastern Cascades that is more resilient to catastrophic habitat loss.

On the Olympic Peninsula, this alternative would provide additional support for the owl population on the western Olympic Peninsula, the area where habitat loss and degradation due to windthrow is most likely. By providing additional sites beyond those protected on federal lands, this alternative reduces the demographic risk associated with recurrent wind storms. It is not known if these sites would, on average, support owls at demographic replacement rates.

In southwest Washington, retention of the known owl sites would provide greater risk reduction against catastrophic habitat loss than the other alternatives.

■ ALTERNATIVE 4 - TFW PROPOSAL

In the eastern Cascades, Alternative 4 would provide demographic support or a combination of demographic support and dispersal in portions of the four most important nonfederal landscapes. In the I-90 corridor, most sites would be within demographic support portions of the I-90 East and Taneum SOSEAs. The Teanaway Basin would be included within a combination function area of the I-90 East SOSEA. In the North Blewett landscape, Alternative 4 would provide demographic support for as many as four territorial sites; however, seven currently recognized sites would not be supported. Of these seven sites, three are on matrix lands, two are on reserved federal lands but suffered habitat losses to fire in 1994, and two sites are centered on nonfederal land. One of the two sites centered on nonfederal land is surrounded by reserved

federal lands. Effective cluster size in the North Blewett landscape has been reduced by fire and likely will be reduced by the designation of lands supporting owl sites as matrix; this alternative would allow further reduction in the size of this cluster. In the Entiat Ridge landscape, some degree of demographic support would be provided at all but three nonfederal sites; however, some lands important to sites within demographic support areas are excluded.

Under Alternative 4, the portion of the owl population reliant on nonfederal lands would likely not be resilient to catastrophic habitat loss. The amount of habitat that would be provided at demographic support sites in the eastern Cascades would be 1,077 acres less than the median amounts found in studies of pair home ranges, less than 77% of the stable or increasing sites analyzed in FMAZ 3 and 4, and 341 acres less than the mean amount of habitat found within a sample of owl sites in FMAZ 2 (discussed in Criterion 3). Sites in the Teanaway Basin would likely receive less support than sites in demographic support areas. Thus these sites may have low reproductive or survival rates. Nonfederal habitat would likely be located adjacent to federal reserves and provide some benefit to sites in these areas.

Along the Pacific coast, Alternative 4 would provide one SOSEA encompassing virtually all known sites centered on nonfederal lands on the western Olympic Peninsula. The amount of habitat that would be provided is 1,182 acres more than the median amount of habitat found in studies of pair home ranges, but less than that found within 2.7 miles of 95% of stable and increasing sites analyzed (discussed in Criterion 3). It is not known whether sites on the western Olympic Peninsula would, on average, support demographic rates sufficient for replacement of the resident individuals. Prioritizing protection of habitats closest to the site center may provide added support for these sites. Sites in southwest Washington would not be supported by this alternative.

Analysis: In the areas where catastrophic habitat losses are most likely, Alternative 4 provides a reduction of the risk to owl populations. In the I-90 corridor and the Teanaway Basin, most owl sites would receive some level of support, while in the North Blewett and Entiat Ridge landscapes, several owl sites would be left unsupported or important nonfederal lands would be excluded from demographic support areas. The habitat amounts provided may be insufficient to support high rates of reproduction at most sites, but the prioritization for protection of the highest quality and closest habitat may ameliorate to some extent the low habitat amounts. This alternative would likely provide some contribution to owl population risk reduction in the eastern Cascades.

On the Olympic Peninsula, this alternative would provide additional support for the owl population on the western Olympic Peninsula, the area where habitat loss and degradation by wind is most likely. By providing additional sites beyond those protected on federal lands, this alternative reduces the demographic risk associated with recurrent wind storms.

Alternative 4 would provide greater risk reduction in all areas than Alternatives 1 and 2. On the Olympic Peninsula, the contribution from this alternative would exceed that from Alternative 3 because of the greater amounts of habitat that would be provided at owl sites. In the eastern Cascades, the contribution to owl population risk reduction would be less than that from Alternative 3.

■ ALTERNATIVE 5 - PROPOSED 4(d) RULE

In the eastern Cascades, Alternative 5 would provide demographic support in the I-90 corridor, Taneum, Teanaway Basin and North Blewett areas; demographic support would not be provided for owl sites in the Entiat Ridge landscape unless they are designated as "shadow" sites. The amount of habitat that would be provided at demographic support sites in the eastern Cascades would be 1,019 acres less than the median amounts found in studies of pair home ranges, less than 73% of the stable or increasing sites analyzed in FMAZ 3 and 4, and 283 acres less than the mean amount of habitat found within a sample of owl sites in FMAZ 2 (discussed in Criterion 3). Thus most of these sites may support low reproductive rates. Under Alternative 5, the portion of the owl population reliant on nonfederal lands would be less resilient to catastrophic habitat loss than under Alternative 3. Nonfederal habitat would likely be located adjacent to federal reserves and provide some benefit to sites in these areas.

Along the Pacific coast, Alternative 5 would provide one SOSEA encompassing virtually all known sites centered on nonfederal lands. The amount of habitat that would be provided is 1,027 acres more than the median amount of habitat found in studies of pair home ranges, but less than that found within 2.7 miles of 95% of stable and increasing sites analyzed (discussed in Criterion 3). Thus it is uncertain whether sites on the western Olympic Peninsula would, on average, support demographic rates sufficient for replacement of the resident individuals. Sites in southwest Washington would not be supported by this alternative.

Analysis: Alternative 5 provides some reduction of risk to owl populations in most of the areas where catastrophic habitat losses are most likely. In the eastern Cascades, most owl sites in the I-90 corridor, Teanaway Basin and North Blewett landscapes would receive some level of support; however, no support would be extended to owl sites in the Entiat Ridge landscape, unless they were included as "shadow" sites. The habitat amounts provided may be insufficient to support high rates of reproduction at most sites. This alternative would likely provide some contribution to owl population risk reduction in the eastern Cascades.

On the Olympic Peninsula, this alternative would provide additional support for the owl population on the western Olympic Peninsula, the area where habitat loss and degradation by wind is most likely. By providing additional sites beyond those protected on federal lands, this alternative reduces the demographic risk associated with recurrent wind storms.

Alternative 5 would provide a level of owl population risk reduction similar to, but a little less than Alternative 4.

■ ALTERNATIVE 6 - NO ACTION

Alternative 6 would provide no risk reduction for owls or habitat on nonfederal lands in Washington.

Analysis: Alternative 6 would contribute no additional risk reduction against catastrophic habitat loss.

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NOTE: References cited in this chapter are listed in Appendix E.

Addenda A through D are located in Appendix F.

Chapter Three

There is no Chapter 3 in this document because this part of the Draft EIS analyzed the marbled murrelet proposed rules. Chapter 3 will be published in the Final EIS.

Chapter Four

Other Species within the Range of the Northern Spotted Owl and the Marbled Murrelet

4.1 Introduction

This chapter completes discussion of the affected environment within the range of the northern spotted owl and the marbled murrelet and the effects of the proposed rule alternatives on that environment. Chapter 1 introduced this discussion by describing the physical environment; Chapters 2 and 3 described the targeted species northern spotted owl and marbled murrelet, respectively, and analyzed the effects of the proposed rule alternatives to those species. This chapter focuses on the other species that share the environment with spotted owls and marbled murrelets. In most cases, the scientific names for the species are not in the text but are located in Appendix C.

Section 4.2, Affected Environment, includes a listing and description of animal species (a) listed as endangered, threatened, or sensitive by the state of Washington, (b) candidates for state listing, and (c) endemic species as well as a listing and discussion of major plants groups found in the target environment.

Section 4.3, Environmental Consequences, discusses the effects of the proposed rule alternatives for the northern spotted owl and marbled murrelet to the described species.

4.2 Affected Environment of Other Potentially Affected Species

Excluding salmonid fish which are discussed separately, a total of 16 animal species were either listed as endangered, threatened, or sensitive by the state of Washington, candidates for state listing or species of concern/endemic species as of November 18, 1994 (WDFW 1994) as shown in Table 4.1.

Table 4.1

Federal and Washington state listed species and sensitive species, as of November 18, 1994 (WDFW 1994)

E = endangered, T = threatened

Federally Listed Species with State Status

Species	Status Federal	Status State	Species	Status Federal	Status State
Gray Wolf	E	T	Grizzly Bear	T	E
*Sei Whale	E	E	*Fin Whale	E	E
*Blue Whale	E	E	*Hump-backed Whale	E	E
*Black Right Whale	E	E	Columbia White-tailed Deer	E	E
*Mountain Caribou	E	E	*Brown Pelican	E	E
Aleutian Canada Goose	T	E	Peregrine Falcon	E	E
*Snowy Plover	T	E	Spotted Owl	T	E
*Oregon Silversport Butterfly	T	E	*Steller Sea Lion	T	E
Bald Eagle	T	E	Marbled Murrelet	T	T
*Green Sea Turtle	T	T	*Loggerhead Sea Turtle	T	T
*Olive Ridley Sea Turtle	T	Candidate			

Additional State Listed Species

*Pygmy Rabbit	E	*Sea Otter	E
*Gray Whale	E	*Sperm Whale	E
*American White Pelican	E	Sandhill Crane	E
Upland Sandpiper	E	Western Pond Turtle	E
*Leatherback Sea Turtle	E	Western Gray Squirrel	T
Lynx	T	Ferruginous Hawk	T

State Sensitive Species

Larch Mountain Salamander

State Species of Concern - Endemic Species

Olympic, Cascade, and Columbia Torrent Salamanders
Salmonids

NOTE: Nineteen species (identified above with an asterisk) are not discussed further in this chapter either because they are not found within the shared range of the northern spotted owl and the marbled murrelet in Washington, or because they are not found in the forested environment affected by forest practices rules.

Endangered Species

■ GRAY WOLF

The gray wolf *(Canis lupus)* is listed by both the federal and state governments as endangered in Washington (WDW 1993a). This species ranges over large areas (Laufer and Jenkins 1989) and potentially occurs throughout the same range as that of the grizzly bear (discussion follows), as well as the Washington Cascade Mountains south to the Columbia River.

The gray wolf uses virtually any type of forest and natural opening as long as the level of human activity is low and there is an ungulate prey base (Laufer and Jenkins 1989). Because the wolf is currently becoming re-established throughout many parts of Washington and little data have been collected on its

habitat use, all naturally vegetated lands should be considered potentially suitable habitat for this species. Vegetation types used include quaking aspen, mixed conifer, ponderosa pine, white or grand fir, alpine meadows, shrublands, riparian zones, marshes, bogs, and swamps (Thomas 1979). Wolf dens are normally located under logs or in rock outcrops.

■ GRIZZLY BEAR

The grizzly bear *(Ursus arctos)* is listed by the federal government as threatened in Washington and by the state as endangered (WDW 1993a). This species potentially occurs throughout the Cascade Range, from Canada south to near Yakima, and across the northern third of the state from the Okanogan Highlands to the Idaho border (Almack et al. 1993). The federally designated North Cascades Grizzly Bear Ecosystem extends through this region at elevations from about 492 to 10,778 feet.

The grizzly bear ranges over large areas and typically uses many vegetation types to fulfill its life requisites. Of special importance to bears are wet meadows, swamps, bogs, streams, and conifer, subalpine, and lodgepole pine forests, as well as alpine meadows and parklands (Brown 1985). However, these habitats alone would not be sufficient for supporting this species. Areas with little human disturbance may be preferred as habitat; however, no actual analysis has been conducted in Washington to confirm this speculation (Almack et al. 1993).

All naturally vegetated land types are considered suitable grizzly bear habitat. Den sites of grizzly bears can be found in nearly any type of forest, but are typically in coniferous forests. Bears normally select den sites on steep slopes above 5,670 feet (Almack 1986). Bears forage in many vegetation types in order to obtain sufficient plant and animal foods. Their diet includes 124 species of plants, winter-killed ungulates, small mammals, and anadromous fish (Almack et al. 1993).

■ COLUMBIAN WHITE-TAILED DEER

The Columbian white-tailed deer *(Odocoileus virginianus leucurus)* is listed by both the federal government and the state as endangered in Washington. The deer's current range is limited to areas less than about 10 feet above sea level (USFWS 1983). Approximately 700 to 1,000 Columbian white-tailed deer occur along the Columbia River (USFWS 1983). They are found only in bottomlands and on several islands in an 18-mile reach of the Columbia River near Cathlamet, Washington, and in an area near Roseburg, Oregon (USFWS 1983). Within Washington, these deer occur in the Julia Butler Hansen Columbian White-tailed Deer National Wildlife Refuge, and on Puget, Brown, Jackson, Ryan, Little, and Hunting Islands, which are owned privately or managed by DNR. Several DNR parcels of land in the refuge and on Puget Island are leased to the U.S. Fish and Wildlife Service and private landowners.

Potential habitat for the Columbian white-tailed deer includes Columbia River bottomland riparian forests (alder, cottonwood, and spruce), grassland, pastures, and farmland not occupied by black-tailed deer (WDFW 1994).

Columbian white-tailed deer are primarily grazers, feeding in active and abandoned farm fields and pastures within 820 feet of forest cover and forest parks (WDFW 1994). The deer's historical habitats include tidal spruce swamps, park forest, open canopy forest, sparse rush, and wetlands (USFWS 1983). Spruce, alder, cottonwood, and willow are common tree and shrub species used by deer for foraging, resting, and thermal cover (USFWS 1983).

Although the population of Columbian white-tailed deer is apparently doing well (i.e., down- or de-listing this population has been considered), range expansion has not occurred, primarily because black-tailed deer have taken over other suitable habitat along the Columbia River, precluding white-tailed deer from using these areas.

■ ALEUTIAN CANADA GOOSE

The Aleutian Canada goose (*Branta canadensis leucopareia*), a subspecies of the Canada goose, is listed by the federal government and state as endangered. In 1967, it became one of the first species to be listed (*Federal Register* v. 32, no. 48). From the early 1970s, when the recovery effort was initiated, to 1984, the population increased five-fold to 4,000 birds (Amaral 1985). This subspecies is distinguished from the other locally ubiquitous subspecies by the broad white ring at the base of its neck. The Aleutian Canada goose nests on Buldir and Chagulak Islands of the Aleutian archipelago in Alaska. Its historic winter range extended from British Columbia to California and into parts of Japan (Amaral 1985). Currently, the San Joaquin Valley of California is the species' main wintering area (Amaral 1985). Habitat used during migration includes agricultural fields, grasslands, wetlands, lakes, and large ponds.

■ PEREGRINE FALCON

The peregrine falcon (*Falco peregrinus*) is listed by the federal government and the state as endangered (WDW 1993a). In Washington, three subspecies occur: *F. p. anatum, F. p. peali,* and *F. p. tundrius* (Allen 1991), but only *F. p. anatum* is believed to nest here (Peregrine Falcon Recovery Team 1982; Johnsgard 1990). Fifteen nesting pairs of peregrine falcons were recorded along the outer coast, in the San Juan Islands, and along the Columbia River Gorge in 1990 (Allen 1991). Washington primarily provides important migratory and wintering habitat for peregrines, including estuaries such as Skagit River flats, Grays Harbor, and Willapa Bay where falcons prey on large concentrations of waterfowl and shorebirds. *F. p. peali* and *F. p. tundrius* are present as winter migrants.

Most peregrine nests are located on cliffs or high escarpments that dominate the nearby landscape, although office buildings, bridges, and river cutbanks have also been used for nesting (PFRT 1982; Craig 1986). Most preferred nesting cliffs are at least 150 feet high and can be found from sea level to 11,000 feet (PFRT 1982). Foraging habitat includes marshes, lakes, river bottoms, croplands, and meadows where peregrines prey primarily on songbirds, waterfowl, and shorebirds (Porter and White 1973). During the

breeding season, peregrine falcons will travel as far as 17 miles from the aerie to hunt, although a hunting range of 10 miles is considered typical (Porter and White 1973; PFRT 1982).

■ SANDHILL CRANE

The sandhill crane (*Grus canadensis*) is a state endangered species (WDFW 1995), that has no federal status. Sandhill cranes migrate throughout the state, and breeding has been documented in both eastern and western Washington (WDFW 1994). Sandhill cranes are extremely wary and therefore use only large tracts of open habitat with good visibility (WDFW 1994). Habitat for this species includes grain fields, wet meadows, nonforested wetlands, and shallow ponds (Type 2 and 3 waters) (Brown 1985; WDFW 1994). Nesting habitat is extensive shallow-water marshes with dense emergent plant cover (Littlefield and Ryder 1968). Wet meadows and grasslands are used for foraging and resting habitat (Brown 1985; WDFW 1994).

■ UPLAND SANDPIPER

The upland sandpiper (*Bartramia longicauda*) is listed in Washington as endangered and has no federal status (WDW 1993a). Upland sandpipers winter in South America and their breeding range includes the northern half of North America and Canada. In Washington the potential breeding range for the upland sandpiper includes the eastern half of the state, however, the only confirmed nesting occurred at Stubblefield Lake on the Turnbull National Wildlife Refuge and in the east Spokane valley (WDFW 1995b).

Upland sandpipers prefer to nest in grasses that are between 6.5 to 12.5 inches tall and which provide nest concealment of at least 50% or more from above, and with at least three covered sides (Kirsch and Higgins 1976). Compared to other ground nesting birds, upland sandpipers have a relatively high hatching success rate ranging from 63% to 100% (Kirsch and Higgins 1976; WDFW 1995b). This high success rate may be attributed to behavior, including mobbing of potential predators, vocalizations and coloniality (WDFW 1995b). The predominant causes of nest failures have been attributed to predation and livestock trampling (WDFW 1995b).

Upland sandpipers utilize a wide range of habitat types during the nesting season including croplands, pastures, native prairies, and wet meadows (WDFW 1995b). Forage areas are generally more open than nest areas in order to allow birds to scan the ground in search of insects. Recently cut or grazed agricultural areas as well as open prairie areas provide the majority of the foraging or loafing areas (WDFW 1995b).

■ SPOTTED OWL

Refer to Chapter 2

■ WESTERN POND TURTLE

The western pond turtle (*Clemmys marmorata marmorata*) is currently a category 2 candidate for federal listing and is listed by the state as endangered (WDW 1993a). This species is known to occur at elevations from sea level to

6,000 feet from extreme southwestern British Columbia to the Sacramento Valley in California, principally west of the Sierra-Cascade crest (Bury 1970; Stebbins 1985); however, all sightings of the turtle north of the Willamette Basin in Oregon occurred below 2,400 feet (WDW 1993c). Recorded sightings in Washington seem to be clustered around the southeastern edge of Puget Sound and along a small portion of the Columbia River (Nussbaum et al. 1983; WDW 1993c). This distance between populations is the largest known disjunction in the range of the western pond turtle (WDW 1993c). Populations are confirmed only in Klickitat and Skamania Counties, with recent individual sightings of the turtles in Pierce and King Counties (WDW 1993c). Historical records also exist in Clark and Thurston Counties. In 1992, 69 turtles were recorded at 15 sites in Washington (Nordby 1992).

Western pond turtles inhabit marshes, sloughs, moderately deep ponds, and slow-moving portions of creeks and rivers. They need basking sites, such as partially submerged logs, vegetation mats, rocks, and mud banks. Evenden (1948) reported two records of pond turtles occurring in rapid-flowing, clear, cold, rock and gravel streams in the Cascade foothills. The pond turtle has also been sighted in brackish coastal waters (Ernst and Barbour 1972). Pond turtles hibernate in the bottom mud of streams or ponds, or on land up to 1640 feet from water (Ernst and Barbour 1972; Holland 1989; Slavens 1992). Western pond turtles feed on aquatic vegetation, invertebrates, small fish, frogs, and carrion (WDW 1993c); however, they apparently prefer live or dead animal tissue to plant material.

Bury (1972) conducted a four-summer study of western pond turtles in a 2.17 mile stretch of Hayfork Creek in Trinity County, California. The study site was situated in an area of woods (oak, ponderosa pine, and scattered Douglas-fir), chaparral, and open grassy areas at 2,000 ft above sea level. Estimates of home-range size of the species were as follows: adult males, 2.41 acres; adult females, 0.61 acres; and juveniles, 0.90 acres.

Throughout their range, western pond turtles nest from late April through August, but in Oregon, the peak breeding period is thought to be June to mid-July. Eggs are deposited in an earthen nest in soft soil on upland sites (Stebbins 1954; Nussbaum et al. 1983), and usually excavated in the morning. The nest is most often located near the margin of a pond or stream, but pond turtles have been found hundreds of yards from water.

Because Washington populations of western pond turtles are extremely low, the continued presence of this species must be confirmed in areas where they have been documented previously. Records in Washington are few and scattered, indicating the possibility of rarity or an ongoing decline. The literature is devoid of information on the possible association of western pond turtles with truly forested areas. In view of the need for lengthy periods of direct sunshine for the successful hatching of buried eggs, the use of ponds or streams in older forests appears unlikely. The possibility of their use of cut-over areas, given proper aquatic habitats, has not been investigated.

Bullfrogs and non-native fish species present a risk to populations of pond turtles through predation and resource competition. Other risks to the species include predation by carnivorous mammals, degradation of shoreline vegetation, and alteration of upland habitat within .25 mile of watercourses (WDW 1993d).

Threatened Species

■ WESTERN GRAY SQUIRREL

Refer to Chapter 5 on the Draft EIS, January 1995.

■ LYNX

The lynx (*Lynx canadensis*) is listed by the state as threatened (WDW 1993a) and is currently a category 2 candidate for federal listing. The range of this species includes north central and northeastern Washington with the largest contiguous range in Okanogan and Chelan Counties (WDW 1993d). Throughout it's range, the lynx occurs at high elevations (above 4,000 feet in north central Washington, and above 3,500 feet in northeast Washington) and requires a mixture of forest conditions from early successional to mature forests. Lynx use early successional forests for foraging activities, escape, hiding, and thermal protection, and use mature forests (older than 150 years) for denning activities (WDW 1993d; Koehler and Brittell 1990). In Washington, mixed conifer stands represent the majority of lynx habitat (WDW 1993d).

Travel corridors are necessary for movement between foraging habitat and den sites and must contain vegetation more than 6 ft. in height and have a minimum of 180 trees per acre (WDW 1993d). Lynx generally do not cross openings larger than 300 feet (Koehler and Brittell 1990; WDW 1993d).

The population dynamics of the lynx are largely dependent on the availability of prey species, primarily snowshoe hares (*Lepus americanus*). Snowshoe hares require early successional forests and prefer to browse on either new growth or small-diameter twigs. Early successional forests with dense stands of 4,690 to 13,440 trees per acre provide hare with essential winter browse as well as habitat for thermal and security cover (Koehler and Brittell 1990). Ideal age classes for these stands average between 6 and 30 years and should cover at least 20-25 acres (the average home range for snowshoe hares) (Koehler and Brittell 1990).

■ BALD EAGLE

The bald eagle *(Haliaeetus leucocephalus)* is listed by both the federal government and the state as threatened (WDW 1993a). Throughout Washington, the bald eagle typically occurs along the coasts, major rivers, lakes, and reservoirs (USFWS 1986). Potential habitats are riparian areas along rivers, streams, lakes, sloughs, and reservoirs; coastal estuaries and beaches; freshwater beaches; and mature and old-growth forest stands within 1 mile of water (Brown 1985).

Washington supports the largest population of nesting bald eagles in the seven-state area covered by the Pacific Bald Eagle Recovery Plan (USFWS 1986). Most nesting in Washington occurs on the San Juan Islands and along the Olympic Peninsula coast; however, nesting territories are also found along Hood Canal, on the Kitsap Peninsula, in Island County, along the Columbia River in southwestern Washington, in the Cascade Range, and in eastern Washington (USFWS 1986). Bald eagles typically nest near water, usually on prominent features overlooking aquatic foraging areas (Stalmaster 1987; Anthony and Isaacs 1989). In western Washington, distance between nest sites and water averages 282 feet (Grubb 1976); within the seven-state recovery area, nest sites are generally within 1 mile of water (USFWS 1986). The average territory radius ranges from 1.55 miles in western Washington to 4.41 miles along the lower Columbia River, where reproduction rates are low (Grubb 1980; Garrett et al. 1988). The three main factors affecting distribution of nests and territories are: (1) proximity to water and food, (2) suitable nesting, perching, and roosting trees, and (3) the number of breeding eagles (Stalmaster 1987). Nest sites in western Washington are most commonly in Douglas-fir and Sitka spruce trees. Nest trees average 116 feet tall and 50 inches dbh and typically exceed the U.S. Forest Service's minimum dbh specifications for old-growth inventory (Anthony et al. 1982).

