N A T U R A L R E S O U R C E S

FINAL (MERGED)

Environmental Impact Statement

HABITAT CONSERVATION PLAN

October, 1998

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Jennifer M. Belcher Commissioner of Public Lands

N A T U R A L R E S O U R C E S

FINAL (MERGED)

Environmental
Impact
Statement

HABITAT CONSERVATION PLAN

October, 1998

Washington State
Department of Natural Resources
1111 Washington ST SE
PO BOX 47000
Olympia WA 98504-7000

(360) 902-1000

Acronyms

C.F.R.	U.S. Code of Federal Regulations
CWD	Coarse woody debris
dbh	Diameter at breast height
DCA	Designated Conservation Area
DEIS	Draft environmental impact statement
DNR	Washington Department of Natural Resources
EIS	Environmental impact statement
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FEIS	Final environmental impact statement
FEMAT	Forest Ecosystem Management Assessment Team
FRP	Forest Resource Plan
FSEIS	Final supplemental environmental impact statement
GIS	Geographic information system
HAU	Hydrologic analysis unit
HCP	Habitat conservation plan
IA	Implementation agreement
ITP	Incidental Take Permit
LOD	Large organic debris
LPU	Landscape planning unit
LSR	Late-Successional Reserve
LULC	Land Use/Land Cover (DNR GIS data layer)
LWD	Large woody debris
MPL	Major Public Lands (DNR GIS data layer)
NAP	Natural Area Preserve
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NRCA	Natural Resource Conservation Area
NRF	Nesting, roosting and foraging habitat
OESF	Olympic Experimental State Forest
RCW	Revised Code of Washington
RMZ	Riparian management zone (as defined in WAC 222)
SEA	Special Emphasis Area
SEIS	Supplemental environmental impact statement
SEPA	State Environmental Policy Act
U.S.C.	U.S. Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WAU	Watershed administrative unit
WDF	Washington Department of Fisheries (merged into WDFW in 1994)
WDW	Washington Department of Wildlife (merged into WDFW in 1994)
WDFW	Washington Department of Fish and Wildlife
WFPB	Washington Forest Practices Board
WRIA	Water resource inventory area

Contents

Section 1. Background and Context

Section 2. - Changes to the Draft EIS

FIGURES

MAPS

Section 3. Response to Comments

Appendix 1. DEIS List of Commentors

Appendix 2. Distribution Lists

Appendix 3. Changes to DNR's draft Habitat Conservation Plan

Appendix 4. Implementation Agreeement

Appendix 5. Economic Information

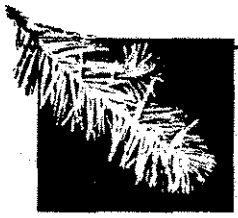
Appendix 6. No Surprises Policy

SECTION

1.

Section 1 - Background and Context

Section 1.1 Process



Section 1. Background and Context

1.1 Process

Following the listing of the northern spotted owl and marbled murrelet, and in anticipation of the possible listing of salmon species, DNR began to consider an Habitat Conservation Plan (HCP), as an alternate method of complying with the Endangered Species Act on state trust lands. In 1993, DNR began development of an HCP for consideration by the Board of Natural Resources on department-managed trust lands. Initial contacts were made with the federal agencies that would likely be involved (U.S. Fish and Wildlife Service [USFWS] and National Marine Fisheries Service [NMFS], referred to jointly as the Services) to solicit information on how to approach an HCP. (This document will use the term "the Service" when referring to just the USFWS.)

To avoid duplication of effort, the Services and DNR decided to prepare an Environmental Impact Statement as co-lead agencies to fulfill both State Environmental Policy Act (SEPA) and National Environmental Policy Act (NEPA) requirements. Public scoping occurred in April and May, 1994, to help determine the scope of the project. Notice of intent to prepare an Environmental Impact Statement appeared in the Federal Register on May 2, 1994. Notice of scoping appeared in the SEPA Register on April 25 and May 13 of 1994. Formal scoping notices were mailed to the media and some 1,600 organizations and individuals, providing information on the background and purpose of DNR's HCP and public scoping workshops and requesting public comment. Ten public meetings were held around the state in May and June of 1994, with about 100 people attending. A citizen's advisory committee was consulted as representatives of the general interests of residents of the state. Two additional public workshops in December, 1993, and a separate citizen policy review committee provided input for the Olympic Experimental State Forest (OESF), a separate planning unit of the HCP. In addition to oral comments received at the workshops, written comments were received during the scoping period. Scoping reports summarizing the comments were prepared by the Services and DNR.

DNR formed a Science Team to prepare recommendations on managing forest lands to provide adequate habitat for listed species and to avoid disruptions in the event of future listings of additional species. The Science Team's recommended approach focused on complementing the conservation efforts being provided by federal land management agencies. The recommendations of the Science Team served as the basis for the HCP options developed by DNR.

The Board of Natural Resources has been involved in the HCP process from the beginning, through frequent presentations and discussions at the Board's regular public

meetings, as well as in special public workshops. In October and November of 1994, preliminary concepts for conservation strategies were presented at the Board's regular monthly public meetings. An open workshop of the Board of Natural Resources was held on February 2, 1995. That same month, following formal announcements to the media and some 3,000 individuals and organizations, four special public meetings of the Board were held around the state to hear comments from the public on the proposed options. Conservation strategies for spotted owls and riparian areas in the OESF, a separate planning unit of the HCP, were presented to the Board at their regular March and April, 1995, public meetings.

To compare effects of the HCP options and current practices on harvest levels and revenues to the trusts, DNR staff used computer modeling to project forest stand growth and harvestability 200 years into the future. The process and results were presented at a special public workshop of the Board on April 20, 1995. Harvest level and revenue projections for the OESF were presented at a regular public meeting of the Board on June 6, 1995. The Board then selected a preferred HCP option.

Over the next several months, the conservation strategies for the Board of Natural Resources-selected option were further developed. Calculations for the harvest level and sales revenue projections were also refined. The preliminary draft of the HCP was presented at the October, 1995 public meeting of the Board.

The Services and DNR prepared a joint Draft Environmental Impact Statement (DEIS) that analyzed DNR's proposal along with other reasonable alternatives, including current practices. The document evaluated the effects of implementation of the alternatives on issues and concerns such as threatened and endangered species and their habitats, other fish and wildlife and their habitats, environmental factors, and potential social and economic consequences.

The draft HCP, including a draft Implementation Agreement, was published and released for public comment in March 1996. The DEIS was published and released for public comment on March 22, 1996. The formal public comment period ended May 20, 1996. Notice of availability of these documents was published in the Federal Register on April 5, 1996 and in the SEPA Register on March 22, 1996. More than 900 copies of the DEIS and draft HCP were distributed and an additional 3,624 copies of Executive Summaries of the two documents were also distributed. (A detailed distribution list is included in Appendix 2 of this Final Environmental Impact Statement [FEIS].) The documents were also sent to state, local, and regional libraries. Notice of public hearings appeared in the Federal Register on April 10, 1996. Following notice to the media and some 3,000 organizations and individuals, the Board and the Services took testimony at five public hearings around the state in April and May, 1996, with a total of approximately 165 attending. A total of 173 comments were received (41 from public testimony which was transcribed), representing 181 individuals and organizations. (Summaries of testimonies from the hearings and written comments received during the comment period are included with responses from the Services and DNR in Section 3.2 of this FEIS, and a list of all commentors to the DEIS is found in Appendix 1.)

More than 3,000 individuals, organizations and agencies have been kept apprised of the planning process and alerted to opportunities to provide comments as the project has developed. All regularly scheduled and special meetings and workshops of the Board of Natural Resources follow the requirements of the Open Public Meetings Act and are open to the public; most offer time for public comment. In addition, the Commissioner of Public Lands and DNR staff have made more than 100 presentations to, and had discussions with, a variety of audiences, including trust beneficiaries, legislators, Tribes, and interested organizations, groups, and individuals.

The Services are currently fulfilling their obligations under Section 7 of the Endangered Species Act. Upon completion of the comment period and the associated review of the comments and revision of the proposed draft HCP, the Services initiated consultation/ conferencing under Section 7. This fulfills the need of a Section 7 intra-Service consultation and determines whether the Section 10 issuance criteria regarding the jeopardy standard is met. The Services will prepare the Section 7 documents, Section 10 Statement of Findings, and a Record of Decision prior to deciding whether to issue the Incidental Take Permit. Based on careful review of all documents, analyses, and public comments, the Board of Natural Resources will determine whether to enter into an agreement with the Services and adopt the draft HCP. A Notice of Issuance would be issued shortly after any approval and issuance of a permit.

((THIS PAGE INTENTIONALLY LEFT BLANK))

Section 1.2 Format for FEIS

1.2 Format for FEIS

This FEIS is written to amend the DEIS in response to public comment and to incorporate additional information, corrections, and modifications. As such, this FEIS incorporates the DEIS by reference and all portions of the DEIS should be considered valid and applicable except for those changes provided in this document.

The FEIS has three sections and six appendices. Section 1 contains this Background and Context. Section 2 contains changes to the DEIS presented in the same order as sections of the DEIS. Sections that do not change are labeled "No Change." Where a change to the DEIS occurs, that change is presented and discussed in the following manner. First, the nature of the change is explained (paragraph modified , word deleted, sentence added, etc.), then the change is shown in redline/strikeout (redline = additions, ~~strikeout~~ = deletions) format. Section 3 contains the outline used to categorize comments, then summaries of public comments and the responses from the Services and DNR, and then summaries of comments from Tribes that responded after the close of the comments period with responses from the Service, all according to the same comment category outline.

Appendix 1 lists all who provided comments in writing or in testimony at the public hearings during the formal public comment period. Appendix 2 lists organizations and individuals who received copies of the draft documents and those who will receive this FEIS in the initial distribution. Appendix 3 shows the changes to the draft HCP, following the order of chapters and sections in the original document, and using a similar format to that used in Section 2 for changes to the DEIS. Appendix 4 contains the revised Implementation Agreement. Appendix 5 contains information about the harvest projections and economic analysis conducted for the proposed HCP. Appendix 6 is a reproduction of the U.S. Department of the Interior's and U.S. Department of Commerce's 1994 No Surprises Policy.

WASHINGTON STATE DEPARTMENT OF
Natural Resources

March 22, 1996

Dear Reviewer:

The Washington Department of Natural Resources (DNR) has developed a draft Habitat Conservation Plan as a method of complying with the Endangered Species Act on the 1.6 million acres of forested state trust lands that lie within the range of the northern spotted owl. The attached Draft Environmental Impact Statement (DEIS) analyzes DNR's proposal along with other reasonable alternatives, evaluating the effects of implementation on issues and concerns such as threatened and endangered species and their habitats, other fish and wildlife and their habitats, environmental factors, and potential social and economic consequences.

The draft Habitat Conservation Plan and the DEIS are part of DNR's application to the U.S. Fish and Wildlife Service and the National Marine Fisheries Service for an Incidental Take Permit and unlisted species agreement, under the authority of the Endangered Species Act. The permit would allow incidental take of all listed species as a result of legal forest management activities on these 1.6 million acres managed under state law by DNR to benefit the trusts. The unlisted species agreement would cover species that may be listed in the future.

A 60-day public comment period begins with the publication of this DEIS. We appreciate your taking the time to review the DEIS and DNR's draft Habitat Conservation Plan. Please send your written comments to Chuck Turley, DNR, P.O. Box 47011, Olympia, WA 98504-7011. Comments must be received or postmarked no later than May 20, 1996. In addition, we invite you to attend and participate in the public meetings that will be held around the state in April and May.

If you have any questions or would like additional information, please call Chuck Turley, DNR, at 306/902-1148, Bill Vogel, U.S. Fish and Wildlife Service, 360/753-4367, or Steve Landino, National Marine Fisheries Service, 360/753-6054.

Sincerely,

JENNIFER M. BELCHER
Commissioner of Public Lands
Washington Department of Natural Resources

CURT SMITCH
Assistant Regional Director
Fish and Wildlife Service
U.S. Department of the Interior

ELIZABETH HOLMES GAAR
Habitat Branch Chief
National Marine Fisheries Service
National Oceanic and Atmospheric Agency
U.S. Department of Commerce

NOTES

On February 28, 1996, the U.S. Fish and Wildlife Service (USFWS) published in the Federal Register (61 Fed. Reg. 7596-7613 (1996)) notice of a change in the status of approximately 4,000 species of animals and plants that had previously been referred to as "candidate species" for listing under the provisions of the Endangered Species Act. Up to this date, three separate candidate categories existed. One of those categories was "Category 2 candidates", species for which the USFWS did not have sufficient scientific information to support a listing. This Category 2 list will no longer be maintained by USFWS.

This change does not affect the status of species (such as coho and other anadromous salmonid fish) for which federal regulatory authority resides with the National Marine Fisheries Service.

With this change in status, USFWS currently considers 182 species "candidates for listing", species for which there is sufficient scientific information to support a listing as either endangered or threatened (previously referred to as Category 1 candidates). The current candidate list includes four species found in Washington State: bull trout (*Salvelinus confluentis*), spotted frog (*Rana pretiosa*), Oregon checker-mallow (*Sidalcea oregana* var. *calva*), and basalt daisy (*Erigeron basalticus*).

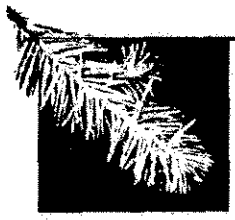
Federal candidate species are referred to in DNR's draft HCP and the draft EIS. The language contained in these documents is consistent with the federal candidate status prior to the February 28 change. The Department of Natural Resources, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service (joint lead agencies for preparation of the EIS) will review this information and, where necessary, modify the final EIS.

SECTION

2.

Section 2 - Changes to the Draft EIS

Executive Summary



Executive Summary

Introduction

This Executive Summary summarizes the draft Environmental Impact Statement that accompanies the draft Habitat Conservation Plan proposed by the Washington Department of Natural Resources (DNR).

DNR is proposing a Habitat Conservation Plan (HCP), authorized under section 10 of the federal Endangered Species Act (ESA) (16 U.S.C. § 1531 et seq.), as a resource management strategy to assure long-term sustainable revenue for the trusts and long-term health of resources and ecosystems.

The draft HCP is part of an application for an incidental take permit and an agreement covering unlisted species to the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). DNR's draft HCP describes mitigation strategies for two federally listed species, the northern spotted owl and the marbled murrelet. In addition, although DNR does not expect to take any individuals of the following species, it is requesting that the other upland species listed by the federal government as endangered or threatened within the range of the northern spotted owl be included in the permit. These additional species are:

- the Oregon silverspot butterfly;
- the Aleutian Canada goose;
- the peregrine falcon;
- the bald eagle;
- the Columbian white-tailed deer;
- the gray wolf; and,
- the grizzly bear.

The draft HCP also outlines a plan to conserve habitat for other species for which DNR is seeking an unlisted species agreement. The proposed agreement would cover western Washington runs of salmonids, other federal and state candidate species west of the Cascade crest, as well as all species using the habitat.

The HCP planning area encompasses approximately 1.6 million acres of state forest land managed by DNR within the range of the northern spotted owl. The Olympic Experimental State Forest (OESF) is one of nine planning units in the HCP planning area. The term of the permit would be 70 to 100 years (See Implementation Agreement).

Because preparation and approval of an HCP are both actions requiring environmental review, DNR and the federal agencies agreed to prepare a single environmental document that would comply with the requirements of the State Environmental Policy Act (SEPA, RCW 43.21C) and the National Environmental Policy Act (NEPA, 42 § U.S.C. 4321 et seq.). Both SEPA and NEPA are intended to help public officials make decisions that are based on an understanding of environmental consequences and to take actions that protect, restore, and enhance the environment. Preparation of a joint document is allowed under both SEPA and NEPA, thereby reducing paperwork while ensuring broad public involvement. Upon completion of the SEPA and NEPA process, the Board of Natural Resources[1] must determine whether the proposed HCP provides increased benefit to the trusts managed by the DNR when compared with the No Action alternative.

DNR's Purpose and Need

Background

At statehood in 1889, the federal government granted specific lands across Washington State to be managed, leased, or sold by the state for the benefit of schools and other public institutions. These lands are referred to as federal land grant trusts. In addition, the state manages lands transferred to the state that had reverted to counties for tax default. These "Forest Board" lands may not be sold and are managed to perpetuate the forest resource and support various tax funds administered by the state and by the counties. The state's duties as the trustee of the federal grant and Forest Board lands are defined in the Washington State Enabling Act, the Washington State Constitution, federal and state statutes, and case law.

In 1957, the legislature established the Washington Department of Natural Resources to serve as manager of trust and other state-owned lands, including forested lands, aquatic lands, urban lands, and agricultural lands. Duties have been added by the legislature so that today DNR also manages special natural areas, fights fires, and regulates forest practices on nonfederal forest lands.

On behalf of the trust beneficiaries, DNR strives to produce the most substantial support possible over the long term while exercising prudent management and preserving the trust estate.

The ESA was created to conserve species of plants and animals formally designated as threatened or endangered, and the ecosystems upon which they depend. Section 9 of the ESA prohibits the "taking" of an endangered species. The term "take" is defined in the ESA to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect,

[1] A Washington State board that establishes policies for the Department of Natural Resources to ensure that the acquisition, management, and disposition of lands and resources within the department's jurisdiction are based on sound principles. The board is composed of six members: the Commissioner of Public Lands, the Governor, the Superintendent of Public Instruction, the dean of the College of Agriculture and Home Economics at Washington State University, the dean of the College of Forest Resources at the University of Washington, and an elected representative from a county that contains Forest Board land.

or attempt to engage in any such conduct." Harm is further defined in USFWS regulations as "an act which actually kills or injures wildlife. Such acts may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering." This interpretation was challenged as exceeding the authority of the Secretary of the Interior, who oversees the USFWS. In Babbitt v. Sweet Home Chapter of Communities for a Greater Oregon, decided on June 29, 1995, the Supreme Court of the United States upheld the regulation and the definition. Substantial penalties exist for taking a listed species.

As noted above, the ESA also contains a provision for the issuance of an "incidental take permit" that allows the taking of a listed species if such taking is "incidental to, and not the purpose of, otherwise lawful activities." A mandatory component of an application for an incidental take permit is preparation of an HCP.

Need for Action

The northern spotted owl was listed as threatened under the ESA in June 1990. The listing had an immediate impact on DNR's ability to conduct timber sales activities. Following the listing of the spotted owl, USFWS biologists described habitat area and density, based on the owl's median home range, within which habitat loss may constitute a taking under the ESA. Their findings were used to establish "owl circles" ranging in radius from 1.8 to 2.7 miles, with a minimum of 40 percent of this area needing to be retained in habitat capable of supporting the owl's nesting, roosting and foraging behaviors. DNR's timber sales policies are consistent with the biological guidance represented in these criteria and are consistent with the objective of avoiding a violation of federal law.

In October 1992, the USFWS listed the marbled murrelet as a threatened species. While the USFWS has not issued guidelines for avoiding take of marbled murrelets, landowners are still at risk if murrelets are taken. DNR currently attempts to avoid take by deferring harvest of most potential suitable habitat. Under current policy, harvest is deferred on potential suitable habitat within 40 miles of marine waters. Between 40 and 52.25 miles (the distance of the most inland documented murrelet detection in Washington) a case-by-case review is conducted.

The listings of the owl and murrelet have significantly increased the environment of uncertainty and inefficiency regarding ESA compliance for trust land managers and have limited DNR's ability to meet its trust obligations. To reduce the risk of violating the ESA, DNR spends approximately $4 million each year to survey proposed timber sale sites for northern spotted owls. Marbled murrelet habitat relationship surveys have just begun at an estimated cost from $900,000 to $1.4 million per year until completion. Surveys are a costly strategy to avoid taking. In addition, approximately 380,000 acres of otherwise harvestable trust lands are currently off-limits to avoid the potential for take of these two species.

Purpose for Action

An HCP serves several purposes: It is a required component of an application for an incidental take permit; it ensures the applicant will mitigate the effects of take; and it allows the applicant to develop a forward-looking strategy that establishes a balance between the protection of listed species and economic requirements. In effect, the status quo forces DNR to react to ESA restrictions, while conservation planning allows DNR to design the most efficient way to achieve ESA compliance.

The purposes of DNR's action are to strive to:

1. Produce the most substantial support possible over the long term consistent with trust duties conveyed on DNR by the state of Washington.

2. Ensure forest productivity for future generations.

3. Reduce the risk of violating the ESA within the range of the northern spotted owl through sound, biologically-based management.

4. Reduce the likelihood of trust management disruptions due to future listings.

5. Enable DNR to conduct management and research activities within the OESF in areas currently occupied by listed species in order to build new knowledge relevant to trust management obligations and species conservation.

6. Enable DNR to adequately carry out the Board's policies as reflected in the Forest Resource Plan.

Issues and Concerns

The primary environmental issues and concerns identified during the development of this draft EIS include:

Northern spotted owl. Conserve forest areas which provide the necessary ecosystem requirements for nesting, roosting, and foraging habitat and dispersal habitat.

Marbled murrelet. Conserve forest areas which provide nesting habitat, specifically, forests with old-growth characteristics.

Salmonid fish species. Protect riparian ecosystems to satisfy habitat requirements. The effects on habitat of erosion and mass-wasting potential are a major concern.

Other wildlife and fish species. Provide wildlife habitat that contributes to demographic support, maintenance of species distribution, and facilitation of dispersal. For plant species, concerns include the protection of limited ranges and/or narrow habitat ecosystem requirements.

Physical landscape (geology and soils). Concerns include soil erosion potential in relation to geomorphology and geologic hazards including mass wasting and sediment delivery.

Other environmental issues and concerns identified during the development of this draft EIS include air quality, water quality, cultural resources, social and economic consequences of the alternatives, and cumulative effects.

Planning Area

DNR has limited the area covered in the proposed actions to the 1.6 million acres of forested trust lands within the range of the northern spotted owl. To achieve the greatest relief through an HCP and still have a manageable scope, DNR limited its conservation planning for unlisted species, including salmonids, to the west side of the Cascade crest. East-side conservation strategies are limited to measures for northern spotted owls and other federally listed upland species, including the gray wolf and grizzly bear.

The 1.6 million-acre planning area for the proposed draft HCP is divided into nine planning units: six on the west side of the Cascade crest and three on the east side (see Map 1). One of the six west-side units is the OESF.

The OESF is a unique planning unit because of its commitment to experimentation and an integrated approach to management. The long-term vision of the OESF is of a commercial forest in which ecological health is maintained through innovative integration of conservation and forest production activities.

There are three components to this experiment: habitat conservation strategies based on a forest without areas deferred from timber management (unzoned forest management); a commitment to monitoring, research, and information-sharing as the basis for experimental management; and creation of a process for integrating intentional learning with management decision-making and course adjustments. In this approach, habitat for owls, murrelets, and fish, in addition to forest products, become outputs of a well-managed unzoned forest.

Description of HCP Alternatives

The eight west-side and east-side planning units (excluding OESF) have been combined for environmental analysis purposes, with exceptions. The draft EIS analyzes three management alternatives (A, B, and C) for these combined units. For the OESF Planning Unit, the draft EIS also analyzes three alternatives (1, 2, and 3). The exceptions are:

- A separate evaluation is conducted on the impacts of the alternatives on the spotted owl on the east side.
- The riparian strategy only applies to the west side.
- The evaluation of the alternatives for the marbled murrelets only applies to the west side.

- All discussion of uncommon habitats only applies to west-side units.

Each of the three alternatives is briefly described below in terms of its effect on the three major resources of concern: spotted owls, marbled murrelets, and salmonids.

Alternative A

In this draft EIS, Alternative A is the No Action alternative. This alternative is defined as no change from current management direction or level of management intensity. For DNR, Alternative A describes the current and likely future management of trust lands within the range of the northern spotted owl without an HCP. The current and likely future management of DNR-managed lands is described in the policies of the Forest Resource Plan (1992), which is in the process of being implemented.

Whereas Alternative A achieves compliance with the ESA through an avoidance-of-take approach, the proposed HCP alternatives achieve compliance with the ESA by allowing and mitigating take in a manner acceptable to the USFWS and NMFS.

Alternative B

Alternative B is the proposed HCP for the five west-side planning units and three east-side planning units and represents DNR's proposed alternative. Under this alternative, DNR would receive an incidental take permit from the USFWS for northern spotted owls, marbled murrelets, and other listed species and an unlisted species agreement from USFWS and NMFS for species utilizing DNR-provided habitat in the west-side planning units. Alternative B includes four principal conservation elements:

- a riparian element that is designed to protect salmonid and riparian species;
- a northern spotted owl element that is designed to contribute to demographic support, dispersal, and maintenance of distribution of current spotted owl populations;
- a marbled murrelet element that proposes an interim strategy designed to preserve options while completing habitat relationship studies and protect all occupied sites found during surveys; and,
- an uncommon habitats element.

The conservation strategies described in this alternative would replace the current case-by-case survey requirements for the northern spotted owl and would benefit other species.

Alternative C

Alternative C proposes an increased level of conservation. It is similar in purpose and strategy to Alternative B but provides the potential for additional protection for species by extending the geographic scope of protected areas and by restricting management to a greater degree. This alternative would provide additional conservation within areas designated for spotted owl nesting, roosting, and foraging habitat; murrelet habitat; and

riparian areas in western Washington. If adopted and implemented, this alternative would be expected to contribute to a higher probability of long-term viability for the species of concern.

Description of OESF Alternatives

Three alternatives are analyzed for the OESF: Alternatives 1, 2, and 3.

Alternative 1

Alternative 1 is the No Action alternative. This alternative is the same as Alternative A described above. Under this alternative, DNR would not receive an incidental take permit and would continue to manage lands within the Experimental Forest according to existing Board policy and external regulatory control. Alternative 1 would continue current management of riparian areas on the OESF. For the past 5 years, DNR's Olympic Region has implemented significantly greater protection of streams and riparian areas than is required by Washington Forest Practices Rules for Riparian Management Zones.[2] This level of protection on DNR-managed lands is consistent with actions to minimize disturbances of unstable channel margins and adjacent hillslopes, as required by WAC 222-16-050 and direction given by the Board of Natural Resources through the Forest Resource Plan (DNR 1992b). Special protective measures are required because of a high potential throughout the OESF for mass wasting and windthrow.

Alternative 2

Alternative 2 is the Unzoned Forest alternative and DNR's proposed alternative. This alternative would establish specific landscape targets for conservation of habitat, which would then be incorporated into landscape plans that specify the amounts and locations of timber that can be harvested over time. No area would be strictly off-limits to timber harvest over the long term (except for interior-core buffers of riparian areas), although there would be less active manipulation of stands along steep slopes and in areas identified as susceptible to erosion, wind damage, and other hazards. In addition, some areas would be deferred from harvest until other areas are available to replace them.