Washington also supports the largest population of wintering bald eagles in the seven-state recovery area. Primary wintering areas include the Olympic Peninsula, the San Juan Islands (particularly Cypress Island), Puget Sound and its tributaries, Hood Canal, and the Cowlitz and Columbia Rivers (Taylor 1989). The Skagit River supports one of the largest concentrations of wintering bald eagles in the contiguous United States, with as many as 553 individuals counted during peak periods (Stalmaster 1989). Food availability is the major factor that attracts bald eagles to wintering locations (Stalmaster 1987). Many areas that have abundant populations of overwintering waterfowl or salmon runs also support large concentrations of wintering eagles (Biosystems Analysis, Inc. 1980; Keister et al. 1987).

Bald eagles use perches during nesting, hunting, feeding, territorial maintenance, and behavioral displays (Stalmaster 1987). Eagles select perches that provide a good view of the surrounding territory; typically, the tallest perch tree available is preferred (Stalmaster 1987). Along the Nooksack River, dead trees are strongly preferred as daytime perches during the winter; tree species commonly used are black cottonwood, big leaf maple, or Sitka spruce (Stalmaster and Newman 1979). Because of its relatively low height, red alder is used less often (Stalmaster 1976).

Wintering bald eagles often roost communally in single trees or large forest stands. Most of these areas are near a rich winter food source (typically anadromous fish) and in forest stands that are of uneven ages and have some old-growth characteristics (Anthony et al. 1982). Many roost sites are in ravines and draws that protect eagles in bad weather (Hansen 1978; Keister 1981). Roost sites are generally positioned in the tallest, most dominant trees that provide unobstructed views of the surrounding landscape (Anthony et al.

1982). In western Washington, communal roost sites have been documented in black cottonwood, Douglas-fir, western red cedar, western hemlock, and other tree species (Hansen et al. 1980; Anthony et al. 1982).

Anthony and Isaacs (1989) recommend that habitat alterations not occur within 1,312 feet of bald eagle nests and that disturbance activities within 2,625 feet of nests be restricted between January 1 and August 15. The Pacific States Bald Eagle Recovery Plan (USFWS 1986) recommends temporary buffers of 1,312 feet around screened roosts and 2,625 feet around visible roosts. Timber harvests can occur, but only between November 1 and April 1. Along foraging areas, a 164- to 326-foot wide strip of tall perch trees should be maintained. Stalmaster (1987) recommends that a buffer zone of 820 to 984 feet be maintained where little screening cover is present. Under WAC 232-12-292, the Washington Department of Fish and Wildlife works with landowners to design site-specific management plans that provide flexible zoning instead of setting standard buffer distances.

■ FERRUGINOUS HAWK

The ferruginous hawk (*Buteo regalis*) is currently a category 2 candidate for federal listing and is listed by the state as threatened (WDW 1993a) The range of this species includes areas in southeast Washington, with the highest concentrations in Benton and Franklin Counties. This hawk is a summer resident only and is rarely seen in Washington during winter months (WDFW 1995c).

Most ferruginous hawk nests occur on the ground, rock outcroppings or cliffs; however, isolated trees or various manmade structures may also be utilized (WDFW 1995c; Woffinden and Murphy 1989). Ferruginous hawks require undisturbed grasslands or desert shrublands and avoid nesting in areas with greater than 50% agricultural cultivation (WDFW 1995c). Disturbance due to recreation and farming practices are two primary causes for nest failures. Research suggests that buffers of 250 meters would prevent the failure of 90% of nests in Washington (WDFW 1995c). Ferruginous hawks may live up to 20 years and often select the same nesting territories throughout their lives (Woffinden and Murphy 1989).

■ MARBLED MURRELET

Refer to Chapter 3 in the Draft EIS, January 1995.

Sensitive Species

■ LARCH MOUNTAIN SALAMANDER

Listed as threatened in Washington and as a candidate by USFWS (Aubrey et al. 1987), the Larch Mountain salamander (Plethodon larselli) appears to be a relic species on the decline. It was first described as a subspecies of the Van Dyke's salamander (*Plethodon vandykei*) (Burns 1954). It is restricted to talus slopes, rock outcrops, and caves in Klickitat, Skamania, and Lewis Counties in Washington. Overstory trees appear to be important to moderate moisture loss

and temperature in preferred habitat. Human activities, including the removal of gravel for road building and clearcutting of overstory trees, are potential threats to existing populations (Herrington and Larsen 1985).

The Larch Mountain salamander has a highly restricted range (Herrington and Larsen 1985) and is found along a 36-mile stretch of the Columbia River Gorge in Washington and Oregon. Most habitat for the Larch Mountain salamander is protected in the Columbia Gorge National Scenic Area (Leonard et al. 1993). Aubry et al. (1988) recently extended the range in two areas of the central Cascades of Washington. Larch Mountain salamanders have been found at a minimum of 35 sites in Washington (WDW 1993b). The Washington Department of Fish and Wildlife identifies the main Washington distribution as extending from the Washougal River to near the Klickitat River, with isolated populations occurring as far north as Lewis and King Counties (WDW 1993b; WDFW 1994). A disjunct population occurs inside a lava tube cave in the Mount St. Helens National Volcanic Monument. Larch Mountain salamander sites also occur at Archer Falls and along the Washougal River. However, surveys of potential habitat are needed to confirm actual presence (K. McAllister, WDW, Olympia, Washington, letter to C. Turley, WDNR, Olympia, Washington, February 15, 1994).

Within its range, the Larch Mountain salamander occurs at elevations between 50 and 1,250 meters above sea level (WDW 1993b) and appears to have relatively restricted habitat requirements, including stabilized talus ranging in size between 1 and 6 cm with soil deposits in the interstitial spaces. Larch Mountain salamanders are more common in areas with dense overstories of coniferous or deciduous trees that help maintain higher moisture levels (WDW 1993b). Herrington and Larsen (1985) make a solid case for a direct, dependent relationship between this salamander and Pacific Northwest old-growth forests. In their study, one site (Mabee Mines Road in Skamania County, Washington) was comprised of two talus slopes separated by a creek. One talus slope had been clearcut 10 years before their study began, and no Larch Mountain salamanders were found on the cut-over area; but the other talus slope, directly across the creek from the cut slope, contained Larch Mountain salamanders.

No data exists regarding the population dynamics of the Larch Mountain salamander. Individuals of this species behave in a manner similar to most other Pacific Northwest plethodontid salamanders; they are active at or near the surface whenever temperature and moisture regimes permit, which could be any day of the year in the Columbia River Gorge (Herrington and Larson 1985, 1987). Courtship behavior has not been observed, but mating occurs primarily in the fall and occasionally in the spring (Herrington and Larsen 1987). No clutches of eggs have been found for this species.

Herrington and Larson (1985) point out that the Columbia River Gorge is an area with numerous potential uses by humans, many of which could be detrimental to populations of these salamanders. Any land use practice which

impacts moisture regimes in suitable stabilized talus slopes probably will eliminate populations of the Larch Mountain salamander. Logging, harvesting talus for road building, and housing developments could all adversely affect the status of this species. The Washington Department of Fish and Wildlife (1994) recommends that a buffer of up to 150 feet of uncut forest be maintained around any occupied talus slope to protect populations of this salamander.

Lehmkuhl and Ruggiero (1991) compiled a list of species associated with late-successional Douglas-fir forests in the Pacific Northwest and modeled the risk of local extinction for each species from habitat loss or fragmentation. This model was based on frequency of occurrence, abundance, body size, and mobility of the various species. The Larch Mountain salamander was determined to be a species of high risk (score of 9, where 1 is low and 10 is high). Thomas et al. (1990) considered populations of this species to be at a medium to high viability risk.

Species of Concern and Endemic Species

■ OLYMPIC, CASCADE, AND COLUMBIA TORRENT SALAMANDER

In 1992, the Olympic salamander (*Rhyacotriton olympicus*) was split into four species (Good and Wake). Three of these species occur in Washington. The Olympic torrent salamander (*R. olympicus*) occurs only on the Olympic Peninsula. The Cascade torrent salamander (*R. cascadae*) occurs in the Cascade Mountains of Washington and Oregon. The Columbia torrent salamander (*R. cascadae*) occurs in the Willapa Hills in Washington, the Oregon Coast range, and in the Cascades Mountains. All of the Torrent salamanders are closely associated with seeps and streams in forested habitats.

■ SALMONIDS

Status and Distribution.

In western North America, anadromous salmonids range from mid-California to the Arctic Ocean (Meehan and Bjorn 1991). Their historic distribution included southern California and Mexico (The Wilderness Society 1993). Freshwater salmonid habitat extends eastward into Idaho, i.e., the Snake River and its tributaries. All species from the Pacific Northwest migrate out into the Pacific Ocean, with some traveling as far north as the Bering Sea. Anadromous salmonids occupy all of Washington except the area north of the Snake River drainage and east of the Columbia River (central Washington) and the area east of the Okanogan highlands (northeastern Washington) (SASSI 1992).

Stocks and Evolutionarily Significant Units

Fisheries management of salmonids is normally done according to stocks. A stock is a discrete breeding population. The Washington State Salmon and Steelhead Stock Inventory (SASSI 1992) has defined stock to be: "The fish spawning in a particular lake or stream(s) at a particular season, which fish to a substantial degree do not interbreed with any group spawning in a different place, or in the same place at a different season."

The spatial or temporal reproductive isolation required by this definition is reflected in the names given to stocks, e.g., "Nisqually River summer steelhead" or "Snohomish River fall chinook". Stocks may possess distinct biological characteristics (e.g., physical appearance, habitat preferences, genetics, or population demography), but not necessarily. As noted by Meehan and Bjornn (1991), "stock" can be considered synonymous with "subspecies."

The Endangered Species Act defines species as "any distinct population-segment of any species of vertebrate fish or wildlife which interbreeds when mature" (16 U.S.C. 1532(15)). For purposes of the Endangered Species Act, salmon stocks are grouped into populations known as evolutionarily significant units (ESU). If conditions warrant federal listing of a salmonid, it is the stated intention of National Marine Fisheries Service to list ESUs, rather than an entire salmonid species or individual stocks (*Federal Register* vol. 56).

An ESU is a population that (1) is substantially reproductively isolated from other conspecific population units and (2) represents an important component in the evolutionary legacy of the species (Waples 1991). The first criterion is essentially the same as the SASSI (1992) definition of a stock. The second criterion requires that subpopulations in separate ESUs possess significant genetic or other biological differences. As a result, many stocks are lumped into a single ESU. For example, agencies in Washington, Oregon, and California have identified more than 200 distinct stocks of coho salmon. These stocks have been grouped into six ESUs. Washington contains at least 90 stocks of coho (SASSI 1992), and these are distributed among three ESUs.

Salmonid Status in the Pacific Northwest

Nehlsen et al. (1991) assessed extinction risks for 214 native naturally-spawning salmonid stocks occurring in Idaho, Washington, Oregon, and northern California. They estimated that 101 (47%) of these stocks had a high risk of extinction, 58 (27%) had a moderate risk, and 54 (25%) were of special concern.

Under the Endangered Species Act, the National Marine Fisheries Service regulates salmonid, and it has declared several different salmonid populations as threatened or endangered. The agency listed Sacramento River winter chinook as threatened in 1990 (Nehlsen et al. 1991) and Snake River sockeye as endangered in 1991 (*Federal Register* vol. 56, no. 224). Spring/summer and fall runs of Snake River chinook were listed as threatened in 1992 (*Federal Register* vol. 47, no. 78). In March 1995, the steelhead populations in the Klamath Mountains of northern California were proposed for listing as threatened (*Federal Register* vol. 60, no. 51).

The National Marine Fisheries Service mitigated status reviews for west coast steelhead trout in May 1993 and coho salmon in October 1993 (*Federal Register* vol. 58, no. 206; vol. 59, no. 102). The status review for steelhead is expected to be completed by late 1995 or early 1996. The status review for coho, completed in July 1995, proposed that the species be federally listed in Oregon and California, but not in Washington.

The federal government initiated coastwide status reviews for the other five anadromous salmonids in September 1994 (*Federal Register* vol. 59, no. 175). The first of these reviews, for pink salmon, will not be completed before October 1995. Completion of the status reviews for chum, sockeye, chinook, and sea-run cutthroat will probably occur in 1996. The federal listing of salmonid species could be followed by federal regulations pertaining to forest practices on state and private lands.

Bull trout are regulated by the U.S. Fish and Wildlife Service and were made a category 2 candidate for federal listing in 1985 (*Federal Register*, vol. 50, no. 181). In response to petitions, the U.S. Fish and Wildlife Service began a rangewide status review in May 1993. This review, completed in June 1994, concluded that the status of the bull trout warranted its listing as a threatened species but was precluded due to other higher priority actions. At that time, the species was assigned a listing priority number of 9 (on a scale of 1 to 12, with 1 being the highest priority) and made a category 1 candidate. In April 1995, the species was reassigned a listing priority number of three. Dolly Varden is not a federal candidate.

Williams et al (1989) listed the bull trout as a species of special concern. In Washington, 77 separate bull trout/Dolly Varden populations have been identified (Mongillo 1993). Information was adequate to determine the status of only 34 population. Of these, nine (6%) were considered to have a high risk, six (18%) a moderate risk, and 13 (38%) a low risk of extirpation.

Salmonid Status in Washington

The Salmon and Steelhead Stock Inventory (1992) identified 435 distinct salmonid stocks in Washington. Information for 322 stocks was adequate to assess their status, and of these, 38% were classified as "depressed" and 4% as "critical" (SASSI 1992). A depressed stock is one "whose production is below expected levels based on available habitat" (SASSI 1992), and a critical stock is one for which "permanent damage to the stock is likely or has already occurred" (SASSI 1992).

Nehlsen et al. (1991) compiled a list of Pacific Northwest salmon stocks threatened with extinction. They defined three risk categories: high risk of extinction, moderate risk of extinction, and special concern. Stocks with a high or moderate risk of extinction have likely attained the threshold for listing under the Endangered Species Act. Stocks with a moderate risk have higher spawning escapements than stocks with a high risk. That is, stocks with a moderate risk have a larger number of spawning adults each year. Stocks of special concern have not attained the threshold for listing, but do face some risk of extinction or possess some unique character that requires attention. For stocks in Washington, their list describes 47 as having a high risk of extinction, 18 as having moderate risk, and 27 as being of special concern. A partial list of extinct stocks (Nehlsen et al. 1991) includes 42 stocks from Washington.

Many western Washington salmonid fish stocks have been petitioned for listing under the Endangered Species Act. These stocks live in almost all streams in the range of the northern spotted owl and include:

- Mid-Columbia basin summer chinook
- All coho salmon in Washington
- Deer Creek (Stillaguamish River) summer steelhead
- All steelhead in Washington
- Hood Canal summer chum salmon
- Discovery Bay summer chum salmon
- Discovery Bay coho
- Baker Lake (Skagit River) sockeye
- Elwha River pink salmon
- Lower Dungeness River pink salmon
- Dungeness River spring chinook
- White River spring chinook
- North Fork Nooksack spring chinook
- South Fork Nooksack spring chinook
- All anadromous and resident bull trout

Table 4.2

Life history of Washington anadromous salmonids.

Species - Run	Age (yr)	Return	Spawning	Time in fresh water	Current Origin
Spring chinook salmon [1,2]	2 - 6	Mar - May	Early Fall	90 days to 1 year	Hatchery and wild
Summer chinook salmon [2,3]	2 - 5	Jun - Jul	Late Sep - Nov	90 - 180 days	Hatchery and wild
Fall chinook salmon	2 - 5	Aug - Sep	Fall	90 - 180 days	Hatchery and wild
Sockeye	3 - 5	Mar - Jul	Sep - Jan	1 - 2 years in lakes	Wild
Coho salmon [1,4]	2 - 3	Aug - Nov	Oct - Dec	1 year	Hatchery and wild
Chum salmon [2,3]	3 - 5	Sep - Mar	Sep - Mar	0 - 30 days	Hatchery and wild
Pink salmon [2,3]	2	Aug - Sep	Sep - Oct	0 - 7 days	Wild
Winter steelhead[5] trout [4]	4 - 6	Nov - Apr	Jan - Jun	2 - 3 years	Hatchery and wild
Summer steelhead[6] trout [4]	3 - 5	May - Oct	Jan - Jun	2 years	Hatchery and wild
Sea-run cutthroat trout [4]	2 - 6	Jul - Dec	Dec - Jun	1 - 4 years	Hatchery and wild

Sources: compiled from Palmisano et al. 1993.

1 Juvenile chinook and coho salmon and steelhead and cutthroat trout develop in streams and rivers.
2 Most young salmon rear in estuaries, with chinook and chum staying the longest time and pink the shortest.
3 Pink and chum salmon fry migrate directly to estuaries upon emergence with little or no fresh-water feeding.
4 All sockeye and some coho salmon develop in lakes.
5 Less than 5 percent of returning fish are repeat spawners.
6 Less than 1 percent of returning fish are repeat spawners.

Plant Species Within the Range of the Northern Spotted Owl and Marbled Murrelet

■ VASCULAR PLANTS

- Water howellia, a proposed candidate for listing, is endemic to western Washington. It is found in lakes, ponds or sloughs at low elevations.
- Golden paintbrush, also proposed for listing, is endemic to the Puget trough and is found in prairies and meadows at low elevations.
- Cold-water corydalis is a federal candidate for listing. It is already listed as threatened in Washington.
- Clustered ladyslipper and Oregon checker-mallow are listed as threatened in Washington.
- Wenatchee larkspur is listed as endangered in Washington.

■ NON-VASCULAR PLANTS

Lichens

Lichens are important components of forest ecosystems. They provide nutrients to a wide variety of vertebrates and invertebrates. At least 26 species of lichens are endemic to the old-growth forests in the Pacific Northwest (USDA et al. 1993). More than 80 other species also live in this area. Forest lichens most commonly grow on trees but may also be found on decaying wood, rock, soil, or in streams where they may take more than 200 years to develop. Because lichens grow slowly and need a stable environment, young, fast-growing trees inhibit lichen growth because these trees alter the microclimate and substrate as the forest ages.

Arboreal lichens help to retain moisture in the forest canopy, fix atmospheric nitrogen, and provide a source of organic material that helps enrich and retain moisture in soils (Hawksworth and Hill 1984). Forest lichens are a primary food source for key prey species of the northern spotted owl, including flying squirrels, red-backed voles, and woodrats (Maser et al. 1985). They are also eaten by deer, elk, and mountain goats during winter. Many canopy-dwelling invertebrates, birds, and small mammals use lichens for food or shelter.

■ FUNGI

Forest fungi are essential components of a healthy ecosystem. They help decompose woody debris, assist in nutrient and water uptake by trees, and their fruiting bodies and mycelium provide food for insects, small mammals including red-backed voles and flying squirrels, and even larger animals such as deer. Insects often help fungi gain access deep into large woody material by leaving a network of boring holes through which the fungi grow. Fungi also cause many forest diseases which can be both detrimental and beneficial for

4.3 Environmental Consequences - Effects of Rule Proposals on Terrestrial, Aquatic, and Riparian Ecosystems Including Listed and Non-listed Species

Effects on Threatened and Endangered Animals

It is likely that the proposed alternatives will have little effect on the following species due to their close associations with habitats other than old-growth forests. These species include: the Columbian white-tailed deer, Aleutian Canada goose, peregrine falcon, sandhill crane, upland sandpiper, western pond turtle, and ferruginous hawk. It is unlikely that the habitats associated with these species would overlap significantly with spotted owl or marbled murrelet territories where protection would occur. As a result, the alternatives would probably have little effect on these species. Although the lynx range does overlap with part of the range for the northern spotted owl, it does not overlap with any of the alternative landscapes. Therefore, it is not likely that the lynx will be affected by any of the proposed alternatives. While the gray wolf and grizzly bear are both associated with large, wild, mountainous areas, most of these are on federal lands and not subject to forest practices regulations.

The bald eagle, Larch Mountain salamander, salmonids, and the Olympic, Cascade and Columbia torrent salamanders are more closely related to mature forests and are likely to be affected by the alternatives. These species should benefit from forest practices regulations that protect habitat within spotted owl or marbled murrelet territories.

Effects on Threatened and Endangered Plants

Effects of the rule alternatives on plants that are associated with late-successional forests and require the moist, woody environment characteristic of such forests will be related to the amount of spotted owl and marbled murrelet habitat protected.

Induced Edge Effects on Other Species Associated with Late-Successional Forest

Thomas et. al. (1993) identified 32 species of wildlife as being associated primarily with old-growth habitat. These species respond to timber harvest in a variety of different ways.

When forests are fragmented by logging, edge area increases relative to interior area. This in turn causes vegetation more tolerant of dry conditions to replace interior forest plants (Ranney et al. 1981). Consequently, small patches of forest may become completely edge habitat. A forest fragment must encompass at least 60 acres in order to provide some interior forest and protection from edge-induced predation (Harris 1984).

other forest inhabitants including the people who use the forest. The coniferous forests of western North America harbor one of the world's more diverse assemblages of mycorrhizal fungi. According to FEMAT (USDA et al. 1993) there are 527 species of fungi in old-growth forests of the Pacific Northwest. About one-fifth of these are considered endemic.

The word "Micorrhizae" literally means "fungus roots" and defines the association between plant roots and specialized soil fungi. Nearly all of the world's plants form some kind of mycorrhiza, and with few exceptions nearly all trees have mycorrhizae. Trees simply could not survive to mature age without the fungus association within their roots. Mycorrhizae help in uptake of nutrients (especially nitrogen and phosphorus) and water and provide a very important barrier to invasion by pathogenic fungi. Mycorrhizae vastly increase the absorbing surface area of the root systems of trees. Scientists believe that mycorrhizal fungi can expand the root systems of trees from hundreds to thousands of times.

Two major mycorrhizal types prevail among forest trees: "ectomycorrhizae", which are formed with the important conifer species of the Pinaceae and hardwoods of the Fagacceae and Betulaceae; and "vesicular-arbuscular" (VA) "mycorrhizae" which are common to other hardwoods, particularly maples sweetgums, cedars and redwoods. Although similar in function, these two groups differ strongly in fungi involved.

The fungi that form ectomycorrhizae include many of the common forest mushrooms, puffballs and hypogeous (below-ground) fruiting fungi called truffles. These fungi belong primarily in the two classes of fungi called the Basidiomycotina and Ascomycotina. *Amanita, Boletus, Heboloma, Laccaria, Lactarius, Pisolithis, Rhizopogon, Russula, Scleroderma, Suillis,* and *Tricholoma* (all Basidiomycotina), and *Cenococcum* and *Tuber* (Ascomycotina) are well known ectomycorrhizal forming genera. Unlike the mushrooms and puffballs, VA mycorrhizae form relatively large solitary spores or clumps of spores in the soil. These spores are not wind disseminated like the small spores of ectomycorrhizal fungi. They are moved in the soil when small animals and insects eat them and disseminate the spores in their fecal droppings. These fungi belong to the Zygomycoutous family and include genera such as *Acaulaspora, Entrophospora, Gigaspora, Sclerocystis,* and *Scutellospora.*

Induced edge habitat affects wildlife. Roads, electrical power lines, and even wide trails have been known to negatively affect interior forest birds (Anderson 1979; Whitcomb et al. 1976). Corridor edges are often invaded by non-native nest-hole competitors such as European starlings that displace native birds (Noss 1983). Studies conducted by Gates and Bysel (1978) revealed that, although edges attracted a variety and abundance of birds not requiring cavities such as warblers, pairs nesting near the edge had smaller clutches than those nesting in the interior. Robbins (1979) found increasing evidence that where edge habitat is predominant, birds characteristic of forest interiors were unable to maintain their populations. Small and Hunter (1988) documented higher rates of predation on ground-nesting birds from foxes, skunks, and raccoons as forest patches became smaller and opportunistic predators moved into these habitats.

Most species of birds that nest in cavities prefer large snags as nest-sites (Raphael 1980). Woodpeckers also prefer large snags as substrates for foraging (Bull 1980). As a result, cavity nesting birds are commonly more abundant in forests with large dead trees (Mannan and Meeslow 1984). The impact will vary depending on the number and size of snags left under each alternative.

Impacts Of Alternatives

The extent to which each of the proposed rule alternatives will affect other species is primarily related to the amount of their habitat that is protected. Since Alternatives 1 and 2 offer little protection for habitat within spotted owl and marbled murrelet territories, the protection offered to other species closely associated with those habitats will be limited. Alternatives 4 and 5 are closely related to each other in the amount of habitat protection they offer. Although Alternatives 3, 4, and 5 provide protection for the Olympic Peninsula, only Alternative 3 provides protection in southwest Washington. In general, Alternative 3 provides the most protection for habitats within spotted owl and marbled murrelet territories and would likely have the most positive effect on other species associated with these habitats. The No Action Alternative will have a negative effect on species that feed and breed in late-successional forests.

Chapter Five

There is no Chapter 5 in this document because this part of the Draft EIS analyzed the western grey squirrel rule concepts. Chapter 5 will be published in the Final EIS.

Appendix A

Northern Spotted Owl

Proposed Rules

FPB Rule Making - Background Information

The Forest Practices Board has been in the process of adopting permanent rules to protect habitat of the northern spotted owls and marbled murrelets since 1994. After the March 1995 public hearings on the proposed rules and the Draft EIS, TFW participants offered to develop a consensus-based rule proposal for the northern spotted owl.

The Board accepted the TFW proposal on November 8, 1995, and directed that it be filed with the Code Reviser as a supplemental rule-making notice, replacing the original three owl alternatives. The two alternatives for the marbled murrelet (occupied stand and MM-WAU) were also included in the supplemental notice. (Note: no changes were made to the marbled murrelet alternatives; for a copy call (360) 902-1413.)

The Board anticipates publishing a Supplemental Draft EIS on the spotted owl alternatives in January 1996.

The Board will consider all oral and written testimony on the proposed rules, and anticipates adopting final rules in May 1996. A Final EIS will be published at least seven days prior to rule adoption.

Overview of Rule

Formatting Notes:
Additions to permanent rule language are underlined.
Deletions from existing permanent rule language are ((~~overstruck~~)).
New sections to existing WACs are labeled New Section.
Comments/additional information are shown in *italics* (right-hand column).

Notice of Public Hearing

The Forest Practices Board will hold a public hearing on the proposed rules and on the Supplemental Draft EIS. Both oral and written testimony will be taken.

Date: February 13, 1996

Time: 3 pm

Location: Natural Resources Building Room 172
1111 Washington Street SE
Olympia Washington

Send Written Comments To:

Judith Holter, FPB Rules Coordinator
DNR-Forest Practices Division
PO Box 47012
Olympia WA 98504-7012

Phone: (360) 902-1412
Fax: (360) 902-1784

Comment Deadline:

March 1, 1996

Assistance for persons with disabilities:

Contact Tami Grant at (360) 902-1413 by Feb. 2, 1996
TDD: (360) 902-1431

Proposed rule language:		*Comments about rules and additional information:*
NEW SECTION **WAC 222-10-040 Class IV-Special threatened and endangered species SEPA policies.** In addition to the SEPA policies established elsewhere in this chapter, the following policies shall apply to Class IV-Special forest practices involving threatened or endangered species. (1) The department shall consult with the department of fish and wildlife, other agencies with expertise, affected landowners, affected Indian tribes, and others with expertise when evaluating the impacts of forest practices. If the department does not follow the recommendations of the department of fish and wildlife, the department shall set forth in writing a concise explanation of the reasons for its action. (2) In order to determine whether forest practices are likely to have a probable significant adverse impact, and therefore require an environmental impact statement, the department shall evaluate whether the forest practices reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species. (3) Specific mitigation measures or conditions shall be designed to reduce any probable significant adverse impacts identified in subsection (2) of this section. (4) The department shall consider the species-specific policies in WAC 222-10-041 when reviewing and evaluating SEPA documents and the impacts of forest practices.		*Guidance to DNR on SEPA Review.* *This section provides general substantive SEPA guidance to the department for use in the review of forest practices applications. This guidance would require the department to consult with the Department of Fish and Wildlife, as well as others, when evaluating impacts of forest practices.* *This section also sets the standard for the threshold determination and potential conditions to mitigate adverse impacts.*

NEW SECTION **WAC 222-10-041 Northern spotted owls.** The effective date of this section is July 1, 1996. The following policies shall apply to forest practices subject to SEPA if the forest practices may cause adverse impacts to northern spotted owls. (1) **In SOSEAs or areas of SOSEAs where the goal is demographic support,** suitable spotted owl habitat should be maintained either to protect the viability of the owl(s) associated with each northern spotted owl site center or to provide demographic support for that particular SOSEA as described in the SOSEA goals. (2) **In SOSEAs or areas of SOSEAs where the goal is dispersal support,** either suitable spotted owl habitat should be maintained to protect the viability of the owl(s) associated with each northern spotted owl site center or dispersal habitat should be managed, over time, to provide the dispersal support for that particular SOSEA as described in the SOSEA goals. Dispersal support is provided by a landscape which includes dispersal habitat at the stand level interspersed with areas of higher quality habitat. Stands of dispersal habitat should be managed to reduce gaps between stands and to maintain a sufficient level of dispersal habitat to meet the SOSEA goals over time.		*This section provides species-specific SEPA guidance for northern spotted owls.* *See other sections of the rule for explanations of SOSEA, habitat types, demographic support, dispersal support, etc.* *SOSEAs may have goals of demographic support, dispersal support, or a combination of the two. SOSEA goals were determined by looking at current habitat conditions and functions of adjacent federal lands, for the purpose of complementing federal conservation strategies.* *Within each SOSEA the landowner will have a choice of addressing the needs of the particular owl circle that is impacted by the forest practices or addressing the SOSEA goals through a planning process (i.e. HCP, LOP,etc.)*
(3) **In SOSEAs or areas of SOSEAs where the goal is a combination of dispersal support and demographic support,** either suitable spotted owl habitat should be maintained to protect the viability of the owl(s) associated with each northern spotted owl site center or a variety of habitat conditions should be provided which in total are more than dispersal support and less than demographic support. This can be accomplished by providing: (a) Dispersal support as described in subsection (2) of this section; (b) Areas of suitable spotted owl habitat that contain some opportunities for nesting as well as roosting and foraging habitat; and (c) Connectivity between areas of SOSEAs designated for demographic support or adjacent federal lands which are designated as late successional reserves, congressionally reserved areas, or administratively withdrawn areas.		

(4) **Within SOSEAS**, the following amounts of suitable habitat are generally assumed to be necessary to maintain the viability of the owl(s) associated with each northern spotted owl site center, in the absence of more specific data or a mitigation plan, as provided for in subsections (6) and (7) of this section respectively: (a) All suitable spotted owl habitat within 0.7 mile of each northern spotted owl site center; (b) Including the suitable spotted owl habitat identified in (a) of this subsection: (i) For the Hoh-Clearwater/Coastal Link SOSEA - A total of 5,863 acres of suitable spotted owl habitat within the median home range circle (2.7 mile radius). (ii) For all other SOSEAs - A total of 2,605 acres of suitable spotted owl habitat within the median home range circle (1.8 mile radius). The department shall first identify the highest quality suitable spotted owl habitat for this purpose. Consideration shall be given to habitat quality, proximity to the activity center and contiguity in selecting the most suitable habitat. Suitable spotted owl habitat identified outside 0.7 mile of a northern spotted owl site center may support more than one median home range circle. Suitable spotted owl habitat harvested by a landowner shall continue to be counted as part of the total acres necessary under (b) of this subsection for other landowners within the median home range circle if the harvest is conducted pursuant to agreements or plans approved under subsection (6) of this section or WAC 222-16-080 (1)(b)(iv), (6)(a), (b), or (e).		*The total acres indicated for each SOSEA is derived from a mathematical calculation of 40% of the area of a 1.8 or 2.7 mile radius circle.* *The selection of habitat is made by the department based on the standards set in this section.* *If habitat is allowed to be harvested within an owl circle based on one of the planning options (HCP, LOP, CHEA, etc.), the harvested habitat area will be counted in the calculation of suitable habitat from the date of the plan approval and forward, even after harvest has occurred. This is intended to prevent the transfer of responsibility for maintenance of habitat from one landowner to another.*
(5) **Outside SOSEAs**, during the nesting season (between March 1 and August 31), seventy acres of the highest quality suitable spotted owl habitat surrounding a northern spotted owl site center. The seventy acres for one site center shall not be utilized for meeting suitable habitat needs of any other site center.		*Protection is provided at the 70-acre level during nesting season only.*

(6) The assumptions set forth in subsection (4) of this section are based on regional data. Applicants may submit information that is more current, accurate, or specific to a northern spotted owl site center, proposal, or SOSEA circumstances or goals. The department shall use such information in making its determinations under this section where the department finds, in consultation with the department of fish and wildlife, that the information is more likely to be valid for the particular circumstances than the assumptions established under subsection (4) of this section. If the department does not use the information, it shall explain its reasons in writing to the applicant.		*Landowners may submit research information which supports the modification of the standards set in this section of the rules.*
(7) The department shall consider measures to mitigate identified adverse impacts of an applicant's proposal. Mitigation measures must contribute to the achievement of SOSEA goals or to supporting the viability of impacted northern spotted owl site centers.		
WAC 222-16-010 General definitions: "Cooperative spotted owl habitat enhancement agreement (CHEA)" see WAC 222-16-100(2).		
"Demographic support" means providing sufficient suitable spotted owl habitat within the SOSEA to maintain the viability of northern spotted owl sites identified as necessary to meet the SOSEA goals.		*Owls will be maintained on the non-federal landscape by protecting enough habitat to support a pair including their breeding activities.*
"Disp rsal habitat" see WAC 222-16-085(2).		
"Dispersal support" means providing sufficient dispersal habitat for the interchange of northern spotted owls within or across the SOSEA, as necessary to meet SOSEA goals. Dispersal support is provided by a landscape consisting of stands of dispersal habitat interspersed with areas of higher quality habitat, such as suitable spotted owl habitat found within RMZs, WMZs or other required and voluntary leave areas.		*The movement of adult and juvenile owls will be supported by maintaining dispersal habitat across the landscape, allowing the owls to seek new territories.*
"Median home range circle" means a circle, with a specified radius, centered on a spotted owl site center. The radius for the median home range circle in the Hoh-Clearwater/Coastal Link SOSEA is 2.7 miles; for all other SOSEAs the radius is 1.8 miles.		

"Northern spotted owl site center" means the location of status 1, 2 or 3 northern spotted owls based on the following definitions: Status 1: Pair or reproductive - a male and female heard and/or observed in close proximity to each other on the same visit, a female detected on a nest, or one or both adults observed with young. Status 2: Two birds, pair status unknown - the presence or response of two birds of opposite sex where pair status cannot be determined and where at least one member meets the resident territorial single requirements. Status 3: Resident territorial single - the presence or response of a single owl within the same general area on three or more occasions within a breeding season with no response by an owl of the opposite sex after a complete survey; or three or more responses over several years (i.e., two responses in year one and one response in year two, for the same general area). In determining the existence, location, and status of northern spotted owl site centers, the department shall consult with the department of fish and wildlife and use only those sites documented in substantial compliance with guidelines or protocols and quality control methods established by and available from the department of fish and wildlife.		*This definition was formerly in the critical wildlife habitat (state) section of the rule. The definition of Status 1 has been modified upon recommendation by the Department of Fish and Wildlife. This means that the USFWS, WDFW and DNR will all used the same definition for Status 1.* *The consultation requirement has been added as new language.*
"Old forest habitat" see WAC 222-16-085 (1)(a).		
"SOSEA goals" means the goals specified for a spotted owl special emphasis area as identified on the SOSEA maps (see WAC 222-16-086). SOSEA goals provide for demographic and/or dispersal support as necessary to complement the northern spotted owl protection strategies on federal land within or adjacent to the SOSEA.		*One of the Board's goals is to complement the protection being provided on adjacent federal lands.*
"Spotted owl dispersal habitat" see WAC 222-16-085(2).		
"Spotted owl special emphasis areas (SOSEA)" means the geographic areas as mapped in WAC 222-16-086. Detailed maps of the SOSEAs indicating the boundaries and goals are available from the department at its regional offices.		
"Sub-mature habitat" see WAC 222-16-085 (1)(b).		
"Suitable spotted owl habitat" see WAC 222-16-085(1).		

"Young forest marginal habitat" see WAC 222-16-085 (1)(b).		
WAC 222-16-080 Critical wildlife habitat (state) and critical habitat (federal) of threatened and endangered species. (1) Critical wildlife habitats (state) of threatened or endangered species and specific forest practices designated as Class IV-Special are as follows: (b) Northern spotted owl - the following shall apply through June 30, 1996: Harvesting, road construction, or aerial application of pesticides on the most suitable 500 acres of ((~~suitable~~)) nesting, ((~~breeding~~)) roosting, and foraging habitat surrounding the ((~~activity center of known Status 1, 2, or 3 spotted owls, documented by the department of wildlife~~)) northern spotted owl site center. The most suitable habitat shall be determined by the department in cooperation with the department of fish and wildlife, tribes, and others with applicable expertise. Consideration shall be given to habitat quality, proximity to the activity center and contiguity in selecting the most suitable 500 acres of habitat.		*This is the SEPA trigger.* *As part of the discussions during the development of the TFW proposal, the goal was set to have new permanent rules in effect by July 1, 1996.* *See SOSEA maps in Attachment A.*
Beginning July 1, 1996 the following shall apply for the northern spotted owl: (i) Within a SOSEA boundary (see maps in WAC 222-16-086), except as indicated in (ii) below, harvesting, road construction, or aerial application of pesticides on suitable spotted owl habitat within a median home range circle that is centered within the SOSEA or on adjacent federal lands.		*A proposed forest practice located within a median home range circle within a SOSEA would be Class IV-Special.*
(ii) Within the Entiat SOSEA, harvesting, road construction, or aerial application of pesticides within the areas indicated for demographic support (see WAC 222-16-086(2)) on suitable spotted owl habitat located within a median home range circle that is centered within the demographic support area or on adjacent federal lands.		*A specific SEPA trigger was negotiated for this SOSEA because Entiat is not included in the federal 4(d) rule proposal, and because a some of the habitat originally identified by SAG was destroyed in the 1994 forest fires.*
(iii) Outside of a SOSEA, harvesting, road construction, or aerial application of pesticides, between March 1 and August 31 on the seventy acres of highest quality suitable spotted owl habitat surrounding a northern spotted owl site center located outside a SOSEA. The highest quality suitable habitat shall be determined by the department in cooperation with the department of fish and wildlife. Consideration shall be given to habitat quality, proximity to the activity center and contiguity.		

(iv) Small parcel northern spotted owl exemption. Forest practices proposed on the lands owned or controlled by a landowner whose forest land ownership within the SOSEA is less than or equal to 500 acres and where the forest practice is not within 0.7 mile of a northern spotted owl site center shall not be considered to be within critical wildlife habitat (state) for northern spotted owls.		*The concept of an exemption for nonindustrial (small) landowners has been modified from earlier rule proposals.*
~~((This rule is intended to be interim and will expire on February 9, 1994. Prior to the above expiration date the forest practices board will reconsider the protection of spotted owls based on consideration of advancing science and increased data analysis, as well as the board's landscape planning for wildlife and would be influenced by the completion of the northern spotted owl recovery plan, rule making under the Federal Endangered Species Act, or other federal action, or other state actions.~~ ~~The department shall rely upon the department of wildlife for the determination of status based on the following definitions:~~ ~~Status 1 Pair or reproductive - the presence or response of two birds of the opposite sex where past or current reproductive activities have been documented.~~ ~~Status 2 Two birds, pair status unknown - the presence or response of 2 birds of the opposite sex where pair status cannot be determined and where at least 1 member must meet the resident single requirements.~~ ~~Status 3 Resident territorial single - the presence or response of a single owl within the same general area on 3 or more occasions within a breeding season with no response by an owl of the opposite sex after a complete survey; or multiple responses over several years (i.e., 2 responses in year one and 1 response in year two, for the same general area).~~))		*This information has been moved to the definitions section WAC 222-16-010.*
(2) ((~~A site specific special wildlife management plan, including a bald eagle site management plan under WAC 232-12-292, developed by the landowner shall replace the critical wildlife habitats (state) listed in subsection (1) of this section when such a plan has been established in cooperation with, and approved by, the department of wildlife.~~ ~~(3)~~)) The following critical habitats (federal) designated by the United States Secretary of the Interior, or specific forest practices within those habitats, have been determined to not have the potential for a substantial impact on the environment: None listed.		*This language has been moved to the new section (6) below and grouped with other SEPA exemptions.*

(((~~4~~))) (3) For the purpose of identifying forest practices which have the potential for a substantial impact on the environment with regard to threatened or endangered species newly listed by the Washington fish and wildlife commission and/or the United States Secretary of the Interior, the department shall after consultation with the department of fish and wildlife, prepare and submit to the board a proposed list of critical wildlife habitats (state) of threatened or endangered species. This list shall be submitted to the board within 15 days of the listing of the species. The department shall, at a minimum, consider potential impacts of forest practices on habitats essential to meeting the life requisites for each species listed as threatened or endangered. Those critical wildlife habitats (state) adopted by the board shall be added to the list in subsection (1) of this section. See WAC 222-16-050 (1)(b)(i).		
(((~~5~~))) (4) For the purpose of identifying any areas and/or forest practices within critical habitats (federal) designated by the United States Secretary of the Interior which do not have the potential for a substantial impact on the environment, the department shall, after consultation with the department of fish and wildlife, submit to the board a proposed list of any forest practices and/or areas proposed for exclusion from Class IV - Special forest practices. The department shall submit the list to the board within 120 days of the date the United States Secretary of the Interior publishes a final rule designating critical habitat (federal) in the Federal Register. Those critical habitats excluded by the board from Class IV - Special shall be added to the list in subsection (((~~3~~))) (2) of this section. See WAC 222-16-050 (1)(b)(ii).		

(((~~6~~))) (5) (a) Except for bald eagles under subsection (1)(b) of this section, the critical wildlife habitats (state) of threatened and endangered species and specific forest practices designated in subsection (1) of this section are intended to be interim. These interim designations shall expire for a given species on the earliest of: (i) The effective date of a regulatory system for wildlife protection referred to in (b) of this subsection or of substantive rules on the species. (ii) The delisting of a threatened or endangered species by the Washington fish and wildlife commission. (b) The board shall examine current wildlife protection and department authority to protect wildlife and develop and recommend ((~~by May 1993~~)) a regulatory system, including baseline rules for wildlife protection. To the extent possible, this system shall: (i) Use the best science and management advice available; (ii) Use a landscape approach to wildlife protection; (iii)Be designed to avoid the potential for substantial impact to the environment; (iv) Protect known populations of threatened and endangered species of wildlife from negative effects of forest practices consistent with RCW 76.09.010; and (v) Consider and be consistent with recovery plans adopted by the department of fish and wildlife pursuant to RCW 77.12.020(6) or habitat conservation plans or 16 U.S.C. 1533(d) rule changes of the Endangered Species Act.		

((~~(7)~~)) (6) Regardless of any other provision in this section, ((~~the following are not critical wildlife habitats (state) or critical habitats (federal) for the particular species:~~ ~~(a) Forest practices on lands covered by a conservation plan and permit for a particular species approved by the U.S. Fish and Wildlife Service pursuant to 16 U.S.C. 1539 (a)(2) consistent with that plan and permit or;~~)) forest practices applications shall not be classified as Class IV-Special based on critical wildlife habitat (state) (WAC 222-16-080 (1)) or critical habitat (federal) (WAC 222-16-050(1)(b)(ii)) for a species if the forest practices are consistent with one of the following proposed for protection of the species: (a) A habitat conservation plan and permit or an incidental take statement covering such species approved by the Secretary of the Interior or Commerce pursuant to 16 U.S.C. §1536 (b) or 1539 (a); an "unlisted species agreement" covering such species approved by the U.S. Fish and Wildlife Service or National Marine Fisheries Service; or a "no-take letter" or other cooperative or conservation agreement entered into with a federal or state fish and wildlife agency pursuant to its statutory authority for fish and wildlife protection that addresses the needs of the affected species and that is subject to review under the National Environmental Protection Act, 42 U.S.C.§ 4321 et.seq., or the State Environmental Policy Act, Chapter 43.21C RCW, as applicable;		
(b) ((~~Forest practices covered by a~~)) A rule adopted by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service for the conservation of a particular threatened species pursuant to 16 U.S.C.§1533 (d);		*This section refers to a federal 4(d) rule. A rule for spotted owls was proposed in February 1995; adoption is anticipated in 1996.*
(c) A special wildlife management plan (SWMP) developed by the landowner and approved by the department in consultation with the department of fish and wildlife; (d) A bald eagle management plan approved under WAC 232-12-292;		*The SWMP would be used for T&E species other than spotted owls and eagles.*
(e) A landowner option plan (LOP) for northern spotted owls developed pursuant to WAC 222-16-100(1); or (f) A cooperative spotted owl habitat enhancement agreement (CHEA) developed pursuant to WAC 222-16-100(2).		
In those situations where one of the options above has been used, forest practices applications may still be classified as Class IV-Special based upon the presence of one or more of the factors listed in WAC 222-16-050 (1), other than critical wildlife habitat (state) or critical habitat (federal) for the species covered by the existing plan.		*This paragraph refers to (a) through (f) above.*

(7) The department, in consultation with the department of fish and wildlife, shall review each SOSEA to determine whether the goals for that SOSEA are being met through approved plans, permits, statements, letters, or agreements referred to in subsection (6) of this section. If so, the department shall recommend to the board the suspension, deletion, modification or re-establishment of the applicable SOSEA from the rules. The department shall conduct a review for a particular SOSEA upon approval of a landowner option plan, a petition from a landowner in the SOSEA, or under its own initiative.		*This section requires the department to periodically review the SOSEAs for needed changes.*
(8) The department, in consultation with the department of fish and wildlife, shall report annually to the board on the status of the northern spotted owl to determine whether circumstances exist that substantially interfere with meeting the goals of the SOSEAs.		*DNR, in consultation with the Department of Fish and Wildlife, will present an annual report to the Board on the status of the owl.*

NEW SECTION WAC 222-16-085 Northern spotted owl habitats. (1) **Suitable spotted owl habitat** means forest stands which meet the description of old forest habitat, sub-mature habitat or young forest marginal habitat found in (a) and (b) of this subsection. Old forest habitat is the highest quality, followed in descending order by sub-mature habitat and young forest marginal habitat. (a) **Old forest habitat** means habitat that provides for all the characteristics needed by northern spotted owls for nesting, roosting, foraging, and dispersal, described as stands with: (i) A canopy closure of 60% or more and a layered, multispecies canopy where 50% or more of the canopy closure is provided by large overstory trees (typically, there should be at least 75 trees greater than 20 inches dbh per acre, or at least 35 trees 30 inches dbh or larger per acre); and (ii) Three or more snags or trees 20 inches dbh or larger and 16 feet or more in height per acre with various deformities such as large cavities, broken tops, dwarf mistletoe infections, and other indications of decadence; and (iii) More than two fallen trees 20 inches dbh or greater per acre and other woody debris on the ground.		*This section provides detailed, technical habitat definitions. The information in this section will be reviewed during the public review process for accuracy through scientific peer review.*
(b) **Sub-mature habitat and young forest marginal habitat.** Sub-mature habitat provides all of the characteristics needed by northern spotted owls for roosting, foraging, and dispersal. Young forest marginal habitat provides some of the characteristics needed by northern spotted owls for roosting, foraging, and dispersal. Sub-mature habitat and young forest marginal habitat stands can be characterized based on the forest community, canopy closure, tree density and height, vertical diversity, snags and cavity trees, dead and down wood, and shrubs or mistletoe infection. They are described in the following tables:		

(i) Western Washington spotted owl sub-mature and young forest marginal habitat characteristics.

Characteristic	Habitat Type	
	Sub-Mature	Young Forest Marginal
Forest Community	conifer-dominated *or* conifer-hardwood (greater than or equal to 30% conifer)	conifer-dominated *or* conifer-hardwood (greater than or equal to 30% conifer)
Canopy Closure	greater than or equal to 70% canopy closure	greater than or equal to 70% canopy closure
Tree Density and Height	115-280 trees/acre (greater than or equal to 4 inches dbh) with dominants/codominants greater than or equal to 85 feet high OR	115-280 trees/acre (greater than or equal to 4 inches dbh) with dominants/codominants greater than or equal to 85 feet high OR
Vertical Diversity	dominants/codominants greater than or equal to 85 feet high with 2 or more layers and 25 - 50% intermediate trees	dominants/codominants greater than or equal to 85 feet high with 2 or more layers and 25 - 50% intermediate trees
Snags/Cavity Trees	greater than or equal to 3/acre (greater than or equal to 20 inches dbh and 16 feet in height)	greater than or equal to 2/acre (greater than or equal to 20 inches dbh and 16 feet in height) OR
Dead, Down Wood	N/A	greater than or equal to 10% of the ground covered with 4 inch diameter or larger wood, with
Shrubs	N/A	25-60% shrub cover

The values indicated for canopy closure and tree density may be replaced with a quadratic mean diameter of greater than 13 inches and a basal area of greater than 100.