Implementation of this alternative considers the current age class distribution on the OESF, where roughly 70 percent of the forest is in stands less than 30 years old. Landscape targets would be set for the development of habitat, based on a working hypothesis of the quality, quantity, and distribution of potential habitat needed to meet the target. In addition to landscape-level management, forest stands would be managed in a way that would provide potential suitable owl habitat during significant portions of the management cycle. Management strategies for uncommon habitats would be the same as under Alternative B.

[2] In the rest of this DEIS, the Forest Practices Riparian Management Zones will be referred to as Forest Practices RMZs to distinguish them from the riparian management zones in the draft HCP and the Forest Resource Plan.

Alternative 3

Alternative 3 is the Zoned Forest alternative. Under this alternative, management would concentrate on areas that have a likely potential to support owl pairs and several special pair areas. Marbled murrelet conservation would be similar to that proposed in HCP Alternative C (described above). Management strategies for uncommon habitats would be the same as under Alternative B.

Description of Management Strategies for the HCP and OESF Alternatives

Management strategies provide a useful basis for comparing the three HCP alternatives and address the following elements:

- spotted owl nesting, roosting, foraging (NRF) habitat;
- spotted owl dispersal habitat;
- provision of experimental areas;
- marbled murrelet habitat (west side only) ;
- riparian protection (west side only);
- unstable hillslopes and mass wasting (west side only);
- road network management;
- hydrologic maturity (west side only);
- wetlands protection;
- uncommon habitats (west side only);
- other federally listed species; and,
- unlisted species (west side only).

Matrix 1a summarizes the management strategies for the proposed HCP alternatives (excluding OESF).

Matrix 1b summarizes the management strategies for the three OESF alternatives. The riparian strategy is the same for all OESF alternatives, including the No Action alternative. While many of the management elements in Matrix 1a are similar to the ones in Matrix 1b, the proposed actions for each element may differ from those in Matrix 1a. Elements of the OESF management strategy include:

- spotted owl nesting, roosting, foraging (NRF) habitat;
- spotted owl dispersal habitat;
- provision of experimental areas;
- marbled murrelet habitat;
- riparian strategy;
- riparian protection;
- interior-core buffers;
- exterior buffers;
- unstable hillslopes and mass wasting;
- road network management;
- hydrologic maturity;
- wetlands protection;

- research and monitoring;
- uncommon habitats;
- other federally listed species; and,
- unlisted species.

Environmental Conditions

Vegetative zones are broad areas, delineated by elevation and climate, that have similar types of vegetation. The proposed HCP planning area includes land in many of the major zones: Sitka spruce, western hemlock, Pacific silver fir, subalpine fir/mountain hemlock zone, alpine zone, grand fir, and Douglas-fir.

The lands managed by DNR vary from scattered parcels of less than 40 acres to large contiguous blocks in excess of 110,000 acres. Although this land is distributed throughout the plan area, much of it is adjacent to or near large blocks of federal ownership along the Cascade and Olympic mountain ranges. The major exception to this pattern is in southwestern Washington, where DNR manages more than 250,000 acres that is not near federal ownership.

The majority of the forest on DNR-managed land covered by the HCP is conifer. Less than 10 percent of the even-aged stands is in hardwood. Most DNR-managed lands have been logged at least once in the last 100 years. About one-fourth of the even-aged stands are 20 years old or less. Over half of the even-aged stands are 60 years old or less. Approximately 85,000 acres of timber older than 200 years remain on state-managed forest land. Of this, less than 40,000 acres contain forests of large-diameter (4- to 8-foot) Douglas-fir, western redcedar, and western hemlock.

Environmental Consequences of Alternatives

This section focuses on the environmental consequences of the alternatives on three species and habitats of concern: the northern spotted owl, the marbled murrelet, and riparian habitat. Environmental consequences to other species and habitats are described below.

The Northern Spotted Owl

The Role of Nonfederal Lands in Spotted Owl Conservation

In developing reasonable alternatives for an HCP, DNR considered, within the context of its trust mandate, the kind of contribution it could best make to support the ESA's goal of listed species stabilization and recovery. DNR identified type and location of habitat making a significant contribution to demographic support, maintenance of species distribution, and facilitation of dispersal as its conservation objective for the northern spotted owl component of the proposed HCP.

Demographic support refers to the contribution of individual territorial spotted owls or clusters of spotted owl sites to the stability and viability of the entire population. Maintenance of species distribution refers to supporting the continued presence of the spotted owl population in as much of its historic range as possible. Dispersal is the

movement of juvenile, subadult, and adult animals from one sub-population to another. For juvenile spotted owls, dispersal is the process of leaving the natal territory to establish a new territory.

In general, nonfederal lands that are intermingled with or are adjacent to federal reserves are important for providing nesting, roosting, and foraging habitat to support clusters of owls that occur largely on federal reserves designated under the President's Forest Plan.[3] Many owls from sites centered on federal land very likely use nonfederal land to meet part of their habitat needs. For example, within the five west-side planning units, 171 territorial sites centered on federal reserves contain DNR-managed land in some portion of the median home range circle.

Results of population modeling indicate that increasing cluster size above 15-20 pairs, especially over 20 pairs, increases the likelihood that the cluster will be self-sustaining for 50-100 years. Most of the Late-Successional Reserves established in the Western Washington Cascades and Olympic Peninsula provinces under the President's Forest Plan currently support clusters of less than 20 activity centers. Most of these reserves also have less suitable habitat than their maximum potential. Thus, nonfederal lands can make the most effective contribution to spotted owl conservation by providing habitat that supports an increase in cluster size and that supports existing clusters centered on federal lands.

The intent of the proposed HCP's spotted owl conservation strategy for western Washington is twofold. First, the strategy is intended to provide nesting, roosting, and foraging habitat and dispersal habitat in strategic areas in order to support conservation objectives of demographic support, maintenance of species distribution, and dispersal on federal lands. Second, in areas designed to provide nesting, roosting, and foraging habitat, DNR's goal is to create a landscape in which active forest management plays a role in the development and maintenance of the structural characteristics that comprise such habitat. To accomplish this goal of an actively managed spotted owl landscape, the strategy includes a research phase, a transition phase, and an integrated management phase.

Criteria for Assessing Alternatives

Five criteria were developed to assess the significant adverse environmental impacts of the three HCP alternatives on the northern spotted owl (west side only):

1. Amount and distribution of nesting, roosting, and foraging (or "suitable") habitat;
2. Effect on spotted owl activity centers;
3. Contribution to dispersal habitat;
4. Contribution to demographic support in the five west-side planning units; and,

[3] In this DEIS, we are using the President's Forest Plan to refer to the 1994 plan. It is also commonly known as the President's Northwest Forest Plan and the Northwest Forest Plan.

7. Contribution to maintenance of species distribution.

Results of Assessment for West-side Planning Units

Change in the amount and distribution of nesting, roosting, and foraging habitat over the next 100 years

At present, there are an estimated 186,000 to 366,000 acres of potential suitable spotted owl habitat on DNR-managed lands within the five west-side planning units. Alternative A would result in the retention of 70,000 acres of spotted owl habitat on DNR-managed lands. Alternative B would result in the retention and development of at least 81,500 acres of spotted owl habitat. Alternative C would result in the retention and development of at least 146,500 acres spotted owl habitat.

The largest loss of potential habitat occurs under Alternative A. Most of the loss of potential habitat under Alternatives B and C occurs in areas farther than 4 miles from federal reserves. Both Alternatives B and C result in improved habitat conditions within 4 miles of federal reserves compared to Alternative A. Thus, both of these alternatives would make higher contributions to the overall demographic support of the spotted owl population that occurs on federal lands than Alternative A.

Effect on Spotted Owl Activity Centers

At present there are 145 known territorial spotted owl site centers that influence DNR-managed lands in the five west-side planning units (i.e., these sites occur either on or within a median home range radius of DNR-managed lands). DNR estimates that there are 42 additional sites that will influence DNR-managed lands in the five west-side planning units. These sites are located in areas that have not yet been surveyed for spotted owls. Under Alternative A, DNR would continue a take-avoidance policy. However, Alternative A does not offer the prospect of improving habitat conditions on DNR-managed lands. In the long term, an estimated 27-31 sites have a low chance of persistence due to poor habitat conditions and isolation from other sites or clusters of sites (see Table 4.2.18). Alternative B would result in putting an estimated 81-85 of the total 187 known and projected unknown sites at risk for incidental take of resident owls. Alternative C would put an estimated 31-33 sites at risk for incidental take of resident spotted owls.

Under Alternatives B and C, management of spotted owl habitat would occur within NRF management areas, such that at least 50 (Alternative B) or 60 percent (Alternative C) of these areas, on a WAU-by-WAU (Watershed Administrative Unit) basis, would be suitable spotted owl habitat at any one time. Any spotted owl habitat that occurs above target conditions within each WAU (refer to the proposed HCP for details) would be available for harvest. The number of future spotted owl sites that could be negatively affected by such a management strategy in the long term depends on (1) current population trends; (2) how quickly habitat conditions improve on federal reserves to the point that the population stabilizes; and, (3) where new sites are established relative to NRF management areas and federal reserves. DNR conducted an analysis based on these factors and concluded that Alternative B could result in between 8 and 36 spotted owl sites being at risk of negative biological impacts over the course of a 100-year HCP.

Alternative C could result in between 3 and 22 sites being at risk of negative biological impacts over a 100-year HCP.

The important outcome of this strategy, however, is that once NRF management areas have reached their target habitat condition, these areas would provide a constant level of support to spotted owls. This is a more certain outcome than under Alternative A, in which habitat would likely decline in quantity and quality and become increasingly fragmented. While both action alternatives present some risk to some existing sites, the creation of more habitat near federal reserves would support an increase in the size and number of owl clusters over the long term.

Contribution to Dispersal Habitat

Alternative A would provide opportunities for dispersal of juvenile spotted owls in the form of NRF habitat retained in spotted owl circles under the current take guidelines. This alternative then would provide habitat through which spotted owls could potentially disperse on 70,000 acres whose location is dependent upon the location of known spotted owl sites. Alternative B would provide dispersal opportunities on 139,500 acres in both NRF management areas (suitable nesting, roosting, and foraging habitat) and in Dispersal management areas (dispersal habitat) on DNR-managed lands. Dispersal management areas are located on DNR-managed lands that occur between large areas that will be managed for spotted owl NRF habitat (mostly federal reserves). Alternative C would also provide dispersal opportunities in NRF management areas and in Dispersal management areas. The dispersal management areas designated in Alternative C are the same as those designated in Alternative B. A total of 204,100 acres of NRF habitat and dispersal habitat on DNR-managed lands would be provided under Alternative C.

Under Alternative A, large portions of DNR-managed lands could be in conditions that are inhospitable to dispersing spotted owls at any one time. In comparison, because of the proximity of NRF management areas to federal reserves, Alternatives B and C both decrease the effective distance that spotted owls would need to travel between large blocks of federal habitat. They also provide areas that would managed specifically for dispersal habitat in areas that are important for population connectivity as identified in the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992b). Thus, Alternatives B and C both support spotted owl dispersal better than Alternative A. Alternative C provides the highest level of support.

Contribution to Demographic Support

Over the short term, Alternative A provides a higher level of demographic support than Alternatives B and C. This is because current levels of habitat contributions to all known activity centers would most likely be retained. In the long term, however, Alternative B would provide a higher level of support to the population than Alternative A because habitat will be provided at higher landscape levels at a watershed scale near federal reserves and because there is a commitment to develop new habitat in areas where habitat levels are presently low but demographic support to the population is important. The nest habitat provisions (see Matrix 1a), in conjunction with the riparian and marbled murrelet components of Alternative B, result in a projected 51,000 acres of forests older than 150 years within NRF areas by the year 2096 (see Table 4.2.10). Alternative B is expected to

provide source habitat to sub-populations at a watershed scale and would provide NRF areas that support federal reserves in all of the five west-side planning units where significant acreage in federal reserves occurs. Therefore, it is projected that NRF areas in Alternative B would be in a condition to contribute individuals to the metapopulation over the course of a 100-year HCP.

Alternative C would provide the most habitat in terms of older forest and high concentrations of large habitat patches near federal reserves. It would lead to a lower impact on spotted owl sites in the near term than in Alternative B, and a higher contribution to the support of a productive owl population in the next 100 years than either Alternatives A or B. Thus, the level of overall, long-term demographic support to populations is projected to be highest in Alternative C. Alternative C has a higher probability than Alternative B of providing source habitat to sub-populations at a watershed level and provides NRF areas that support owls on federal reserves in all of the five west-side planning units where significant acreage of federal reserves occur. Neither Alternative B nor C would provide long-term support for spotted owls that are not part of clusters that are associated with the federal reserve system.

Contribution to Maintenance of Species Distribution

When Alternatives A, B, and C are compared, Alternative C contributes most to long-term maintenance of species distribution in terms of contributing habitat in a wider range of ecological conditions, providing nesting, roosting, foraging habitat in areas of distributional concern, and maintaining connectivity among federal reserves. Alternative B provides significant long-term support but less than Alternative C. Alternative A contributes the most to maintenance of species distribution over the short term, but it contributes the least over the next 100 years.

In keeping with federal strategies, none of the alternatives provide a long-term contribution to the maintenance of spotted owls in southwest Washington or the rest of the Western Washington Lowlands Province. Thus, all of the alternatives would contribute to an eventual contraction of the species range in western Washington. Alternative B would likely lead to a more rapid loss of sites than would Alternative C and thus contribute more to accelerating the increased risk of extirpation of the population from the Western Washington Lowlands Province. Alternative C would provide some prospect for five sites to persist in southwest Washington but would not provide a much higher chance for the population to recover in this province than Alternative B.

Results of Assessment for East-Side Planning Units

There are 288,800 acres of DNR-managed land in the east-side planning units, of which 29 percent (67,400 acres) is classified as spotted owl habitat.

The main objective of the HCP action alternatives is the support of spotted owls that reside on federal lands. Twenty-two percent of spotted owl habitat on DNR-managed land in the east-side planning units lies within 2 miles of federal reserves, but only 3 percent lies between 10 and 12 miles from federal reserves. Over half of the spotted owl habitat on DNR-managed land in the east-side planning units lies within 6 miles of federal reserves.

The alternatives were evaluated using the same five criteria as for the west-side planning units, thereby isolating DNR-managed habitat. Alternative B concentrates owl habitat in proximity to federal reserves, and it is projected that this habitat will support territorial spotted owls. Of the action alternatives, DNR's analysis shows that Alternative C is expected to better provide for the survival and recovery of spotted owls in the Eastern Washington Cascades Province (see Matrix 4.3.1). For all five evaluation criteria, Alternative C results in either greater net benefit or lesser adverse impact to the owl population. Alternative C provides more NRF and dispersal habitat (Table 4.3.23) than Alternative B. Owl habitat would be the less fragmented, have wider geographic distribution, and be maintained with a higher level of certainty.

The most important comparison of Alternatives A and B is an assessment of short-term risk versus long-term risk. Alternative B poses greater short-term risk to the current spotted owl population in the Eastern Washington Cascades Province, but Alternative A poses greater long-term risk to the survivability of future generations. Over the short term, Alternative B harvests more owl habitat and puts more current site centers at risk for take (Table 4.3.23). Alternative A is likely to maintain a larger proportion of existing owl habitat and site centers over the short term, but over the long term natural disturbance and shifting site centers are likely to cause a substantial reduction in both habitat and occupied site centers. An important element in comparing the long-term risk of the alternatives is certainty. Alternative B is projected to remove more habitat, but the amount, spatial distribution, and proximity to federal lands of the remaining habitat, and habitat to be developed are known through the development of the HCP. It is likely that under Alternative A, owl habitat on DNR-managed land will become more fragmented and less capable of supporting spotted owls. Furthermore, under Alternative A, low confidence must be assigned to any estimate of future owl habitat conditions on all DNR-managed land. This is particularly true in the eastern Washington Cascades where fire suppression has greatly increased the probability of future catastrophic disturbances.

Marbled Murrelet

While the amount of scientific information that is available for this species has increased dramatically in recent years, it is still extremely limited. Additionally, no recovery plan and no designation of critical habitat for this species have been adopted by the federal government, although draft proposals for both have been released. Because many basic questions about this species' needs remain unanswered, DNR proposes to develop an interim approach designed to protect the marbled murrelet on DNR-managed lands in the area covered by the HCP while collecting the information needed to develop a long-term conservation plan.

The Role of Nonfederal Lands in Marbled Murrelet Recovery

When all factors (including at-sea conditions and the condition of nonfederal lands) affecting the species were taken into account in a second assessment of population viability by the Marbled Murrelet Working Group of the President's Forest Plan, the assessment team rated Option 9 as having a 60 percent likelihood that murrelet populations on federal lands would be stable and well-distributed after 100 years. In addition, the group stated that the management and development of marbled murrelet habitat on nonfederal lands could provide for a higher viability rating and an increased

likelihood that the ecosystem plan adopted on federal lands would maintain marbled murrelets for the long term. DNR-managed lands contain approximately 43 percent of the old-growth and mature forests found on nonfederal lands in western Washington that are potential suitable marbled murrelet habitat.

Criteria for Assessing Alternatives

Two evaluative criteria were developed to analyze any significant adverse environmental impacts of the three HCP alternatives on the marbled murrelet:

1. Amount of potential nesting habitat protected by each alternative; and,
2. Likelihood that the alternative would protect or enhance the reproductive potential of the population in conjunction with federal conservation efforts.

Amount of potential nesting habitat protected by each alternative

Under Alternatives A and 1 (No Action), DNR will continue its risk-avoidance strategy by not harvesting known occupied sites. DNR is conducting habitat relationship studies to assist the Board of Natural Resources in assessing the risk of take, as well as to identify unoccupied areas that can be released for harvest. These studies will provide more precise information to determine what constitutes high quality habitat for marbled murrelets in each planning unit. These studies will help minimize the harvest of occupied sites and further define the areas that are likely to contain additional breeding sites.

Under Alternatives A and 1, currently known occupied sites on DNR-managed lands would be protected per ESA requirements. As of 1993, the area of nonfederal lands under ESA restrictions due to known occupancy by marbled murrelets included approximately 1,814 acres of old growth and 1,633 acres of mature forest habitat. However, known sites involve only a fraction of the potential suitable habitat that DNR and other land managers must consider in order to avoid a possible violation of the ESA.

An estimated 60,283 acres of habitat on DNR-managed lands in western Washington is being deferred by these alternatives (A and 1) for an unknown period of time. Approximately 60,019 acres are currently deferred between 0-40 miles inland, and 264 acres are currently deferred between 40-52.25 miles inland. One hundred percent of the suitable habitat on DNR-managed lands in the 0-40 inland distance zone and 33 percent of the suitable habitat in the 40-52.25 inland distance zone is deferred based on current DNR protection guidelines.

Alternatives B and 2 propose to minimize the loss of potential nesting habitat in two important ways. First, the habitat relationship studies employed to identify the small percentage of occupied sites in marginal habitat that may be taken by this alternative use a statistical model that calculates the probability that a site may be occupied by marbled murrelets. Only sites with the lowest probabilities of occupancy would be available for harvest. Although the exact relationship between the number of murrelet detections recorded at a site and the number of birds using a site is unknown, it is generally accepted that a higher number of detections indicates that a larger number of birds are using an

area. Therefore, by harvesting only stands with the lowest probability of occupancy, Alternatives B and 2 minimize the effect on the population by concentrating the protection given to those sites that support the majority of the population. Although a maximum of 5 percent of the occupied sites in marginal habitat on DNR-managed lands in a planning unit might be taken, the actual percentage of the population affected is much smaller.

Second, Alternative B requires that each planning unit be evaluated with regard to the conservation of marbled murrelet habitat. Plan objectives would ensure that any reduction in breeding habitat or population size is minimized to the greatest extent practicable. The strategy would also help ensure that all population-level factors such as isolation and genetic diversity are considered and that full consideration is given to the protection of sites important in maintaining a population on DNR-managed lands in conjunction with expected habitat conditions on federal lands.

Alternative C is similar to Alternative B except that all suitable habitat, even marginal or habitat known to be unoccupied, would be retained until a long-term conservation plan is developed. Approximately 60,664 acres of occupied nesting habitat and suitable unoccupied habitat would be protected by Alternative C over a 10-year period.

Likelihood that the alternative would protect or enhance the reproductive potential of the population in conjunction with federal conservation efforts

This criterion makes a qualitative assessment of whether enough protection is provided to the population to increase the likelihood that successful reproduction is maintained or increased, adult survival is maintained or increased, breeding sites are not disturbed during the breeding season, genetic variability is not decreased, and occupied sites are not isolated.

Alternative A has the lowest likelihood of protecting or enhancing the reproductive potential of the population at a level that would lead to the long-term persistence and adaptation of the species in Washington in conjunction with federal conservation strategies. No special considerations or protection strategies are provided to those portions of USFWS conservation zones specifically designated as important to recovery efforts by the USFWS draft recovery plan. In addition, Alternative A would continue practices which create a higher risk of isolating occupied sites, and it does not plan for the creation of new suitable habitat for potential future populations.

Alternative B differs significantly from Alternative A in that its short-term purpose is to maintain options while collecting information needed to develop a long-term management plan with a goal of protecting at least 95 percent of the breeding sites located on DNR-managed lands. After completion of the habitat relationship study within a planning unit, DNR would initiate an intensive survey effort. Concentration of the occupancy survey effort in the highest quality habitat would ensure the most efficient and cost-effective survey effort and increase the chance of locating the majority of breeding sites. This strategy would expose to harvest marginal habitat expected to contain a maximum of 5 percent of the occupied sites located on DNR-managed lands in

each planning unit. All occupied sites currently known or located during the habitat relationship study, however, would be protected, regardless of habitat quality.

Under Alternative B, on-site management plans would be developed for each occupied site found. Management plans would identify the specific needs for each site and address those needs. Once the occupied sites for each planning unit become known, a long-term plan would be drafted for the entire planning unit that would then have the ability to take into consideration the entire landscape condition and juxtaposition of occupied sites to each other. After an interim period of developing long-range plans on a planning unit basis, DNR would assemble a team of scientists with expertise in conservation biology, ornithology, and silviculture to develop a long-term landscape-level conservation plan. This landscape-level planning would allow an analysis of ways to avoid the isolation of breeding sites, to identify areas with suitable unoccupied habitat, to identify gaps in murrelet distribution, and to develop long-range strategies. Breeding populations would have a greater likelihood of being maintained in southwest Washington, the Puget trough, and near the coast of the Olympic Peninsula than under Alternative A due to efforts to locate and protect occupied sites in these areas within a reasonable time frame. The proposed actions under Alternative B are more consistent with recovery actions outlined in the Draft Marbled Murrelet Recovery Plan (Marbled Murrelet Recovery Team 1995) than those under Alternative A. Alternative B's near-term strategy to locate and protect occupied sites may greatly benefit the species because the recovery ream has stated that the next 50 years will be a critical time for the marbled murrelet since little additional suitable habitat is expected to develop within Late-Successional Reserves on federal lands before that time.

Alternative C would provide enhancement of breeding potential similar to that of Alternative B, except that no harvest of suitable unoccupied murrelet habitat or marginal habitat within a planning unit would be allowed until a long-term conservation plan had been developed. This approach would preserve all options for the final planning team to develop a long-term conservation plan that can utilize all available habitat options and have the highest likelihood of success. The proposed actions under Alternative C are even more consistent with recovery actions outlined in the Draft Marbled Murrelet Recovery Plan than those of Alternative B because of the provisions for suitable unoccupied habitat as replacement habitat and objectives to develop suitable habitat in critical areas over time. Therefore, Alternative C has the highest likelihood that the reproductive potential of the population would be maintained or increased in conjunction with federal conservation efforts. It has the highest likelihood that adult survival would be maintained or increased, that breeding sites would not be disturbed during the breeding season, and that source populations would be provided for the colonization of future habitat.

Riparian Conservation

Background

Salmon are a natural resource of great cultural and economic value to the people of Washington State and elsewhere. From 1981 to 1990, the total marine and freshwater salmon catch for Washington averaged 7.2 million fish per year. According to historical

records, the peak harvests between 1961 and 1979 were 57 percent lower than those between 1864 and 1922. This large reduction in the productivity of the Pacific Northwest salmon fishery has been attributed to many factors, including large-scale water projects (dams), poor fisheries management (over-fishing and hatchery practices), urbanization, and certain types of agricultural and forest practices. As a result, some stocks east of the area covered by the HCP have been listed by the federal government as threatened, and several stocks within the area covered by the HCP are candidates for federal listing.

Seven species of anadromous salmonids inhabit the rivers and streams of western Washington: sockeye salmon, pink salmon, chum salmon, chinook salmon, coho salmon, steelhead trout, and sea-run cutthroat trout. Anadromous fish spend part of their life at sea and return to freshwater to reproduce. During the portion of their life cycle spent in freshwater, these fish are vulnerable to many human activities, including forest practices, that can affect the integrity of riparian ecosystems.

The Riparian Ecosystem

The riparian ecosystem as discussed in this draft EIS includes the aquatic area, riparian area, and the zone of direct influence. Although salmonids live in the aquatic environment, their welfare is directly dependent on how well the entire riparian ecosystem is functioning. Measures of riparian ecosystem function include water temperature, stream bank stability, sediment, detrital sources, large woody debris recruitment, and stream flow. Maintaining these components within levels of natural background variability is critical to maintaining a riparian ecosystem that is beneficial to salmonids.

To provide for protection of the riparian ecoystem components, DNR developed and analyzed three alternative approaches to riparian protection: Alternative A is the No Action alternative, Alternative B is aimed at maintaining and restoring habitat, and Alternative C is aimed at enhancing and restoring habitat. There is no proposal to alter current management of riparian or aquatic habitat on the east side of the Cascade crest.

HCP Alternatives

Under Alternative A, the width of the riparian management zones currently applied by DNR on Type 1 and 2 Waters averages 196 feet (range 50-400 feet). While this average is well within the 150-200 foot range suggested in the literature, the range indicates that Alternative A may not consistently provide an adequate riparian management zone. Under Alternative A, Type 3 Waters would continue to receive a riparian management zone width averaging 89 feet (range 0-300 feet). Type 4 Waters would receive a riparian management zone averaging 55 feet in width (range 0-300 feet). Roughly half of the Type 5 Waters would receive riparian management zones averaging 40 feet in width (range 0-150 feet). These average widths for riparian management zones associated with Type 3, 4, and 5 Waters are considerably less than is recommended by the literature to protect riparian ecosystems. No buffers are designated to prevent windthrow in the riparian management zone.