(ii) Eastern Washington spotted owl sub-mature and young forest marginal habitat characteristics.

Characteristic	Habitat Type		
	Sub-Mature	Young Forest Marginal (closed canopy)	Young Forest Marginal (open canopy)
Forest Community	greater than or equal to 40% fir	greater than or equal to 40% fir	greater than or equal to 40% fir
Tree Density and Height	110-260 trees/acre (greater than or equal to 4 inches dbh) with	100 - 300 trees/acre (greater than or equal to 4 inches dbh)	100 - 300 trees/acre (greater than or equal to 4 inches dbh)
	dominants/codominants greater than or equal to 90 feet high OR	dominants/codominants equal to or greater than 70 feet high	dominants/codominants equal to or greater than 70 feet high
Vertical Diversity	dominants/codominants greater than or equal to 90 feet high with 2 or more layers and	2 or more layers	2 or more layers
	25 - 50% intermediate trees	25 - 50% intermediate trees	25 - 50% intermediate trees
Canopy Closure	greater than or equal to 70% canopy closure	greater than or equal to 70% canopy closure	greater than or equal to 50% canopy closure
Snags/Cavity Trees	greater than or equal to 3/acre (greater than or equal to 20 inches dbh 16 feet in height) OR	N/A	2/acre or more (greater than or equal to 20 inches dbh 16 feet in height)
Mistletoe	high or moderate infection	N/A	high or moderate infection
Dead, Down Wood	greater than or equal to 5% of the ground covered with 4 inch diameter or larger wood	N/A	N/A

The values indicated for canopy closure and tree density may be replaced with the following:

(A) For sub-mature a quadratic mean diameter of greater than 13 inches and a relative density of greater than 44;

(B) For young forest marginal a quadratic mean diameter of greater than 13 inches and a relative density of greater than 28.

The chart defines young forest marginal habitat in eastern Washington as either open canopy forest or closed canopy forest; either definition is acceptable.

(2) **Spotted owl dispersal habitat** means habitat stands that provide the characteristics needed by northern spotted owls for dispersal. Such habitat provides protection from the weather and predation, roosting opportunities, and clear space below the forest canopy for flying. Timber stands that provide for spotted owl dispersal have the following characteristics: (a) **For western Washington**, timber stands 5 acres in size or larger with: (i) 70% or more canopy cover; and (ii) 70% or more of the stand in conifer species greater than 6 inches dbh; and (iii) A minimum of 130 trees per acre with a dbh of at least 10 inches or a basal area of 100 square feet of 10 inch dbh or larger trees; and (iv) A total tree density of 300 trees per acre or less; and (v) A minimum of 20 feet between the top of the understory vegetation and the bottom of the live canopy, with the lower boles relatively clear of dead limbs.		
(b) **For eastern Washington**, timber stands 5 acres in size or larger with: (i) 50% or more canopy closure; and (ii) A minimum of 50 conifer trees per acre, with a dbh of 6 inches or more in even-aged stands or 4 inches or more in uneven-aged stands, and an average tree height of 65 feet or more; and (iii) Total tree density of 200 trees per acre or less; and (iv) A minimum of 20 feet between the top of the understory vegetation and the bottom of the live canopy, with the lower boles relatively clear of dead limbs; or (v) Conifer stands with a quadratic mean diameter of 9 inches or more and a relative density of 33 or more or a canopy closure of 55% or more.		
(c) Suitable spotted owl habitat provides all of the required characteristics needed by spotted owls for dispersal. (d) Landowners may submit information to support an alternate definition of dispersal habitat for review and approval by the department in consultation with the department of fish and wildlife.		

NEW SECTION **WAC 222-16-086 Northern spotted owl special emphasis areas and goals.** "Spotted owl special emphasis areas (SOSEA)" means the following geographic areas and the associated goals as mapped. Detailed maps of the SOSEAs indicating the boundaries and goals are available from the department at its regional offices.		*This list of 10 SOSEAs includes all the special emphasis areas identified by SAG except the North Olympic Coast and Southwest Washington. Combined SOSEAs are noted below, as are some modifications to original SAG boundaries.* *See Attachment A for a map of showing all SOSEAs and for individual SOSEA maps. Detailed maps will be available at DNR Region offices.*
(1) Columbia Gorge		*The western boundary was moved to exclude areas of non-habitat.*
(2) Entiat		*Area is smaller than originally proposed because some habitat was destroyed by 1994 forest fires. Entiat is not included in the federal 4(d) rule proposal. A specific SEPA trigger was negotiated for this SOSEA.*
(3) Finney Block		
(4) Hoh-Clearwater/Coastal Link		
(5) I-90 East		*Includes I-90 East/Teanaway, Taneum and Easton SOSEAs listed by SAG Report.* *Boundary was moved to the Cascade Crest, making this SOSEA contiguous with I-90 West.*
(6) I-90 West		
(7) Mineral Block/Link		*Combination of two SAG SOSEAs.*
(8) North Blewett		*Boundaries were changed because of 1994 fires.*
(9) Siouxon		*The boundary was modified to exclude an area of non-habitat.*
(10) White Salmon		*The eastern boundary was modified. Trout Lake and a suburban area were excluded.*

NEW SECTION **WAC 222-16-100 Planning options for the northern spotted owl.** (1) **Landowner option plans for the northern spotted owl.** Landowner option plans (LOPs) are intended to provide landowners with a mechanism, entered into voluntarily, to contribute to the protection of northern spotted owls by considering the needs of overall population maintenance or dispersal habitat across a defined geographic area. LOPs should be designed to achieve an appropriate contribution from nonfederal lands toward meeting SOSEA goals and are intended to be an efficient and effective alternative to site-by-site management planning. In eastern Washington, LOPs must also consider the need to protect the forests from catastrophic loss from wildfire, insects, and diseases. Forest practices applications that are in an area covered by an LOP, and that are consistent with the LOP, will not be classified as Class IV-Special on the basis of critical wildlife habitat (state) or critical habitat (federal) for the northern spotted owl. This does not preclude classification as Class IV-Special because of the presence of other factors listed in WAC 222-16-050(1).		*These planning options provide opportunities for landowners to both manage their lands and protect public resources.* *The LOP is voluntary planning mechanism that contributes to the protection of the northern spotted owl: it is an alternative to owl site center management planning.* *Required elements, goals and objectives, the approval process, and enforcement are covered in the rule.*
(a) **Required elements of LOPs.** The level of detail to be included in a LOP will depend on the area of ownership involved, the time period for which the plan will be in effect, and the complexity of the management strategy. Nevertheless, each plan shall contain the elements set forth in this subsection. (i) **Goals and objectives.** The specific goals and objectives for the landowner's contributions proposed under the LOP shall be developed by the landowner and approved by the department in consultation with the department of fish and wildlife based on the following: (A) Mitigation under the plan must be reasonable and capable of being accomplished; and (B) To the maximum extent practicable, the plan must minimize and mitigate significant adverse impacts caused by, and identified in, the plan on individual northern spotted owl site centers or the ability of the SOSEA to meet SOSEA goals. Specific short (one to five-year) and long (greater than five-year) term goals and objectives for the LOP should be clearly stated, where applicable.		

(ii) **Other required elements:**

(A) A description of the planning area. The LOP planning area shall include a sufficient amount of the landowner's forest land within the SOSEA to meet the goals and objectives of the plan.

(B) A description of the physical features in the planning area (e.g., geology, topography, etc.).

(C) The current habitat status. Suitable spotted owl habitat should be categorized and mapped as old forest, sub-mature, young forest marginal, or dispersal.

(D) The current species status. All status 1, 2, and 3 northern spotted owl site centers and the associated median home range circles that overlap any of the landowner's ownership within the LOP boundary must be mapped.

(E) Management proposals and relevant operations plans.

(F) Projected suitable habitat development.

(G) A plan for training.

(H) A monitoring program.

(I) Reporting standards.

(J) The conditions under which the LOP may be modified.

(K) The term of the LOP and conditions for termination. The term of the LOP shall be sufficient to meet its goals and objectives. The conditions of the LOP run with the land unless the LOP specifies alternative means to achieve the LOP goals and objectives upon mid-term sale or transfer. In addition to any other termination provisions in the LOP, plans may be terminated by mutual agreement of the landowner and the department.

(b) **Approval of LOPs.** Upon receipt of a landowner option plan, the department shall circulate the plan to the department of fish and wildlife, affected Indian tribes, local government entities, other forest landowners in the SOSEA, and the public for a thirty day review and comment period. The department may extend the review period for up to thirty additional days. Within ninety days of receipt of the plan, the department shall review the comments and approve or disapprove the plan or submit the plan to the landowner to revise as appropriate. The department, after consultation with the department of fish and wildlife, shall approve the plan if: (i) The plan contains all of the elements required under this section; (ii) The plan is expected to be effective in meeting its goals and objectives; (iii) The plan will not have a probable significant adverse impact on the ability of the SOSEA to meet its goals; and (iv) The plan will not appreciably reduce the likelihood of the survival and recovery of the northern spotted owl in the wild. In making its determination under this subsection, the department shall consider the direct, indirect, and cumulative effects of the plan; both the short-term and long-term effects of the plan; and whether local, state, or federal land management, regulatory, or nonregulatory requirements will mitigate identified significant adverse impacts. If the department does not approve the plan, or approves it over the objections of the department of fish and wildlife, the department shall set forth in writing a concise explanation of the reasons for its action.		
(c) **Enforcement of LOPs.** The department shall review all applications and notifications from the landowner, proposed within the plan area, for consistency with the plan. Any applications or notifications found to be inconsistent with the plan shall be returned to the landowner for modification. After landowner review, applications and notifications which are not consistent with the plan shall be classified as Class IV-Special.		
(2) **Cooperative northern spotted owl habitat enhancement agreements.** A cooperative northern spotted owl habitat enhancement agreement (CHEA) is intended to provide flexibility for the landowner as well as an increase in the amount of available habitat for northern spotted owls over time. A CHEA is an agreement between the department and a landowner, developed in cooperation with the department of fish and wildlife, for the purpose of restoring, enhancing or maintaining northern spotted owl habitat. The agreement will only apply to forest land identified by the landowner, outside of the median home range circles of northern spotted owl site centers in existence at the time of implementation.		*The CHEA planning option is available to landowners not currently impacted by owls. The intent of this concept is to preclude early harvesting based on fear of regulatory impact and to, in the long-term, provide additional habitat.* *Required elements, goals and objectives, the approval process, and enforcement are covered in the rule.*

(a) **Required elements of CHEAs.** The level of detail to be included in a CHEA will depend on the area of ownership involved, the time period for which the agreement will be in effect, and the complexity of the management strategy. Nevertheless, each agreement shall contain the elements set forth in this subsection.

(i) **Goals and objectives.** The specific goals and objectives for the landowner's contributions proposed under the CHEA shall be developed by the landowner and approved by the department in consultation with the department of fish and wildlife.

(ii) **Other required elements:**

(A) A description of the agreement area. The CHEA planning area shall include a sufficient amount of the landowner's forest land to meet the goals and objectives of the agreement.

(B) The current habitat status. Suitable spotted owl habitat should be categorized and mapped as old forest, sub-mature, young forest marginal, or dispersal.

(C) Management proposals. Management proposals may include, at the landowners discretion, proposed harvest dates or ages, silvicultural management plans, etc.

(D) Projected habitat development.

(E) The conditions under which the CHEA may be modified.

(F) The term of the CHEA and conditions for termination. CHEAs shall be effective for a duration mutually agreed to between the department and the landowner, but must be of sufficient duration to aid in the conservation of the northern spotted owl. CHEAs may be terminated by the landowner, in part or whole, prior to the time that the forest land is determined to be within the median home range circle surrounding a northern spotted owl site center. If forest land covered by the agreement is found to fall within a median home range circle surrounding a northern spotted owl site center, the agreement shall remain in effect on that forest land for its full term. If a CHEA is terminated, in part or in whole, all rights and relief from the rules shall also be terminated on those lands removed from the CHEA. In addition to any other termination provisions in the CHEA, agreements may be terminated by mutual agreement of the landowner and the department.

(G) Extensions. The term of a CHEA may be extended by the department based upon a written request from the landowner.

(b) **Approval of a CHEA.** Upon receipt of a CHEA, the department shall circulate the agreement to the department of fish and wildlife, affected Indian tribes, local government entities, other forest landowners in the SOSEA, and the public for review and comment. Within sixty days of receipt of the agreement, the department shall review the comments and approve or disapprove the agreement or submit the agreement to the landowner to revise as appropriate. The department, after consultation with the department of fish and wildlife, shall approve the agreement if: (i) The agreement contains all of the elements required under this section; (ii) The agreement is expected to be effective in meeting its goals and objectives; (iii) The agreement will restore, enhance or maintain northern spotted owl habitat in a manner that provides potential benefit to northern spotted owls. In making its determination under this subsection, the department shall consider the direct, indirect, and cumulative effects, and the short- and long-term effects of the agreement. If the department does not approve the agreement, or approves it over the objections of the department of fish and wildlife, the department shall set forth in writing a concise explanation of the reasons for its action.		
(c) **Enforcement of CHEAs.** The department shall review all applications and notifications from the landowner, proposed within the agreement area, for consistency with the agreement. Any applications or notifications found to be inconsistent with the agreement shall be returned to the landowner for modification. After landowner review, applications and notifications which are not consistent with the agreement shall be classified based on the rules in effect at the time of application and without any of the benefits of the agreement.		

WAC 222-24-030 Road Construction (10) Disturbance avoidance. Road construction, operation of heavy equipment and blasting within a SOSEA boundary shall not be allowed within 0.25 mile of a northern spotted owl site center between March 1 and August 31, provided that, this restriction shall not apply if : (a) The landowner demonstrates that the owls are not actively nesting during the current nesting season; or (b) The forest practice is operating in compliance with a plan or agreement developed for the protection of the northern spotted owl under WAC 222-16-080 (6)(a), (e), or (f).		*Disturbance avoidance language has been modified to apply only within SOSEAs during nesting season.*
WAC 222-30-050 Felling and Bucking (5) Disturbance avoidance. Felling and bucking within a SOSEA boundary shall not be allowed within 0.25 mile of a northern spotted owl site center between March 1 and August 31 provided that, this restriction shall not apply if: (a) The landowner demonstrates that the owls are not actively nesting during the current nesting season; or (b) The forest practice is operating in compliance with a plan or agreement developed for the protection of the northern spotted owl under WAC 222-16-080 (6)(a), (e), or (f).		
WAC 222-30-060 Cable Yarding (6) Disturbance avoidance. The operation of heavy equipment within a SOSEA boundary shall not be allowed within 0.25 mile of a northern spotted owl site center between March 1 and August 31 provided that, this restriction shall not apply if: (a) The landowner demonstrates that the owls are not actively nesting during the current nesting season; or (b) The forest practice is operating in compliance with a plan or agreement developed for the protection of the northern spotted owl under WAC 222-16-080 (6)(a), (e), or (f).		

NEW SECTION **WAC 222-30-065 Helicopter yarding.** Helicopter operations within a SOSEA boundary shall not be allowed within 0.25 mile of a northern spotted owl site center between March 1 and August 31, provided that, this restrictions shall not apply if: (1) The landowner demonstrates that the owls are not actively nesting during the current nesting season; or (2) The forest practice is operating in compliance with a plan or agreement developed for the protection of the northern spotted owl under WAC 222-16-080 (6)(a), (e), or (f).		
WAC 222-30-070 Tractor and Wheeled Skidding Systems (10) Disturbance avoidance. The operation of heavy equipment within a SOSEA boundary shall not be allowed within 0.25 mile of a northern spotted owl site center between March 1 and August 31, provided that, this restriction shall not apply if: (a) The landowner demonstrates that the owls are not actively nesting during the current nesting season; or (b) The forest practice is operating in compliance with a plan or agreement developed for the protection of the northern spotted owl under WAC 222-16-080 (6)(a), (e), or (f).		
WAC 222-30-100 Slash disposal or prescribed burning. (6) Disturbance avoidance. Burning within a SOSEA boundary shall not be allowed within 0.25 mile of a northern spotted owl site center between March 1 and August 31, provided that, this restriction shall not apply if: (a) The landowner demonstrates that the owls are not actively nesting during the current nesting season; or (b) The forest practice is operating in compliance with a plan or agreement developed for the protection of the northern spotted owl under WAC 222-16-080 (6)(a), (e), or (f).		
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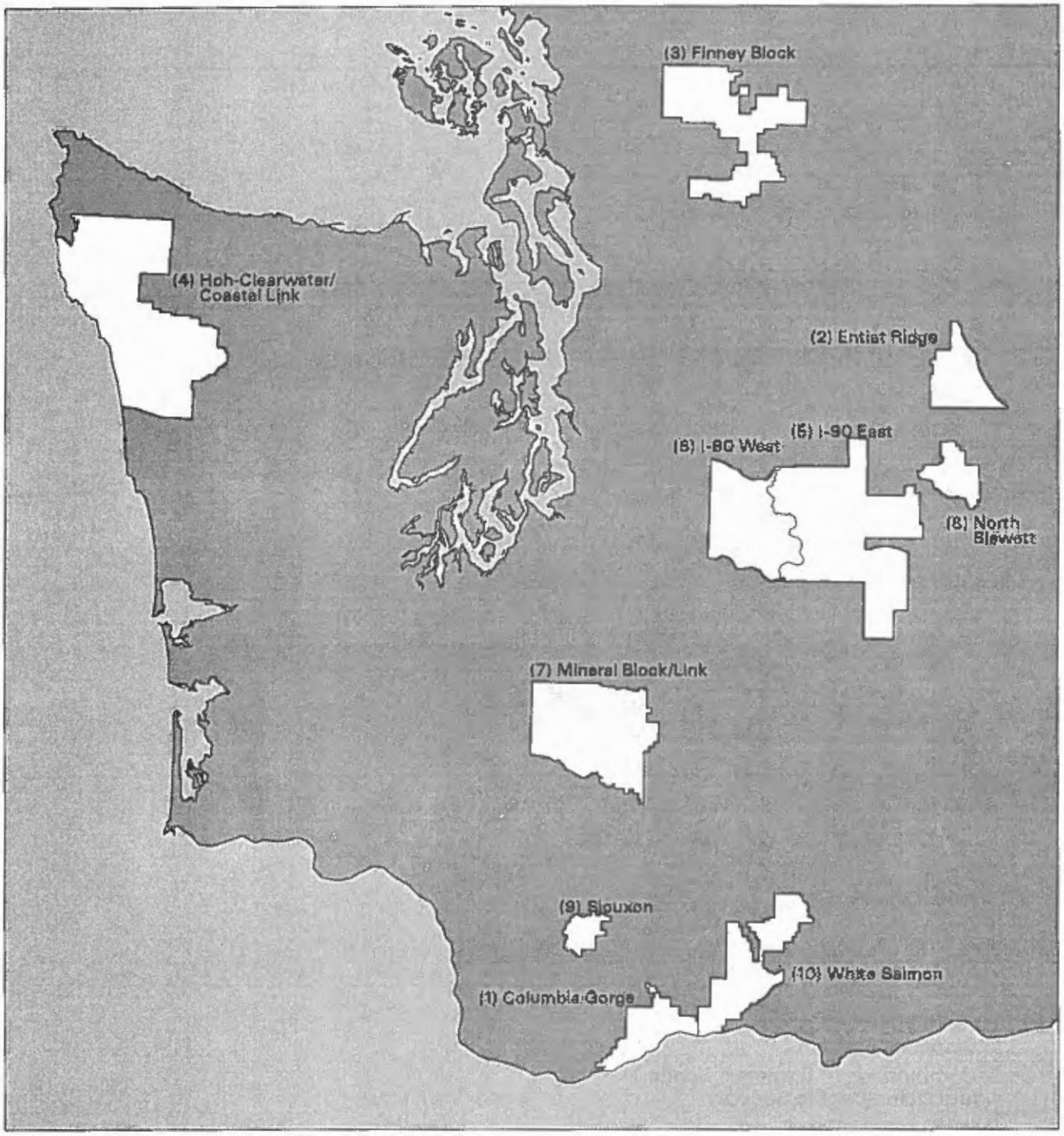
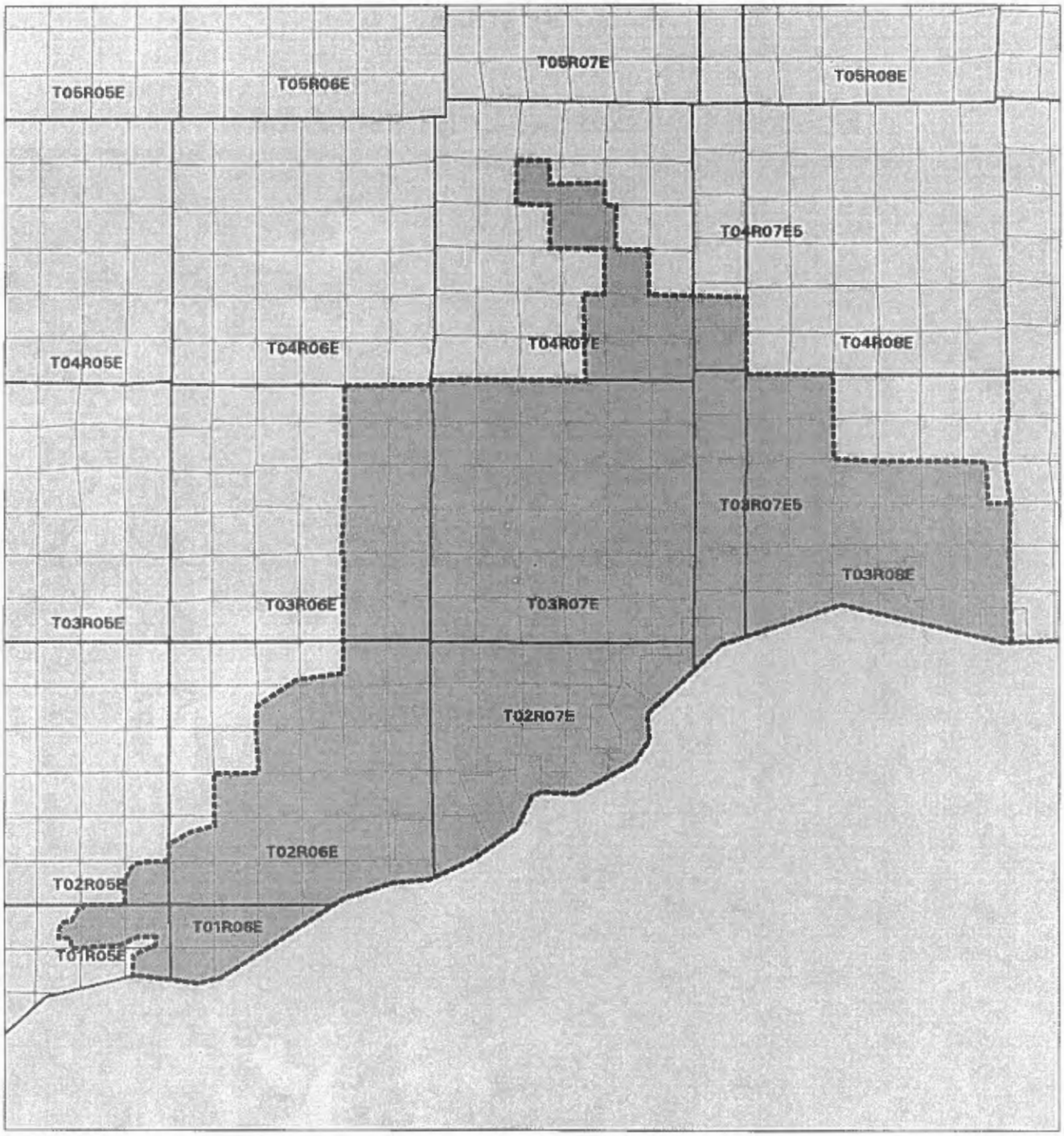
Forest Practices Board Proposed Rules for the Northern Spotted Owl