Under Alternative B, the average width of the riparian management zone on Type 1, 2, and 3 Waters would equal one site potential tree height and average 150 feet (range 100-

215 feet). In areas of high potential for windthrow, Type 1, 2, and 3 Waters would receive an additional wind buffer outside the riparian management zone of 100 feet on the windward side of Type 1 and 2 Waters, and 50 feet on the windward size of Type 3 Waters greater than 5 feet wide. Type 4 Waters would receive a riparian management zone width of 100 feet under this alternative. Riparian management zones for Type 5 Waters would be defined by the area of unstable slope and, in stable areas, by Policy No. 20 of the 1992 Forest Resource Plan. In addition, a research program would be developed and initiated under this alternative to study the effects of forest management on Type 5 Waters, leading to recommendations for a more definitive protection strategy for these streams.

Under Alternative B, no harvest other than that related to restoration activities would be allowed within 25 feet of the active channel margin on Type 1, 2, 3, and 4 Waters. Entry could occur within this area for road crossings or yarding when necessary. Harvest activities that maintain or restore salmonid habitat would be allowed between 25 and 100 feet from the active channel margin on Type 1, 2, 3, and 4 Waters.

Under Alternative C, riparian management zone widths would average the same as under Alternative B, but protection would be applied on Type 1 through 5 Waters. Alternative C would also provide an additional wind buffer of 100 feet on each side of Type 1 and 2 Waters and 50 feet on each side of Type 3 Waters greater than 5 feet wide where appropriate.

Under Alternative A, the lack of specified buffer widths on Type 4 Waters, the allowance of logging within 25 feet of streams, the absence of a wind buffer, and the lack of a comprehensive road network management plan could result in damage to riparian ecosystem components.

Forest Practices Riparian Management Zone (RMZ) widths may not always ensure protection of riparian components because minimum widths, as specified by the Washington Forest Practices Rules, are insufficient to protect riparian ecosystems. Current practices result in a wide range of riparian protection measures that in many instances are not sufficient to address salmonid habitat needs (i.e., detrital input, water temperature, stream bank stability, and large woody debris recruitment). Alternative A generally results in adequate riparian management zone widths on Type 1 and 2 Waters but may not be sufficiently protective of Type 3 and 4 Waters. Alternatives B and C both address the need for sufficiently wide riparian management zones on Type 1 through 4 Waters.

Alternative A permits logging within the entire width of the riparian management zone, but Alternatives B and C exclude logging within 25 feet of the stream, except for ecosystem restoration, and restrict logging in the remainder of the riparian management zone. Both Alternatives B and C allow riparian restoration work to occur in riparian management zones. These specific protection requirements recognize that many of the existing riparian areas are in need of enhancement work if they are to be returned to a fully functioning condition in the relatively near future. Measures required under Alternatives B and C will provide for stream bank integrity and the protection and

potential enhancement of riparian ecosystem productivity, which, in turn, will benefit salmonids.

Alternative A does not require a wind buffer on riparian management zones in wind-prone areas and, therefore, fails to protect against wind damage. The failure to address wind damage vulnerability of riparian management zones in the past has resulted in frequent loss of riparian integrity and salmon habitat values. Alternatives B and C both specify that a wind buffer be added to riparian management zones in wind-prone areas, although Alternative B requires the wind buffer only on the windward side of the stream.

Logging roads are a significant cause of sedimentation in salmonid streams. Under Alternative A, the 1992 Forest Resource Plan directs the department to develop and maintain a road system that controls adverse environmental impacts. Alternatives B and C go further, however, by specifying that active road densities shall be minimized as part of a comprehensive road network management plan. The comprehensive road network management plan required under Alternatives B and C would be far more specific in addressing sediment problems related to roads.

Criteria for Assessing Alternatives

Many factors, both anthropogenic (e.g., fisheries management, hydropower dams, agriculture, and urbanization) and natural (e.g., El Niño, natural slides, and heavy storm events) affect salmonid populations, and these are beyond the control of DNR. The role that DNR, or any forest manager, has in the fate of a particular salmonid population is difficult to gauge, but the effects that DNR has on the quality of freshwater salmonid habitat are clearly demonstrable.

The alternatives were assessed in terms of their ability to maintain and/or restore ecosystem components important to salmonids within natural background ranges. The criteria used to assess the alternatives included water temperature, stream bank stability, sediment, detrital input, large woody debris, stream flow, and windthrow.

Environmental Consequences of OESF Alternatives on Spotted Owls, Marbled Murrelets, and Riparian Zone Conservation

Spotted Owl Conservation

Spotted owls are known to occur as high as 3,500 feet in elevation on the western Olympic Peninsula, but no nests are known to exist above 2,500 feet. Forests at these elevations are within the Sitka spruce, western hemlock, or silver fir zones. Owls in the western Olympic Peninsula use very large home ranges, probably because of the limited prey base. The trend toward larger ranges in areas of scarce old forests is consistent with the findings of Carey et al. (1992) in southwestern Oregon.

Over half of the area of the northwestern Olympic Peninsula — 712,000 acres — is in younger forest cover or other open conditions; the great majority of these cover types are

the result of harvests of older forests within the past 40 years. Over 73,000 acres of old-growth forests were harvested on the Olympic National Forest between 1974 and 1988. Approximately 119,000 acres of DNR-managed forests on the OESF are 30 years old or younger.

Assessment of Alternatives

Three criteria were used in evaluation of the alternatives. Two criteria centered on the degree to which each alternative addressed major threats to the viability of spotted owls on the Olympic Peninsula: the amount and distribution of owl habitat, and the size and trends in size of the sub-population. The third evaluation criteria was the degree to which each alternative placed owl sites at risk for incidental take.

Two independent analyses of the ability of habitat to support spotted owl pairs generally concurred in their findings. Habitat currently capable of supporting owl pairs is concentrated on the mid-elevation, mostly federal lands in the interior of the Olympic Peninsula. The low-elevation, coastal plain, mostly nonfederal forest lands that dominate the OESF have little current capability as habitat for owl pairs. Two projections of Alternative 1 (no action) 100 years into the future showed that the habitat capability of the interior Olympic Peninsula increases with time but that little change occurs on the low-elevation lands of the OESF.

Two projections of Alternative 2 (unzoned forest) 100 years into the future predicted even greater increases than Alternative 3 in the ability of the low-elevation coastal plain forests of the OESF to support owl pairs relative to current conditions: one analysis predicted a greater than three-fold increase in the area of DNR-managed lands in the OESF capable of supporting owl pairs; another analysis predicted that the area that included DNR-managed lands in the OESF would be capable of supporting 80 percent more owl pairs.

Two projections of Alternative 3 (zoned forest) 100 years into the future predicted substantial increases in the ability of the low-elevation coastal plain forests of the OESF to support owl pairs relative to current conditions: one analysis predicted a two-fold increase in the area of DNR-managed lands in the OESF capable of supporting 50 percent more owl pairs.

Projections of each of the alternatives 100 years into the future predicted that, regardless of the alternative, the spotted owl sub-population on the Olympic Peninsula would decline for approximately 60 years. After that time, the population would reverse its negative trend and begin to increase in size because of the increase in habitat capability resulting from habitat development on federal lands. There were no statistically significant differences among predicted population trends under Alternative 1 or either action alternative. Alternatives 2 and 3, projected 100 years into the future, predict an Olympic Peninsula spotted owl sub-population that is 2 percent and 5 percent larger, respectively, relative to 100-year projections for Alternative 1.

Estimates of the risk for incidental take of owls were developed for all three alternatives based on the 60 currently known spotted owl sites in the OESF area. Alternative 1 is based on actively avoiding risk for incidental take of owl sites thus, the risk of incidental

take is negligible. Alternative 2 is estimated to place 31 sites at risk for incidental take, although an alternative analysis suggests that 24 sites could be at risk.

Alternative 1 maintains the status quo, although likely inadequately. Under the action alternatives, the landscape is managed for habitat capability at broader scales, with potentially a much more positive outcome for owl conservation in the OESF area. It appears that one risk to the viability of the spotted owl sub-population on the Olympic Peninsula remains under the President's Forest Plan: that resulting from a relatively restricted geographic and ecological distribution of owls and their habitat in the mid-elevation forests of the interior Olympic Peninsula. Both action alternatives are predicted to extend the geographic and ecological distribution of owls and habitat into the low-elevation, coastal-plain forests in the OESF area. Predictions are that the habitat capability of this area will increase by 27 percent under Alternative 3 and by 51 percent under Alternative 2.

Summary and Comparison of the Alternatives

It is important to directly compare the characteristics of the action alternatives to Alternative 1 as they relate to the threats to spotted owls discussed above. Alternative 1 only manages to protect the frequently inadequate *status quo* around relatively geographically fixed owl site centers, thus ensuring that regulatory incidental take is unlikely. Under both action alternatives, the landscape is managed for habitat capability at broader scales with potentially much more positive outcomes for owl conservation in the OESF area. This distinction between Alternative 1 and the action alternatives is manifest in an examination of the effects each alternative has on threats to the viability of spotted owls on the Olympic Peninsula.

Population Size and Trends -- Segments of the owl population on the Olympic Peninsula are almost certainly not at equilibrium with their environment, as habitat has been removed more rapidly than the long-lived, site-faithful territory-holders relinquish occupancy of their territories. Even without further removals of owl habitat, segments of the population may continue to decline until they reach a new equilibrium with the available habitat. This is suggested by the recent (over the past 4 years) loss of formerly reproductive owl pairs from several sites on DNR-managed lands around which most habitat was removed before the sites were protected following the listing of the owl in 1990. And it is apparent in the predictions of two independent modeling efforts. Occupancy rates of other marginal sites on or near DNR-managed lands in the OESF will probably decline further, at least until habitat capability begins to recover.

Alternatives 1, 2, and 3 -- Further reductions in numbers of owls occupying marginal sites are likely under all alternatives. It is possible that additional reductions in habitat capability could exacerbate declines at some marginal sites, perhaps more so with increasing harvest of habitat (as under either action alternative). This prediction, however, could not be demonstrated by modeling. There were no statistically significant differences among the predicted numbers of owl pairs for either action alternative, Alternative 1, or for a static landscape during the continued, predicted population declines that persist for 60 years.

Rates of habitat development significantly exceed rates of harvest of habitat under both action alternatives for the OESF. Very small interim reductions in old-forest habitat are accompanied by very large increases in young-forest habitat with long-term increases in both young- and old-forest habitat. Numbers of suitable sites predicted by modeling begin to increase immediately for each action alternative, relative to Alternative 1. Population modeling predicts a very slight gain, 2 percent to 5 percent, in overall numbers of owl pairs on the Olympic Peninsula for Alternatives 3 and 2, respectively, relative to Alternative 1. Each OESF alternative differs in the degree to which it protects or enhances habitat capability on and near DNR-managed lands in the OESF and, thus, numbers of owls on the Olympic Peninsula. However, given the current estimates of a fairly sizable sub-population on the Olympic Peninsula and predictions of a fairly sizable sub-population in the future, those relatively small differences on a peninsula-wide scale may not be important.

The effects of the alternatives on population trends are likely to resemble those on population size. Habitat conditions on the much larger area of federal lands on the Olympic Peninsula are the most important factor affecting the viability of the sub-population. Given the current conditions of habitat on the Olympic Peninsula and model assumptions, the spotted owl population may continue to decline for several decades. Under the President's Forest Plan, peninsula-wide habitat conditions are predicted to reach a state that supports a viable population. Holthausen et al. (1994) concurred and concluded that, regardless of habitat conditions on nonfederal lands,"it is likely, but not assured that a stable population would be maintained" on portions of the federal lands at the core of the Olympic Peninsula. Thus, it appears that neither near-term nor long-term trends in the size of the sub-population will change as the result of either Alternative 1 or the action alternatives for the OESF.

Geographic and Ecological Distribution of Owls and Habitat -- Threats to the viability of owls on the peninsula resulting from a restricted geographic and ecological distribution would remain if owls inhabited only the mid-elevation forests in the federal lands. Holthausen et al. (1994) concluded that "a biologically significant contribution" could result from maintaining a more widely distributed, stable population of owls.

Alternative 1, projected 100 years into the future, shows no change in the geographic and ecological distribution of owls and their habitat relative to current conditions.

Alternative 2 contributes to the broadest geographic and ecological distribution of owls and their habitat relative to either current conditions, Alternative 1, or Alternative 3 projected into the future. Alternative 2 contributes appreciably to the overall habitat capability of mostly the lower elevation, coastal-plain forests in the OESF, adding 51 percent to the current overall habitat capability in this area, and results in a greater than three-fold increase in the habitat capability of DNR-managed lands.

Alternative 3 contributes to a broader geographic and ecological distribution of owls and their habitat relative to either the current condition or Alternative 1 projected into the future. Alternative 3 contributes appreciably to the overall habitat capability of mostly the lower elevation, coastal-plain forests in the OESF, adding 27 percent to the current

overall habitat capability in this area and resulting in a nearly two-fold increase in the habitat capability of DNR-managed lands. Under this alternative, habitat capability is extended farther from the federal lands at the core of the Olympics.

Incidental take of currently known owl sites -- Sixty-nine owl sites currently exist on DNR-managed lands in the OESF within 2.7 miles of federal land.

Alternative 1 avoids incidental take of known owls.

Alternative 2 is based on managing all landscapes in the OESF to maintain or restore threshold proportions of owl habitat. Throughout the life of an HCP under this alternative, harvests of habitat would proceed under the guidance of general, landscape-level management plans and without regard for then-current locations of owl sites. Those harvests could constitute incidental take. However, habitat capability would increase across the OESF for most of the life of an HCP under this alternative until stabilizing at a much higher level than currently exits. Levels of take after the first 40-60 years would likely be lower because of the greater habitat capability that would result on DNR-managed lands.

Alternative 3 is based on delineating areas (owl zones) in which management for the retention and restoration of owl habitat until threshold proportions are attained (predicted to be in 40-60 years) is a priority. An additional feature of this alternative is the designation of several high priority areas (approximated by current owl circles) for interim conservation of owl habitat. Harvests of habitat would be deferred for 40-60 years within the owl zones, as well as in the interim conservation areas. Take could occur in circles whose boundaries are not entirely within the zones or interim protection areas. After threshold proportions of habitat are attained, harvests of habitat would proceed under the guidance of more general, landscape-level management plans and without regard to then-current locations of owl sites.

Incidental take of owls that are not yet known will also occur under all the alternatives for the OESF. The risk of incidental take of unknown owls appears to be lowest in the near term for Alternative 1, slightly greater for Alternative 3, and highest for Alternative 2.

Marbled Murrelets

The effects of the OESF alternatives on marbled murrelets are the same as for HCP Alternatives A, B, and C discussed in a previous section.

Riparian Zone Conservation

The western Olympic Peninsula differs from other physiographic provinces of the state in its unique combination of soil parent materials, precipitation and soil-saturation regimes, and windthrow characteristics. Natural sedimentation rates are high relative to those in other parts of the state because:

- annual precipitation rates are substantial, ranging across the OESF from 90 to 200 inches per year; and,

- hillslopes are composed of highly erodible materials derived from deeply weathered, marine sedimentary bedrock and glacial deposits.

In addition, tectonic activity along the continental margin has resulted in extensive fracturing, folding, and shearing of the bedrock, which has increased hillslope susceptibility to mass wasting in many parts of the OESF.

Several studies of the western Olympic Peninsula have shown that forest management activities have increased the natural rate of mass wasting by as much as several orders of magnitude. For example, it has been shown that rates of mass wasting have increased by 600-700 percent since forest harvest and road building began on state lands in the Hoh River basin.

A significant percentage of debris avalanches and flows in the OESF are generated in Type 5 channels. Landslide and debris flow materials typically reach salmonid habitat via Type 4 and 5 Waters because these channels have steep gradients, are relatively short, and, thus, are capable of delivering materials directly, and often catastrophically, to fishbearing waters.

Assessment of the Alternatives

The three alternatives for the OESF were assessed using the following criteria:

a. mass wasting and channel-bank instability;
b. windthrow;
c. coarse (large) woody debris;
d. water quality;
e. nutrient productivity;
f. microclimate;
g. riparian system functions; and,
h. cumulative effects.

Stream buffers on DNR-managed lands are expected to reduce cumulative impacts of forest management by:

- minimizing generation of sediment associated with landslides and channel-bank erosion to streams, wetlands, and estuaries;
- enhancing sources of coarse woody debris and shade for streams and wetlands; and,
- restoring or retaining mature, compositionally and structurally diverse streamside and wetland forests capable of providing bank stability, habitat components, some degree of wind and microclimate protection, and buffering of management-related disturbances on adjacent uplands.

Cumulatively, DNR and federal agencies control slightly more than one-half of the land base on the OESF. Improving riparian conditions on DNR-managed lands is expected to contribute positively toward the enhancement and restoration of river and wetland

systems as a whole in the OESF. The action alternatives have a greater potential for reducing management-related disturbances on the OESF than Alternative 1.

Other Resources of Concern

The effects of HCP Alternatives A, B, C, 1, 2, and 3 on section 10A permit species were examined. Section 10A species are federally listed species which may exist on DNR-managed lands and for which an incidental take permit is being sought, although DNR has no plans to take any individuals of these species.

Alternative C was consistently found to provide the greatest protection for the seven species for which a section 10A permit is being sought. This is because Alternative C provides the greatest amount of riparian protection and protection for late-successional habitat compared to Alternatives A and B. Most of these species do not occur in the OESF planning area, but for those that do (the Aleutian Canada goose, bald eagle, peregrine falcon), Alternatives 2 and 3 both provide greater protection than Alternative 1.

In addition, the DEIS reviews the probable effects of the alternatives on other wildlife and plant species, including arthropods, molluscs, resident fish, amphibians and reptiles, birds, mammals, and vascular plants, in the OESF and other five west-side planning units.

Summary

Tables have been included in this draft EIS that summarize the strategies and environmental consequences of the HCP alternatives for western Washington (excluding the OESF), eastern Washington, and the OESF. These tables are located at the end of Chapter 2 and include:

Matrix 1a: Management strategies for HCP (excluding OESF);

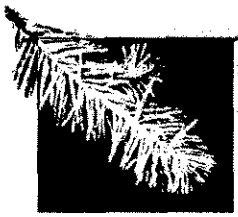
Matrix 1b: Management strategies for alternatives related to the OESF planning unit;

Matrix 2a: Summary of environmental consequences in western Washington (excluding OESF);

Matrix 2b: Summary of environmental consequences in eastern Washington (within HCP planning area); and

Matrix 2c: Summary of environmental consequences in Olympic Experimental State Forest.

1. Purpose of and Need for Action



1. Purpose of and Need for Action

1.1 Introduction

The Washington Department of Natural Resources (DNR) is proposing a Habitat Conservation Plan (HCP) as a resource management strategy to assure long-term sustainable revenue for the trusts and long-term health of forest resources. Species listed as threatened and endangered under the federal Endangered Species Act (16 U.S.C. § 1531 et seq.) currently occupy lands managed by DNR. Further, these lands contain a wide variety of habitat types that support fish and other species. DNR has prepared a draft Habitat Conservation Plan to address trust land management issues relating to compliance with the Endangered Species Act (ESA). In addition, the draft HCP addresses the goal of enabling DNR to conduct large-scale experimentation within the Olympic Experimental State Forest. The HCP planning area encompasses approximately 1.6 million acres of state forest lands managed by DNR within the range of the northern spotted owl (see Map 1). The Olympic Experimental State Forest is one of nine planning units in the HCP planning area (see Map 2). The term of the permit would be 70 to 100 years (See Implementation Agreement).

The proposed draft HCP is part of an application for an incidental take permit and an agreement covering unlisted species. DNR will submit the draft HCP for review to the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). The two federal agencies (referred to as "the Services") will comment at that time. The proposed draft HCP describes mitigation strategies for two federally listed species -- the northern spotted owl (*Strix occidentalis caurina)* and the marbled murrelet (*Brachyramphus marmoratus).* In addition, although DNR does not expect to take any individuals of these species, it is requesting that other upland species listed by the federal government as endangered or threatened within the range of the northern spotted owl be included in the permit. These additional species are the Oregon silverspot butterfly (*Speyeria zerene hippolyta*), the Aleutian Canada goose (*Branta canadensis leucopareia*), the peregrine falcon (*Falco peregrinus*), the bald eagle (*Haliaeetus leucocephalus*), the Columbian white-tailed deer (*Odocoileus virginianus leucurus*), the gray wolf (*Canis lupus*), and the grizzly bear (*Ursus arctos*). The HCP also outlines a plan to conserve habitat for other species in western Washington, for which DNR is seeking an unlisted species agreement. The proposed agreement would cover western Washington runs of several salmonids and other unlisted species, including federal and state candidate species, west of the Cascade crest.

DNR, USFWS, and NMFS are serving as joint lead agencies in the preparation of this draft environmental impact statement (DEIS) to meet their respective requirements under the Washington State Environmental Policy Act (SEPA) and the National Environmental

Policy Act (NEPA). The agencies are seeking public comment on both the draft HCP and draft EIS before they finalize the HCP and prepare the final EIS. The Services will be providing comments on the proposed draft HCP during the public comment period. This will be the Services' first formal opportunity to provide feedback to DNR regarding the proposed draft HCP.

This chapter describes the purposes and needs associated with the joint lead agencies' proposal for action. The purposes DNR seeks to achieve as permit applicant are defined within the context of DNR's trust management responsibilities. The chapter also provides an overview of the Olympic Experimental State Forest and its unique position within the proposal. The chapter concludes with a summary of the concerns raised during public scoping for the HCP project and the Olympic Experimental State Forest project.

1.2 DNR's Purpose and Need

Context of the Proposed Action

At statehood in 1889, the federal government granted specific lands across Washington State to be managed, leased, or sold by the state for the benefit of schools and other public institutions. These lands are referred to as Federal Land Grant Trusts. In addition, the state also manages Forest Board Trust lands that may not be sold and are managed to perpetuate the forest resource and support various tax funds administered by the state and by the counties. The state's duties as the trustee of these lands are defined in the Washington State Enabling Act, the Washington State Constitution, federal and state statutes, and case law.

In 1957, the State Legislature established the Washington Department of Natural Resources to serve as manager of trust lands, including forested, aquatic, and urban and agricultural lands. Duties have been added by the legislature, so that today DNR also manages special natural areas, fights fires, and regulates forest practices on state and private forest lands. By statute, DNR consists of the Board of Natural Resources,[1] the Commissioner of Public Lands as Department Administrator, and the Department Supervisor. DNR is statutorily charged with managing forested trust lands. DNR has legal duties beyond those of other landowners as a result of its trust management responsibilities. On behalf of the trust beneficiaries, DNR strives to produce the most substantial support possible over the long term while exercising prudent management and preserving the trust estate. Recognizing the perpetual nature of the trusts, DNR strives to do this without unduly favoring either the present or the future recipients of trust benefits. (See Chapter II of the draft HCP for more information about the trust mandate.)

[1] The Board consists of four publicly elected officials (a county commissioner from a county with Forest Board Lands, the Governor, the Superintendent of Public Instruction, and the Commissioner of Public Lands) and two technically knowledgeable members: the dean of the College of Forest Resources at University of Washington and the dean of the College of Agriculture and Home Economics at Washington State University.

The policies of the Board of Natural Resources that guide DNR's management of 2.1 million acres of forested trust land are reflected in the Forest Resource Plan (1992). The Forest Resource Plan provides policy direction for timber harvest, protection of special ecological features, landscape planning, aquatic system protection, wildlife, public use, silviculture, research, and more. (See Appendix A for a description of current policies.) The plan was adopted by the Board in 1992 to address the challenges of the 1990s. The plan is a comprehensive plan and must be read and interpreted as a whole (DNR 1992b p. No. 1). One of the greatest challenges facing DNR that is addressed in the Forest Resource Plan is the need to generate income for the trusts from the sale of timber while providing wildlife habitat for native species. The plan provides two policy statements that clarify DNR's position on wildlife habitat (Policy No. 22) and on endangered, threatened, and sensitive species (Policy No. 23). The policy statements follow:

> Policy No. 22: The department will provide wildlife habitat conditions which have the capacity to sustain native wildlife populations or communities. The department will develop wildlife habitat objectives based upon habitat availability and function, species status and species vulnerability, and trust obligations. When there are apparent conflicts between meeting the wildlife habitat and trust management objectives, the department will seek balanced solutions and policies.

> Policy No. 23: The department will meet the requirements of federal and state laws and other legal requirements that protect endangered, threatened and sensitive species and their habitats. In addition, the department will voluntarily participate in efforts to recover and restore endangered and threatened species to the extent that such participation is consistent with trust obligations.

The conflicts mentioned in Policy No. 22 currently exist within DNR's management and operations. Federal regulations under the ESA have placed constraints on trust land management and have limited DNR's ability to provide predictable income from forest management activities. While DNR is currently meeting its trust responsibilities as directed in the Forest Resource Plan, DNR is proposing an HCP as the means to ensure compliance with the ESA in a way that best meets the policy goals set forth in the Forest Resource Plan. This is the context for DNR's proposal. (See Chapter III of the draft HCP for more discussion of the planning context.)

DNR's Need for Action

The listings of the northern spotted owl and the marbled murrelet have created an environment of uncertainty and inefficiency for trust land management and have limited DNR's ability to meet its trust obligations. Future listings of forest-dependent species under the ESA may further disrupt DNR's ability to provide support to beneficiaries.

It is within the larger context of trust responsibilities that DNR states its need:

> DNR has a need to secure an incidental take permit and an agreement on unlisted species if doing so is in the best interests of the trust beneficiaries.

Purpose of the Proposed Action

The purposes for DNR's action are to strive to:

1. Produce the most substantial support possible over the long term consistent with trust duties conveyed on DNR by the state of Washington;
2. Ensure forest productivity for future generations;
3. Reduce the risk of violating the Endangered Species Act within the range of the northern spotted owl through sound, biologically based management;
4. Reduce the likelihood of trust management disruptions due to future listings;
5. Enable DNR to conduct management and research activities within the Olympic Experimental State Forest in areas currently occupied by listed species in order to build new knowledge relevant to trust management obligations and species conservation; and,
6. Enable DNR to adequately carry out the Board's policies as reflected in the Forest Resource Plan.

Based on a full analysis of the final HCP and final EIS, the Board of Natural Resources will determine whether to enter into an agreement with USFWS and NMFS.