Attachment A

Spotted Owl Special Emphasis Areas

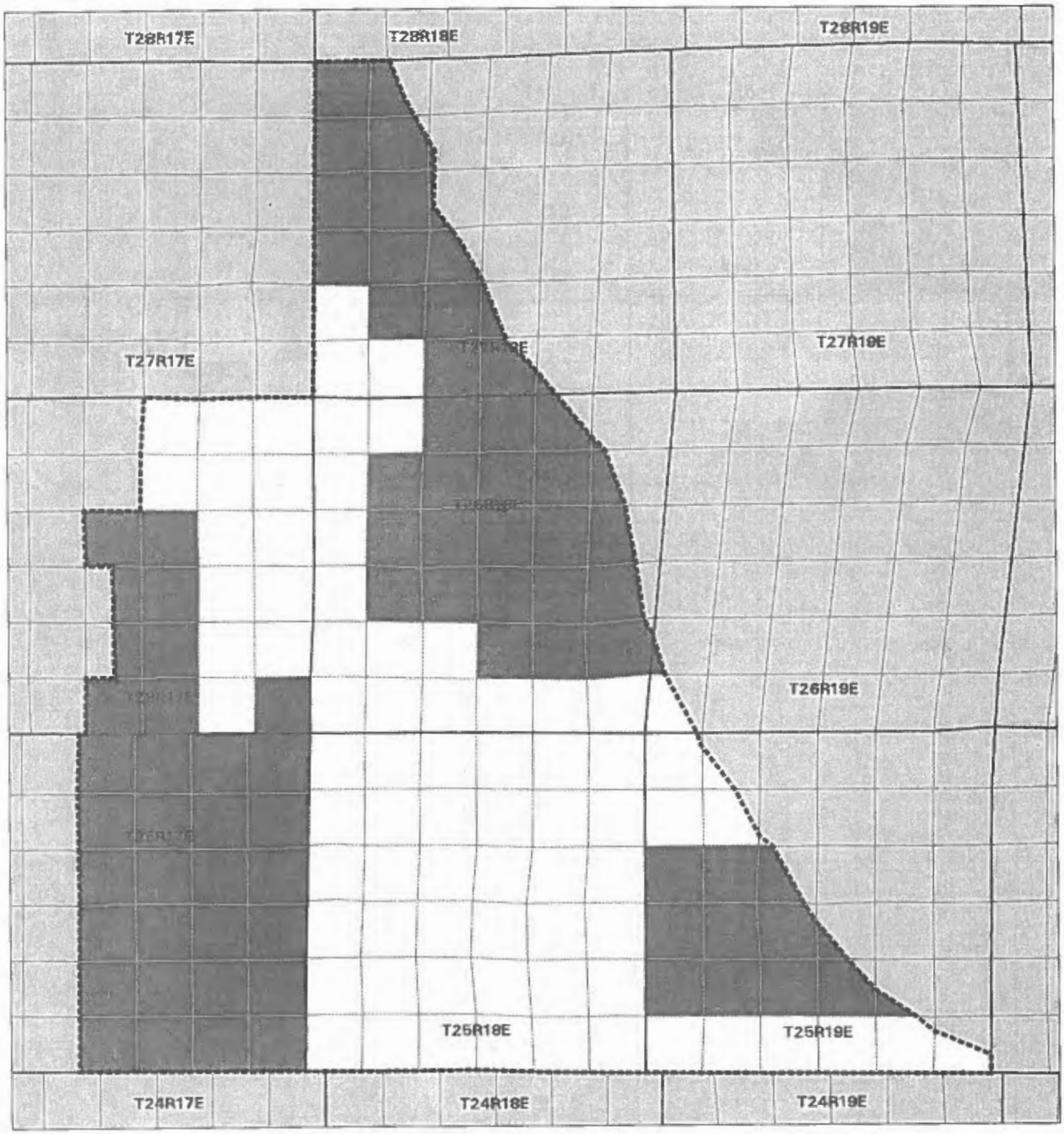


(1) Columbia Gorge SOSEA



Demographic Support
Dispersal Support
Combination of Dispersal Support and Demographic Support
SOSEA Boundary

(2) Entiat SOSEA



Demographic Support
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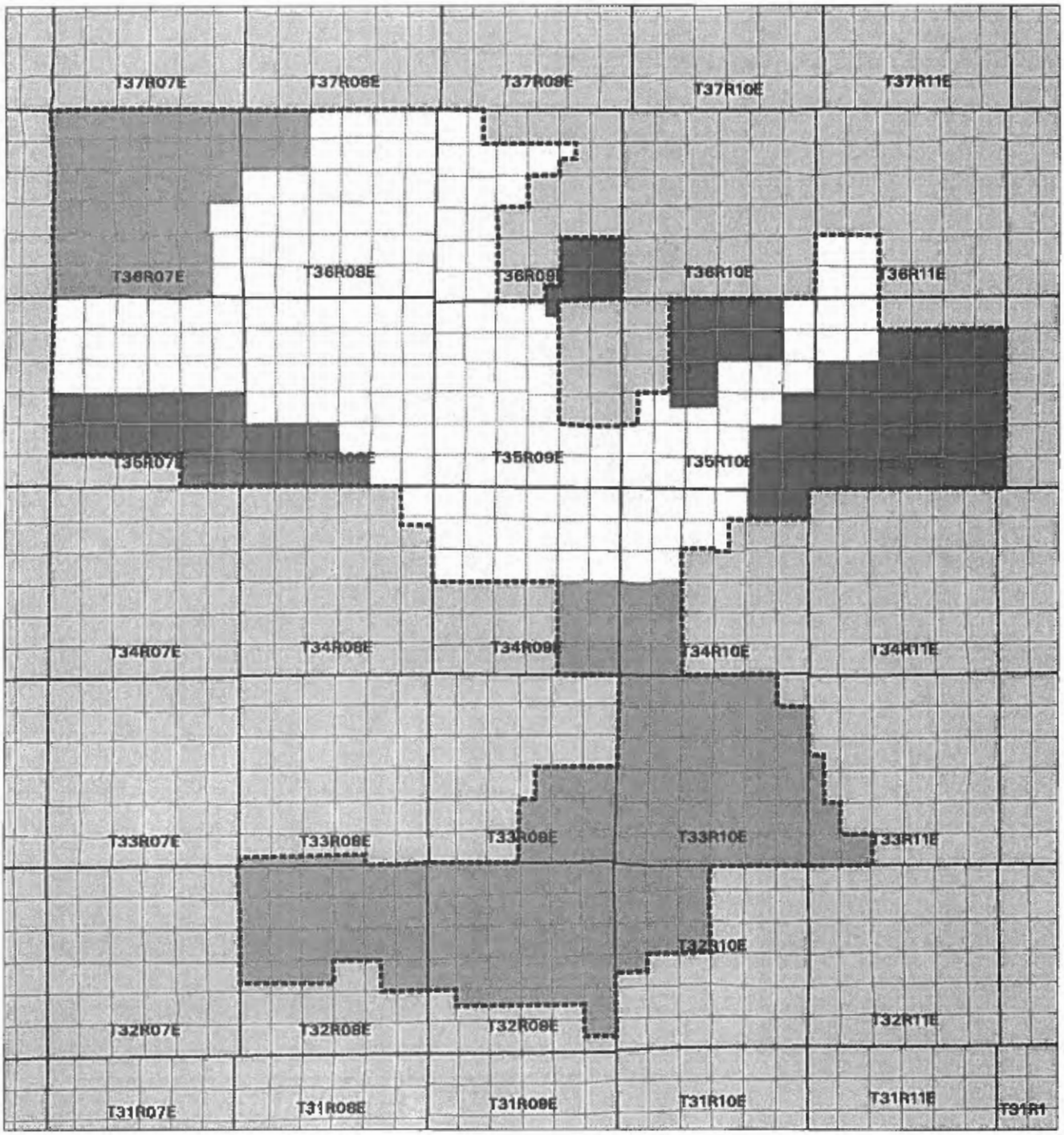
SOSEA Boundary

(3) Finney Block SOSEA



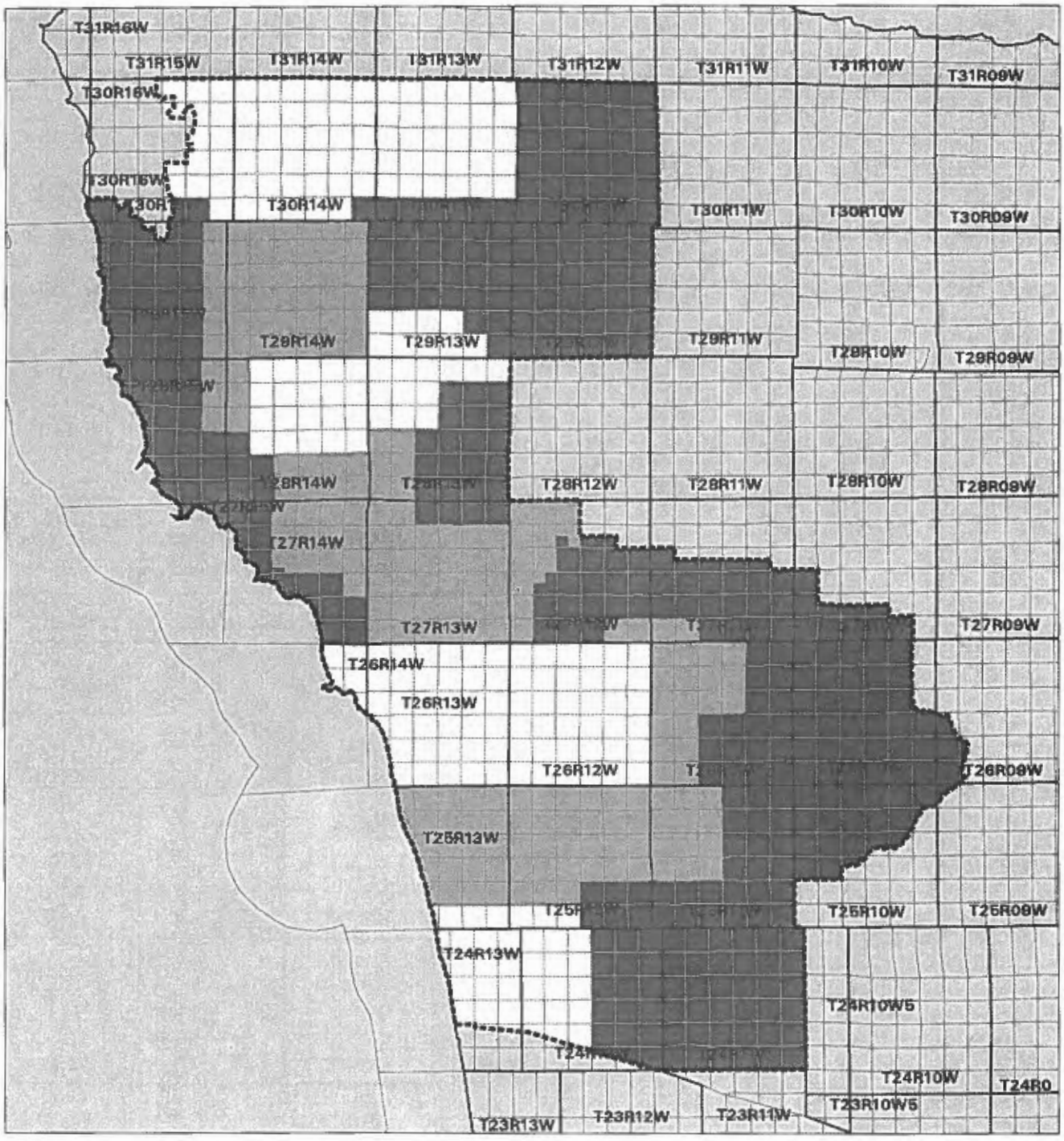
Demographic Support

Dispersal Support

Combination of Dispersal Support and Demographic Support

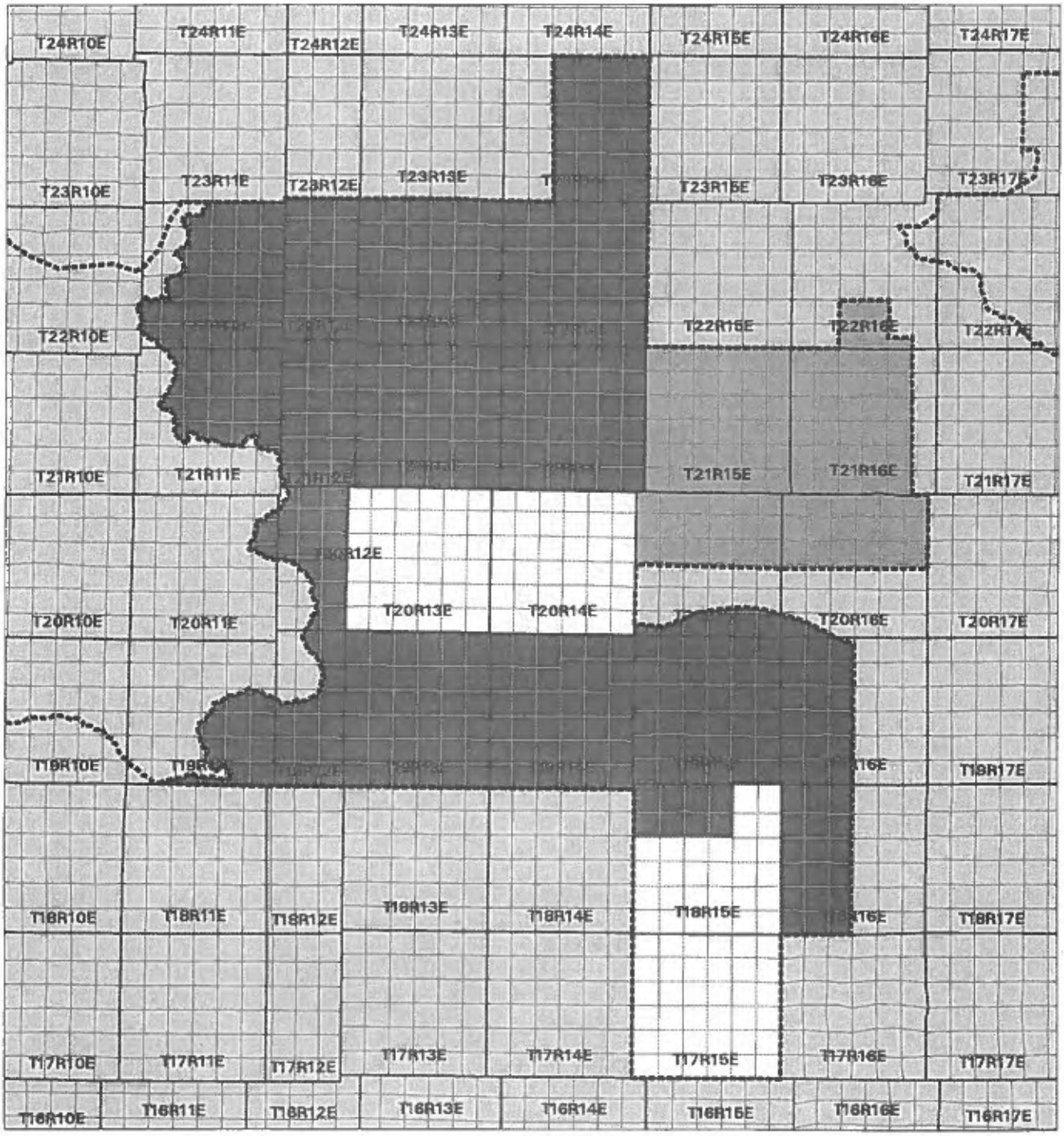
SOSEA Boundary

(4) Hoh-Clearwater/Coastal Link SOSEA



Demographic Support
Dispersal Support
Combination of Dispersal Support and Demographic Support
SOSEA Boundary