1.3 USFWS' and NMFS' Purpose and Need

U.S. Fish and Wildlife Service Context

The USFWS is proposing to issue an incidental take permit to, and enter into an unlisted species agreement with, DNR. The purpose of the USFWS proposal is to authorize incidental take of nine listed species (northern spotted owl, marbled murrelet, Oregon silverspot butterfly, Aleutian Canada goose, peregrine falcon, bald eagle, Columbian white-tailed deer, gray wolf, and grizzly bear), including habitat modification for up to 100 years.[2] Such authorization is necessary because activities associated with implementation of DNR's HCP may result in take of listed species despite the extensive mitigation program sponsored by DNR. The purpose of the USFWS proposal to enter into an unlisted species agreement is to provide assurances to DNR that no additional land restrictions or financial compensation will be required from DNR for species adequately covered by a properly functioning habitat conservation plan. The USFWS, NMFS, and DNR consider the implementation of a habitat conservation plan and unlisted species agreement to be the most effective means to reconcile the applicant's proposed activities with the prohibitions against take and other conservation mandates of the Endangered Species Act (ESA).

The needs and goals of the USFWS are (1) to conserve listed species, their habitats, and associated species during DNR's proposed actions; and, (2) to ensure compliance with the ESA, National Environmental Policy Act (NEPA), and other applicable federal laws and regulations.

[2] The length of permit has not been negotiated at the time of this writing.

The decision to be made by the USFWS is whether or not to issue an incidental take permit and enter into an unlisted species agreement. The USFWS may issue an incidental take permit pursuant to section 10(a)(2)(B) of the ESA conditioned on implementation of an agreed upon habitat conservation plan submitted by DNR. In reaching its decision, the USFWS must consider five criteria for permit issuance, specifically:

1. Is the proposed take incidental to an otherwise lawful activity?

2. Are the impacts of the proposed taking minimized and mitigated to the maximum extent practicable?

3. Has the applicant ensured that adequate funding will be provided to implement the measures proposed in the habitat conservation plan?

4. Is the proposed take such that it will not appreciably reduce the likelihood of survival and recovery of the species in the wild?

5. Are there other measures that should be required as a condition of the permit?

In addition, the Secretary of the Interior must have received such other assurances as he may require that the plan will be implemented.

Issuance of a permit allowing for incidental take must comply with the intent and provisions of sections 10 and 7 of the ESA; that is, the permit must not jeopardize the continued existence of listed species while promoting habitat and species conservation and allowing incidental take of listed species during nonfederal activities.

National Marine Fisheries Service Context

In addition to the need stated above, the National Marine Fisheries Service (NMFS) intends to meet certain ecological goals necessary to conserve anadromous fish and fish habitat in the Pacific Northwest. These goals can be achieved through coherent integration of conservation measures on federal and nonfederal lands. The development of HCPs on nonfederal lands that supplement the more protective conservation measures in place on federal lands is central to this effort. The HCP conservation measures described by DNR for anadromous fish are designed to complement, to the maximum extent practicable, the measures presently being implemented on federal lands. These federal measures are summarily stated in the Aquatic Conservation Strategy objectives outlined in the President's Forest Plan (USDA and USDI 1994b), which include:

1. Maintain and restore the distribution, diversity, and complexity of watershed- and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include flood plains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically

unobstructed routes to areas critical for fulfilling life history requirements for aquatic and riparian-dependent species.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must be within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

6. Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

7. Maintain and restore the timing, variability, and duration of flood-plain inundation and water table elevation in meadows and wetlands.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate areas of surface erosion, bank erosion and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

With HCPs on forested landscapes, such as the proposal by DNR, meaningful contributions to these ecological goals can be made through a variety of mitigation measures. This draft EIS evaluates the contributions and limitations of the reasonable alternatives with respect to the water quality and riparian functions necessary to conserve anadromous fish.

While NMFS is not proposing to issue an incidental take permit, NMFS is proposing to enter into an unlisted species agreement. On the basis of their full analysis of the final HCP and final EIS, the Services will determine whether to issue or deny the requested permit and agreement or to recommend amendments prior to issuance.

1.4 Regulatory Framework

DNR's Regulatory Framework for Compliance with Environmental Laws

The policies of the Board of Natural Resources and thus DNR's land management activities comply with all generally applicable federal and state laws and are consistent with general state laws affecting land management activities. Federal and state laws relevant to this action include the ESA, NEPA, Clean Water Act, Clean Air Act, Washington State Forest Practices Act, Washington State Environmental Policy Act, and the Washington State Hydraulic Code Rules.

Overview of Federal Requirements for Species Conservation

The Endangered Species Act (ESA) protects species that have been formally designated as either "endangered" or "threatened." Once a species is listed, a variety of protections are conferred on it by the ESA. Two federal agencies, USFWS and NMFS, have responsibilities for implementing the ESA, including the designation of critical habitat and planning for the recovery and delisting of each listed species. The ESA prohibits the "take" of listed animal species.[3] Take is defined in the ESA as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. §1532 (19)). Harm is further defined in USFWS regulations as "an act which actually kills or injures wildlife. Such acts may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering" (50 C.F.R. 17.3). Finally, as noted above, section 10 of the ESA allows nonfederal landowners to seek approval of a conservation plan and issuance of an incidental take permit as an alternative to the take prohibition.

Brief Review of Listings with Major Impacts on DNR Management

The northern spotted owl was listed as threatened under the federal Endangered Species Act in June 1990. The listing had an immediate impact on DNR's ability to conduct timber sales activities. Following the listing of the spotted owl, USFWS biologists described habitat area and density, on the basis of the owls' median home range, within which habitat loss may constitute a taking. The criteria established "owl circles" ranging in radius from 1.8 to 2.7 miles. While USFWS guidelines were later rescinded, the biology behind the "owl circles" was not challenged. Current DNR timber sales are designed to meet an acceptable level of risk as defined by the Board of Natural Resources. DNR's timber sales policies are consistent with the biological guidance

[3] The civil penalties for taking a threatened species range up to $25,000 (16 U.S.C. § 1540 (a)). Any person who "knowingly violates" the ESA could receive up to 1 year in prison, a $100,000 fine or both (U.S.C. § 1540 (b)(1)). In some cases, the violator could be charged with a Class D felony and receive up to 5 years in prison and a $250,000 fine or both. The act prohibits anyone who has been convicted of a violation from receiving a permit for incidental take.

represented in the rescinded guidelines and are designed to avoid a violation of federal law.

DNR conducts 2-year surveys on proposed timber sales to collect and update information about owl sites. DNR maintains 40 percent of the area within owl circles in habitat, and DNR situates many of its timber sales within suitable habitat outside the 40 percent. DNR's application of these criteria has resulted in potential harvest constraints on 680,000 acres (approximately 42 percent) of the 1.6 million acres of DNR-managed trust land within the owl's range. Section 4.2.1 of this draft EIS describes DNR's current management strategies to identify owl sites and to comply with the prohibition against take.

Forest management activities on state lands also comply with the Washington State Forest Practices Act (RCW 76.09) rules that currently require detailed environmental analysis for most forest practices occurring on the 500 acres of suitable habitat surrounding spotted owl sites, except where a federal incidental take permit has been issued by the USFWS.

USFWS guidance for managers of nonfederal forest lands within the range of the northern spotted owl can be found in various places. The "Final Draft Recovery Plan for the Northern Spotted Owl" (USDI 1992b) defines conservation objectives for nonfederal lands. USFWS is currently drafting a special regulation for the northern spotted owl pursuant to section 4(d) of the ESA. In addition, the USFWS has issued a special report providing background information for the development of the proposed 4(d) special rule as it pertains to owls on the Olympic Peninsula (Holthausen et al. 1994).

In October 1992, USFWS listed the marbled murrelet as a threatened species. While USFWS has not issued guidelines for avoiding take of the marbled murrelet, landowners are still at risk for taking. As much as 75 percent of the HCP planning area is within the range of the marbled murrelet.[4] At present, DNR's timber sales are designed to meet an acceptable level of risk as defined by the Board of Natural Resources. The result of a "risk management" strategy is that no timber sales are currently planned within the majority of potential suitable murrelet habitat (roughly 90 percent) within 40 miles of marine waters for an indeterminate period. DNR timber sales in potential suitable murrelet habitat located from 40 to 52.25 miles of marine waters are reviewed on a case-by-case basis. In the spring of 1994, DNR initiated a survey program designed to help the Board assess risk by studying the relationship between conditions of forest stands and murrelet activity in those stands.

Other species that may occur on state lands are candidates for protection under the ESA. These include various species of plants, fish, and amphibians.

[4] See Section 4.2.2. This amount depends on which distance from marine water is used (i.e., 40 miles, 52.25 miles, or 66 miles). The potential maximum distance is 66 miles, based on the furthest inland distance of a known occupied site recorded in Oregon. If 66 miles is used, then 1,222,069 acres (or 75 percent) of the 1,636,856 acres of DNR-managed lands within the plan area are included.

In summary, the listings of the owl and murrelet have significantly increased the environment of uncertainty and inefficiency regarding ESA compliance for trust land managers and have limited DNR's ability to meet its trust obligations. To reduce the risk of violating the ESA, DNR spends approximately $4 million each year to survey for northern spotted owls. Marbled murrelet habitat relationship surveys have just begun, at an estimated cost of $900,000 to $1.4 million per year until completion. Surveys are a costly strategy to reduce the risk of take. Survey programs react to ESA restrictions, whereas conservation planning enables DNR to design the most efficient way to achieve ESA compliance. An approved HCP would establish a balance between protecting listed species and meeting the needs of current and future generations of trust beneficiaries.

1.5 Overview of the Olympic Experimental State Forest

Before DNR considered doing a multispecies HCP to resolve compliance issues, the department made a commitment to seek new ways to integrate timber harvest and ecological protection in the Olympic Experimental State Forest (DNR 1995f). Conceived amid the debates that preceded the listing of the northern spotted owl, the primary objective of the Experimental Forest was to discover - through experimentation - ways in which DNR could manage the remaining mature, natural forests on state lands on the western Olympic Peninsula (approximately 60,000 acres). Several actions were taken to implement the Experimental Forest; however, the listing of the owl and murrelet prevented DNR from initiating any experiments in mature forest habitat. While some relief from spotted owl restrictions was provided in a planning process approved by Congress (HR4489), the single species approach was not sufficient to realize the goal of the Experimental Forest.

Enabling DNR to conduct large-scale experimentation in a working forest that provides substantial income to the trusts is a priority for DNR. For this reason, the Olympic Experimental State Forest is an integral part of DNR's multispecies habitat conservation proposal. The basic assumption underlying the Experimental Forest is that rigorously designed experimentation and the application of nontraditional forest practices in a commercial forest will provide solutions to forest management problems. The knowledge gained will be valuable for trust land management, species conservation, and production of forest commodities.

The 264,000 acres of DNR-managed lands on the western Olympic Peninsula present unparalleled opportunities for research. Olympic National Park is close to much of the Experimental Forest, and contains unmanaged watersheds. The national park offers "control areas" for rigorous comparisons between actively managed and unmanaged areas. Olympic National Forest land is adjacent to several large blocks of DNR-managed land and contains designated USFS reserves and USFS Adaptive Management Areas. DNR-managed lands offer a host of possibilities for silvicultural manipulation in existing habitat, restoration, and other innovative practices more appropriate to areas outside federal reserves. Further, the Olympic Peninsula is considered one of the most productive

tree-growing regions in North America. The west side of the peninsula contains a large, continuous block of low-elevation commercial forest land, of which DNR is a major land manager. The productivity of these lands should produce rapid results from innovative practices, in comparison with other growing regions. Finally, a large portion of the Experimental Forest contains young stands, the result of intensive harvest of old growth from the 1960s through the 1980s. These stands hold the potential for large-scale application of innovative silvicultural practices intended to accelerate development of forest conditions associated with older forests. Such experiments may increase the habitat value of these stands while returning substantial income to the trusts.

Based on this rationale, the department has envisioned the Olympic Experimental State Forest as a unique commercial forest where innovative techniques are applied, where new knowledge is aggressively sought and applied, and where creative ideas can grow and long-standing problems be solved. In future decades, the implementation of the Experimental Forest will enable DNR to seek and test new methods while meeting its trust management obligations. However, realizing the vision of the Experimental Forest means securing an incidental take permit for both the northern spotted owl and the marbled murrelet. For this reason, the Olympic Experimental State Forest is included in the draft HCP and in the application for the incidental take permit and unlisted species agreement. Because of the uniqueness of the Experimental Forest, it is a separate planning unit (see Map 2). The draft HCP details the conservation elements of the Experimental Forest.

1.6 Issue and Concerns

Public scoping was conducted to assist the lead agencies (DNR, USFWS, and NMFS) in determining the issues that would be addressed in developing DNR's proposal and the range of alternatives considered. Scoping also helped assess the level of analysis and the types of data that were required. Table 1.1 summarizes the lead agencies' efforts to involve the public during the information-gathering phase. Scoping was conducted separately for the Olympic Experimental State Forest and DNR's HCP project. Following scoping, the lead agencies found that the action required to implement the Experimental Forest was an application for an incidental take permit and that one permit application was sufficient for the Olympic Experimental State Forest and the remainder of the 1.6 million acres. Therefore one EIS, not two, would analyze the impacts of DNR's proposal and the permit decisions of the federal agencies.

Table 1.1: Summary of public information and involvement for DNR's conservation planning project

Public Information and Involvement	DNR's Habitat Conservation Planning Project (HCP)	Olympic Experimental State Forest (OESF)
Pre-Scoping Public Involvement	No formal meetings[5]	2 public workshops (34 people, 12/93)
Scoping Notice in SEPA Register Notice of Intent in Federal Register	4/25/94, 5/13/94 5/2/94	2/28/94, 4/8/94 3/3/94
Public Scoping Meetings Written Comments Received	10 meetings (total of 100 people, 5/94 & 6/94) 46 letters	1 meeting (8 people, 3/29/94) 32 letters
Scoping Reports and Summaries	7/19/94 (DNR) 9/12/94 (USFWS) *Bulletin* article (DNR)	5/28/94 (DNR) 9/14/94 (USFWS) *Vision* article (DNR)
Presentations to Board of Natural Resources[6]	Project Director updates at regular meetings; Special workshops open to public 2/2/95 and 4/20/95; Board held 4 special meetings during 2/95 to hear public input.	Project Manager gave regular updates; 12/94 briefed Board on need to streamline project with HCP
Presentations made to interested groups on request	HCP team members made more than 40 presentations	OESF team members made more than 10 presentations

Following the formal scoping periods, DNR and USFWS continued to receive public input, to respond to requests for information, and to issue news bulletins to more than 3,000 people. The Board of Natural Resources received regular updates at each monthly meeting. In addition, more than 40 briefings were held with interested groups, such as the Northwest Indian Fisheries Commission and the Washington Association of Counties. Formal comments on the scope of the Olympic Experimental State Forest and HCP

[5] Project Director and other DNR representatives spoke on behalf of the project to variety of audiences prior to initiating formal public involvement through the scoping process.

[6] All meetings of the Board follow the notification procedures for open public meetings.

proposals were submitted as individual letters, oral comments noted at public meetings, and a video tape. In addition to these, letters related to the scope of the proposals were added to the record.

The primary environmental issues and concerns identified during the development of this draft EIS, listed below in the order they are addressed in the document, include the potential for effects from DNR's proposed management activities and the proposed incidental take permit on:

Northern spotted owl. Concerns include conserving forest areas which provide the necessary ecosystem requirements for nesting, roosting, and foraging habitat and dispersal habitat.

Marbled murrelet. Concerns include conserving forest areas which provide nesting habitat, specifically, forests with old-growth characteristics.

Salmonid fish species. Concerns include protecting riparian ecosystems to satisfy habitat requirements. The effects on habitat from erosion and mass-wasting potential are a major concern.

Other wildlife and plant species. Concerns include provision of wildlife habitat that contributes to demographic support, maintenance of species distribution, and facilitation of dispersal. For plant species, concerns include the protection of limited ranges and/or narrow habitat ecosystem requirements.

Physical landscape (geology and soils). A discussion of soil types, soil erosion potential in relation to geomorphology, and geologic hazards including mass wasting and sediment delivery.

Air quality. A discussion of existing air quality in the planning area and the potential impact of the alternatives on air quality.

Water quality. Concerns discussed include the impacts of the alternatives on water quality and quantity, and proposed measures to minimize and mitigate impacts.

Cultural resources. A discussion of the potential impacts of the alternatives, and measures for conservation, protection, and management of cultural resources.

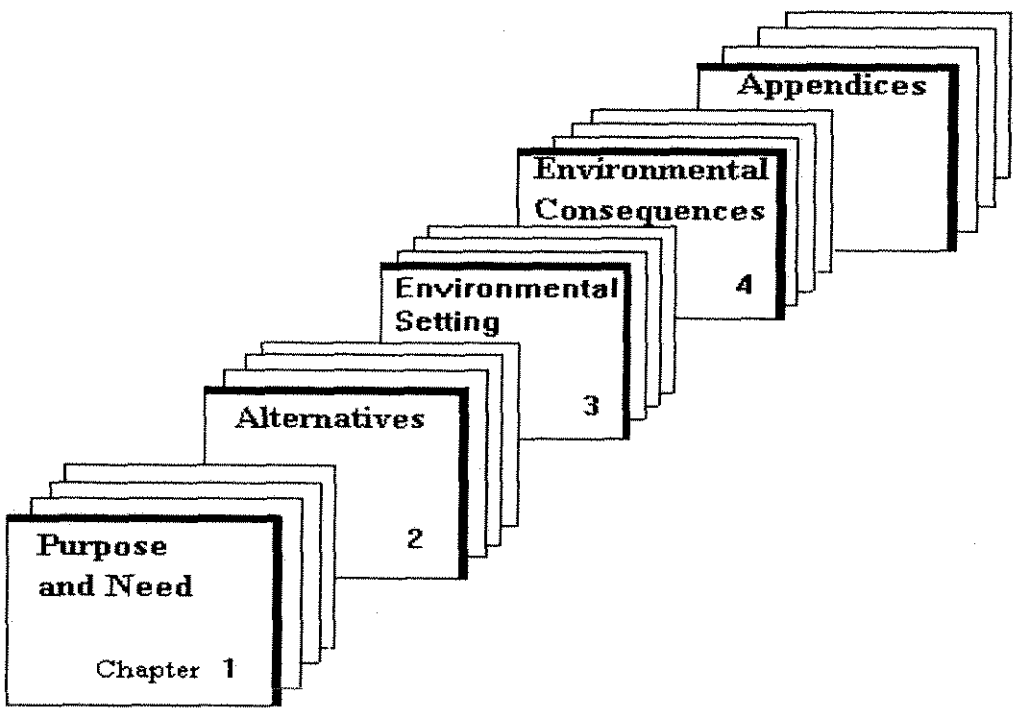
Potential social and economic consequences. A discussion of the potential impact of the alternatives on local communities and the region.

Cumulative effects. A discussion of the effects of the alternatives together with past and reasonably foreseeable actions.

1.7 Overview of the Remaining Chapters

Chapter 2 describes the range of alternatives considered, including "No Action" or no change from current management. Chapter 2 also compares the extent to which each reasonable alternative meets the stated purpose and need for action. Chapter 3 provides an overview of the elements of the environment that may be affected by the alternatives under consideration. Chapter 4 details the anticipated effects of the alternatives on the resources of concern. Figure 1-1 illustrates the organization of this draft EIS.

Figure 1-1: How this draft EIS is organized



Chapter 1: The purpose and need to which DNR, USFWS, and NMFS are responding, and the public issues surrounding the proposed action.

Chapter 2: The review of the range of alternatives originally considered and comparison of the reasonable alternatives.

Chapter 3: Broad overview of resources within HCP planning area.

Chapter 4: An analysis of the affected environment and the potential impacts and proposed mitigation provided by the alternatives under consideration.

2. Alternatives

2. Alternatives

2.1 Introduction

The previous chapter described the joint lead agencies' purposes and needs for the proposed action. Chapter 2 focuses on the proposed action and its alternatives. The joint lead agencies considered a range of alternatives, including the proposed action and no action. Because applying for an incidental take permit is an applicant-driven process, DNR can propose a variety of alternatives on which the Services would act. As stated in Chapter 1, it is the responsibility of USFWS and NMFS, as permitters, to evaluate and respond to proposals submitted by applicants under section 10 of the Endangered Species Act (ESA).

This chapter describes how the range of alternatives was narrowed to the reasonable alternatives and No Action. For the HCP planning area excluding the Olympic Experimental State Forest, a total of 14 alternatives are identified and discussed, and of those, three alternatives are discussed in detail. Ten distinct alternatives are identified and discussed for the Olympic Experimental State Forest; of those, three are discussed in detail. The evaluation of alternatives summarized in this chapter centers around the purposes and needs for action, described in Chapter 1.

2.2 Development of DNR's Alternatives

The range of alternatives is constrained by both the need and the purposes. First, alternatives must meet the stated need. As described in Chapter 1, DNR states its need within the larger context of its trust responsibilities:

> DNR has a need to secure an incidental take permit and an agreement on unlisted species if doing so is in the best interests of the trust beneficiaries.

DNR's proposed action is discretionary. When an agency is involved in discretionary decision making, the agency should define what is likely to occur if the action is not taken, in this case, if the permit is not issued and no HCP is implemented. In this draft EIS, the No Action alternative is defined as no change from current management direction or level of management intensity.[1] For DNR, the No Action alternative

[1] Section 1502.14(d) of NEPA requires the alternatives analysis in the EIS to include the alternative of no action. The President's Council on Environmental Quality provides guidance to assist agencies in defining the no action alternative (46 Fed. Reg. 18026 (1981)). There are two distinct interpretations of no action; the first captures DNR's definition, while the second describes USFWS' and NMFS' perspectives. The first interpretation of no action is more common for agency planning proposals in which the no action

describes the current and likely future management of trust lands within the range of the northern spotted owl without an HCP.[2] Whereas the No Action alternative achieves compliance with the ESA through an avoidance-of-take approach, the HCP alternatives use the section 10 process to determine if ESA compliance through an HCP provides increased benefits to each of the trusts managed by DNR when compared to No Action.[3] As explained in Chapter 1, DNR will explore this question throughout the development of, and public comment on, the draft EIS and the proposed draft HCP.

The comparison of reasonable alternatives contained in this draft EIS will assist DNR, USFWS, and NMFS during the decision-making process. Prior to any decision to approve an HCP, DNR must find that implementation of an HCP is consistent with all trust duties placed on it by the Legislature. DNR will submit a final proposal (consisting of the final EIS with response to public comments, final HCP, and Implementation Agreement) to USFWS and NMFS **only if the Board of Natural Resources determines an incidental take permit is in the best interests of the trust beneficiaries.** Further, the Services will not issue a permit or enter into agreements with DNR unless adequate conservation is secured, and the intent of the ESA is satisfactorily addressed. Through the comparison of the No Action alternative to the HCP proposal and the other reasonable alternative, the joint lead agencies will consider the benefits and disadvantages of reserving for some future time the implementation of the proposal.

This DEIS is part of a State Environmental Policy Act (SEPA) phased review for forest resource management on DNR- managed lands. SEPA review began with the 1992 Forest Resource Plan (FRP) and EIS. The proposed draft HCP is one planning component under the FRP. The proposed draft HCP more specifically defines the following FRP policies:

Policy No. 20, Riparian Management Zones;
Policy No. 21, Wetlands;
Policy No. 22, Wildlife Habitat (for some habitat characteristics); and,
Policy No. 23, Endangered Species.

---

alternative may be defined as "no change" from current management direction or level of management intensity. This definition of no action means continuing with the present course of action until that action is changed; thus the basis for comparison would be the projected impacts of the continued implementation of the existing management plan. The second interpretation of the no action alternative is illustrated in instances involving federal decisions on proposals for projects. No action in this case would mean that USFWS and NMFS would not issue the permit, and the resulting environmental effects from taking no action (no HCP) would be compared with the effects of implementing the proposed HCP. See Section 2.5 for a description of the No Action alternative.

[2] The No Action alternative has been referred to as No Action, No Change, or No HCP during the early planning phase.

[3] DNR will consider public comment before determining if the proposal is in the best interests of the trusts. In addition to this draft EIS, the Board of Natural Resources has requested information on the economic impacts of this proposal to each of the trust beneficiaries. Additional information is contained in staff reports to the Board and in the paper entitled "Background and Analytical Framework for the Proposed Draft HCP", dated 10/16/95, produced by DNR's Office of Policy Analysis and Research (DNR 1995b).

If adopted, the HCP will be incorporated into landscape planning (FRP Policy No.16).

Phased review assists the department, other agencies, and the public to study issues at the appropriate scope and level of environmental review to coincide with meaningful points in their planning and decision-making processes. The department will conduct a SEPA review when the environmental effects of proposed subsequent plans or activities can be meaningfully evaluated. This DEIS will be used as appropriate to meet the department's future responsibilities under SEPA.

Like the need statement, purposes help narrow the range of alternatives. Purposes are the goals to be attained by meeting the need through the proposed action. DNR's purposes reflect the overriding goal of prudent trust land management. The purposes for DNR's action are to strive to:

1. Produce the most substantial support possible over the long term consistent with trust duties conveyed on DNR by the state of Washington;
2. Ensure forest productivity for future generations;
3. Reduce the risk of violating the ESA within the range of the northern spotted owl through sound, biologically based management;
4. Reduce the likelihood of trust management disruptions due to future listings;
5. Enable DNR to conduct management and research activities within the Olympic Experimental State Forest in areas currently occupied by listed species in order to build new knowledge relevant to trust management obligations and species conservation; and,
6. Enable DNR to adequately carry out the Board's policies as reflected in the Forest Resource Plan.

2.3 Features Common to All Reasonable Alternatives

The reasonable action alternatives and the No Action alternative are analyzed in detail in this draft EIS. Other alternatives were considered but eliminated from detailed analysis for specific reasons explained in this chapter. The No Action alternative and each of the reasonable alternatives attempt to meet DNR's trust responsibilities, comply with the ESA, and are operationally feasible. Resource management actions of the department would be consistent with the policies of the Board of Natural Resources, as reflected in the Forest Resource Plan (1992), under the reasonable action alternatives as well as the No Action alternative. Management actions that are not specifically addressed in the alternatives would continue to be guided by the Board's policies.

Compliance with existing law is required of all reasonable alternatives and the No Action alternative. The Board of Natural Resources' ability to modify its policies appropriately is

maintained under all alternatives. All reasonable alternatives preserve DNR's ability to adjust to legal or regulatory changes.[4]

Unlike the No Action alternative, reasonable action alternatives provide for the incidental take of federally listed species occurring on DNR-managed lands. Reasonable alternatives are constrained geographically to the planning area (see Map 1). DNR has limited the area and species covered in the planning area to the 1.6 million acres of forested trust lands within the range of the northern spotted owl. To achieve the greatest relief through an HCP and still have a manageable scope, DNR limited its conservation planning for unlisted species and salmonids to the west side of the Cascade crest. DNR did not seek to address multiple habitats and species throughout eastern Washington.[5] Reasonable alternatives are therefore limited in scope for trust lands east of the Cascade crest to conservation measures for northern spotted owls and other federally listed upland species (including the gray wolf and grizzly bear, see p. 1-1). Efforts to seek an incidental take permit for aquatic and riparian-dependent species on the east side of the Cascade crest may be developed in a later and separate process. In the interim under all reasonable alternatives, DNR will continue the protection as described in the No Action alternative for riparian ecosystems east of the Cascade crest.

The conservation elements common to all alternatives are aquatic and riparian habitat conservation strategies, as well as species conservation strategies for listed species. Reasonable OESF alternatives contain an explicit information-gathering element. The major difference in strategies to achieve compliance with the ESA between the reasonable alternatives and the No Action alternative is the focus on habitat development through time rather than a focus on the current habitat of individual animals.

2.4 Range of Alternatives Originally Considered

The range of reasonable alternatives available for analysis was constrained by the six purposes reflecting DNR's trust responsibilities, ESA compliance, and management efficiency. During the scoping process (see Section 1.6) a variety of alternatives was suggested for consideration. In addition to the No Action alternative, only those that met the need and purposes were analyzed in detail in this document. An alternative is not considered reasonable if it fails to achieve the stated objectives including the purpose and need.

Two coarse filters were used to evaluate the suggestions received. First, the lead agencies determined which alternatives were outside the scope of the proposal. Alternatives that

[4]A draft of the Implementation Agreement accompanies the proposed draft HCP. Such agreements are used to document the legal commitments between the applicant and the Services associated with approved incidental take permits.

[5] DNR's current management considers at-risk fish stocks and the possible listings of fish and other species on all DNR-managed lands. Current management includes compliance with SB 1309 Ecosystem Standards for State-owned Agricultural and Grazing Lands, and the consideration of the proposed draft wild salmonid policy (WDFW et al. 1995).

were undefined, remote, or speculative were excluded from further analysis. These included alternatives that expressly did not meet ESA requirements by directing DNR to resist compliance with ESA and/or contest the listing of the northern spotted owl. Similarly, alternatives that directed DNR to pursue amendments to the Enabling Act or the Washington State Constitution in order to broaden or narrow the definition of trust beneficiaries were determined to be beyond the scope of this proposal. Suggested alternatives directing DNR to halt all timber harvest and generate income for trust beneficiaries through recreational fees and nontimber resource extraction were also determined to be remote, speculative, and outside the scope of this proposal.[6] Second, the joint lead agencies further refined the range of alternatives by separating distinct alternatives from suggested management strategies. Because of the nature of this proposal, nearly all conceivable management strategies could be applied to meet the conservation objectives. Therefore, suggestions to avoid harvest of old growth, apply natural selection ecoforestry, ban clearcuts, use rail to transport logs, and use longer rotations did not represent distinct alternatives. DNR maintains flexibility to employ various land management strategies, including selective harvest and land transfers, regardless of the proposed action.

A few of the suggested alternatives that did not make it through the two coarse filters are described in Section 2.5 in order to further explain their elimination from consideration.

2.5 Evaluation of Alternatives Related to Eight Planning Units in HCP Area (Excluding OESF)

This section describes and evaluates against the stated purposes and needs 14 potential alternatives relating to DNR's proposed action for the HCP planning area outside of the Olympic Experimental State Forest (see Table 2.5.1).

Potential alternatives relating to DNR's proposal for the Olympic Experimental State Forest are discussed separately in Section 2.6. OESF alternatives are numbered, in order to make sure the OESF alternatives are not confused with those considered for the larger HCP planning area. The matrices at the end of this chapter summarize the management strategies and the environmental consequences of the reasonable alternatives and No Action.

[6] DNR currently sells nontimber resources for the benefit of the trusts.

Table 2.5.1: Key to potential alternatives related to eight planning units in HCP area (excluding OESF)

Fully Developed Alternatives: A-C	
Alternative A: No Action Continue under current management direction. Comply with ESA by avoiding take of listed species. Survey to assess risk of take. Subject to changing regulations and future listings.	
Alternative B: Proposed HCP Comply with ESA by implementing long-term plan, minimize and mitigate the take of listed species throughout the range of the spotted owl. Provide habitat to obtain an unlisted species agreement on DNR-managed lands in five west-side planning units.	
Alternative C Similar to Alternative B, with added conservation elements designed to enhance likelihood of approval from the permitting agencies.	
Alternatives Eliminated from Detailed Analysis: D - N	
Potential Alternative	Why Eliminated? [1]
D. Revisit previous Board Policies	Does not meet purposes 1,2,3,4,6
E. HCP for spotted owls and marbled murrelets only	Does not meet purposes 2,3,4
F. Watershed analysis-based HCP	Does not meet purposes 1,6
G. Hybrid of Alternatives A and B	Is not a distinct alternative
H. HCP scenarios based on proposed 4(d) special rule	Does not meet purposes 3,4
I. Separate HCPs for each trust	Does not meet purposes 1,2,3
J. Statewide multispecies HCP for all trust lands	Beyond scope of this action
K. Regulatory HCP for Forest Practices	Beyond scope of this action
L. Unzoned conservation strategy throughout	Does not meet purposes 1,3
M. "Ecoforestry" HCP	Does not meet purpose 1
N. No Harvest	Does not meet purpose 1

[1] See p. 2-18 for description of Alternatives D-N. See p. 2-3 for list of six purposes.

Alternative A

Alternative A is considered in detail throughout this draft EIS. Under Alternative A, DNR would not implement a habitat conservation plan, and the Services would not issue an incidental take permit or agreement on unlisted species. Chapter 4 of this draft EIS provides a detailed examination of the environmental consequences associated with continued implementation of the No Action alternative in order to permit a comparison to the reasonable alternatives. The results of this analysis are summarized in a matrix at the end of this chapter.

Under the No Action alternative, DNR would continue the implementation of the policies of the Board of Natural Resources as described in the Forest Resource Plan (1992) and comply with the ESA without an HCP. The relevant policies of the Board as articulated in the Forest Resource Plan (1992) are stated below:

Policy No. 23: Endangered, Threatened, and Sensitive Species Policy

> The department will meet the requirements of federal and state laws and other legal requirements that protect endangered, threatened, and sensitive species and their habitats. In addition, the department will voluntarily participate in efforts to recover and restore endangered and threatened species to the extent that such participation is consistent with trust obligations.

Policy No. 22: Wildlife Habitat

> The department will provide wildlife habitat conditions which have the capacity to sustain native wildlife populations or communities. The department will develop wildlife habitat objectives based upon habitat availability and function, species status and species vulnerability, and trust obligations. When there are apparent conflicts between meeting the wildlife habitat and trust management objectives, the department will seek balanced solutions and policies.

Policy No. 20: Riparian Management Zones

> The department will establish riparian management zones along Type 1 through 4 Waters and when necessary along Type 5 Waters.[7] The department will focus its efforts on protecting key nontimber resources, such as water quality, fish, wildlife habitat and sensitive plant species.

Policy No. 21: Wetlands

> The department will allow no overall net loss of naturally occurring wetland acreage and function.

Policy No. 19: Watershed Analysis

> The department will analyze by watershed the effects of past, present and reasonably foreseeable future activities on water quality and quantity, and it will modify operations to control risks to public resources and trust interests.

[7] See Glossary for definition of Water Typing System.

Policy No. 28: Developing and Maintaining Roads

The department will develop and maintain a road system which integrates management needs and controls effects on the forest environment.

Policy No. 40: Research

The department will conduct applied research to monitor and evaluate silvicultural activities, test current practices and, where appropriate, initiate a process for change. The research will focus on issues relating to protection and conservation as well as forest production.

Where the Board's policies are broadly stated, implementation would continue to involve a wide range of management activities. In projecting the effects of the No Action alternative on specific habitats, a range of management activities is described to illustrate the current variability in implementation and what is likely to occur in the near future as DNR strives to meet the policy goals. For example, the constraints on management activities around riparian habitats may vary under Alternative A from a buffer of 25 feet on a Type 3 stream less than 5 feet wide to a buffer 150 feet on the same stream type, with the average being 85 feet.

Uncertainty regarding compliance with the ESA is the dominant feature of this alternative and would continue through time. Requirements could stiffen, more species could be listed, or requirements could relax with changes in federal policy. DNR would respond to changing ESA requirements and take precautions when guidance is lacking to ensure compliance with the ESA.

Regarding compliance with applicable laws including the ESA, DNR would continue management policies and practices designed to reduce the risk of violating the ESA (summarized in Table 2.5.2). Risk-management practices or policies include: (1) conducting 2-year surveys on proposed timber sales in suitable spotted owl habitat; (2) deferring from sale 15,000 acres of mature forest within the boundary of the OESF until 2005; (3) deferring timber sales involving potential marbled murrelet habitat within 40 miles of marine waters and conducting a case-by-case review of sales between 40 and 52.25 miles; (4) conducting marbled murrelet habitat relationship studies to assist the Board of Natural Resources in determining an acceptable level of risk; and, (5) screening certain other sales for potential taking of a federally listed species.

Under the No Action alternative, the focus of DNR's conservation efforts related to compliance with the ESA is on current habitat conditions. Existing suitable habitat for murrelets would be essentially off-limits for harvest; in areas now occupied by owls, sales would only be offered where there is more than 40 percent suitable habitat within a territorial owl circle.

Spotted Owls

As indicated above, in areas now occupied by owls, sales would only be offered where there is more than 40 percent suitable habitat within a territorial owl circle. Where survey information shows an owl activity center (or circle) has been abandoned, additional acres would be available for sale upon the completion of a series of decertification surveys.

Therefore, no new habitat is likely to be developed over time. Conversely, where surveys show new owl activity and habitat below the 40 percent threshold, these areas would be off-limits. The No Action alternative assumes DNR will continue to survey in an attempt to clear for harvest as much mature timber as possible but also that the Board would continue its current risk-management approach regarding sales in suitable habitat. The costs of complying with ESA would include the costs of continuing the current survey program.

Marbled Murrelet

Under the No Action alternative, DNR would not be permitted to incidentally take a marbled murrelet and would not implement a habitat conservation plan. Management of potential murrelet habitat in the foreseeable future under this alternative is uncertain; however, it would likely follow current management direction.

DNR is currently implementing an interim, internal approach to ESA compliance, designed to protect marbled murrelet habitat on DNR-managed lands. Initiated in April 1994, the approach automatically defers timber sales on any state trust lands where the structural characteristics of the forest meet the Forest Practices Board's definition of suitable marbled murrelet habitat as originally defined by the marbled murrelet emergency rule alternative (WAC 222-16-010), commonly referred to as the Occupied Stand Approach. DNR currently defers from timber harvest 100 percent of the stands within 40 miles of marine waters if those stands contain eight or more trees per acre that are greater than or equal to 32 inches diameter at breast height (dbh) and/or contain two potential nesting platforms per acre. The stem density criterion is most commonly used to determine whether a stand is suitable habitat because of the difficulty of counting potential nest platforms.

Proposed timber sales that include stands located within 40 miles of marine waters that contain between two and seven trees per acre that are greater than or equal to 32 inches dbh are deferred. For timber sales located between 40 and 52.25 miles inland, DNR evaluates each stand on an individual basis to make a determination whether to defer the sale. The factors considered include habitat quality, stand size, potential nest platform density, isolation of stand, distance to saltwater, and whether the stand is located in a watershed administrative unit where murrelet presence has been documented by WDFW. Timber sales in stands located beyond 52.25 miles from marine waters are not currently evaluated for murrelet habitat.

Under the No Action alternative, DNR would continue to conduct the habitat relationship studies in western Washington. These studies were initiated in 1994 and assist DNR in determining marginal habitat types that could be made available for harvest. Once completed, data from these habitat relationship studies will be used by the Board of Natural Resources to make decisions concerning the deferral or harvest of stands determined to have some potential as marbled murrelet habitat. It is unknown how this decision process may function or what level of risk the Board may decide is appropriate.

Riparian Areas

Under the No Action alternative, riparian areas would receive protection as guided by DNR's Forest Resource Plan (1992) and the Washington Forest Practices Rules. This includes protection of unstable slopes, riparian and wetland management zones, integrated road management plans, research and application of watershed analysis.[8]

Under the No Action alternative, DNR would continue its current policy of establishing and protecting riparian management zones of varying widths along all Type 1 through 4 Waters and on approximately 50 percent of Type 5 Waters. While generally treated as no-harvest areas, these zones may be actively managed provided that fish and other key nontimber resources receive adequate protection. The widths of these zones range from forest practices minimums to substantial buffers applied on a site-specific basis (see Matrix 1a). Based on data collected from recent years, average buffer widths (measured from the stream edge on each side of the stream) on Types 1 and 2 were 196 feet and ranged up to 400 feet. On Types 3 and 4 the average widths were 85 feet and 55 feet, respectively, and ranged up to 300 feet. Thus, under No Action, DNR would continue to provide protection exceeding the minimum requirements of the Forest Practices Act based on site-specific resource issues.

[8]There are several ways in which watershed analysis may occur under No Action. DNR may initiate or enter into a forest practices watershed analysis with other landowners, may conduct a watershed assessment as part of state land management planning (usually through the landscape planning process being implemented under the Forest Resource Plan), or may acquire new or existing information through cooperative efforts with local tribes, organizations and state or federal agencies.

Table 2.5.2: Summary of management under the No Action alternative

A more detailed description of management strategies under the No Action alternative and the two reasonable HCP alternatives is provided at the end of this chapter in Matrix 1a.

Element	Management Under No Action Alternative
Northern Spotted Owl	• Timber sales are designed to meet level of acceptable risk as determined by Board of Natural Resources. • Two-year surveys conducted on proposed timber sales to collect/update information on owl sites. Maintain 40% of existing habitat within owl circles in habitat, manage remaining % so that no additional forest land becomes owl habitat. As owls move, surveys will likely add and subtract sites.
Marbled Murrelet	• Timber sales are designed to meet level of acceptable risk as determined by Board of Natural Resources. • No timber sales within majority of potential suitable habitat within 40 miles of marine waters for indeterminate period. • Case-by-case review of sales in potential habitat within 40-52.25 miles of marine waters. • Conduct habitat relationship study to determine an acceptable level of risk.
Riparian / Aquatic Habitat	• Conservation strategies for the protection of riparian areas (including streams, lakes, wetlands, steep slopes) range from forest practices minimums to substantial buffers applied on a site-specific basis.
Olympic Experimental State Forest	• See Section 2.6, same as OESF Alternative 1.

Alternative B (Preferred Alternative)

Alternative B is DNR's proposed alternative and is designed to meet all of the stated purposes and needs. Under this alternative, DNR would implement an HCP and receive an incidental take permit for spotted owls, marbled murrelets, and other federally listed species throughout the planning area, as issued by the Services, for 70 to 100 years (See Implementation Agreement). DNR would enter into an agreement on unlisted species which may occur on DNR-managed lands within western Washington. The conservation plan would ensure that specific habitat conditions were achieved where designated, and DNR would be relieved of the prohibition against take for the permitted species. DNR would set objectives for management to implement specific conservation strategies for the following habitats: spotted owl nesting, roosting, and foraging; spotted owl dispersal habitat; riparian and aquatic habitat; and nesting habitat for marbled murrelets.

Under this alternative, DNR would receive an incidental take permit from USFWS for northern spotted owls, marbled murrelets and other listed species (see p. 1-1). DNR would implement the conservation strategies in accordance with an approved HCP. A science-based conservation plan would replace the case-by-case survey requirements for compliance with ESA. Alternative B is described in greater detail in the proposed draft Habitat Conservation Plan.

DNR would provide a mix of habitat types benefiting other species and would be assured by USFWS and NMFS that additional species occurring on DNR-managed lands in western Washington would be included under the permit if listed. Thus, under this alternative, DNR would gain regulatory certainty by entering into an agreement covering presently unlisted species that might become listed during the term of the HCP. Chapter 4 of this draft EIS provides a detailed examination of the environmental consequences associated with Alternative B in order to permit a comparison of the reasonable alternatives and the No Action alternative. The results of this analysis are summarized in a matrix at the end of this chapter.

Washington State Forest Practices Rules and the policies of the Board of Natural Resources as described in the Forest Resource Plan policies (1992) would continue to guide DNR's forest management activities in programs and locations not addressed in the HCP.

The conservation strategies contained in Alternative B are derived in large part from the conceptual description of "HCP Option #1" which is contained in the recommendations of the HCP Science Team that advised DNR during the scoping of the HCP (DNR 1995e). The following describes the main features of the proposed alternative. (See Table 2.5.3)

Northern Spotted Owl

The intent of the spotted owl conservation strategy under Alternative B is twofold. First, the strategy is intended to provide nesting, roosting, and foraging (NRF) habitat and dispersal habitat in strategic areas such that the conservation objectives of demographic support, maintenance of species distribution, and dispersal are achieved. Second, in areas designed to provide NRF habitat, DNR will seek to create a landscape in which active forest management plays a role in the development and maintenance of the structural characteristics that comprise such habitat. To accomplish this actively managed spotted owl landscape, the strategy includes a research phase, a transition phase, and an integrated management phase.

There are four main components of DNR's conservation strategy for the northern spotted owl: identification of DNR-managed lands most important to spotted owl conservation, determination of habitat goals for areas established to provide NRF habitat, development of guidelines for management activities allowed within NRF habitat areas; and, development of guidelines for provision of dispersal habitat. Several scenarios are possible in the actual application of this strategy. It is important, therefore, to read the draft Habitat Conservation Plan for details. In general, in areas designated to provide NRF habitat, DNR will manage its trust lands to provide a target condition of at least 50

percent NRF habitat within each landscape. Specific provisions are also applied to nesting habitat within these areas.

The conservation strategy for spotted owls on the east slopes of the Cascades is constructed on the same principles as that for western Washington. Differences in the strategy between eastern and western Washington arise from differences in forest ecology and spotted owl habitat ecology on the east versus west side of the Cascades. Matrix 1a provides additional information about the proposed spotted owl habitat management under Alternative B.

Marbled Murrelet

Under this alternative, DNR would implement an interim strategy that includes deferral of all timber sales that meet a minimum definition of marbled murrelet nesting habitat until the habitat relationship studies are completed for each planning unit in western Washington.

Unlike the definition used in the No Action alternative, the interim definition of potential nesting habitat in Alternative B refers to suitable habitat blocks as contiguous forested areas that: (1) are at least 5 acres in size; (2) contain an average of at least two potential nesting platforms per acre; and, (3) are within 50 miles of marine waters. The Alternative B definition of nesting habitat is a more conservative definition than that used in Alternative A.

During the interim period, a 2-year habitat relationship study would be conducted in each planning unit. The studies would sample the vegetation and conduct protocol surveys in all forest types that might potentially be used by murrelets. Data produced from these studies would be used to identify the sites with the lowest probability of occupancy (marginal habitat) and that, from this sample, would be predicted to contain 5 percent or less of the actual occupied sites that exist on DNR-managed lands within the planning unit. These sites would be released from deferral as soon as the habitat relationship study is completed for that planning unit. Every acre of the remaining suitable habitat (which would be expected to contain at least 95 percent of the occupied sites with the highest probability of occupancy) would be surveyed using a standard survey protocol acceptable to the USFWS. Once these intensive surveys are completed, surveyed unoccupied habitat would be available for harvest if the harvest adheres to all other provisions of the HCP.

Upon completion of the habitat relationship studies and inventory surveys within each planning unit, a long-term conservation plan would be developed for each planning unit and the HCP ammended.

Riparian and Aquatic Ecosystems

The riparian strategy for Alternative B applies to the five west-side planning units only. Alternative B does not propose a riparian strategy for the east side, rather it continues DNR's current management of riparian and wetland habitats (same as No Action). As a result, DNR is not seeking an agreement from the Services on unlisted species occurring on the eastern slopes of the Cascades.

Under Alternative B, DNR proposes a riparian strategy for western Washington that is designed to maintain healthy riparian ecosystems with an emphasis on providing quality salmonid habitat. The strategy assumes that while salmonids live in the aquatic environment, their welfare is directly dependent on how well the entire riparian ecosystems is functioning. The riparian strategy proposed in this alternative is intended to reduce the likelihood that DNR's management would be disrupted in the event that salmonids are listed as threatened or endangered in western Washington.

Alternative B addresses the protection of unstable slopes and wetlands. Alternative B would likely provide greater protection to the riparian ecosystem by specifying the parameters for management activities. Comprehensive landscape-based road network management plans would be developed for designing and routing road systems. Two-thirds of DNR-managed forest land in the significant rain-on-snow zone would be maintained in a hydrologically mature condition, as applied to drainage basins that are approximately 100 acres in area. There are some exceptions to this which are described in the draft HCP.

Under the proposed alternative, riparian management zone widths, specified as a range, would be set for Type 1, 2, 3, and 4 Waters, with the protection of Type 5 Waters being linked to unstable slopes. The riparian zone widths (each side of the stream) would be based on site potential tree height for Type 1 through 3 Waters and 100 feet for Type 4 Waters, with added buffer to protect certain wind-prone areas. The inner 25 feet of the riparian management zone would be a no-harvest area; the next 75 feet would consist of a minimal-harvest area; the remaining portion would be a low-harvest area. By providing a more consistent, and in some cases wider, riparian management zone on all water types compared to No Action, Alternative B would provide greater certainty of protection.

Other species of concern

The conservation of habitat designed to address the needs of spotted owls, marbled murrelets, salmonids and riparian areas contained in this alternative would benefit many additional species. In addition, Alternative B would apply strategies for protecting uncommon habitats, such as talus slopes and caves within the five west-side planning units. Finally, this alternative would provide specific protective measures for the other federally listed, upland species within the range of the northern spotted owl. (See Matrix 1a).

Table 2.5.3: Summary of management under Alternative B

Element	Management under Alternative B: Proposed HCP
Northern Spotted Owl	• Based on strategies designed to contribute to demographic support and species distribution and to facilitate dispersal. • Supports spotted owl populations near federal reserves with 50% nesting, roosting and foraging (NRF) habitat and 50% dispersal habitat developed and maintained in designated areas. • Allows NRF habitat for spotted owls to move over time as other stands reach target conditions within designated landscapes. • Allows management activities within dispersal habitat and some within designated NRF habitat.
Marbled Murrelet	• Proposes interim strategy to preserve options while developing information needed to prepare long-term plans on planning unit basis. • Includes collect of region-specific data through a series of 2-year habitat relationship studies to determine relative importance of various habitat types. • Protects all occupied murrelet sites found during surveys. • Releases for harvest surveyed but unoccupied murrelet habitat.
Riparian Areas	• Protects aquatic and riparian ecosystems (in-stream and streamside) in western Washington by buffering all Type 1 through 4, and some Type 5, Waters. • Establishes riparian zone width based on site potential tree height for Type 1 through 3 Waters, and 100 feet for Type 4 Waters, with added buffer to protect certain wind-prone areas. • Allows commercial management activities in riparian buffer consistent with objective of maintaining or restoring salmonid habitat. • Protects unstable slopes. • Protects wetland acreage and function to meet objective as stated in Forest Resource Plan. • Limits cumulative impacts of management activities by addressing hydrologic maturity in rain-on-snow zones, road network management. • Provides the same as riparian management in eastern Washington as No Action.

A more detailed description of management strategies under Alternatives B, C, and No Action is provided at the end of this chapter in Matrix 1a.

Alternative C (Environmentally Preferred Alternative)

This alternative describes another reasonable alternative, similar to Alternative B but with added conservation, and is considered in detail. Under this alternative, DNR would implement an HCP and receive an incidental take permit for spotted owls, marbled murrelets, and other federally listed species throughout the planning area. DNR would enter into an agreement on unlisted species which may occur on DNR-managed lands in western Washington. Chapter 4 of this draft EIS provides a detailed examination of the environmental consequences associated with this alternative in order to permit a comparison of the reasonable alternatives and the No Action alternative. The results of this analysis are summarized in a matrix at the end of this chapter.

This alternative was designed to provide DNR with a high degree of certainty with regard to ESA compliance; as a result, it places more restrictions on management within designated habitat areas than does Alternative B (see Table 2.5.4). Alternative C is derived in large part from the conceptual description of "HCP Option No. 2" which is contained in the recommendations of the HCP Science Team that advised DNR during the scoping of the HCP (DNR 1995e).

Alternative C was designed to provide a greater likelihood of compliance with the ESA for spotted owls, marbled murrelets, and salmon in comparison with Alternative B. This alternative provides additional protection within areas designated for spotted owl NRF habitat, murrelet habitat, and riparian areas in western Washington. In all other aspects, the objectives of this HCP alternative would be similar to those of Alternative B. DNR would provide a mix of habitat types benefiting other species in western Washington and would be assured by USFWS and NMFS that additional species would be included under the permit if listed.

Northern Spotted Owls

The conservation strategy for spotted owls proposed in this alternative would be similar to those described in Alternative B, with the following additional conservation measures: (1) the addition of experimental management areas in the South Coast Planning Unit; (2) additional NRF areas would be designated in Klickitat Planning Unit to support an existing cluster of owl sites on nonfederal lands; (3) NRF areas would be designated within 2.7 miles of federal reserves in Straits Planning Unit; (4) an increased NRF goal in designated areas of 60 percent level (by WAU) [9]; no active management would be allowed in spotted owl habitat that is of Type A or B quality; (5) the goal for development of new habitat in WAUs that have less than 60 percent habitat on DNR-designated NRF areas would be increased to old-forest standards (forests that are not yet of old forest quality can be managed to speed development of old-forest characteristics); (6) no salvage or forest health risk reduction activities would take place in spotted owl NRF habitat; and, (7) no harvest of habitat that is in excess of the 60 percent goal in a WAU would occur during the spotted owl breeding season to avoid direct harm to nesting pairs and their young. (See Matrix 1a).

[9] WAU is a watershed administrative unit, the basic geographic unit used by DNR for watershed analysis.

Marbled Murrelet

Under Alternative C, DNR would implement an interim "no take" strategy for marbled murrelet habitat while information is gathered for a long-term plan. Conservation strategies for the marbled murrelet under Alternative C would be similar to those described for Alternative B, except that no harvest of marginal habitat or surveyed, unoccupied suitable habitat would occur until long-term plans had been developed and approved for entire planning area. Thus, Alternative C does not take a unit-by-unit approach to long-term planning; rather, it defers harvest until the completion of one long-term plan for murrelet habitat.