(5) I-90 East SOSEA



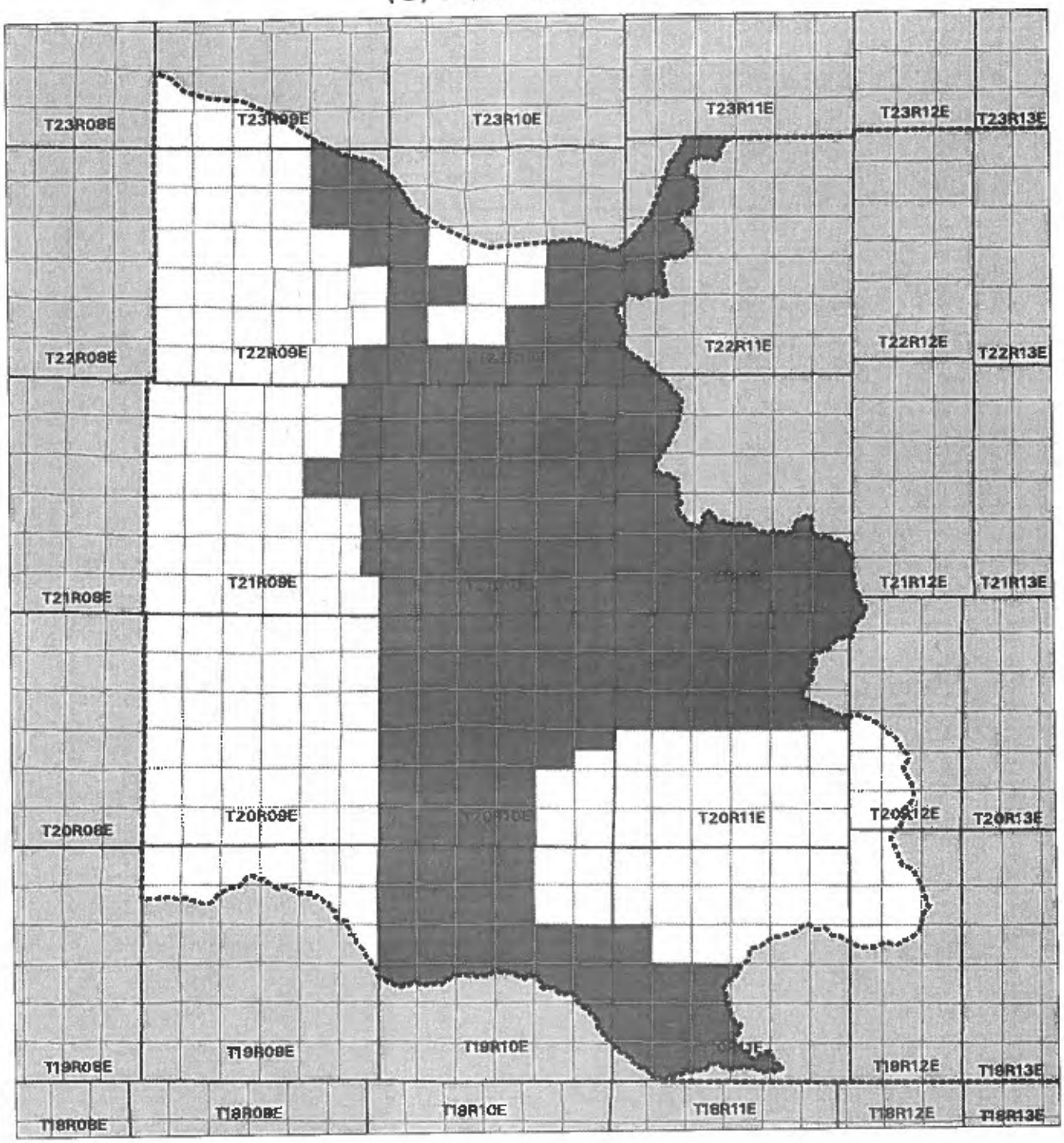
Demographic Support

Dispersal Support

Combination of Dispersal Support and Demographic Support

SOSEA Boundary

(6) I-90 West SOSEA



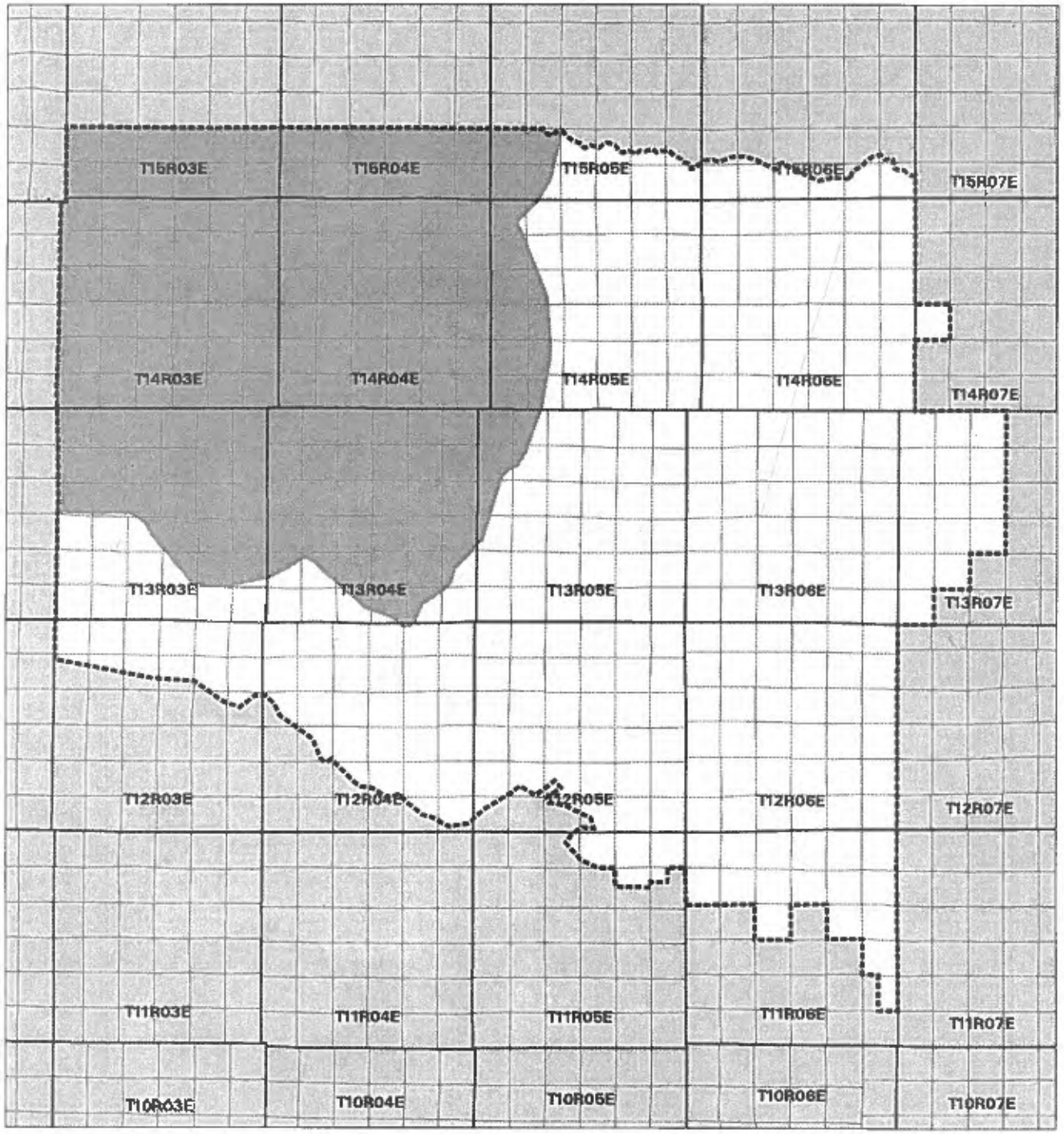
Demographic Support

Dispersal Support

Combination of Dispersal Support and Demographic Support

SOSEA Boundary

(7) Mineral Block/Link SOSEA



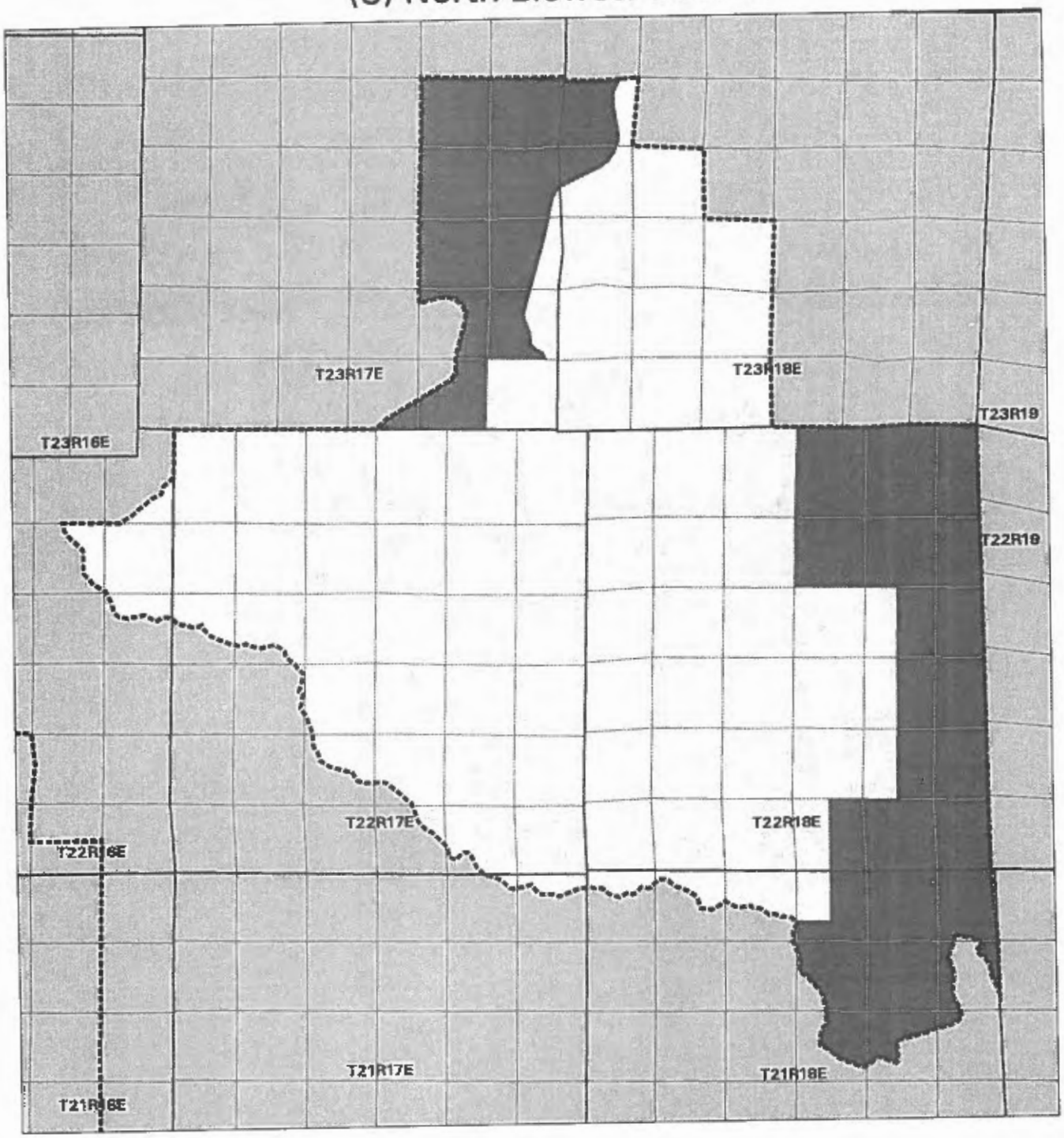
Demographic Support

Dispersal Support

Combination of Dispersal Support and Demographic Support

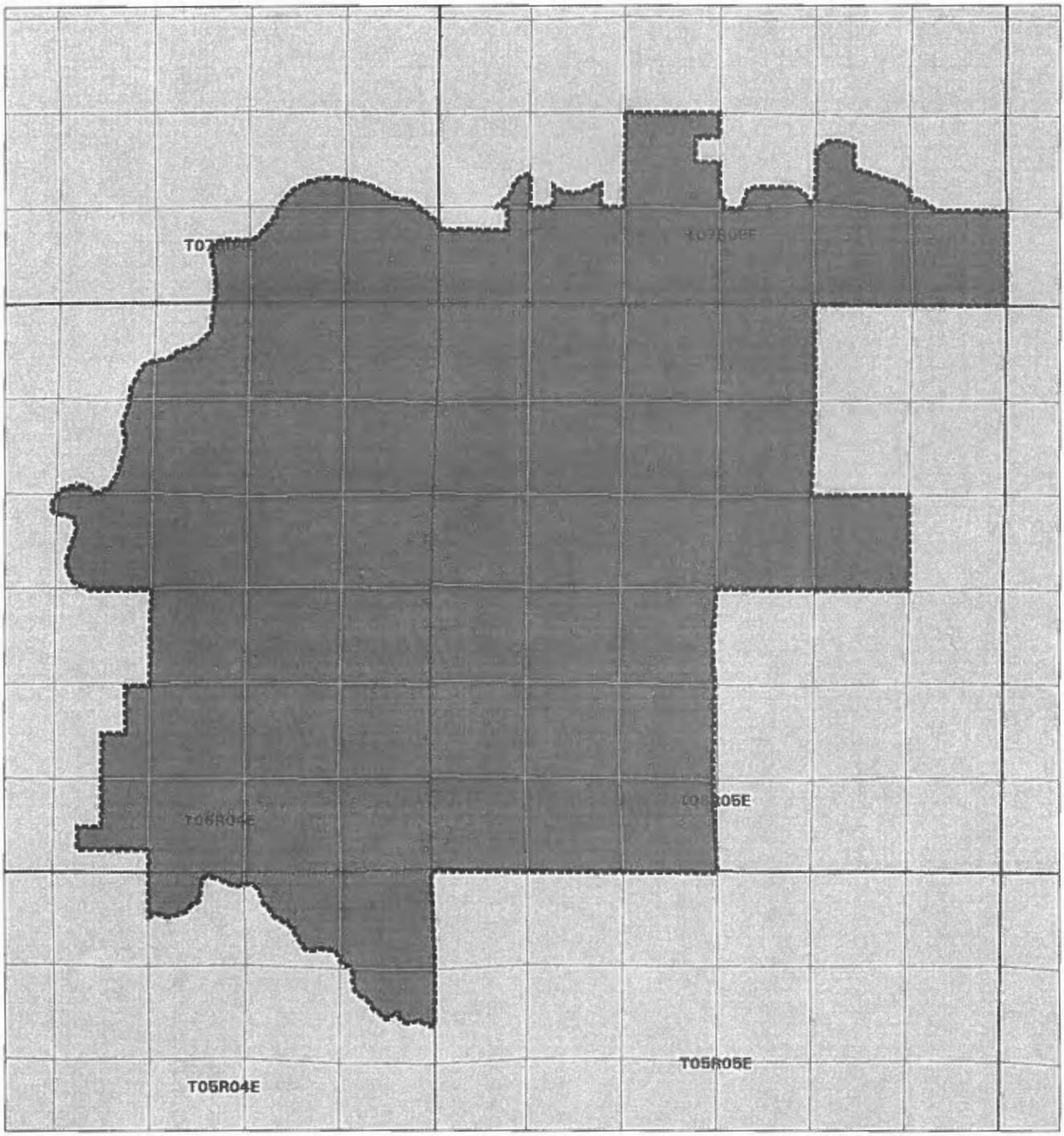
SOSEA Boundary

(8) North Blewett SOSEA



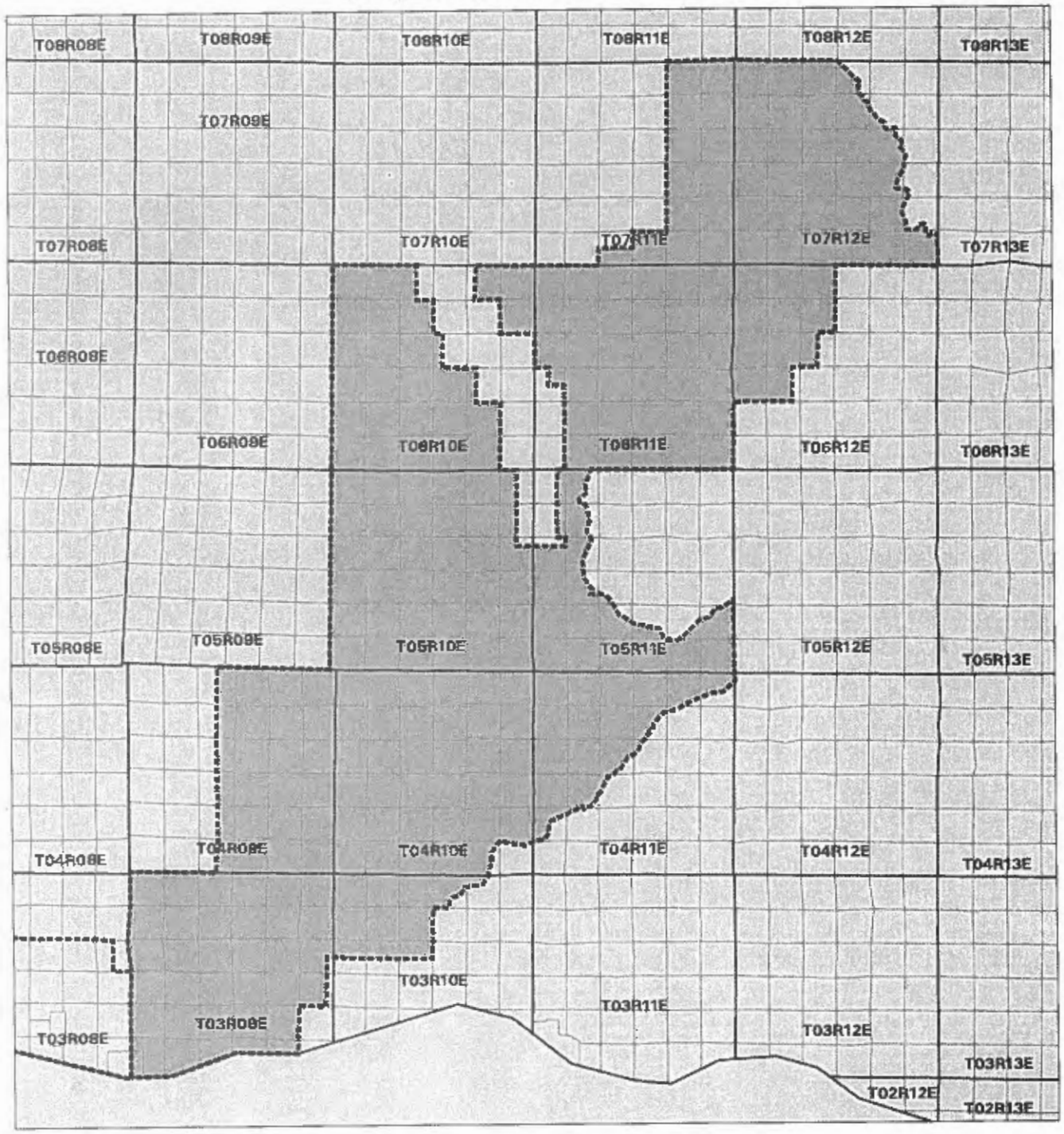
Demographic Support
Dispersal Support
Combination of Dispersal Support and Demographic Support
SOSEA Boundary

(9) Siouxon SOSEA



Demographic Support
Dispersal Support
Combination of Dispersal Support and Demographic Support
SOSEA Boundary

(10) White Salmon SOSEA



Demographic Support

Dispersal Support

Combination of Dispersal Support and Demographic Support

SOSEA Boundary

Appendix B

Northern Spotted Owl

Summary and Comparison of Alternatives

DRAFT FOREST PRACTICES RULES

SUMMARY and COMPARISON OF NORTHERN SPOTTED OWL ALTERNATIVES

Revised November 1995 to include TFW Proposal and the 4(d) Proposed Rule

Rule Concept:	TFW Proposal	PROPOSED 4(d) Rule	Alternative 1 WFPA	Alternative 2 FPB WILDLIFE CTTE	Alternative 3 WEC-YIN
1. Definitions	Cooperative spotted owl habitat enhancement agreement (CHEA) Demographic support Dispersal habitat Dispersal support Old forest habitat Median home range circle Northern spotted owl site center SOSEA goals Spotted owl dispersal habitat Spotted owl special emphasis area (SOSEA) Sub-mature habitat Suitable spotted owl habitat Young forest marginal habitat	Adaptive management area Administratively wWithdrawn area CA conservation planning area Congressionally reserved area Conservation Federal Forest Plan Federal Reserve Habitat Conservation Plan Home Range Incidental Take Matrix Land Nesting, roosting, foraging habitat or suitable habitat Northern spotted owl Person Province or Physiographic Province Record of Decision Site Center Special Emphasis Area Take Threatened Species Timber harvest activity or harvest	Class IV-Special: Critical wildlife habitat (state) Degraded habitat Dispersal habitat Disturbance: Concentrated helicopter use w/in 70 acres, Mar 1-July 31 Dispersal & pair maintenance by SOSEAs Important landscapes Local option plan (LOP) Northern spotted owl site centers: Status 1-3 owl site centers Spotted owl special emphasis area (SOSEA) Federally approved plans Site center management plans Habitat Excess - W.Washington Excess - E.Washington Forage - W.Washington Forage - E. Washington Pair maintenance habitat Prohibited acts Single resident NSO Small harvest exception	Class IV-Special: Critical wildlife habitat (state) Demographic support Dispersal habitat Foraging habitat Landowner option plans (LOP) Natural disasters Northern spotted owl site center Status 1-3 owl site centers Old-forest habitat Spotted owl special emphasis areas (SOSEAs) Sub-mature habitat Suitable spotted owl habitat Young forest marginal habitat	Class IV-Special: Critical wildlife habitat (state) Degraded habitat Dispersal habitat Disturbance avoidance plan Essential life requisites for wildlife Impacts on the population or major sub-populations of NSO Important landscapes Modified sub-mature & mod. young forest marginal habitat Northern spotted owl site centers: Status 1-3 owl site centers Old-forest habitat Provincial median home range Sub-mature habitat Suitable spotted owl habitat Young forest marginal habitat

Rule Concept:	TFW Proposal	PROPOSED 4(d) Rule	Alternative 1 WFPA	Alternative 2 FPB WILDLIFE CTTE	Alternative 3 WEC-YIN
2. Landscapes	10 SOSEAs (13 SAG SOSEAs) Columbia Gorge* Entiat* (+special SEPA trigger) Finney Block I-90 West I-90 East* (includes Teanaway, Taneum, Easton) Mineral Block/Link Siouxon* White Salmon* North Blewett Hoh-Clearwater/Coastal Link * means modifications have been made to original SAG boundaries. Note: SOSEA goals (functions) are identified on SOSEA maps in WAC 222-16-086.	6 SEAs Columbia River Gorge/White Salmon (combined) Finney Block I-90 Corridor (includes I-90E, I-90W, Taneum, Easton, Blewett) Mineral Block (includes Mineral Link) Siouxon Creek Hoh-Clearwater All SEAs provide demographic support except in areas surrounded by or located within matrix or AMA lands, except if sites are centered on reserve or withdrawn areas.	6 SOSEAs Columbia Gorge-dispersal Finney Block-dispersal I-90 West-demo support I-90 East/Teanaway-demo supp Mineral Block-demo support Mineral Link-dispersal	10 SOSEAs Columbia Gorge-dispersal Easton-dispersal Finney Block-dispersal I-90 West-demographic support I-90 East/Teanaway-demo support Mineral Block-demo supp & disp Mineral Link-dispersal Siouxon-demographic support Taneum-demographic support White Salmon-dispersal	15 SOSEAs Columbia Gorge-demo supp & disp Easton-dispersal Entiat Ridge-demo supp & dispersal Finney Block-demo supp &dispersal I-90 West-demo supp & dispersal I-90 East/Teanaway-demo supp & dispersal Mineral Block-demo supp & disp Mineral Link-dispersal Siouxon-demo support & dispersal Taneum-demographic support White Salmon-demo supp & disp North Blewett-demo supp & disp Southwest Washington-dispersal Hoh-Clearwater/Coastal Link-demographic support & dispersal North Olympic Coast-demo support

Rule Concept:	TFW Proposal	PROPOSED 4(d) Rule	Alternative 1 WFPA	Alternative 2 FPB WILDLIFE CTTE	Alternative 3 WEC-YIN
3.Circle Dimensions: In SOSEAs-Radius/Acres	Hoh-Clearwater SOSEA: 2.7 miles/5,863 acres All other SOSEAs: 1.8 miles/2,605 acres	*(Dimensions not given)* • "median annual home range" • at least 40 percent NRF habitat within median home range	W.Wash-1.8 miles/2,608 acres E.Wash-1.8 miles/1,956 acres	W.Wash-2.0 miles/3,200 acres E.Wash-1.8 miles/2,400 acres	W. of I-5 2.7 miles/3,827 acres W.Wash 2.0 miles/3,586 acres E.Wash. 1.8 miles/3,249 acres
Outside SOSEAs	The 70 acres highest quality habitat around the site center from March 1 through August 31.	• the 70 acres of NRF closest to an owl site center	70 acres around site center	70 acres around site center	70 acres around site center

Rule Concept:	TFW Proposal	PROPOSED 4(d) Rule	Alternative 1 WFPA	Alternative 2 FPB WILDLIFE CTTE	Alternative 3 WEC-YIN
4. SEPA Trigger: **Within Impt Landscapes**	Within SOSEA boundaries, harvesting, road construction or aerial application of pesticides on suitable habitat inside owl circles, except within the Entiat SOSEA where the trigger applies only on suitable habitat inside owl circles and inside the areas indicated for demographic support.	Under the ESA "take" is generally prohibited; under 4(d) "incidental take" is allowed under strict circumstances. *(Note: The SEPA triggers in the other alternatives require SEPA review; they are not prohibitions of activities.)* • Timber harvest activities are allowed in SEAs if they result in more than 40 percent suitable habitat remaining within the median home range of the owl. • Harvesting on non-federal lands surrounded by or located w/in matrix or AMA lands is allowed if the prescriptions and restrictions are followed.	Harvesting or road construction within a SOSEA on suitable habitat below the following threshold levels: • Western Washington: 2,608 acres within a 1.8 mile radius of status 1, 2 or 3 site center; or • Eastern Washington: 1,956 acres within a 1.8 mile radius of status 1, 2 or 3 site centers. Concentrated helicopter use within 70 acres around the site center.	Harvesting, road construction or aerial application of pesticides within SOSEAs on suitable habitat below the following threshold levels: • Western Washington: 3,200 acres within a 2.0 mile radius of status 1,2 or 3 site centers; • Eastern Washington: 2,400 acres within a 2.0 mile radius of status 1, 2, or 3 site centers.	Harvesting, road construction or aerial application of pesticides: • on suitable habitat within .7 miles of site center; or • on old growth forest within provincial median home range; or • radii of site center; or • on sub mature or young forest within the provincial median home range of site center.
Outside Impt Landscapes:	Outside of a SOSEA, harvesting, road construction, or aerial application of pesticides, between March 1 and August 31, on the 70 acres of highest quality suitable habitat.	Timber harvest activities are prohibited if they result in less than 70 acres of NRF habitat closest to the site center or impact owls with site centers inside Federal Reserves, Administratively withdrawn lands or Congressionally reserved lands.	Harvesting, road construction or helicopter use within the most suitable 70 acres of habitat around site center.	Harvesting, road construction or aerial application of pesticides within the 70 acres surrounding a status 1, 2 or 3 site center.	Harvesting, road construction or aerial application of pesticides on 70 acres of suitable habitat which includes the site center.

Rule Concept:	TFW Proposal	PROPOSED 4(d) Rule	Alternative 1 WFPA	Alternative 2 FPB WILDLIFE CTTE	Alternative 3 WEC-YIN
Exemptions to SEPA:	•An approved Landowner Option Plan (LOP) •HCP approved by USFWS •Pre-listing agreements or habitat management plan accompanied by a "no-take" letter from USFWS or NMFS. •4(d) rule adopted by USFWS or NMFS •Small parcel exemption (See #7, below)	Harvest is allowed: •With an approved HCP •With an approved Local Option Conservation Plan •With a Spotted Owl Habitat Enhancement Agreement	•HCP approved by USFWS •Local plan •Pre-listing agreements or habitat management plan accompanied by a "no-take" letter from USFWS or NMFS. •4(d) rule adopted by USFWS or NMFS. •Small harvest exemption	•HCP approved by USFWS or NMFS •Pre-listing agreements or habitat management plans accompanied by a "no-take" letter from USFWS or NMFS. •Olympic Experimental Forest Plan approved by the USFWS. •Small landowner exemption (See #7, below)	A site specific wildlife management plan developed by the landowner in cooperation with Washington Dept of Fish & Wildlife and approved by DNR.

Rule Concept:	TFW Proposal	PROPOSED 4(d) Rule	Alternative 1 WFPA	Alternative 2 FPB WILDLIFE CTTE	Alternative 3 WEC-YIN
5. Planning Components	Establishes a process for the development of Landowner Option Plan (LOP): •Identifies elements that are to be included in a LOP: - Goals and Objectives - Description of planning area - Physical features - Current spotted owl habitat status - Current owl status - Mgt proposals & operation plans - Projected spotted owl habitats - Training - Monitoring - Reporting - Plan modification - Duration of plan - Approval process - Enforcement process • LOPs to be approved by DNR in consultation with WDFW, others.	Application Plan to include: • description of area to be covered; • size of affected ownership; • intended duration; • number of affected owls and habitat conditions to be covered; • extent to which plan will contribute to owl needs for SEA affected by plan; • extent to which incidental take will be complementary with Federal Forest Plan goals for area; • extent to which land is adjacent to or interspersed with matrix or AMA lands; • measures to be taken to minimize or mitigate impacts of incidental take; • impact of plan on affected watershed; • commitments to implementation; • procedures to deal with unforeseen circumstances which could result in adverse impacts to owls; • any additional measures the USFWS deems necessary; • state certification, if necessary. Public Comment period Approval upon certain findings	Establishes Local Option Plans (LOPs) approved by DNR. (Details are not developed; the planning section from the Wildlife Committee Preferred Alternative could be added to this option.)	Establishes a process for the development of Landowner Option Plan (LOP): • Recognizes two types of LOPs - Dispersal Plans and Site Center Management Plans •Identifies elements that are to be included in a LOP: - Goals and Objectives - Physical features - Current spotted owl habitat status - Current owl status - Mgt proposals & operation plans - Projected spotted owl habitats - Training - Monitoring - Reporting - Plan modification - Duration of plan • LOPs to be approved by the DNR • Criteria by which the LOP will be evaluated for adequacy are in process of being developed and will be added prior to adoption.	Allows for site specific special wildlife management plans developed by landowners in cooperation with WDF&W and approved by DNR. • An operation specific plan which will result in modified sub-mature habitat or modified young forest marginal habitat but not degraded habitat; or • A spotted owl site center management plan; or • A landscape level management plan which considers life requisites to maintain the viability of the existing multiple northern spotted owl site centers within the landscape. Allows for disturbance avoidance plans approved by DNR.

Rule Concept:	TFW Proposal	PROPOSED 4(d) Rule	Alternative 1 WFPA	Alternative 2 FPB WILDLIFE CTTE	Alternative 3 WEC-YIN
5. Planning Components (continued)	Establishes a process for the development of cooperative NSO habitat enhancement agreements (CHEA) ● Identifies elements in CHEA: - Description of agreement area - Current spotted owl habitat status - Management proposals - Projected habitat development - Agreement modification - Duration of agreement - Approval process - Enforcement process ● CHEA to be approved by DNR in consultation with WDFW, others.				

Rule Concept:	TFW Proposal	PROPOSED 4(d) Rule	Alternative 1 WFPA	Alternative 2 FPB WILDLIFE CTTE	Alternative 3 WEC-YIN
6.Disturbance	**Road Construction** within SOSEA boundary restricted within .25 miles of site center between March 1 and August 31, unless owls are not actively nesting. **Felling and Bucking** within SOSEA boundary restricted within .25 miles of site center between March 1 and August 31, unless owls are not actively nesting. **Cable Yarding** within a SOSEA boundary restricted within .25 miles of site center between March 1 and August 31, unless owls are not actively nesting. **Helicopter Yarding** within SOSEA boundary restricted within .25 miles of site center between March 1 and August 31, unless owls are not actively nesting.	*(Nothing noted)*	Applies to all classes of fp applications: **Road Construction** prohibited in the 70 acres of suitable habitat surrounding a site center, unless permitted by a federally approved plan. **Harvesting** prohibited in the 70 acres of suitable habitat surrounding a site center, unless permitted by a federally approved plan. **"Concentrated" helicopter** use prohibited in the 70 acres of suitable habitat surround a site center, unless permitted by a federally approved plan.	Applies to all classes of fp applications: **Road Construction** restricted within .25 miles of site center between March 1 and July 31. **Felling and Bucking** restricted within .25 miles of site center between March 1 and July 31, unless a disturbance avoidance plan has been approved. **Cable Yarding** restricted within .25 miles of site center between March 1 and July 31. **Helicopter Yarding** restricted within .25 miles of site center between March 1 and July 31. Shall maintain a minimum above ground altitude of 500 feet when flying over designated "critical" spotted owl habitat.	Applies to all classes of fp applications: **Road Construction** restricted within .25 miles of site center between March 1 and July 31. **Felling and Bucking** restricted within .25 miles of site center between March 1 and July 31, unless a disturbance avoidance plan has been approved. **Cable Yarding** restricted within .25 miles of site center between March 1 and July 31. **Helicopter Yarding** restricted within .25 miles of site center between March 1 and July 31. Shall maintain a minimum above ground altitude of 500 feet when flying over designated "critical" spotted owl habitat.