Riparian Areas

Alternative C follows a similar, though enhanced, strategy to Alternative B for the protection of riparian habitats on the west side. This alternative would provide riparian management zones on all water types and an additional wind buffer on both sides of the Type 1 and 2 Waters and the larger Type 3 Waters. Alternative C would expand the restrictions on management activities within riparian, wetland, and unstable slope buffers.

Other Species

Alternative C provides the same strategies for uncommon habitats for the west-side planning units and for federally listed species as Alternative B.

Table 2.5.4: Summary of management under Alternative C

Element	Management under Alternative C
Northern Spotted Owl	• Supports spotted owl populations near federal reserves with 60% (NRF) habitat and 50% dispersal habitat developed and maintained in designated areas. • Provides demographic support in more areas by adding acres of NRF habitat for spotted owls to those in Alternative B and by including protection in areas not near federal reserves. • Restricts types of management activities that can occur within designated NRF areas to those that restore or enhance habitat conditions.
Marbled Murrelet	• Follows a sequence of information gathering similar to that defined in Alternative B. • Defers harvest of marginal habitat as well as surveyed but unoccupied habitat until completion of a long-term plan.
Riparian Areas	• Protects aquatic and riparian ecosystems (in-stream and streamside) in western Washington by buffering all Type 1 through 5 Waters and wetlands. • Protects riparian zone width based on site potential as indicated by tree height, with added buffer to protect certain wind-prone areas. • Restricts management activities in riparian areas to those that restore or enhance habitat conditions. • Protects unstable slopes. • Limits cumulative impacts of management activities by addressing hydrologic maturity in rain-on-snow zones, road density, road maintenance.

The following alternatives were considered but not included in the detailed analysis because they did not meet the need and purposes and were not determined to be feasible.

Alternative D: Revisit Previous Board Policies

Under Alternative D, DNR would not propose an HCP, and the Board of Natural Resources would reconsider its current risk-management position with regard to timber sales involving potential habitat. DNR would follow the Washington Forest Practices Rules, and the Board of Natural Resources would rescind or replace the Forest Resource Plan (1992). Under Alternative D, DNR sales practices would challenge federal guidelines for ESA compliance, putting DNR and trust beneficiaries at increased risk of violating the prohibition against take. The potential legal challenges, injunctions, and stop-work orders associated with this alternative would not result in efficient operations or prudent management. Alternative D would increase the likelihood of management

disruptions due to future listings and would not constitute sound, biologically based management for trust lands. Alternative D is not considered to be a reasonable alternative because it does not meet the need or purposes of the proposed action.

Alternative E: HCP for Northern Spotted Owls and Marbled Murrelets Only

Under this alternative, DNR would apply for incidental take permits for spotted owls and marbled murrelets only. DNR would not plan for other species likely to be listed. This alternative was considered and rejected by DNR because it provided only short-term, limited relief. A species-by-species approach would not address the issue of disruptions of DNR's trust management activities as a result of future listings. Because of the diversity of species occurring on DNR-managed lands, this alternative was not considered reasonable. This alternative fails to address the objectives stated in purposes 2, 3, and 4. (See Section 2.2.)

Alternative F: Watershed Analysis-Based HCP

Under this alternative, DNR would propose an HCP using the forest practices watershed analysis process as the strategy to address riparian habitat conservation. The riparian conservation strategy would consist of buffers on fishbearing streams with a varying amount of harvest allowed within the buffers. Widths of buffers would be determined through watershed analysis. No protection would be provided for non-fishbearing streams unless they were associated with unstable slopes. The conservation strategies for the northern spotted owl and marbled murrelet would be similar to those under Alternative B.

There are several reasons why this alternative fails to meet the stated need and purposes. First, the current forest practices watershed analysis process does not consider either riparian or aquatic ecosystems, and at present there is no water-quality module or wildlife module.[10] Second, because of the time and staff necessary to conduct watershed analysis, this alternative does not represent an economically or operationally feasible conservation strategy for 1.6 million acres of DNR-managed forested trust land (containing several hundred watershed units). Finally, many of the lands managed by DNR contain stocks of wild anadromous fish and may contain other aquatic and riparian-dependent species under consideration for listing under the ESA. It is unlikely that the Services would enter into an agreement on unlisted species without added conservation measures or extensive monitoring prior to completion of watershed analysis across all DNR-managed lands. If DNR proposed watershed analysis as the riparian conservation strategy, an extensive monitoring effort would be required to ensure that high quality conditions were achieved and maintained in exchange for the potentially risky conservation approach. Use of the watershed analysis tool as a riparian conservation strategy would not, in and of itself, be consistent with the policies of the Board of Natural Resources as articulated in the Forest Resource Plan (1992) relating to the protection of key nontimber resources.

[10] A water quality module is in draft form and is currently under review by the Timber, Fish, and Wildlife Administration Committee.

After consultation with the USFWS and NMFS regarding the requirements that may be attached to this conservation strategy for fish and other species, DNR determined that it was neither prudent nor feasible to consider it in detail. Further, in order to apply watershed analysis as a conservation strategy throughout western Washington, it was deemed likely by DNR that measures very similar to those described in Alternatives B and C would need to be added -- making this less of a distinct alternative. This alternative was eliminated from further consideration.

Alternative G: Hybrid of Alternatives A and B

Under this alternative, DNR would implement an HCP and receive an incidental take permit for spotted owls and murrelets using the same conservation strategies as in Alternative B, but would employ a different riparian strategy. Under this alternative, DNR would seek an agreement on unlisted species using the riparian strategy described in the No Action alternative as the basis for its conservation of riparian habitat. The Forest Resource Plan policies would guide riparian management; however, DNR would include a comprehensive monitoring plan of riparian habitat. DNR would provide additional clarification and direction to the current policies to ensure that conservation measures benefiting fish and riparian-dependent species are consistently applied. Such clarification and direction is provided in the riparian strategies of Alternative B. Thus, DNR does not consider Alternative G to be a distinct alternative.

Alternative H: HCP Scenarios Based on Proposed 4(d) Special Rule

Alternative H is not considered to be a reasonable alternative. Alternative H encompasses a number of variations on the 4(d) theme. At present there has been no issuance of a special rule under section 4(d) of the ESA. A draft rule relating to northern spotted owls has been circulating for several months at the time of this writing. Under Alternative H, DNR would achieve ESA compliance for the northern spotted owl as directed by the proposed 4(d) special rule. Prior to the final approval of the proposed 4(d) special rule, DNR would continue under No Action since the draft rule is likely to change as a result of public review, making any planning now inefficient. Under Alternative H, DNR would achieve ESA compliance regarding the northern spotted owl only. Therefore, several scenarios could be constructed under Alternative H.

In the event that USFWS's draft proposed 4(d) special rule for the northern spotted owl is adopted in its current form, there would be six Special Emphasis Areas (SEAs) (60 Fed. Reg. 9484 (1995)). Outside the SEAs, DNR would need to maintain 70 acres of suitable habitat around owl site centers. Under one scenario, DNR would prepare six HCPs (and six environmental analysis documents) or one HCP with six planning areas, in order to receive an incidental take permit for spotted owls within the SEAs. It is reasonable to assume that DNR would have to continue to survey proposed timber sales in areas outside SEAs in order to maintain the 70 acres around site centers. Since the proposed 4(d) special rule is for spotted owls only, DNR would continue to avoid take of other listed species wherever they might occur. This scenario fails to adequately address management disruptions resulting from listings of other species, including the marbled murrelet and fish, thus does not meet purposes 3 and 4 (see Section 2.2). While feasible, this alternative would not result in efficient management, nor would it provide the level of relief available under a comprehensive HCP.

A second scenario would consist of applying for an incidental take permit and an agreement on unlisted species with a conservation strategy for the owl based on compliance with the proposed 4(d) special rule, and employing all the non-owl strategies defined in Alternative B. Surveys would be required outside of the SEAs. Under this scenario DNR would not be tailoring an HCP to meet its needs, rather, it would wait for the USFWS to define a set of rules, then follow them.

A third scenario would consist of following the proposed 4(d) special rule guidance for owls in eastern Washington, while in western Washington, DNR would prepare a multispecies HCP as described in Alternative B. DNR would develop HCP strategies for the two eastern SEAs. In the eastern Cascades, outside the two eastern SEAs, DNR would be required to survey for owls and maintain 70-acre circles around documented sites.

In summary, DNR considers the application of draft strategies of a controversial federal rule package to be speculative and therefore not prudent. Furthermore, as noted in Section 2.3, DNR maintains the flexibility to adjust to changing federal regulations under any alternative.

Alternative I: Separate HCPs for Each Trust

Alternative I was not considered a reasonable alternative. Under Alternative I, DNR would prepare a separate HCP for each trust.[11] Separate HCPs for each trust -- or for groups of trusts -- would be an inefficient way for DNR to apply for an incidental take permit or to implement conservation strategies because trust lands are interspersed. Within a township (36 square miles) DNR manages anywhere from one trust ownership to as many as six different trust ownerships. While riparian conservation strategies could be applied similarly for each trust ownership, separate conservation strategies for each territorial species potentially occupying that ownership would need to be developed. Such conservation strategies would need to offset the proposed take with a long-term, biologically based plan to develop and maintain habitat tailored to the particular ownership of the trust. For this reason, it is unlikely that DNR would be able to base spotted owl conservation solely on the strategy of augmenting federal reserves.

Under this alternative, mitigation for incidental take would either be greater for each trust separately or applied across the landscape to each trust in roughly the same way as proposed in Alternative B; as a result, only a negative or neutral impact would be achieved by separating the ownerships. DNR has worked to consolidate trust lands into reasonable management blocks to gain efficiencies in land management, and this alternative runs counter to efficient management and practicability. Separate HCPs would likely hinder DNR's ability to trade among trusts, sell, or transfer lands. In

[11] The major trust beneficiary groups include the Federal Land Grant Trusts, (i.e., Common schools (K-12)); Capitol (public buildings on the Capitol campus); University (University of Washington); Scientific and Agricultural Colleges (Washington State University); Normal Schools (Western Washington University, Evergreen State, Central Washington University, and Eastern Washington University); Charitable, Educational, Penal, Reformatory Institutions; and Forest Board (consisting of lands deeded to the state by counties after nonpayment of taxes).

addition, the preparation of separate HCPs would be impractical and inefficient, requiring redundant SEPA/NEPA documents as well as multiple draft and final HCPs.

Alternative J: Statewide Multispecies HCP for all Trust Lands

DNR chose to limit the geographic scope of the proposed HCP to trust lands within the range of the northern spotted owl. During scoping it was suggested that DNR do an HCP for all 2.1 million acres of DNR-managed forested trust lands statewide. Addressing multispecies issues on both the east and west sides of the Cascades would have expanded the scope of the proposed action beyond what was considered feasible.

Alternative K: Regulatory HCP for Forest Practices

Alternative K was not considered in detail because it is beyond the scope of the proposal. Under this alternative, DNR would propose a regulatory HCP rather than a proprietary HCP. This would expand the scope beyond the lands DNR manages to include all private forest lands in Washington. The Washington State Forest Practices Board, a separate state agency, would have to initiate this alternative. DNR does not consider this alternative to be a feasible or reasonable way to meet its stated need and purposes.

Alternative L: Unzoned Conservation Strategy throughout HCP Planning Area

The unzoned approach was developed to meet the need for landscape-level experimentation on the Olympic Experimental State Forest and is described in Section 2.6. It has been suggested that DNR consider applying the unzoned concept to the other eight planning units within the HCP planning area. Alternative L is not considered to be a reasonable alternative. Under Alternative L, DNR would establish specific landscape targets for conservation of habitat and for timber harvest. No area would be strictly "off-base," although conditions would be placed on areas such as steep slopes. Under this alternative, landscape targets would be set for the development of habitat; however, in landscapes approaching the target, some reduction of habitat would be allowed. Conservation would emphasize the development of future habitat in conjunction with an active research program and adaptive management. Alternative L may not focus on owl habitat where it could be most productive. Alternative L would, however, provide some habitat for late-successional species across all DNR-managed lands in the HCP area. To provide enough owl habitat, it is also likely that landscape targets would be high, resulting in reduced harvest levels. Broadly applying this approach to the other planning units would expand the research program and increase costs beyond what is manageable. DNR considers this approach to be feasible only within the Olympic Experimental State Forest Planning Unit, where it can be tested before broader application is considered.

Alternative M: "Ecoforestry" HCP

Alternative M is not considered to be a reasonable alternative. As discussed above (see Section 2.4), use of ecoforestry[12] is not prohibited under any of the reasonable alternatives. However, it would be uneconomical for DNR to apply the concept of

[12]Ecoforestry is used here as portrayed in the video tape "Natural Selection Ecoforestry" which was submitted to the joint lead agencies during scoping.

"ecoforestry" or "natural selection ecoforestry" as an exclusive management strategy to achieve sustained yields across all 1.6 million acres of trust lands. As more information is developed through U.S. Forest Service trials in Adaptive Management Areas and other research efforts, DNR may consider using "ecoforestry" techniques to achieve specific management objectives regardless of the proposed action.

Alternative N: No Harvest

Under the No Harvest alternative, DNR would achieve compliance with the ESA by not conducting harvest activities, building roads, or other land management activities within or near existing and potential habitat for listed and candidate species. Forested trust lands would be unmanaged in an effort to grow new habitat for listed and candidate species. Under this alternative, DNR would fail to meet its legal obligations to the trusts. This alternative was eliminated from detailed analysis because it does not meet DNR's stated need or purposes.

2.6 Evaluation of Potential Olympic Experimental State Forest Alternatives

One of DNR's stated purposes is to enable DNR to proceed with the implementation of the Olympic Experimental State Forest (referred to as OESF, or Experimental Forest in this section). This includes enabling DNR to conduct management and research activities in areas currently occupied by listed species. Distinct alternatives were considered as a result of the unique objective of the Experimental Forest. Features common to OESF alternatives are the same as described earlier in Section 2.3, with the addition of an explicit information-gathering element. Reasonable OESF alternatives include flexibility to employ a wide range of silvicultural treatments, new harvest technologies, various rotation ages, and other activities needed to promote the experimental nature of the forest. Detailed silvicultural prescriptions will be developed and tested throughout implementation on the basis of the general direction of the selected alternative.

During scoping for the OESF project several alternatives were suggested, many of which are evaluated below. The following alternatives are considered to be outside the scope of the proposal: (1) no harvest of ancient forest within the Experimental Forest; (2) ban all clearcutting within the Experimental Forest; (3) use "ecoforestry" techniques to achieve conservation goals and sustained harvest; (4) use long rotations (150 years) with various harvest techniques and new technologies; and, (5) increase harvest to limits of ESA and conduct no research.

Two planning contexts, zoned and unzoned, were used to generate different alternatives for the Experimental Forest. The concept of establishing special management areas, or zones, for habitat protection has become the prevailing strategy for forest management. As with the two reasonable HCP alternatives for other planning units (Alternatives B and C above), DNR could apply this strategy to retain and develop habitat areas in order to meet the needs of owls, murrelets, and riparian-dependent species within the Experimental Forest. Owl conservation zones would include varying objectives designed

to provide nesting, roosting, foraging, and dispersal habitat. Owl zones would attempt to cluster owl nesting sites and to develop habitat areas adjacent to federal owl reserves established in the President's Forest Plan (USDA and USDI 1994b).

The concept of an unzoned forest is viewed as more "experimental" than a zoned approach. It is based on the integrated management of the Experimental Forest to meet the objectives of trust revenue production and species conservation across the whole forest. The long-term vision of an unzoned forest includes the development of older forest stands that are well-distributed across the whole Experimental Forest. Habitat objectives would be met on an individual landscape scale and would be connected through association with the stream network.

In order to meet the purpose of enabling DNR to build new knowledge from the Olympic Experimental State Forest (see p. 2-3, no. 5), 10 alternatives were originally considered. (See Table 2.6.1). Three distinct alternatives are analyzed in detail for the OESF Planning Unit. In addition to the No Action alternative, two action alternatives were designed to enable forest-wide experimentation; they are referred to as Unzoned and Zoned. Following a description of these three alternatives is a discussion of seven additional alternatives that were considered but did not meet the need and purposes. These alternatives apply only to the Olympic Experimental State Forest Planning Unit. Matrix 1b at the end of this chapter summarizes the management strategies under OESF Alternatives 1, 2 and 3.

Table 2.6.1: Key to potential alternatives related to Olympic Experimental State Forest (OESF)

Fully Developed Alternatives: 1 - 3	
1. Alternative 1: No Action Continue under current management direction, same as Alternative A. Continue current level of research activities consistent with FRP Policy No. 40 without emphasizing OESF as focal point for experimentation. Do not concentrate effort to integrate commodity production with conservation, or to integrate other unique aspects of the OESF.	
2. Alternative 2: Unzoned Forest Initiate innovative program of experimental management, research, and habitat restoration activities throughout 11 landscape units. Comply with ESA by implementing long-term plan, minimize take of listed species, and provide habitat that benefits listed and unlisted species.	
3. Alternative 3: Zoned Forest Initiate experimental management, research, and restoration activities across majority of DNR-managed lands in OESF. Conduct limited research activities within zones designated to support clusters of spotted owl pairs. Comply with ESA, same as OESF Alternative 2.	
Alternatives Eliminated from Detailed Analysis: 4 - 10	
Potential OESF Alternative	Why Eliminated?[1]
4. Research permit for spotted owls	Does not meet purposes 1,3,4,5
5. Scenario based on proposed 4(d) special rule	Does not meet purposes 4,5
6. Implement recommendations of the Commission on Old Growth Alternatives	Does not meet purposes 3,4,5
7. Plan under HR 4489	Does not meet purposes 4,5
8. Transition from Zoned to Unzoned	Does not meet purposes 1,5
9. Plan similar to Federal Ecosystem Management Assessment Team (FEMAT) recommendations	Does not meet purposes 1,5
10. No harvest	Does not meet purposes 1,5

[1] See page 2-3 for list of six purposes.

OESF Alternative 1

This alternative is the same as Alternative A described in Section 2.5. (See Table 2.6.2.) Under the No Action alternative, DNR would continue to manage lands within the Experimental Forest area according to existing policy and external regulatory control. No federal permits would be sought to enable DNR to conduct experimental management activities in potentially suitable spotted owl or marbled murrelet habitat. DNR would

conduct small-scale experiments involving second-growth stands, as mandated under FRP Policy No. 40. Also, under the Forest Resource Plan (1992), DNR is beginning to use a landscape planning process to identify landscape-level objectives consistent with department policies and to coordinate local management activities around these objectives. Initial working boundaries have been identified in DNR's Olympic Region. Eleven of these fall within the OESF boundaries.

When DNR's Forest Resource Plan was written, the department was already developing plans for an Olympic Experimental State Forest. Although a management plan was not yet adopted, it was assumed that a recommendation by the Commission on Old Growth Alternatives for Washington's Forest Trust Lands (1989) to defer harvest on 15,000 acres of mature timber within the proposed boundaries would be part of that plan; the department has been deferring harvest within the agreed-upon 15,000 acres since 1991. The deferral was to continue for 15 years (until 2005). At that time, the Board of Natural Resources would determine whether the deferral should continue and would base the decision on research results gained within the OESF. Since the larger OESF program, including the old growth research component, was not implemented as intended due to ESA restrictions, it is unclear what criteria will be used by the Board to make this determination. Nevertheless, the 15,000-acre deferral is part of the No Action alternative.

Northern Spotted Owls
Under this alternative, DNR would follow the management strategy described in Alternative A. Within a spotted owl site center (2.7 miles radius) no harvest would occur if existing habitat is equal to or less than 40 percent of the total area. Two-year surveys would be conducted to identify owl sites.

Marbled Murrelet
The conservation strategy for marbled murrelet under No Action in the OESF is the same as described in Alternative A.

Riparian Areas
In the past 5 years, field staff of DNR's Olympic Region have implemented significantly greater protection of streams and riparian areas than is required by Washington Forest Practices Rules for riparian management zones (WAC 222-30-020(3). This level of protection on DNR-managed lands is consistent with actions to minimize disturbances of unstable channel margins and adjacent hillslopes, as required by WAC 222-16-050 and direction given by the Board of Natural Resources through the Forest Resource Plan (DNR 1992b). The special protective measures have been applied because of a high potential throughout the OESF for mass wasting and tree blowdown.

The No Action alternative for managing riparian areas in the OESF consists of the following:

(1) riparian buffers on all stream types, the widths of which are based on ground protection required to minimize disturbance of unstable channel margins and adjacent hillslopes (referred to as the "interior-core buffer");
(2) routine road maintenance;

(3) protection of nonforested wetlands, as well as some forested wetlands and bogs;

(4) a sidecast-pullback program for maintaining and reducing failure potential of sidecast-constructed roads;

(5) landscape planning, under way in one of 11 landscape planning units within the Olympic Experimental State Forest;

(6) an in-stream restoration program in the Hoh basin, (COHO project; see Chapter 4); and,

(7) several different forms of watershed assessments leading to forest-practices prescriptions, including a process designed for state lands within the Usual and Accustomed Areas of the Hoh Tribe (Hoh Tribe and DNR 1993), Washington Forest Practices Board (1995b) watershed analysis, and watershed-assessment methods developed specifically for landscape-planning efforts (e.g., DNR 1995c).

Under this alternative, DNR would continue its present management and operational strategies for minimizing channel disturbances by mass-wasting and windthrow processes, as well as conservation efforts leading toward full implementation of the Forest Resource Plan (DNR 1992b).

Present practices range in different watersheds from Washington Forest Practices Rules minimums (WFPB 1995c) to substantial buffers on all stream types and wetland acreage to address nontimber resource issues and unstable slopes. Today, approximately 55 percent of riparian areas are protected by riparian management zones (i.e., limited-harvest to no-harvest buffers) that have average widths comparable to the OESF interior-core buffers described in Chapter 4 of this draft EIS. The variability in riparian protection across the OESF is due to a lack of detailed mass-wasting and channel condition inventories for all portions of the Experimental Forest and insufficient science staff to assist in the field with analyses of riparian conditions. In addition, DNR is making a transition from a site-specific to a watershed-scale mode of management; consequently, not all riparian areas are treated similarly.

Streamside buffers in the OESF currently exceed the current Washington Forest Practices Rules for Riparian Management Zone (RMZ) widths (WAC 222-30-020(3); WFPB 1995c), especially where they incorporate unstable ground. The intent of these buffers is to protect all unstable ground associated with riparian systems. These riparian buffers are actively managed to promote windfirm, structurally and compositionally diverse streamside forests capable of maintaining bank stability and functioning ecologically. For example, most Type 4 and 5 Waters located in proposed harvest areas with local slopes exceeding approximately 70 percent have been, or will be, protected by no-harvest or limited-harvest buffers.[13] Buffer widths for Type 5 Waters currently are determined on the ground by qualified staff and average 105 feet wide. Harvest practices in these areas are not likely to change until a mechanism is invented for stabilizing ground that naturally is prone to failure. Furthermore, current practices in the Olympic Region often provide

[13] This is due to the recurrence and severity of landslides and debris flows that originate in the headwalls of such drainages (e.g., see Benda 1993; Hoh Tribe and DNR 1993; O'Connor and Cundy 1993; Shaw 1993; DNR 1995c; McHenry et al. 1995; S. C. Shaw, DNR Olympic Region, Forks, WA, unpubl. data, 1991-94).

greater protection than Forest Practices RMZs in low-gradient, alluvial stream systems (i.e., Type 1 through 3) because Forest Practices RMZs do not adequately protect incised channel margins, unstable terrace and hillslope margins, and flood-plain wetlands.

Table 2.6.2: OESF management under Alternative 1 (No Action)

Element	OESF Management under Alternative 1
Northern Spotted Owl	• Timber sales are designed to meet level of acceptable risk as determined by Board of Natural Resources. • Two-year surveys conducted on proposed timber sales to collect/update information on owl sites. (There have been no surveys since 1993 in OESF.) • 40% of area within owl circles in habitat is maintianed. As owls move, sites will be added and subtracted. • 15,000 acres of suitable habitat is deferred until 2005.
Marbled Murrelet	• Same as HCP Alternative A.
Riparian Areas	• Due to the physical features of the region, protection of unstable slopes is the key component of riparian conservation strategies. • Unstable hillslopes are protected per Forest Resource Plan and DNR agreement with Hoh Tribe. • Activity within riparian areas ranges from forest practices minimums to substantial buffers is based on site-specific characteristics, per the Forest Resource Plan.
Experimentation	• No concentrated effort.

OESF Alternative 2

Under this OESF alternative (see Table 2.6.3), DNR would receive an incidental take permit and enter into an agreement on unlisted species by including this alternative with the overall HCP proposal as the proposed habitat conservation strategy for the OESF Planning Unit.

Northern Spotted Owl

This alternative would establish specific landscape targets for conservation of northern spotted owl habitat, which would be integrated with harvest level targets through strategic application of harvest techniques and silvicultural treatments. This alternative considers the particular age class distribution on the OESF where roughly 70 percent of the forest is in stands less than 30 years old. Landscape targets would be set for the development of habitat based on a working hypothesis of the quality, quantity, and distribution of potential habitat needed to meet the target. In addition to landscape-level management, forest stands would be managed in such a way that they are potential suitable spotted owl habitat during significant portions of the management cycle. Conservation would

emphasize the development of future owl habitat in conjunction with an active research program and adaptive management in order to learn how to provide robust ecosystem protection as well as timber harvest opportunities across the entire OESF.

Development of an unzoned forest would occur in two phases. The first is considered a habitat recovery phase. During this time each landscape would be managed so that old forest habitat (NRF) exceeds 20 percent of the acres in that landscape and sub-mature and old forest habitat (RF and NRF) together (that is, including the 20 percent above) exceeds 40 percent. The second phase is maintenance and enhancement, during which these same or higher percentages would be maintained within a mosaic of habitat that shifts location over time as guided by analyses and plans for individual landscape planning units.[14] Under the unzoned forest alternative, the OESF would be managed to produce owl habitat as a by-product of the integrated management approach. While threshold amounts are specified in this DEIS, they should not be viewed as targets but as projections; the unzoned approach is an experimental hypothesis.

Under this alternative, the spotted owl strategy would be linked to the riparian and marbled murrelet strategies. Ecosystem protection is intended to derive, in large part, from management directed at maintaining or restoring riparian ecosystem function and older forest conditions across much of the managed uplands. Management of streamside forests, landslide-prone areas, areas important to marbled murrelet conservation, and owl nest groves would be designed to protect or restore ecosystem functions. A long-term effect of the intended management practices will be the development of large areas of older forests, well-distributed across the OESF. Under the Unzoned Forest alternative, larger patches of older forest with greater areas of interior-forest conditions would be developed across the OESF. Interim strategies for marbled murrelet conservation and for riparian ecosystem protection would provide owl habitat in addition to seasonal protection of nest groves. The long-term strategy for murrelet conservation, and its interaction with owl conservation, can not yet be predicted. The 15,000-acre deferral described under Alternative 1 is not part of the OESF action alternatives.