Rule Concept:	TFW Proposal	PROPOSED 4(d) Rule	Alternative 1 WFPA	Alternative 2 FPB WILDLIFE CTTE	Alternative 3 WEC-YIN
Disturbance (continued)	**Tractor and Wheel Skidding Systems** operations of heavy equipment within a SOSEA boundary restricted within .25 miles of site center between March 1 and August 31, unless owls are not actively nesting. **Slash disposal or prescribed burning within** SOSEA boundary restricted within .25 miles of site center between March 1 and August 31, unless owls are not actively nesting.			**Tractor and Wheel Skidding Systems** restricted within .25 miles of site center between March 1 and July 31. **Hauling** restriction within .25 miles between March 1 and August 31. **Slash disposal or prescribed burning** restricted within .25 miles of site center between March 1 and July 31. **Handling, storage or applications of pesticides aerial application** restricted within .25 miles of site center between March 1 and July 31. **Handling, storage or application of fertilizers aerial application** restricted within .25 miles of site center between March and July 31.	**Tractor and Wheel Skidding Systems** restricted within .25 miles of site center between March 1 and July 31. **Hauling** restriction within .25 miles between March 1 and August 31. **Slash disposal or prescribed burning** restricted with .25 miles of site center between March 1 and July 31. **Handling , storage or applications of pesticides** restricted within .25 miles of site center between March 1 and July 31. Helicopter operations shall maintain a minimum above ground altitude of 500 feet when flying over designated "critical" spotted owl habitat. **Handling, storage or application of fertilizers** restricted within .25 miles of site center between March 1 and July 31. Helicopter operations shall maintain a minimum above ground altitude of 500 feet when flying over designated "critical" spotted owl habitat.

Rule Concept:	TFW Proposal	PROPOSED 4(d) Rule	Alternative 1 WFPA	Alternative 2 FPB WILDLIFE CTTE	Alternative 3 WEC-YIN
7. Small Landowner Exemption	Provides for small parcel exemption: - if a landowner owns or controls 500 acres or less within the SOSEA and - the forest practice is not within .7 mile of a northern spotted owl site center.	Owners of not more than 80 acres may 'take' a northern spotted owl, as long as harvest does not destroy or degrade the 70 acres of suitable habitat closest to the owl site center.	Provides for a small harvest exemption: • Can harvest 10 acres per year; or • Up to 4 years with an accumulation of suitable habitat up to 40 acres.	Allows for a small landowner exemption for timber harvest, road construction, or aerial application of pesticides within a SOSEA outside the 70 acres surrounding a known site center if the entire harvestable acreage of an ownership is within a status 1, 2 or 3 site center and: •All harvesting complies with disturbance avoidance criteria; and •The annual harvest is 20 acres or smaller; and •Within a 10 year period, no more than 2% of the ownership between the outer edge of the 70 acre around the site center and the outer edge of the circle is harvested.	

Appendix C

Scientific Names

of Species

Appendix C

Scientific Names of Species

Common and Scientific Names of Plants (Hitchcock and Cronquist 1991) and Animals (Banks et al. 1987).

Mammals

Abert's squirrel	*Sciurus aberti*
black bear	*Ursus americana*
black-tailed deer	*Odocoileus hemionus*
bobcat	*Lynx rufus*
bushy-tailed woodrat	*Neotoma cinerea*
California ground squirrel	*Spermophilus beecheyi*
cougar	*Felis concolor*
coyote	*Canis latrans*
deer mouse	*Peromyscus spp.*
Douglas' squirrel	*Tamiasciurus douglasii*
eastern gray squirrel	*Sciurus carolinesis*
elk	*Cervus elaphus*
fisher	*Martes pennati pacifica*
fox squirrel	*Sciurus niger*
gray fox	*Urocyon cinereoargenteus*
gray wolf	*Canis lupis*
grizzly bear	*Ursus arctos*
hoary bat	*Lasiurus cinereus*
Kaibab squirrel	*Sciurus aberti kaibabensis*
marten	*Martes americana*
mountain beaver	*Aplodontia rufa*
mountain goat	*Oreamnos americanus*
northern flying squirrel	*Glaucomys sabrinus*

porcupine	*Erethizon dorsatum*
raccoon	*Procyon lotor*
red-backed vole	*Clethriomomys sp.*
red squirrel	*Tamiasciurus hudsonicus*
river otter	*Lutra canadensis*
skunk	*Mephitis sp. and Spilogale sp.*
snowshoe hare	*Lepus americanus*
Townsend's chipmunk	*Tamias townsendii*
voles	*Microtus spp. and Clethrionomys spp.*
western gray squirrel	*Sciurus griseus*

Birds

acorn woodpecker	*Melanerpes formicivorous*
American crow	*Corvus brachyrhynchos*
American robin	*Turdus migratorius*
ancient murrelet	*Synthilboramphus antiquus*
ash-throated flycatcher	*Myiarchus cinerascens*
Atlantic puffins	*Fratercula artica*
bald eagle	*Haliaeetus leucocephalus*
band-tailed pigeon	*Columba fasciata*
barred owl	*Strix varia*
brown-headed cowbird	*Molothrus ater artemisiae*
Cassin's auklet	*Ptychoramphus aleuticus*
cedar waxwing	*Bombycilla cedrorum*
chipping sparrow	*Spizella passerina*
common murre	*Uria aalge*
common raven	*Corvus corax*
Cooper's hawk	*Accipiter cooperii*
crested auklet	*Aethia pygmaea*
dusky flycatcher	*Empidonax oberholseri*
European starling	*Sturnus vulgaris*
evening grosbeak	*Coccothraustes vespertinus*
golden eagle	*Aquila chrysaetos*

gray jay	*Perisoreus canadensis*
great blue heron	*Ardea herodias*
great-horned owl	*Bubo virginianus*
guillemot	*Uria aalge*
hairy woodpecker	*Picoides villosus*
harlequin duck	*Histrionicus histrionicus*
Kittlitz's murrelet	*Brachyramphus brevirostris*
lazuli bunting	*Passerina amoena*
least auklet	*Aethia pusilla*
Lewis' woodpecker	*Melanerpes lewis*
long-billed murrelet	*Brachyramphus marmoratus perdix*
mallard	*Anas platyrhynchos*
marbled murrelet	*Brachyramphus marmoratus*
Merriam's wild turkey	*Meleagris gallapavo*
mountain chickadee	*Parus gambeli*
Nashville warbler	*Vermivora ruficapilla*
northern oriole	*Icterus galbula*
northern saw-whet owl	Aegolius acadicus
northern spotted owl	*Strix occidentalis*
northern flicker	*Colaptes auratus*
northern goshawk	*Accipiter gentilis*
orange-crowned warbler	*Vermivora celeta*
peregrine falcon	*Falco peregrinus*
pigeon guillemot	*Cepphus columba*
pileated woodpecker	*Dryocopus pileatus*
purple martin	*Progne subis*
razorbill	*Alca torda*
red-breasted nuthatch	*Sitta canadensis*
red-tailed hawk	*Buteo jamaicensis*
rufous hummingbird	*Selasphorus rufus*
scrub jay	*Aphelocoma coerulescens*
Steller's jay	*Cyanocitta stelleri*
Swainson's thrush	*Catharus ustulatus*
western bluebird	*Sialia mexicana*

western grebe	*Aechmophorus occidentalis*
western tanager	*Piranga ludoviciana*
Wilson's warbler	*Wilsonia pusilla*
wood duck	*Aix sponsa*
yellow warbler	*Dendroica petechia*
Xantus' murrelet	*Endomychura hypoleuca*

Reptiles and Amphibians

bullfrog	*Rana catesbeiana*
Larch Mountain salamander	*Plethodon larselli*
northwestern salamander	*Ambystoma gracile*
northern alligator lizard	*Elgaria coerulea*
red-legged frog	*Rana aurora*
ring-necked snake	*Diadophis punctatus*
roughskin newt	*Taricha granulosa*
rubber boa	*Charina bottae*
sharp-tailed snake	*Contia tenius*
tailed frog	*Ascaphus truei*
western pond turtle	*Clemmys marmorata*
western spotted frog	*Rana pretiosa*

Fish

bull trout	*Salvelinus confluentus*
chinook salmon	*Oncorhynchus tshawysstcha*
chum salmon	*Oncorhynchus keta*
coho salmon	*Oncorhynchus kisutch*
northern anchovies	*Engraulis mordax*
Pacific herring	*Clupea harengus*
Pacific sand lance	*Ammododytes hexapterus*
pink salmon	*Oncorhynchus gorbuscha*
sockeye salmon	*Oncorhynchus nerka*
steelhead trout	*Oncorhynchus mykiss*

Plants

bigleaf maple	*Acer macrophyllum*
big sagebrush	*Artemesia tridentata*
bitterbrush	*Purshia tridentata*
black cottonwood	*Populus trichocarpa*
black walnut	*Juglans nigra*
California hazel	*Corylus cornuta*
clustered ladyslipper	*Cypripedium fasiculatum*
coldwater corydalis	*Corydalis aquaegelidae*
coastal redwood	*Sequoia sempervirens*
common snowberry	*Symphoricarpos albus*
Douglas fir	*Pseudotsuga menziesii*
English walnut	*Juglans regia*
golden paintbrush	Castilleja levisecta
grand fir	*Abies grandis*
Indian plum	*Oemleria cerasiformis*
larch	*Larix sp.*
lodgepole pine	*Pinus contorta*
mistletoe	*Arceuthobium sp.*
mountain hemlock	*Tsuga mertensiana*
noble fir	*Abies procera*
ocean spray	*Holodiscus discolor*
Oregon ash	*Fraxinus latifolia*
Oregon checker-mallow	*Sidalcea oregana calva*
Oregon white oak	*Quercus garryana*
Pacific dogwood	*Cornus nuttallii*
poison oak	*Rhus diversiloba*
ponderosa pine	*Pinus ponderosa*
quaking aspen	*Populus tremuloides*
red alder	*Alnus rubra*
salmonberry	*Rubus spectabilis*
silver fir	*Abies amablis*
Sitka spruce	*Picea sitchensis*

tall Oregon grape	*Berberis aquifolium*
vine maple	*Acer circinatum*
water howellia	*Howellia aquatilus*
Wenatchee larkspur	*Delphinium viridescens*
western hemlock	*Tsuga heterophylla*
western red cedar	*Thuja plicata*
western serviceberry	*Amelanchier alnifolia*
western white pine	*Pinus monticola*
wild blackberry	*Rubus spp.*
wood decay fungi	*Polyporus dryophilus; Gnomonia veneta*
yellow cedar	*Chamaecyparis nootkatensis*

Appendix D

Glossary

Appendix D

Glossary

aerie: the nest of a large bird, especially a bird of prey, built on a high place.

allele: one of two or more alternative forms of a gene.

anadromous fish: species which migrate from the sea to spawn in fresh water; their offspring return to the sea and spend most of their adult lives there, e.g., salmon and steelhead.

arboreal: of or pertaining to trees.

basal area: the area of the cross section of a tree stem near its base, generally at breast height (4.5 ft.) above the ground and inclusive of bark.

clutch: a hatch of eggs; the number of eggs produced or incubated at one time.

codominant trees: trees in a forest stand that are not quite as tall as the dominant trees, yet have large crowns and are rapid-growing; together with dominant trees they compose the main canopy of the stand.

dbh: diameter at breast height; the standard diameter measurement for standing trees, including bark, taken at 4.5 feet above the ground.

deme: a local population or gene pool of a species. A clearly defined group of randomly mating individuals.

demographic: of or pertaining to populations; the statistical data of a population; the facts shown by such data.

discretization: making something into distinct or separate entities; making something not continuous.

ecological niche: the functional role of a species in its environment, including activities and interactions with other organisms.

ecosystem: a dynamic natural system, including all the component organisms together with the abiotic (non-living) environment.

ecotone: transitional area between two ecological communities; the area influenced by the transition between plant communities or between successional stages or vegetative conditions within a plant community.

edge: the place where different plant communities meet or where successional stages or vegetative conditions within plant communities come together.

endemic: native to or restricted to a certain region.

epiphytic plant: a plant which lives on the surface of other plants, deriving support but not nutrients from the plants; nutrients are derived from the air.

eradicate: to destroy utterly; exterminate; annihilate; erase or remove.

extirpate: eradication in some particular area, but not globally extinct.

fecundity: producing or capable of producing offspring, or fruit, vegetation, etc. in abundance; fruitful.

fledgling: a young bird having just acquired feathers necessary for flight.

fungi: mushrooms, molds, yeast, rusts, etc.; organisms that are unicellular or made of cellular filaments called hyphae, lacking chlorophyll; reproduce sexually and asexually with the formation of spores; many species are microscopic, though some fruiting bodies reach a large size; saprophytes or parasites of other plants and animals; take part with other organisms in decomposition of plant and animal residues; important as agents of many plant and some animal diseases.

geomorphology: study of landforms, including their physical characteristics (elevation, slope, etc.), active processes, and history.

herbaceous: vegetation that does not develop persistent woody tissue.

heurism: of or relating to exploratory problem solving techniques that utilize self educating techniques to improve performance.

hybridization: crossbreeding from two distinct breeds, varieties, species, or genera.

hydrologic: pertaining to the properties, distribution, quantity, quality, and circulation of water.

interspecific: relationships between members of separate species.

invertebrate: a class of animals lacking spinal columns.

lichen: any primitive photosynthetic plant composed of a fungus in symbiotic union with an alga, and growing in leaflike, crustlike, or branching forms on rocks, trees, etc.

life form: a group of wildlife species whose requirements for habitat are satisfied by similar stand conditions within given plant communities.

mast: the fruit of forest trees used as food for animals.

metapopulation: spatially subdivided populations whose subpopulations (or local populations) are partially, but not wholly, isolated.

microclimate: climatic conditions within a small or local area.

mycorrhizal fungi: fungi which have a symbiotic relationship with the roots of certain plants; they improve plants' uptake of nutrients from soil.

natal: of or pertaining to birth.

predation: the relation between animals in which one organism captures and feeds on others.

raptor: any predatory bird that has feet with sharp talons or claws adapted for seizing prey and a hooked beek for tearing flesh.

riparian: of, relating to, or existing near or in the immediate vicinity of the bank of a river, creek, or stream.

seral stages: distinct aggregations of plants and animals at particular points in time.

shelterwood: remnants of an old stand that protects a new tree crop.

shrub-steppe: an extensive plain, typically dominated by shrubs and no trees. In Washington State, it is a common vegetative type of the Columbia Basin and adjacent areas.

silviculture: the science and art of growing and tending forest crops by controlling the establishment, composition, distribution and representation of tree species, age and/or size classes.

stochastic: referring to patterns resulting from random factors.

strix response: owl response to a vocal call.

substrate: the surface on which a plant or animal grows or is attached; the bottom materials in a lake, stream, or estuary.

terrestrial: of or pertaining to land as distinct from water; growing in the ground, not epiphytic, aerial, or marine.

thermoregulator: vegetative cover used by animals to modify the adverse effects of weather.

transpiration: to emit or give off waste matter, watery vapor, an odor, etc. through a surface; specifically: the process by which plants give off the products of photsynthesis and respiration (oxygen, carbon dioxide, and water vapor) through leaf stomata.

vascular plants: higher level plants having conducting tissue for the movement of water, nutrients, and food materials as compared to nonvascular plants in which all life functions must be carried out in each cell.

vertebrate: animal having a spinal column.

Appendix E

Literature Cited

Appendix E

Literature Cited

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Appendix F

Addenda to Chapter 2

Appendix F

Addendum A — Personal Communications

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Addendum B

Status Definitions

"Status 1, 2, or 3" in reference to the spotted owl is defined in the current emergency rule within the definition of "northern spotted owl site center" in WAC 222-16-010:

Status 1 Pair or reproductive - the presence or response of two birds of the opposite sex where past or current reproductive activities have been documented.

Status 2 Two birds, pair status unknown - the presence or response of two birds of the opposite sex where pair status cannot be determined and where at least one member must meet the resident single requirements.

Status 3 Resident territorial single - the presence or response of a single owl within the same general area on three or more occasions within a breeding season with no response by an owl of the opposite sex after a complete survey; or multiple responses over several years (i.e., two responses in year one and one response in year two, for the same general area).

Suitable Habitat Definitions from DNR Owl Memo #3

Suitable spotted owl habitat may be classified into 3 categories: Type A, B, and C habitat. Generally, Type A habitat is the highest quality habitat, and Type C is habitat of marginal quality. **TYPE C SUITABLE HABITAT IS DEFINED ON THE BASIS OF USE BY SPOTTED OWLS.** Descriptions of Type A, B, and C suitable habitat differ between western and eastern Washington.

Western Washington

These descriptions should be used to help identify suitable habitat west of the Cascade Crest.

Type A Suitable Habitat: optimal, old-growth forest habitat that has the following characteristics:

- a multi-layered, multi-species canopy dominated by large (30"+ DBH) overstory trees (typically 15-75 stems/acre)
- moderate to high (60-80%) canopy closure
- a high incidence of large trees with various deformities (e.g., large cavities, broken tops, dwarf mistletoe infections)
- numerous large (30"+ DBH) snags (typically 2+ stems/acre)
- large accumulations of fallen trees and other woody debris on the ground

Type B Suitable Habitat: mature forest habitat that has the following characteristics:

- few canopy layers, multi-species canopy dominated by large (20"+ DBH) overstory trees (typically 75-100 stems/acre, although densities as low as 35 stems/acre are possible where large diameter trees are present)
- moderate to high (60-80%) canopy closure
- some large trees with various deformities (e.g., large cavities, broken tops, dwarf mistletoe infections)
- large (20"+ DBH) snags present
- accumulations of fallen trees and other woody debris on the ground

Type C Suitable Habitat: marginal habitat, usually younger stands with some old-growth/mature components and/or structural characteristics. **TYPE C SUITABLE HABITAT IS DEFINED ON THE BASIS OF USE BY SPOTTED OWLS.**

Type C suitable habitat includes "atypical" habitat documented to be used by spotted owls in Washington. Generally, such habitat results from fire or windthrow. Fire and windthrow often result in patchy habitat, with remnants of old-growth/mature forest are [*sic*] interspersed among younger stands and/or old-growth/mature structural components are retained [*sic*]. Examples of Type C suitable habitat include:

- the "'21 Blow" stands on the western Olympic Peninsula, where old-growth components remain within younger, even-aged stands resulting from windthrow
- the "Doghair" stands on the Quilcene Ranger District on the eastern Olympic Peninsula, where remnant old-growth forest patches remain within younger, even-aged stands resulting from fire

- portions of the "Yacolt Burn" region north of the Columbia River, where old-growth components remain within younger, even-aged stands resulting from fire

Type C suitable habitat may also include partially harvested stands that have had less than 40% volume removed and still contain the structural components important to spotted owls (multi-layered canopies; multi-species composition; moderate to high canopy closure; some large trees; snags; down woody debris; large trees with cavities, broken tops, dwarf mistletoe infections, and other evidence of and evidence of [*sic*] decadence).

Eastern Washington

These descriptions should be used to help identify suitable habitat east of the Cascade Crest.

Type A Suitable Habitat: Generally these are stands within the Pacific Silver Fir, Grand Fir, Douglas-fir, and Ponderosa Pine Forest Zones (Franklin and Dyrness 1973) that have not been logged. Stands are typically old-growth and mature forest habitat that has the following characteristics:

- a multi-layered, multi-species canopy dominated by large (20"+ DBH) overstory trees (typically 70-100 stems/acre, although tree densities as low as 35 stems/acre are possible where large diameter trees are present)
- moderate to high (60-85%) canopy closure
- some large trees with various deformities (e.g. [*sic*] large cavities, broken tops, dwarf mistletoe infections)
- large (20"+ DBH) snags present (typically 3+ stems/acre)
- accumulation of large (20"+ DBH) fallen trees and other woody debris on the ground.

Type B Suitable Habitat: Generally these are stands within the Grand Fir, Douglas-fir, and Ponderosa Pine Forest Zones (Franklin and Dyrness 1973). Stands are typically mature forest habitat that has naturally regenerated following fire or windthrow and has the following characteristics:

- a multi-layered, multi-species canopy dominated by overstory trees approximately 12"+ DBH. Stands must contain 20%+ fir (Douglas-fir, Grand Fir) and/or hemlock in the overstory to be considered Type B suitable habitat.
- approximately 50%+ canopy closure.
- dominant live trees with various deformities (e.g., large cavities, broken tops, dwarf mistletoe infections).

- snags and down logs, at least some of which are of similar DBH to dominant live trees.

Type C Suitable Habitat:

TYPE C SUITABLE HABITAT IS DEFINED ON THE BASIS OF USE BY SPOTTED OWLS.

These are usually younger stands occurring at low to mid-elevations where some old-growth/ mature components and/or structural characteristics are present. This habitat often appears as a mosaic of relatively small, older stands scattered among and within younger stands. Type C habitat also includes areas of historic high-grade logging and partial entry. Type C suitable habitat known to be used by spotted owls in eastern Washington includes:

- historically selectively harvested stands that have had less than 40% volume removed and still contain the structural components important to spotted owls [multi-layered canopies, multi-species composition, moderate to high canopy closure (40%+), some large trees, snags, down woody debris, and evidence of decadence and/or deformities]. Examples of owl occupancy in this type of habitat occur in mixed conifer stands near the Swauk Pass/Swauk Meadows area of the Wenatchee National Forest.

- stands that have most of the characteristics of Type A or B habitat (see above) but grow on rocky or poor soils resulting in highly variable canopy closure. This habitat appears as clumps or pockets of stands with high canopy closure in a patchwork distribution. Examples of owl occupancy in this type of habitat occur in mixed conifer stands on Longview Fiber Co. lands near Leavenworth.

- multi-layered stands that have most of the characteristics of Type A and B habitat (see above) but are dominated by ponderosa pine, with as little as 10% of the overstory comprised of Douglas-fir. Examples of owl occupancy in this type of habitat occur near the Teanaway River east of Cle Elum.

- Type A and B habitat at elevations greater than 5,000 feet comprised of Douglas fir [*sic*], pacific silver fir, western hemlock, or a combination of these species. There are several examples of owl occupancy at elevations higher than 5,000 feet, including areas near Frost Meadows, south of Cle Elum. Habitat suitability should be evaluated in these areas on a case-by-case basis.

Addendum C — Methods Used in the Habitat Capability Analyses

A question central to effectively managing spotted owl populations is how much habitat is needed to support a pair of spotted owls with survival and reproductive rates high enough to replace themselves in the population. Radio-telemetry studies of owl pair home ranges provide some indication of how much habitat owl pairs use on an annual basis (Hanson et al. 1993, Hicks et al. 1995). It is generally unknown, however, whether habitat conditions at owl sites studied in Washington were sufficient to support resident owls at demographic replacement rates. (See Amount of Nesting, Roosting and Foraging Habitat within Owl Home Ranges in Section 2.2 and Criterion 3.) Also, because relatively few owl pair home ranges have been studied in Washington, it is unknown to what extent habitat amounts in these ranges are representative of habitat amounts used by owls elsewhere.

Because of the uncertainty in how well available studies of habitat amounts within home ranges characterize the amount of habitat needed to support owl pairs at replacement rates, the amounts of habitat within various radii of owl site centers (status 1-4) were investigated in relation to the annual reproductive output (juveniles fledged per year) at each site. Annual reproductive output rates were used as an index to the finite rate of population change (λ) for individual sites. The purpose was to gain additional information on the question of how much habitat is needed by an owl pair to support demographic replacement, using available owl monitoring and habitat data. This was investigated for sites in the western Cascades, the eastern Cascades, and the western Olympic Peninsula.

Selecting Owl Sites for Inclusion in Analyses

Owl sites in these areas were selected for inclusion in analyses if habitat at the sites had been reliably typed (discussed below), and if WDFW could document that the sites had been surveyed for occupancy and reproduction using at least a three-visit protocol during two or more good reproductive years from 1991-1995. Reproduction data from WDFW was used to classify years as "good" or "low" reproductive years. In recent years, reproduction by spotted owls has been highly variable (unpublished data WDFW); low reproductive years were identified as those in which very little or no reproduction was detected at owl sites in the region. On the Olympic Peninsula there was no reproduction detected during the years 1991 and 1995, while reproduction was detected at one site during 1993 despite intensive monitoring of more than 80 sites during these years. Reproductive rates were comparatively high during the years 1988, 1989, 1990, 1992 and 1994. Similarly, in the western Cascades, virtually no reproduction was recorded 1993 (one of 35 sites used in habitat capability analyses fledged young), although much higher levels of reproduction were recorded during 1991, 1992 and 1994. In the eastern Cascades, where reproductive rates are typically the highest, there was very little reproduction by owls in FMAZs 3 and 4 during 1993 (one of 37 sites used in habitat

capability analysis fledged one juvenile); however, reproduction in FMAZ 2 during 1993 was not as low relative to other recent years. The years 1991, 1992, 1994, and 1995 were classified as good reproductive years for owl sites in the eastern Cascades.

Although sites were often monitored during low reproductive years, monitoring data from these years have little or no ability to distinguish between sites based on site quality because there was little or no variability in reproductive output between sites during these years. Consequently, only monitoring data collected during good reproductive years is useful in discriminating between sites supporting high and low reproductive rates. The analyses were limited to the years 1991 through 1995 because it was thought that these were the years that the habitat data most typified.

Additionally, owl sites in the three analysis regions were included only if habitat at the sites had been reliably typed and the typing was available in digital format. For the purposes of these and other analyses in this SDEIS, the DNR mosaic map of owl habitat was used as a starting point for developing a statewide map of owl habitat in Washington. The DNR mosaic map incorporates data from several sources which are of varying reliability due to the methods used in classifying forests as suitable habitat or non-habitat for spotted owls. Generally, habitat typing based on aerial photographs and field visits most accurately portrays the actual distribution of owl habitat. Additional "field typing" was sought for portions of the state that were typed by other methods in the DNR mosaic map. Habitat data from WDFW, DNR and industrial landowners were incorporated into the DNR mosaic map using a GIS to provide a better representation of spotted owl habitat in Washington. Owl sites were included within the habitat capability analyses if habitat at the sites had been "field typed" by WDFW, DNR, industrial landowners, or the U.S. Forest Service. Additionally, typing resulting from Landsat data was used for a few sites within or overlapping the Olympic National Park.

Since most nonfederal sites that would be supported under the proposed rule alternatives in the western Cascades and the western Olympic Peninsula are at relatively low elevations, only sites including predominantly low and middle elevation lands were used. High elevation sites, such as many of those on exclusively federal lands, were not used in the analyses; most sites used in the analyses included nonfederal lands within their provincial median home range radii.

Habitat Amounts and Annual Reproductive Rates

Amounts of habitat within 0.7 miles and within the provincial median home range radii of site centers were calculated using a GIS for each site included in the analyses. Provincial median home range radii used were 2.7 miles for the western Olympic Peninsula, 2.0 miles for the western Cascades and 1.8 miles for the eastern Cascades. A two-mile radius was used for sites in the western Cascades because the median amount of area included within annual pair home ranges studied in the region is equal to a circle of radius 2.02 miles

(Hanson et al. 1993). Amounts of type A and B and Type C habitat (WDNR Owl Memo #3) were considered in analyses for the eastern Cascades; habitat quality was not considered in the western Cascades and western Olympic Peninsula analyses because this information was not available at all sites.

For the good reproductive years each site was surveyed, the mean number of juveniles fledged per year was calculated using data from WDFW. Because not all sites used in the analyses were surveyed each year, reproductive data from the years surveyed (from 1991 through 1995) were used to extrapolate an annual reproductive rate for each site covering a four, five or eight year period for the western Cascades, the eastern Cascades, and the western Olympic Peninsula respectively. Low reproductive years were incorporated into the site-specific rate calculations for this period by multiplying the mean number of juveniles fledged during good years by the number of good years in the period and then dividing by the total number years in the period. For example, in the western Cascades, the mean number of juveniles fledged during good years was multiplied by 3/4 to compute the overall reproductive rate during the years 1991 through 1994. The sites used in the analyses and the number of good reproductive years monitored are listed below.

For the western Olympic Peninsula, overall rates of reproduction for the period 1988 through 1995 were calculated slightly differently. Reproductive data from the years 1988, 1989, 1990, 1992 and 1994 indicate that reproductive rates in 1992 and 1994 were higher than in the earlier years and that reproductive rates during 1989 and 1990 were higher than that in 1988. Because of this, calculating the overall reproductive rate for all sites combined for the eight year period by adjusting data from 1992 and 1994 for five good years out of eight total years resulted in mean reproductive rates greater than that found when the actual reproductive data from each year were considered (Table C.1). Adjusting the 1992 and 1994 data for four good years out of seven total years (in effect "dropping" 1988) resulted in reproductive rates closer to but still higher than those calculated from the reproductive data from each year (Table C.1). Consequently, it was concluded that calculating site-specific annual reproductive rates for the eight year period 1988 through 1995 would best be accomplished by adjusting the 1992 and 1994 data by four good years and seven total years.

Table C.1

Overall percentage of sites reproductive and and mean juveniles per site on the western Olympic Peninsula for the period 1988 through 1995.

This table has been calculated three different ways: (1) using mean reproductive rates for teach of the eight years; (2) adjusting data from 1992 and 1994 for five good years and eight total years; and (3) adjusting data from 1992 and 1994 for four good years and seven total years (equivalent to "dropping" the year 1988). See text for further explanation.

Method of Calculation	% Sites Reproductive	Mean Juveniles/Site
Mean Annual Rates 1988-1995	22.125	0.34375
1992, 1994 mean x 5/8	25.31	0.40000
1992, 1994 mean x 4/7	23.14	0.36570

For each analysis area, total habitat amounts at each site included within the analysis was graphed against the annual reproductive output at the site extrapolated for the analysis period. Habitat amounts within 0.7 miles of site centers were also graphed against the annual reproductive output for each site. For sites in the eastern Cascades, separate graphs are displayed for the amounts of type A and B habitat and amounts of type C habitat within 0.7 and 1.8 miles of the site centers.

Identifying Demographically Increasing, Stable and Decreasing Sites

To get an indication of the demographic performance of sites included in the habitat capability analyses, annual reproductive rates calculated for each site were used as indices to the finite rate of population change (λ). By using information on survival rates from on-going demographic studies in Washington (Forsman et al. in prep., Irwin and Fleming 1994) and a life table simulator, the ranges of annual reproductive rates roughly corresponding to demographically increasing, stable, and declining sites were estimated. The life table simulator, constructed on a Quattro Pro spreadsheet, was used to identify the annual reproductive output needed to have a net reproductive rate (R_0) equal to one (indicating demographic replacement or a stable population), given a particular set of juvenile, subadult, and adult survival rates. If T is the generation time, $\lambda=R_0^{1/T}$.

To estimate the limits of the range of annual reproductive outputs that could lead to demographic replacement, optimistic and pessimistic survival rate sets (Tables C.2, C.3) were entered into the life table simulator, and the annual reproductive output needed for stability under each survival regime was determined. Sites with annual reproductive outputs below the lower limit were classified as "declining" (demographic rates likely insufficient for demographic replacement), while sites with annual reproductive outputs above the upper limits were classified as "increasing" (demographic rates likely above that needed for replacement). Sites whose annual reproductive outputs fall within

the limits were classified as "stable." These limits are demarcated by isoclines (horizontal lines) on some of the graphs presented in Criterion 3 (Figures 2.3-1 to 2.3-10). Because a range of survival rate estimates were used to calculate the values of the isoclines, the "stable" zone of each graph should be interpreted as the range of values which likely include the actual annual reproductive output needed for stable populations. Portions of the stable range may actually lead to declining or increasing owl populations. The width of the "stable" zone in each graph is a reflection of the degree of uncertainty in the survival rate estimates resulting from the demographic studies.

Demographic studies in progress on the Olympic Peninsula and the western Cascades (Forsman et al. in prep., Irwin and Fleming 1994) provided information on adult and juvenile survival rates. Optimistic and pessimistic adult survival rates used for identification of stability limits for sites in the western Olympic Peninsula and the western Cascades were based on the estimate of adult survival on the Olympic Peninsula (Forsman et al. in prep.b) bracketed in both directions by two standard errors (Table C.2). The adult survival rates used for identification of the stability limits for sites in the eastern Cascades were based on the adult survival rate estimate for the Cle Elum study area by Forsman et al. (in prep.b). For the optimistic rate, the estimated adult survival rate was increased by two standard errors, while the pessimistic rate was decreased by one standard error (Table C.3). Adult survival information from Forsman et al. (in prep.) was used to estimate stability limits rather than results from Irwin and Fleming (1994) because estimates of adult survival are higher in the former study and the standard errors are smaller, thus yielding more conservative estimates of the range of annual reproductive rates needed for stability. The adult survival rate for the eastern Cascades was reduced by only one standard error in the pessimistic rate set for the same reason.

Long-term juvenile survival rates are poorly estimated by the current demographic studies. (See Survival in Section 2.2, Affected Environment.) The range of juvenile survival rates chosen for these analyses (0.40 - 0.60) roughly coincide with the point estimates of juvenile survival rates adjusted for emigration estimated by Forsman et al. (in prep.b) in the eastern Cascades and the western Olympic Peninsula (Tables C.2, C.3). The chosen values probably result in conservative estimates of the ranges of annual reproductive outputs that could lead to stability. In the life table simulator, juvenile survival rates applied to the first year of an owl's life, and subadult survival rates applied to the second year. Adult survival rates applied to all other years of an owl's life.

Table C.2

Demographic rates estimated for spotted owls on the Olympic Peninsula (Forsman et al. in prep.b), optimistic and pessimistic demographic rates used in habitat capability analyses for the western Olympic Peninsula and the western Cascades. See text for further discussion.

	Estimated Rate (Standard Error)	Optimistic Rates	Pessimistic Rates
Annual adult survival	0.862 (0.017)	0.896	0.828
Annual subadult survival	NA	0.800	0.800
Annual juvenile survival	0.245 (0.064)[a] 0.611 (0.204)[b]	0.600	0.400
Annual reproductive rate needed for stability		0.467	1.09

[a] Estimated juvenile survival rate unadjusted for juvenile emigration.
[b] Estimated juvenile survival rate adjusted for juvenile emigration.

Table C.3

Demographic rates estimated for spotted owls in the eastern Cascades (Forsman et al. in prep.b), optismistic and pessimistic demographic rates used in habitat capability analyses for the eastern Cascades. See text for further discussion.

	Estimated Rate (Standard Error)	Optimistic Rates	Pessimistic Rates
Annual adult survival	0.850 (0.0312)	0.9124	0.8188
Annual subadult survival	NA	0.800	0.800
Annual juvenile survival	0.140 (0.026)[a] 0.34 (0.098)[b]	0.600	0.400
Annual reproductive rate needed for stability		0.411	1.14

[a] Estimated juvenile survival rate unadjusted for juvenile emigration.
[b] Estimated juvenile survival rate adjusted for juvenile emigration.

Sites Used in the Analyses

For the western Olympic Peninsula, 41 sites were included in the habitat capability analysis; 17 additional sites that were surveyed during one good reproductive year are displayed on the graphs (Figures 2.3-9, 2.3-10) although

they are not used to assess the alternatives. Eleven of the two-year sites and 16 of the one-year sites are centered within or overlap the Hoh-Clearwater SOSEA proposed by Alternatives 3, 4 and 5.

For the western Cascades, 48 sites were included in the habitat capability analysis; 20 additional sites that were surveyed during one good reproductive year are displayed on the graphs (Figures 2.3-1, 2.3-2) although they are not used to assess the alternatives. Thirty-five of the two-year sites and seven of the one year sites are centered within or overlap SOSEAs proposed by the SAG (Hanson et al. 1993).

For the eastern Cascades, 43 sites from FMAZs 3 and 4 were included in the habitat capability analysis (Figures 2.3-3 to 2.3-8). Forty-one of these sites are centered within or overlap SOSEAs proposed by the SAG (Hanson et al. 1993), while 42 include nonfederal lands. From FMAZ 2, 27 sites were included in the analyses; because no pattern was evident between habitat amounts and annual reproductive output at these sites, graphs are not provided. No habitat information was available for sites in FMAZ 1, and information was available for only four sites in FMAZ 5. Consequently, analyses were not done for these areas.

Sites included in the habitat capability analyses, their WDFW site numbers, and the number of years of monitoring during good reproductive years are listed below.

Western Olympic Peninsula Sites:

Site Number	Site Name	Good Years Surveyed
3	Bear Creek Upper	2
7	Brandeberry Creek	2
22	East Fork Humptulips Lower	2
23	Elk Creek	2
25	Gatton Creek	2
33	West Fork Humptulips Hdwtrs	2
44	Matheny Creek East	2
46	Matheny Creek West	2
49	Sams River Middle	2
50	Moonlight Dome	2
53	Hoh Ranger Station	2
58	Rugged Ridge East	2
66	Queets Campground	2
69	Matheny Ridge East	2
71	Neilton Ridge	2
73	Rugged Ridge	2
74	Lost Creek - Calawah River	2
76	Sams River Lower	2
79	Kahkwa Creek	2

80	West Fork Humptulips Lower	2
86	Stovepipe Mtn	2
92	Sitkum River Upper	2
103	Ziegler Creek	2
115	Lower Bear Creek	2
148	Morganroth Creek	2
151	Shuwah Creek	2
153	Gibson Peak	2
183	Finley Creek	2
210	Falls Creek - Quinault Lake	2
211	Upper Willaby Creek	2
305	Flatbottom Creek	2
306	Canoe Creek	2
400	Reade Hill	2
442	Three Lakes Drainage	2
446	Upper Falls Creek	2
449	Sams Ridge	2
871	Canoe Creek East	2
872	Petes Creek - West Fork Humptulips	2
946	Indian Pass	2
947	Kloshe Creek	2
1144	Stovepipe Mtn North	2
1	Willoughby West	1
15	Hoh River - Mile 35	1
30	Willoughby Ridge	1
42	Lower Stequaleho	1
77	Sams River Upper	1
78	Shale Creek	1
81	Rugged Ridge-South Fork Calawah	1
82	Kloochman	1
89	Third Beach Trail	1
154	North Fork Salmon	1
234	Kunamakst Creek	1
236	Kalaloch	1
237	Minter Creek	1
239	Miller Creek	1
262	Upper Clearwater River	1
864	Sollecks River	1
1061	Snahapish River	1

Western Cascades Sites:

Site Number	Site Name	Good Years Surveyed
366	Drift Creek Upper	3
558	Twin Camp Creek	3
652	Yale Lake	3
653	North Siouxon Creek	3

762	Champion Creek	3
799	Rock Creek - Lake Merwin	3
876	North Siouxon Creek Lower	3
879	Siouxon Creek Middle	3
1009	Yale Lake North	3
165	Drift Creek	2
167	Siouxon Creek	2
172	Siouxon Creek Upper	2
176	Trout Creek - Wind River	2
178	Ninemile Creek	2
212	Snow Creek - Sunday Creek	2
214	Tilton River North Fork	2
215	Cispus River Lower	2
253	Kalama River	2
269	Wind River Upper	2
307	Mineral Creek	2
364	Dry Creek - Wind River	2
457	Wildcat Creek - Siouxon	2
519	Excelsior Mine	2
548	Friday Creek	2
554	Rock Point - Dry Creek	2
561	Carroll Creek	2
642	Winnie Creek	2
667	Steep Creek	2
670	North Fork Tolt River	2
727	Nagrom	2
737	Sunday Creek - Green River	2
740	Ole Creek	2
759	Siouxon Creek Lower	2
760	Green Canyon - Green River	2
770	Mill Creek - Skagit River	2
782	Hoffstadt Mountain	2
792	Huffman Pk - North Siouxon Creek	2
849	Dog Creek - Lewis River	2
857	East Creek - Sunday Creek	2
859	McCain Creek	2
870	Calamity Creek	2
888	Twin Camp Creek Lower	2
932	Hiawatha Creek	2
933	Cougar Mountain	2
934	Winston Creek	2
935	Little Nisqually West Fork	2
939	Rockies Creek	2
955	Champion Creek Upper	2

144	Pepper Creek Upper	1
166	Paradise Creek	1
168	Pelvy Creek	1
189	Davis Creek	1
221	Silver Creek East Fork	1
252	Pepper Creek	1
260	Curly Creek	1
482	Clear Creek	1
483	Copper Creek - Clear Creek	1
507	Stillaguamish North Fork	1
544	Annette Lake	1
687	Wells Creek	1
783	Mallardy Creek	1
790	Kelly Butte	1
830	The Pothole	1
878	Sister Creek-Middle Fork Nooksack	1
905	Little Creek - Lewis River	1
930	Little Nisqually River	1
940	Jesse Creek	1
945	Rock Creek - Columbia	1

Eastern Cascades Sites, FMAZ 3 and 4:

Site Number	Site Name	Good Years Surveyed
34	Dry Meadow	2
85	Caseknife Creek Lower	3
272	Cabin Creek - Yakima	4
312	Box Canyon Creek	3
314	Cooper Lake	3
315	Taneum Ridge East	4
321	Jim Creek	3
324	Hicks Butte	2
326	Mole Mountain	4
329	No Name Creek	2
330	Para Creek	2
337	Taneum North Fork	4
349	Jungle Creek - Naches River	2
352	Mathew Creek	2
389	Caseknife Creek West Fork	4
390	French Cabin Creek	4
391	Big Creek Lower	4
393	Greek Creek	4
394	Howson Creek	4
395	Kachess Lake East	4
397	Thorp Creek	2
451	Morrow Meadow	3
656	Taneum Creek Upper	2

657	Cedar Grove	2
659	Frost Creek	4
662	Manastash Lower	4
679	Icicle Doctor	3
695	Big Creek Upper	4
696	South Cle Elum Ridge	2
717	Pileup Creek	4
732	Fishook Flats	3
748	Branch Creek	4
763	Little Creek - Yakima River	4
850	Caseknife Creek - East Fork	4
860	Little Kachess Lake	1
862	Panther Ridge	3
865	Bear Creek West Fork	2
952	Morrow Meadow Upper	2
954	Camp Creek - Cle Elum River	3
1005	Paris Creek 3	3
1011	Goat Peak	2
1013	Mathew Creek North	3
1127	Lookout Mountain	2

Addendum D — Habitat Regression Analyses

This addendum presents summaries of exploratory multiple regression analyses of the relationships between landscape characteristics around spotted owl sites and spotted owl reproductive rates. These analyses were conducted by Dr. John Skalski and Mr. Alan Lowther of the Center for Quantitative Science at the University of Washington, and by Richard Fredrickson, WDFW and author of the spotted owl portion of this SDEIS. Separate analyses were conducted for the western Olympic Peninsula, the southwestern Cascades, and the eastern Cascades. These analyses sought to discern patterns in correlations between habitat variables calculated using a GIS and the reproductive output at individual sites. Habitat variables used in analyses included amounts, elevational variables, and several indices of habitat fragmentation; in the eastern Cascades, habitat quality (type A and B, type C) and Fire Management Analysis Zones (FMAZ) were also included in analyses.

Sites were included in the analyses if habitat at the site had been reliably typed as discussed above in Addendum C and if they had been surveyed to a three-visit protocol during at least one "good" reproductive year from 1991-1995. In recent years, reproduction by spotted owls has been highly variable (unpublished data WDFW). For example, on the Olympic Peninsula virtually no reproduction was recorded during the years 1991, 1993 and 1995 despite intensive monitoring, while reproductive rates were relatively high during 1992 and 1994. Similarly, virtually no reproduction was recorded in the western Cascades during 1993. In the eastern Cascades, where reproductive rates are typically the highest, there was very little reproduction by owls in

FMAZs 3 and 4 during 1993; however, reproduction in FMAZ 2 during 1993 was not as low relative to other recent years. Although many sites were monitored during "low" reproductive years, monitoring data from these years have little or no ability to distinguish between sites based on site quality because there was little or no variability in reproductive output between sites during these years. Consequently, only monitoring data collected during "good" reproductive years were used to construct regression analyses; "low" reproductive years were accounted for in the analyses by the use of offsets described in the memorandum following this section. All status 1, 2, 3 and 4 sites that met these criteria were used in the analyses. The analyses were limited to the years 1991 through 1995 because it was thought that these were the years that the habitat data most typified.

Initially, regressions were also computed using pair occupancy as a dependent variable. However, stronger patterns were found when habitat variables were regressed on reproductive output (number of juveniles fledged each year at a site). As a result regressions using pair occupancy were not calculated for all areas.

The methods, results and conclusions from these analyses are described in the memorandum following this section. Results from the southwestern Cascades suggest that reproductive output of sites is negatively affected by decreases in habitat amounts and increases in habitat fragmentation. On the western Olympic Peninsula, results suggest that reproductive output was most sensitive to amounts of habitat at three distances (0.7, 2.0 and 2.7 miles). Several fragmentation variables, however, were miscalculated in initial GIS runs; corrected values for these variables were not subsequently available for inclusion in regressions. In the eastern Cascades, patterns between habitat variables and reproductive output were not as strong or consistent as in other provinces. Additional analyses combining all available sites in the northwestern and southwestern Cascades may detect stronger, more reliable patterns.

Variables used in the southwestern Cascades analyses included:

■ **HABITAT AMOUNT VARIABLES**

Corehab - acres of habitat within 0.7 miles of the site center.

Outerhab - acres of habitat in the "ring" 0.7 to 2.0 miles from the site center.

Tothab - acres of habitat within 2.0 miles of the site center.

■ **ELEVATIONAL VARIABLES**

Elev - elevation at the site center by 500 foot elevation class.

Hihabcore - proportion of habitat above 3,000 feet elevation within 0.7 miles of the site center.

Hihabtot - proportion of habitat above 3,000 feet elevation within 2.0 miles of the site center.

■ **OVERLAP VARIABLES**

Overlappro - proportion of suitable habitat that is overlapped by other owl sites (status 1-4).

Overlapacr - acreage of suitable habitat that is overlapped by other owl sites (status 1-4).

■ **FRAGMENTATION VARIABLES**

Patcharea - mean area of habitat patches within 2.0 miles of the site center.

Patchden - number of habitat patches within a 2.0 mile radius/ area of 2.0 mile radius circle.

PASD - standard deviation of Patcharea.

Patcharea5 - mean area of habitat patches within 2.0 miles of the site center using 100 meter patch breaks. A patch is "broken" into two patches wherever the width of the patch is less than 100 meters.

Patchden50 - number of habitat patches within a 2.0 mile radius using 100 meter patch breaks/ area of 2.0 mile radius. circle.

PA50SD - standard deviation of Patcharea5.

Totcore07 - total area of "interior" habitat within 0.7 miles of the site center. "Interior" habitat was calculated by buffering 300 feet into each habitat patch from the edge and calculating the remaining area of habitat.

Meancore07 - mean area of interior habitat patches within 0.7 miles of the site center.

CoreSD07 - standard deviation of Meancore07.

CoreCV07 - coefficient of variation of Meancore07.

Totcore20 - total area of "interior" habitat within 2.0 miles of the site center. "Interior" habitat was calculated by buffering 300 feet into each habitat patch from the edge and calculating the remaining area of habitat.

Meancore20 - mean area of interior habitat patches within 2.0 miles of the site center.

CoreSD20- standard deviation of Meancore20.

CoreCV20 - coefficient of variation of Meancore20.

Clump - mean of the distance of each 1 ha habitat cell to the nearest non-habitat cell.

ClumpSD - standard deviation of Clump.

Meannbh - mean neighborhood index within 2.0 miles of the site center. Neighborhood index was calculated by focusing a 9 x 9 cell window on each 1 ha map cell coded as habitat and dividing the number of cells within the window coded as habitat by 81.

Sdnbh - standard deviation of Meannbh.

Perim07 - perimeter of habitat within 0.7 miles of the site center/ area of habitat within 0.7 miles of the site center. Dropped from analysis due to calculation errors.

Perim20 - perimeter of habitat within 2.0 miles of the site center/ area of habitat within 2.0 miles of the site center. Dropped from analysis due to calculation errors