Marbled Murrelet

Marbled murrelet conservation would be identical to that proposed in Alternative B. (See Section 2.5.)

Riparian Areas

The riparian strategy, which is the same for Alternative 2 (Unzoned) and Alternative 3 (Zoned), is a restoration-based long-term effort to find solutions through experimentation and active resource management. The riparian strategy relies heavily on protection of unstable slopes which are common in the majority of drainages on the OESF. The strategy for managing riparian areas includes:

(1) Continuation of the first seven activities listed under Alternative 1 (No Action) above, such that riparian, wetlands, and forest management policies of the DNR Forest Resource Plan (1992) are fully implemented and the HCP objectives for riparian habitat conservation are achieved;

[14]See Matrix 1b for additional details.

(2) Addition of exterior buffers (on all stream types) outside of the streamside (i.e., interior-core) buffers described under No Action, with their primary purpose being to protect the interior-core buffers from wind disturbances;

(3) A comprehensive road-maintenance plan for each landscape planning unit;

(4) Buffer protection of forested wetlands and enhanced protection of nonforested wetlands; and,

(5) A rigorous program of research and experimentation, designed to foster a better understanding of riparian processes and their land-management-induced modification, specifically with regard to protecting riparian buffers from windthrow and disturbances related to upland management practices.

Management activities in riparian buffers would be limited to those that promote forest windfirmness and support the physical and biological integrity of riparian systems. A principal working hypothesis of this alternative is that buffers designed to minimize mass wasting and blowdown will be sufficient to protect other key physical and biological functions of riparian systems. A primary objective of the research and monitoring program on the OESF is to test this hypothesis.

Other Species

In general, the combination of the spotted owl, marbled murrelet, and riparian strategies is expected to provide conservation for many other species as well. However, some additional strategies are provided for selected species and habitats. These are outlined in Matrix 1b at the end of this chapter.

Table 2.6.3: OESF management under Alternative 2 (Unzoned Forest)

Element	Management Under OESF Alternative 2
Northern Spotted Owl	• Conservation strategy for owls is designed to meet this objective: To develop, implement, test and refine landscape-level forest management techniques in the OESF that support a wide range of forest ecosystem values in DNR-managed commercial forests, including their occupancy by successfully reproducing spotted owls that are a functional segment of the Olympic Peninsula sub-population.
Marbled Murrelet	• Same as Alternative B.
Riparian Areas	• Unstable slope protection is the foundation for a majority of riparian conservation strategies. • Riparian management activities consistent with the objective of maintaining and restoring riparian functions and processes within a commercial forest. • Management activities within riparian zones and wind buffers will be designed, executed, and monitored as experiments.
Experimentation	• Incidental take permit and agreement on unlisted species enable DNR to fully implement an innovative program of experimental management and research. Conservation is integrated throughout management of the OESF.

OESF Alternative 3

Under this OESF alternative (see Table 2.6.4), DNR would receive an incidental take permit and enter into an agreement for unlisted species by including this alternative with the overall HCP proposal as the proposed conservation strategy for the OESF Planning Unit.

Northern Spotted Owls

The zoned conservation strategy for spotted owls is based on near- and long-term conservation of spotted owls in the OESF by special management for nesting, roosting, and foraging habitat to provide for owl pairs within strategically located areas. Size and location of these areas are based on five considerations: (1) the juxtaposition and density of DNR-managed lands and federal reserves at the scale of the size of pair ranges; (2) the presence of existing habitat; (3) an objective to maintain pairs in the coastal lowlands; (4) the locations of currently and recently occupied pair sites; and, (5) the size of pair ranges, and the types and amounts of habitat used by pairs. Each zoned forest area has a specific intended function, such as to support occupancy and productivity by pairs in or adjacent to the Olympic National Park coastal strip to support occupancy and productivity by pairs in this area that bridges the coastal lowlands from upland forests in the interior federal

reserves to the Olympic National Park coastal strip and to support pairs in coastal lowland forests, in or adjacent to the Olympic National Park corridor, pairs in upland forests near Olympic National Park, and pairs in mostly lowland forests around the DNR-managed Clearwater Corridor Natural Area Preserve and the current Kalaloch pair site. Several "special pair areas" are also selected for interim support of occupancy and productivity at selected pair areas.

This strategy incorporates a stratified management design to develop NRF habitat configurations that will attract and support territorial owls, hypothesizing that owls will occupy sites as they become habitable. The habitat developed through this strategy is intended to meet the life needs of owl pairs in the following manner:

Nest Groves - Designed to provide prime habitat for nesting at multiple levels: individual stands, pair ranges, and pair clusters. Possibly more than one nest grove per pair area to provide for alternate nest-sites. About 200 acres in area; 100 percent "old-forest habitat" (following the terminology of Hanson et al. 1993).

Core Areas - Designed to provide prime habitat for provisioning nesting females, nestlings, and fledglings at multiple scales - stand, pair range, and pair cluster. Centered on nest groves. As compact as possible, based on ownership patterns, existing habitat, and management considerations. About 2,000 acres in area, at least 50 percent in sub-mature or old-forest habitat types (following the terminology of Hanson et al. 1993).

Annual Range - Designed to meet annual life needs for pairs. Centered on nest groves. As compact as possible, based on ownership patterns, existing habitat, and management considerations. Minimal overlap with adjoining areas managed as pair sites. About 14,000 acres; at least 40 percent in young-forest marginal or better habitat types (terminology and definitions for habitat follow Hanson et al. 1993).

Special Pair Areas - Designed to maintain or restore (around four of five sites) at least the minimum amount of habitat (young-forest marginal or better) recommended by the U.S. Fish and Wildlife Service (Frederick 1994) to avoid taking owls, 5,708 acres within 2.7 miles of the site center. The prescriptions for these areas may be relaxed when restoration of the areas managed for pair clusters results in threshold types and amounts of habitat in those areas.

Matrix - The rest of the DNR-managed lands will be managed without specific objectives for owl habitat.

The objectives of land management within each of the strata are to support the functions of those areas for resident spotted owl pairs. Management within nest groves will maintain and/or restore old-forest habitat conditions. In core areas, management activities will maintain and/or 50 percent or more of the area to sub-mature and old-forest habitat conditions. Other practices will maintain and/or restore young-forest marginal habitat conditions. Management in the annual range area will maintain and/or restore 40 percent or more young-forest marginal, sub-mature, and old-forest habitat conditions, including those stands in the nest groves and core area. Management practices within the

annual range may detract from habitat capability if they do not conflict with objectives for this stratum.

Management outside the special owl zones will be directed by other conservation, revenue, and information-gathering objectives. However, the conservation of riparian ecosystems and the interim strategies for marbled murrelet conservation will provide additional owl habitat. The long-term marbled murrelet strategy and the effects of its interaction with owl conservation can not yet be predicted.

Marbled Murrelet
Marbled murrelet conservation would be similar to that proposed in Alternative C (see Section 2.5).

Riparian Areas
The riparian strategy would be similar to the strategy described under Alternative 2. It relies heavily on protection of unstable slopes which are common in the majority of drainages on the OESF. Riparian protection would consist of a restoration-based strategy and a long-term effort to find solutions through experimentation and active resource management.

Other Species
In general, the combination of spotted owl, marbled murrelet, and riparian strategies are expected to provide conservation for many other species as well. However, some additional strategies are provided for selected species. These are outlined in Matrix 1b at the end of this chapter. Species associated with older forests will be concentrated in the owl zones.

Table 2.6.4: OESF management under Alternative 3 (Zoned Forest)

Element	Management under OESF Alternative 3
Northern Spotted Owl	• Designate specific areas for spotted owl conservation within which management and active research activities are limited.
Marbled Murrelet	• Same as Alternative C.
Riparian Areas	• Unstable slope protection is the foundation for a majority of riparian conservation strategies. • Riparian management activities consistent with the objective of maintaining and restoring riparian functions and processes within a commercial forest. • Management activities within riparian zones and wind buffers will be designed, executed, and monitored as experiments.
Experimentation	• Initiate experimental management, research, and restoration activities across a majority of DNR-managed lands in the OESF. Conduct limited research activities within zones designated to support clusters of spotted owl pairs.

The following OESF alternatives were considered but not included in the detailed analysis *because they were not considered* to be reasonable.

OESF Alternative 4: Research Permit for Spotted Owls

Under this alternative, DNR would not seek incidental take permits or unlisted species agreements. DNR would continue to manage within the OESF area under the No Action alternative, but it would apply for "scientific permits" allowed under the ESA for specific research projects in habitat. Such scientific permits would be narrow in scope and are generally used to cover such actions as banding individual birds. Alternative 4 does not address possible disruptions resulting from future listings. This alternative would not enable DNR to conduct experimental management activities at the landscape level. This alternative does not provide the regulatory relief or the flexibility to enable the implementation of the Olympic Experimental State Forest. Thus, it does not meet the need or purposes.

OESF Alternative 5: Scenario Based on Proposed 4(d) Special Rule

Alternative 5 is similar to Alternative H described above for the other eight planning units. According to the draft rule proposal currently circulating from USFWS, the vast majority of the OESF would be within a Special Emphasis Area (SEA). Thus, under such a 4(d) rule, DNR would have a choice of complying with owl circles (similar to No Action) or preparing an HCP for spotted owls. Under this alternative, DNR would either wait until the final rule is adopted and then pursue an HCP for spotted owls within the

SEA, or start now to prepare an HCP, assuming that the final rule will resemble the draft rule.

OESF Alternative 5 fails to adequately address management disruptions resulting from listings of other species, including the marbled murrelet and fish. While feasible, this alternative would not result in efficient management, nor would it provide the level of relief available under a comprehensive HCP.

OESF Alternative 6: Implement the Recommendations of the Commission on Old Growth Alternatives

Under this alternative, DNR would resume work on a management plan for the Experimental Forest as described in the 1989 report of the Commission, to attain the goal of a projected, separate sustained yield of 145 million board feet. This alternative describes a course of action that was feasible prior to the listing of the spotted owl in 1990, the marbled murrelet in 1992, and heightened concern for salmon. Under this alternative, it is likely that DNR would risk violating the ESA's prohibition on take. Given the current prohibitions on take of listed species and the negotiated agreements, this alternative is no longer considered reasonable by DNR. In addition, this alternative would not reduce management disruption in the event of future listings affecting the OESF.

OESF Alternative 7: Plan under HR 4489 (Public Law 102-436)

Under this alternative, DNR would propose a separate research and management plan for the Olympic Experimental State Forest. DNR would design a plan to cover all the elements outlined by Congress in HR 4489 and would achieve relief from ESA restrictions for spotted owl habitat.[15] DNR would not achieve relief for species other than the spotted owl through this planning effort. This alternative would not reduce management disruption in the event of future listings affecting the OESF. OESF Alternative 7 is not considered a reasonable alternative because it does not meet the stated purpose (p. 2-3 no. 5). Due to the restrictions on research and management activities within marbled murrelet habitat, this alternative would not enable DNR to conduct large-scale experimentation.

OESF Alternative 8: Transition from Zoned to Unzoned Forest

Under this OESF alternative, DNR would receive an incidental take permit and an agreement on unlisted species by including this alternative with the overall HCP proposal as the proposed conservation strategy for the OESF Planning Unit. Under OESF Alternative 8, DNR would start with the protection of basic owl zones as described in OESF Alternative 3 (Zoned) but would also begin to develop habitat objectives in all 11 landscape planning units across the Experimental Forest, as described in OESF Alternative 2 (Unzoned). The result would be retention of most of the currently occupied owl and murrelet habitat in the Experimental Forest until habitat targets are reached on all landscapes. Marbled murrelet conservation would be similar to that proposed in

[15] A brief history of the Congressional action along with the complete text of this legislation is contained in the March 1995 briefing materials for the Board of Natural Resources (DNR 1995f).

Alternative C (see Section 2.5). The riparian strategy is common to all OESF action alternatives.

The transition from a zoned to an unzoned forest would likely result in a limited harvest for the first five or six decades in all landscape units because of the disparity in age classes across the OESF. When potential harvest levels are considered, the zoned and unzoned alternatives are relatively similar in the amount of area unavailable for harvest during the early decades. However, under Alternative 8 *both sets* of constraints are applied in order to create the zoned owl areas *and* begin developing the habitat to meet landscape-level targets for the unzoned strategy. As a result, the amount of timber that would be available for harvest during the early decades under either strategy alone is reduced by nearly half under Alternative 8. This alternative is not considered reasonable because of the constraints on experimentation in habitat and the limited revenue generation to the trusts during the next 50 or more years.

OESF Alternative 9: Plan Similar to Forest Ecosystem Management Assessment Team

Under Alternative 9, DNR would prepare a plan that uses an approach similar to that recommended by the Forest Ecosystem Management Assessment Team (FEMAT) and that avoids most old growth harvest. This alternative would provide substantial protection for species and habitats, and would place little emphasis on manipulative research in habitat. This alternative would not enable DNR to conduct experimental management activities at the landscape level. DNR would invest in habitat restoration and habitat acceleration actions in young forest stands. This alternative is similar to the conservation strategy employed within designated U.S. Forest Service reserves. However, FEMAT was responding to legal direction applicable to federal forest lands. DNR-managed lands have a different legal mission, and all alternatives being considered must be consistent with that mission. OESF Alternative 9 does not meet DNR's need or purposes and is not considered reasonable.

OESF Alternative 10: No Harvest (Retain all existing habitat and grow more)

OESF Alternative 10 is similar to Alternative 4 except that there would be no harvest activities, including research-related harvests, within currently occupied habitat. This alternative would establish specific landscape targets for conservation of habitat and for timber harvest, and DNR would begin immediate implementation of landscape targets. Timber sales under this alternative would be limited to thinnings. This alternative is not reasonable because it would not provide DNR the ability to conduct large-scale experiments and would not provide reasonable trust revenue.

Matrix 1a: Management strategies for HCP (excluding OESF)

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Spotted Owl			
Nesting, Roosting, and Foraging (NRF) habitat	Within spotted owl site centers (1.8- or 2.7-mile radius), 40% of total acreage is maintained in suitable owl habitat. The remaining area will be harvested. No additional acreage will become habitat.	202,000 acres designated for NRF function in N. Puget, S. Puget, Columbia, Chelan, Yakima, and Klickitat planning units with at least 101,000 acres (50%) developed and maintained at any time. On the west side, two 300-acre nest patches[1] per 5,000 acres (approximate) of NRF are identified and retained until knowledge is acquired allowing provision of adequate nesting structure while managing entire acreage. Balance of acreage may be sub-mature forests.	337,000 acres designated for NRF function in Straits, N. Puget, S. Puget, Columbia, Chelan, Yakima, and Klickitat planning units with 202,000 acres (60%) developed and maintained in a late-seral forest condition at any time.
Dispersal Habitat	No provision for dispersal habitat.	200,000 acres designated for dispersal function in Yakima, N. Puget, S. Puget, Klickitat, and Columbia planning units with at least 100,000 acres developed and maintained at any time.	172,000 acres designated for dispersal function in Yakima, N. Puget, S. Puget, Klickitat, and Columbia planning units with 86,000 acres developed and maintained at any time.

[1] See draft HCP for details of the nature and configuration of these areas for various planning units.

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Spotted Owl (continued)			
Experimental Areas	No provision for experimental areas.	No provision for experimental areas.	43,000 acres designated for experimental management in S. Coast Planning Unit.
Marbled Murrelet			
West-side units and OESF unit	Continuation of take-avoidance policy through deferral of most potentially suitable nesting habitat (no harvest of potential suitable habitat within 40 miles of marine waters and case-by-case review of sales involving potential habitat between 40 and 52.25 miles for indeterminate period of time). DNR would currently conduct habitat relationship studies.	Interim strategy that preserves options for consideration in long-term management plan while complying with the ESA and providing some interim relief to DNR: Step 1 - identify and defer harvest of any potentially suitable murrelet habitat within 50 miles of marine waters. Step 2 - conduct a 2-year habitat relationship study in each planning unit to determine the relative importance of various habitat types. Step 3 - marginal habitat types expected to contain a maximum of 5% of the occupied sites on DNR-managed lands within that planning unit available for harvest without survey for murrelets. No known occupied sites will be harvested. Step 4 - All acres of suitable habitat types not made available for harvest in Step 3 receive a protocol murrelet inventory survey to locate occupied sites. Surveyed, unoccupied habitat available for harvest. No known occupied sites will be harvested. (continued)	Same as Alternative B except additional options would be maintained for consideration in long-term management plan by the following additions: (1) no harvest of marginal habitat would occur until long-term plan is developed and approved; and, (2) no harvest of surveyed, unoccupied habitat would occur until long-term plan is developed and approved.

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Marbled Murrelet (continued)			
West-side units and OESF unit (continued)		Step 5 - All available information, including that collected in Steps 1-4, used to develop a long-term management plan for marbled murrelets.	
Riparian			
Riparian Protection Area (west-side planning units)	Continued implementation of Forest Resource Plan; conservation strategies range from Forest Practices regulations minimums to substantial buffers applied on a site-specific basis. Review of 129 sales since implementation of FRP began shows no harvest riparian in management zones of following size on each side of stream: (1) Types 1 and 2 Waters, average riparian management zone width = approx. 196 feet, range = 0-350 feet. (2) Type 3 Waters, average riparian management zone width = approx. 85 feet, range = 0-300 feet. (3) Type 4 Waters, average riparian management zone width = approx. 55 (continued)	Riparian management zones (each side of stream) defined as: (a) Type 1, 2, and 3 Waters, width = height of site tree at age 100 years or 100 feet, whichever is greater, (b) Type 4 Waters, width = 100 feet; and, (c) Type 5 Waters are protected "where necessary" according to FRP. Wind buffers added on windward side of riparian management zone where there is at least a moderate potential for windthrow: (a) Type 1 and 2 Waters, wind buffer width = 100 feet; (b) Type 3 Waters that are greater than 5 feet wide, wind buffer width = 50 feet. Riparian management zone activities: (a) no harvest except for restoration within first 25 feet, (b) minimal harvest between 25 and 100 (continued)	Riparian management zone defined as: (1) riparian buffers on each side of Type 1 through 5 Waters - width = height of site tree at age 100 years or 100 feet, whichever is greater, (2) wind buffers added on both sides of riparian buffer: (a) Type 1 and 2 Waters, wind buffer width = 100 feet; (b) Type 3 Waters that are greater than 5 feet wide, wind buffer width = 50 feet, and (3) riparian buffer management activities: (a) no harvest within first 25 feet, (b) restoration activities allowed beyond 25 feet.

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Riparian (continued)			
Riparian Protection Area (west-side planning units) (continued)	feet, range = 0-300 feet. (4) Type 5 Waters, riparian management zones on 47% of streams, average riparian management zone width for those streams = 40 feet. Remaining 53% receive no riparian management zones. Range on all = 0-150 feet.	feet, (c) low harvest beyond 100 feet.	
Unstable Hill slopes and Mass Wasting	No timber harvest on unstable slopes unless and until it can be done with no increase in failure rate or severity.	Same as Alternative A.	Same as Alternative A.
Road Network Management	Implement Forest Resource Plan direction to develop and maintain a road system that integrates management needs and controls adverse environmental impacts on the forest environment.	Implement Forest Resource Plan direction to develop and maintain a road system that integrates management needs and controls adverse environmental impacts on the forest environment. Minimize road density based on comprehensive road network management plan.	Same as Alternative B.
Hydrologic Maturity	Hydrologic maturity addressed as part of Forest Practices watershed analysis. This process completed for only a small percentage of DNR-managed land. (continued)	Two-thirds of DNR-managed lands in the rain-on-snow zone, with some exceptions, to be hydrologically mature.	Same as Alternative B.

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Riparian (continued)			
Hydrologic Maturity (continued)	While not a specific requirement, hydrologic maturity is often considered when laying out harvest units, is included on the timber sale environmental checklist, and is part of the landscape planning process.		
Wetlands Protection	Wetlands protected in the future through full implementation of FRP Policy No. 21- "no net loss of acreage or function." Could change if policy is replaced or modified. Buffers provided based on size of wetland: (1) .25-1 acre wetlands, buffer width = 100 feet; and, (2) wetlands larger than 1 acre, buffer width = height of site tree at age 100 or 100 feet whichever is greater. Buffer and forested wetland management activities: (1) maintain at least 120 feet^2 of basal area in wind-firm trees with large root systems; (2) no roading without on-site mitigation; (3) natural surface and subsurface (continued)	Same as Alternative A. and guaranteed for length of HCP.	Same wetland buffers as in Alternatives A and B plus: (1) bogs 0.1-0.25 acres receive 100-foot buffers; (2) small wetlands that are inter-connected or connected to a typed water are buffered; and, (3) wetlands within 200 feet upslope of unstable hill slopes have the buffer width increased by 50% on the half of the wetland closest to the unstable area. Management of forested wetlands and buffers around forested wetlands same as Alternative A plus: (1) the required 120 feet^2 of basal area consists of the most wind-firm dominant and co-dominant trees; (2) maintain a minimum of at least 75 trees per acre; and, (3) no ground-based equipment operation (continued)

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Riparian (continued)			
Wetlands Protection (continued)	drainage conditions must be maintained or restored; and, (4) ground-based equipment generally precluded.		within wetland or 50 feet of wetland edge. Management of buffers around nonforested wetlands same as forested wetlands plus: (1) no harvest within 50 feet of wetland edge; and, (2) no ground-based equipment within 100 feet of bogs.
Uncommon Habitats			
West-side units	No specific provisions for uncommon habitats. Wildlife habitat objectives developed as required under FRP Policy No.22	Same as Alternative A with additional mitigation provided for: (1) talus fields larger than 1 acre: no harvest, 100-foot buffer with maximum harvest of 1/3 (vol.), yarding generally cannot physically disrupt talus, includes provision for mining of talus and road construction, (2) caves important to wildlife: 250-foot no-harvest buffer around entrance, 100-foot no-harvest buffer around passages that may be disturbed by surface activities, new caves explored and mapped prior to management; (3) cliffs: mining of rock from cliffs for road construction avoided when materials can otherwise be reasonably acquired, site-specific prescriptions developed; (continued)	Same as Alternative B.

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Uncommon Habitats (continued)			
West-side units (continued)		(4) oak woodlands: retention of large dominant oaks, maintenance of 25-50% canopy cover, encroaching conifers removed, dead and dying oaks retained, prescribed burns where appropriate; and, (5) very large, old trees: large trees will be specified for retention with preference given to wildlife trees; applicable safety standards will be followed; attempt will be made to retain at least 2 live trees per acre harvested and at least 1/2 of the trees retained from the largest diameter class available; leave trees may be clumped.	
Other Federally Listed Species			
West-side units, east-side units, and OESF	Other federally listed species protected through meeting requirements of federal and state laws and the development of bald eagle site management plans.	Other federally listed species protected through meeting requirements of federal and state laws and the development of bald eagle site management plans, plus spotted owl, marbled murrelet, and riparian conservation strategies and additional mitigation for: (1) peregrine falcon: site-specific protection with restricted access to lands within .5 mile of active aerie and protection of location information; (continued)	Same as Alternative B.

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Other Federally Listed Species *(continued)*			
West-side units, east-side units, and OESF (continued)		(2) gray wolf: establish wolf habitat management area and develop plans to limit human disturbance for land within 8 miles of documented sightings; and, (3) grizzly bear: establish grizzly bear habitat management area and develop plans to limit human disturbance for land within 10 miles of documented sightings.	
Unlisted Species			
West-side units	Protection will be provided according to state regulations. Additional protection may occur in DNR-designated Natural Area Preserves and Natural Resource Conservation Areas. No specific provisions for unlisted species except for the northwestern pond turtle, sandhill crane, and western grey squirrel under the Washington Forest Practices Act (WAC 222-16-080(1) Unlisted species may be protected through development of wildlife habitat objectives required under FRP Policy No. 22.	Protection will be provided according to state regulations. Additional protection may occur in DNR-designated Natural Area Preserves and Natural Resource Conservation Areas. Unlisted species protected through spotted owl, marbled murrelet, and riparian conservation strategies, protection of uncommon habitats, and additional mitigation for species of concern as follows: (1) harlequin duck: no activity allowed that would appreciably reduce likelihood of nesting success within 165 feet of a known active nest between May 1 and September 1; (continued)	Same as Alternative B.

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Unlisted Species (continued)			
West-side units (continued)		(2) northern goshawk: no activity allowed that would appreciably reduce likelihood of nesting success within 0.55 mile of a known active nest between April 1 and August 31; (3) common loon: no activity allowed that would appreciably reduce likelihood of nesting success within 500 feet of a known active nest between April 1 and September 1; (4) Vaux's swift: trees and snags known to be used as night roosts will not be harvested; (5) myotis bats: trees and snags known to be used as communal roosts or maternal colonies will not be harvested; and, (6) California wolverine and Pacific fisher: no activity allowed that would appreciably reduce likelihood of denning success within 0.5 miles of a known active den between January 1 and July 31 (for wolverine) or February 1 and July 31 (for fisher).	

Matrix 1b: Management strategies for alternatives related to the OESF Planning Unit

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Spotted Owl			
Nesting, Roosting, and Foraging (NRF) Habitat	Two-year surveys conducted on proposed timber sales to collect/update information on owl sites (no surveys since 1993 in OESF). Within spotted owl site centers, no harvest of owl habitat if existing owl habitat in the (2.7 mile) circle is equal to or less than 40% of the total area. Management of non-habitat will result in maintaining these stands in a non-habitat condition. As owls move or survey information shows an owl activity circle has been abandoned, additional acres would be available for harvest (consistent with the regulatory and policy decertification guidelines currently available). 15,000 acres of suitable habitat are (continued)	Emphasis on developing future habitat distributed across the entire 270,000-acre forest through integrated forest management consists of 2 phases: (1) initiate habitat recovery within each landscape until (a) old-forest habitat (NRF) exceeds 20% of the acres; and, (b) sub-mature and old-forest habitat (RF & NRF), including the 20% above, exceeds 40%; (2) maintain and enhance a mosaic of habitat that shifts over time guided by analyses and plans for individual landscape planning units, working to achieve habitat goals at or greater than the 20% and 40% minimum standards. Near-term harvest of potential habitat is not limited by 40% threshold (this will not delay achieving the target since new acres acquire the structures), but is limited by riparian and murrelet (continued)	Emphasis on strategically located areas designated for owl habitat management. Prescriptions to be achieved within the designated areas over time: (1) Nest Grove:100% old forest; each 200 acres in size (5,000 acres total) (2) Core Area: 50% sub-mature or better; each 2,000 acres in size (78,000 acres total) (3) Range Area: 40% young-forest marginal or better; each 14,000 acres (40,000 acres total) (4) Special Pair Areas: 40% habitat within 2.7 miles of five selected owl sites (40,000 acres) *Interim provision:* Special pair areas will not be retained after range areas meet or exceed thresholds.

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Spotted Owl (continued)			
Nesting, Roosing, and Foraging (NRF) Habitat (continued)	being deferred until 2005. Criteria have not been developed for determining whether the deferral will end or be extended beyond year 2005. Initially this decision was expected to be linked with OESF research results, but that portion of the Commission on Old Growth Alternatives' recommendations was not implemented and is not part of No Action.	strategies and 20% old-forest habitat threshold. Guidelines provided for harvest of suitable owl habitat are linked to (a) riparian and marbled murrelet conservation, (b) old-forest habitat thresholds, (c) an emphasis on the harvest of habitat being a combination of young- and old-forest habitat scheduled somewhat evenly across the recovery period, and (d) opportunities to learn new silvicultural techniques for achieving habitat goals. Known owl nests will not be disturbed during nesting season.	
Dispersal Habitat	No provision for dispersal habitat.	Provided within the landscape requirements for percentage of young-forest marginal and better habitat.	Provided within the nest, core, and range area requirements.
Experimental Areas	No provision for experimental areas.	Entire forest plays role in innovative experimental management, research and monitoring program.	Conduct limited research activities within zones designated to support clusters of spotted owl pairs. Conduct limited second-growth research activities outside zones.
Marbled Murrelet			
Murrelet Conservation Strategy	Same as HCP Alternative A.	Same as HCP Alternative B.	Same as HCP Alternative C.

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Riparian			
General strategy	Protection of unstable areas by Washington Forest Practices Rules, DNR Forest Resource Plan, and existing agreements (such as the Hoh Agreement regarding unstable slopes).	Resource protection and natural restoration with a long-term effort to find management and conservation solutions through experimentation and active resource management. Laws of general applicability and existing policies and agreements continue to be in effect.	Same as Alternative 2.
Riparian protection	Protection of riparian areas ranges from the minimums allowed by Washington Forest Practices Rules to substantially greater protection to meet site-specific needs. Harvest restrictions range from minimal to maximum (no-harvest) in buffers. Management activities can occur provided that they do not conflict with the Washington Forest Practices Rules and the resource protection objectives of the DNR Forest Resource Plan.	Relies on watershed-level assessments of physical and biological conditions of riparian forests for determining the level of protection over long term. Interim management strategies and buffer-width guidelines provided while assessments are completed. Strategies remain in effect through interim phase landscape planning and implementation of landscape plans. Harvest restrictions range from moderate (partial-cut) to maximum (no-harvest) in buffers. Management activities can occur provided that primary conservation objectives are met.	Same as Alternative 2.

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Riparian (continued)			
Interior-core buffers	Current riparian management areas fall into two categories: (1) those that average 146 feet (slope distance) on Type 1 Waters, 136 feet on Type 2 Waters, 95 feet on Type 3 Waters, 96 feet on Type 4 Waters, and 105 feet on Type 5 Waters [totals approximately 55% of the riparian areas in the OESF]; and, (2) those that fall below these averages. Timber will be removed only when adequate protection can be provided to fish and other nontimber resources, as per Forest Resource Plan.	Interior-core buffers derived from statistical analysis of No Action buffer strategy. Interior-core buffers designed to minimize mass wasting and protect/aid natural restoration of physical and ecological riparian processes and functions. Harvest may occur if it promotes these primary objectives. All Type 1 through 4 Waters and most but not all Type 5 Waters will have interior-core buffers. (Buffers expected to average 150 feet on Type 1 and 2 Waters; 100 feet on Type 3 and 4 Waters; Type 5 Waters will be highly variable.) Working hypothesis is that buffers designed to reduce mass wasting will be wide enough to protect and sustain ecological functions of streams and streamside forest	Same as Alternative 2.

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Riparian (continued)			
Exterior buffers	No provision for exterior buffers.	Exterior-core buffers designed experimentally to protect the integrity of the interior-core buffer from damaging wind disturbances. Initial experimental hypothesis about average widths: Type 1 through 3 Waters = 150 feet; Type 4 and 5 Waters = 50 feet; however, may range from zero to a few hundred. Light partial cutting and experimental harvest allowed.	Same as Alternative 2.
Unstable Hillslopes and Mass wasting	Protected by Forest Resource Plan policies, including landscape planning, and Forest Practices Rules (Class IV-Special).	See interior-core buffer strategies above.	Same as Alternative 2.
Road Network Management	Implement Forest Resource Plan direction to develop and maintain road system that integrates management needs and controls adverse environmental impacts on the forest environment.	Implement Forest Resource Plan direction to minimize adverse environmental impacts from roads. Develop comprehensive road maintenance plans, that include annual inventories of road conditions, aggresive maintenance, stabilization, and access control to minimize management and environmental problems; and controls on (continued)	Same as Alternative 2.

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Riparian (continued)			
Road Network Management (continued)		expansion of road network densities. Consistently apply and, when appropriate, update standards for quality new road construction and appropriate placement based on current and new knowledge and technology.	
Hydrologic Maturity	Forest Practices rain-on-snow regulations are in effect until watershed analysis is conducted; hydrologic maturity issues also may be addressed through landscape planning.	Forest Practices regulations remain in effect. Hydrologic maturity also addressed through landscape planning. Strategy promotes a more diverse mosaic of forest ages and composition across the landscape, for example, partial cuts and multi-age stands. Knowledge gain through research.	Forest Practices regulations remain in effect. Hydrologic maturity also addressed through landscape planning. Multi-age management less evenly applied across the landscape due to zoning older forests for owl habitat and riparian conservation and more intensively managed forests outside owl areas. Knowledge gain through research.
Wetlands Protection	Wetlands will be protected through full implementation of FRP Policy No. 21 - "no net loss of acreage or function." Guidelines for implementation would contain the same protection measures as (continued)	Buffer widths based on average site-potential tree heights. Average buffer widths expected to be 150 feet on forested wetlands greater than 5 acres and 100 feet on forested wetlands 0.25 to 5 acres. Harvest allowed within forested wetlands and (continued)	Same as Alternative 2.

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Riparian (continued)			
Wetlands Protection (continued)	described in HCP Alternative B.	buffers; will retain at least 120 feet^2 basal area and design buffers for windfirmness. No harvest within 50 feet of non-forested wetland's edge. Harvest within remaining buffer will be designed to maintain windfirmness. Leave trees will be representative of dominant and co-dominant species in the wetland's intact forest edge. Conservation strategy to be integrated with research and monitoring strategies.	
Research and Monitoring			
Research and Monitoring	Current level of research activities consistent with FRP Policy No. 40 without special emphasis in OESF. No concentrated effort to integrate commodity production with conservation or to integrate other unique aspects of the OESF.	Initiate innovative program of experimental management, research, and habitat restoration activities throughout 11 landscape units. Initiate clearly defined, structured decision-making process for adapting management in response to new, validated information.	Inititate experimental management, research, and restoration activities across majority of DNR-managed lands in OESF. Conduct limited research activities within: (a) zones designated to support clusters of spotted owl pairs; (b) in riparian and marbled murrelet habitat; and, (c) second-growth stands outside owl zones. The full extent of this research has not been defined; program is assumed to be less than (continued)

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Research and Monitoring (continued)			
Research and Monitoring (continued)			Alternative 2 due to lower expected revenues. Initiate clearly defined, structured decision-making process for adapting management in response to new, validated information.
Uncommon Habitats			
Uncommon Habitats	No specific provisions for uncommon habitats, development of wildlife habitat objectives required under FRP Policy No. 22.	Same as HCP Alternative B treatment of cliffs, caves, talus fields, and very large, old trees, except greater latitude for experimentation related to integrating conservation and production. Attention to protecting known nesting, denning and/or roosting sites, but no special surveys unless unique circumstances. Combined riparian, marbled murrelet, and spotted owl strategies will increase the presence of large, old trees.	Same as Alternative 2.
Other Federally Listed Species			
Other Federally Listed Species	Other federally listed species protected through meeting requirements of federal and state laws, development of bald eagle site management plans (continued)	Landscape-level management, built around riparian, spotted owl, and marbled murrelet conservation, provides primary protection for other federally listed species. (continued)	Same as Alternative 2.

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 *Zoned Forest*
Other Federally Listed Species (continued)			
Other Federally Listed Species (continued)		Additional mitigation for: (1) bald eagle: continue nest-site-management process; and, (2) peregrine falcon: site-specific protection; restricted access within 0.5 mile of aerie; protect location information.	
Unlisted Species			
Unlisted Species	Protection will be provided according to state regulations. Additional protection may occur in DNR-designated Natural Area Preserves and Natural Resource Conservation Areas. No specific provisions for unlisted species. Unlisted species may be protected through development of wildlife habitat objectives required under FRP Policy No. 22.	Protection will be provided according to state regulations. Additional protection may occur in DNR-designated Natural Area Preserves and Natural Resource Conservation Areas. Unlisted species protected through spotted owl, marbled murrelet, and riparian conservation strategies, landscape-level management planning, and protection of uncommon habitats. Conservation primarily derives from integrated, ecosystem-oriented management, rather than directing the nature of that management. Additional mitigation: (1) Vaux's swift: trees and snags known to be (continued)	Protection will be provided according to state regulations. Additional protection may occur in DNR-designated Natural Area Preserves and Natural Resource Conservation Areas. Same as Alternative 2, except conservaton of upland wildlife that are associated with older forests will be concentrated in the owl zones.

	Alternative 1 No Action	Alternative 2 Unzoned Forest Proposed OESF	Alternative 3 Zoned Forest
Unlisted Species (continued)			
Unlisted Species (continued)		used as nests or night roosts will not be harvested; (2) Myotis bats: trees and snags known to be used as communal roosts or maternal colonies will not be harvested; and, (3) Fisher: within 0.5 mile of a known active den between February 1 and July 3, no activity that would appreciably reduce likelihood of denning success. Exceptions to the additional mitigation restrictions related to nesting and roosting are limited to formal, experimental studies designed to address information needs related to integrating conservation and production or as other exceptional circumstances warrant.	

Matrix 2a: Summary of environmental consequences in western Washington (excluding OESF)

Resource	Alternative A No Action	Alternative B - Proposed HCP	Alternative C
FEDERALLY LISTED SPECIES' HABITATS			
Spotted Owl			
Amount & distribution of NRF	Managed on circle-by-circle basis with emphasis on present sites. No intentional creation of new habitat. High risk of loss over long term, with largest loss of potential owl habitat acres when modeled to year 2096. Distribution: dispersed, fragmented.	Owl habitat strategically located to more effectively support population. Some improvement of habitat quality, but potential loss of quality in some areas. Higher certainty than Alternative A of maintaining larger quantity over long term. Length of research phase uncertain. Strategy targets amount and configuration of nesting habitat that meets current research findings for stand and landscape-level needs. Lower reduction in acres of owl habitat than Alt A. Distribution: near federal reserves in western Cascades.	Owl habitat strategically located for effectiveness. Smallest loss of potential owl habitat acres when modeled to year 2096. Some improvement, and no loss, of habitat quality. Risk and potential benefits of designated experimental area. Distribution: near federal reserves in all planning units.
Impacts to present & future sites	No incidental take of current sites. Loss of some sites due to harvest behind shifting circles and natural disturbance. No new habitat created.	Highest potential for incidental take in short term, particularly outside NRF-management areas. Less risk than Alternative A over long term. Habitat conditions improve in areas not currently supporting owls and are maintained at a designated level. NRF areas expected to meet or exceed habitat goals by year 50.	Lower risk of incidental take than Alternative B; but higher than Alternative A. Potential for adding future sites.
Dispersal habitat	No specific provisions for dispersal habitat beyond what exists within owl circles and by coincidence outside.	Includes NRF management areas and Dispersal habitat management areas. Large blocks near and between federal reserves.	Similar to Alternative B, but providing nearly one-third more acreage.

Resource	Alternative A No Action	Alternative B - Proposed HCP	Alternative C
Spotted Owl (continued)			
Demographic support	Individual spotted owl territories supported in less than optimal habitat conditions. Landscape-level habitat increasingly fragmented. Less contribution through time.	Higher long-term contribution and when compared to Alternative A; decreasing short-term contribution due to reduced habitat.	Highest level of contribution toward demographic support over the long term, despite lower contribution in short term.
Maintenance of species distribution	Maintains current range for short term. Range pulls back to near federal lands over long term. Low connectivity throughout.	Range pulls back to western Cascades near federal reserves. Maintains connectivity within western Cascades over the long term. Greater certainty than Alternative A that distribution will be maintained.	Range pulls back to western Cascades and Olympic Peninsula near federal reserves. Maintains connectivity near federal reserves over long term. Greater certainty of maintaining distribution than Alternative A.
Marbled Murrelet			
Protection of potential nesting habitat	Known occupied sites and potential habitat protected under takeavoidance policy; all future options available. Habitat relationship studies will advance knowledge. No guarantee as to future policies; no search for unknown sites. Risk of habitat loss due to disturbance.	More habitat lost in short-term than under Alternative A, but more certainty of long-term habitat protection. Habitat relationship studies advance knowledge. Long-term conservation plan at landscape level increases potential effectiveness of habitat locations. Provides greater certainty of adequate habitat and breeding site protection than Alternative A.	Similar to Alternative B, except retains all options until long-term plan developed. Highest potential for habitat replacement if loss due to natural disturbance. Highest potential for providing adequate habitat and breeding site protection.
Protection and/or enhancement of reproductive potential	High short-term protection of known sites. No certainty as to long-term protection. No effort to actively locate additional occupied sites beyond habitat relationship study. No effort to distribute habitat in meaningful way across the landscape. Overall, low likelihood of protecting or enhancing (continued)	Maintains most options while collecting information needed to develop long-term plan. Intensive survey effort after habitat relationship study increases likelihood of locating breeding sites. Landscape-level planning increases likelihood of adequate protection of reproductive potential.	Similar to Alternative B, except maintains all options until long-term plan developed. Highest likelihood of successfully supporting reproductive potential.

Resource	Alternative A No Action	Alternative B - Proposed HCP	Alternative C
Marbled Murrelet (continued)			
Protection and/or enhancement of reproductive potential (continued)	reproductive potential at level required over long term.		
OTHER FEDERALLY LISTED SPECIES' HABITAT			
Oregon Silverspot Butterfly	Low risk.	Low risk; could benefit.	Low risk; could benefit.
Aleutian Canada Goose (peripheral due to rare occurrence)	General protection under FRP and Washington Forest Practices Rules; inconsistent habitat quality.	Higher protection due to more explicit riparian wetland conservation strategy.	Highest protection due to enhanced wetlands and riparian strategies.
Bald Eagle	Adequate protection of existing eagle habitat. Minimal emphasis on developing future habitat.	More substantial, widely distributed, and potentially effective protection through time due to riparian strategy and retaining very large, old trees.	Highest protection due to enhanced wetlands and riparian strategies.
Peregrine Falcon (peripheral because rarely associated directly w/ forests)	Riparian and wetland protections help maintain prey habitat. Little certainty for future and for undetected nest sites.	Could complement benefits of current practices through protection of cliff habitat and riparian strategy.	Greatest enhancement through riparian and wetlands strategies. Site access limitations and cliff habitat protection.
Columbian White-tailed Deer (not expected to affect unless range expands)	*Should provide adequate* protection of future deer.	*Greater potential for* benefits due to riparian strategy.	*Highest certainty that* future habitat would be provided.
Gray Wolf	No specific consideration given to gray wolf or public access in road strategy.	Improved wildlife and ecosystem conditions (shelter, denning, prey, and individual protection if sighted).	Similar to Alternative B, with stronger riparian contribution.

Resource	Alternative A No Action	Alternative B - Proposed HCP	Alternative C
OTHER FEDERALLY LISTED SPECIES (continued)			
Grizzly Bear (not significant percentage of N. Cascades Grizzly Bear Recovery Zone)	Minimal protection. Provides some protection of habitat important to foraging, travel, resting and hiding opportunities. Subject to disturbance along roads.	Higher occurrence of hiding, resting, and travel cover, shelter, and provisions for prey/forage habitat. Individual protection based on class 1 observations. Still subject to disturbance along roads.	Highest level and greatest certainty for conservation of bear habitat. Still subject to disturbance along roads.
CANDIDATE, STATE LISTED, AND OTHER SPECIES OF CONCERN			
Arthropods			
Beller's Ground Beetle, Long-horned Leaf Beetle, and Hatch's Click Beetle	Some protection to sphagnum bog habitat.	Greater protection of sphagnum bog habitat than Alternative A.	Greater protection of sphagnum bog habitat than Alternative A or Alternative B.
Columbia River Tiger Beetle	Not within planning area.	Not within planning area.	Not within planning area.
Fender's Soliperian Stonefly, Lynn's Clubtail	Not known within planning area; if occurs, some protection given under current riparian management.	Adequate protection.	Substantial protection.
Molluscs			
Newcomb's Littorine Snail	Known areas already protected inside Natural Area Preserves; if elsewhere, some protection of estuarine and wetland habitat.	If found outside NAP, adequate protection.	If found outside NAP, substantial protection.
California Floater, Great Columbia River Spire Snail	Not likely to occur in planning unit.	Not likely to occur in planning unit.	Not likely to occur in planning unit.
Fish			
Anadromous Salmonids	Ranges from low to high protection of various salmon habitat elements.	Moderate to high level of protection for salmon habitat.	High level of protection for salmon habitat.

Resource	Alternative A No Action	Alternative B - Proposed HCP	Alternative C
Fish (continued)			
Bull Trout, Olympic Mudminnow, Pacific Lamprey, River Lamprey	Some protection of spawning and rearing habitats used by these fish.	Adequate, guaranteed protection of spawning and rearing habitats used by these fish.	Substantial, guaranteed protection of spawning and rearing habitats used by these fish.
Green Sturgeon	Not in planning area.	Not in planning area.	Not in planning area.
Amphibians and Reptiles			
Larch Mountain Salamander	No provisions but some protection of talus being provided.	Adequate protection of talus fields expected; substantially more than Alternative A.	Higher protection than Alternative B.
Dunn's Salamander, Van Dyke's Salamander, and Tailed Frog	Some habitat protection provided.	Adequate protection of breeding, foraging, and resting habitats.	Higher protection than Alternative B.
Northern Red-legged Frog, Cascades Frog and, Spotted Frog	Protects some suitable breeding, foraging, and resting habitat.	Adequate protection of breeding, foraging, and resting habitats.	Higher protection than Alternative B.
Northwestern Pond Turtle	Substantial protection of known breeding, foraging, and resting sites.	Protection of both known and unknown sites.	Higher protection than Alternative B.
California Mountain Kingsnake	Currently not at risk since oak woodlands not being harvested; no guarantees.	Some guaranteed protection of breeding, foraging, and resting habitat.	Guaranteed protection of habitat.
Birds			
Harlequin Duck	At least some protection of breeding, foraging, and resting habitats.	Adequate protection of breeding, foraging, and resting habitats.	Substantial protection of breeding, foraging, and resting habitats.
Northern Goshawk	At least some protection of breeding, foraging, and resting habitats.	Should provide suitable breeding, foraging, and resting habitat.	Should provide substantially more habitat than Alternative A.
Sandhill Crane, Black Tern	Provides some suitable foraging and resting habitat for black tern and foraging, resting, and breeding habitat for sandhill crane.	Provides adequate foraging and resting habitat for black tern and foraging, resting and breeding habitat for sandhill crane.	Same as Alternative B.

Resource	Alternative A No Action	Alternative B - Proposed HCP	Alternative C
Birds (continued)			
Olive-sided Flycatcher	Limited habitat provided.	Should provide suitable forest conditions for breeding, foraging, and resting habitat.	Substantially more habitat provided than under Alternative A.
Little Willow Flycatcher	Provides some habitat; no guarantee long term.	Should provide breeding, foraging, and resting habitat.	Same as Alternative B.
Common Loon	Sufficient protection of nesting habitat; not guaranteed.	Substantially greater protection of seasonal nest sites.	Same as Alternative B.
Golden Eagle	Adequate protection of some habitat.	Greater certainty of protection of breeding, foraging, and resting habitat.	Same as Alternative B.
Vaux's Swift	Some suitable snag habitat provided.	Should provide breeding, foraging, and resting habitat; greater certainty and at higher level than Alternative A.	Same as Alternative B.
Lewis' Woodpecker	Small amount of incidental and temporary habitat provided.	Should provide breeding, foraging, and resting habitat; greater certainty and at higher level than Alternative A.	Same as Alternative B.
Pileated Woodpecker	Some suitable snag habitat.	Should provide breeding, foraging, and resting habitat; greater certainty and at higher level than Alternative A.	Same as Alternative B.
Purple Martin	Incidental and temporary provision of snags.	Should provide breeding, foraging and resting habitat; greater certainty and at higher level than Alternative A.	Same as Alternative B.
Western Bluebird	Provides foraging and resting habitat; provides some breeding habitat.	Should provide breeding, foraging and resting habitat.	Same as Alternative B.

Resource	Alternative A No Action	Alternative B - Proposed HCP	Alternative C
Mammals			
Myotis bats and Townsend's Big-eared Bat	Minimal protection of caves and talus.	Should protect breeding, foraging, and resting habitat.	Same as Alternative B.
Western Gray Squirrel	No specific conservation provisions.	Guarantees some protection of breeding, foraging, and resting habitat.	Same as Alternative B.
California Wolverine and Pacific Fisher	Little or no protection except where coincides with protected owl habitat.	Greater protection specific to wolverine habitat.	Same as Alternative B.
Lynx (small likelihood of occurrence)	Incidental protection of habitat.	Incidental protection of known active den sites.	Incidental protection of habitat.
California Bighorn Sheep	No effect expected.	Same as Alternative A.	Same as Alternative A.
Plants			
No special actions being taken for federally listed and proposed endangered and threatened plant taxa.	Very limited ranges, narrow habitat requirements and restricted to very small areas; anticipated they can be effectively managed while meeting other land management objectives through current database process. However, comprehensive inventories are lacking.	Same as Alternative A.	Same as Alternative A.
HABITAT			
Conifer-dominated			
Structurally complex forest	Likely to be provided (estimate 30 percent in 100 years); no guarantee as to amount or quality.	Targets 50 percent for complex forest in designated areas; owl strategy contributes none outside these areas. Additional, but uncertain amount provided from murrelet strategy and greater amount complex forest in riparian areas. (Overall estimate 30 percent in 100 years with some guarantee as to amount and quality.)	Similar to Alternative B, but with estimate of 34 percent complex forest in 100 years.

Resource	Alternative A No Action	Alternative B - Proposed HCP	Alternative C
Conifer-dominated (continued)			
Fully functional ("old")	No guarantee; potentially 16 percent of DNR-managed lands in this state.	Some in 300-acre patches, riparian, unstable slopes and murrelet habitat. (estimate 12 percent of DNR-managed lands, distributed among Dispersal habitat management areas and NRF management areas and in remaining areas.	Greater than 14 percent estimated.
Interior forest	Quantity uncertain; greatest potential in unstable slope areas associated with riparian areas.	Same as Alternative A, but with added potential for significant interior forest in 500-acre patches within NRF management areas.	Somewhat higher than Alternative B, due to no manipulation of older forest type.
Closed-canopy Forest	Ready supply for many decades; changes in rotation age could increase or decrease amount.	Greater certainty for continuing, although dynamic, amount of closed-canopy forests.	Difficult to predict actual quantity, but adequate amounts expected.
Dense-pole Forest	Sufficient quantities expected. Little variation among areas.	Same as Alternative A.	Same as Alternative A.
Regeneration Forest	Sufficient quantities expected. Little variation among areas.	Same as Alternative A.	Same as Alternative A.
Open Forest	Sufficient quantities expected. Some variation in distribution as result of riparian, unstable slopes, murrelet, owl habitat, etc.	Same as Alternative A.	Same as Alternative A.
Wildlife Trees (snags, large wildlife trees, cavities, and downed logs)	Will meet minimums under state regulations.	Adequate quantity expected to develop over time.	Larger quantity and better distribution expected to develop over time.

Resource	Alternative A No Action	Alternative B - Proposed HCP	Alternative C
Riparian and Aquatic Systems			
Detrital inputs	Sufficient riparian management zone widths on Type 1 & 2 Waters to provide detrital inputs. Riparian management zones on Type 3, 4 & 5 Waters may not provide adequate inputs in some places, due to varying widths and composition.	Sufficient riparian management zone widths on Type 1-4 Waters to provide detrital inputs. Type 5 Water width probably adequate on unstable slopes, but may not be on flat ground.	Sufficient riparian management zone widths on all water types to provide detrital inputs.
Large woody debris	Short-term LWD recruitment provided on Type 1 & 2 Waters in most situations; long term less certain due to windthrow and other elements of this strategy. No guarantee of LWD protection on Type 3-5 Waters, although provided in many cases.	Short-term LWD recruitment maintained on most streams; protection on Type 1 & 2 Waters more certain than Type 3-5 Waters. Reduced chance of compromising future recruitment, especially on Type 1, 2, and larger 3 Waters.	Short-term LWD protection provided on all water types. Even stronger protection against compromising future recruitment, especially on Type 1, 2, and larger 3 Waters.
Windthrow	High risk of windthrow (no buffers).	Reduced chance of windthrow on Type 1, 2 and larger Type 3 Waters (windward-side buffers).	Less chance of windthrow than either Alternative A or Alternative B on Type 1, 2 and larger Type 3 Waters (buffers on both sides). Increased chance of protecting fully functional riparian management zone.
Water temperature	Adequate shading provided on Type 1 & 2 Waters. Type 3, 4, and 5 Waters may be adequately shaded, but lack of minimum width means some will not (especially Type 5).	Greater certainty of adequate shading for Type 1, 2, 3, and 4 Waters. Type 5 on unstable grounds probably have adequate shading; those on flat are less certain.	Shading should be adequate on all water types.
Sediment	Riparian Management zones on Type 1 & 2 Waters provide adequate sediment filtering. Type 3-5 Waters have no *minimum width and may* not always provide adequate sediment filtering.	High likelihood of providing adequate sediment filtering. Ground-based harvest activity in forested wetlands buffer *may compromise wetlands* filtering.	High likelihood of providing adequate sediment filtering.

Resource	Alternative A No Action	Alternative B - Proposed HCP	Alternative C
Riparian and Aquatic Systems (continued)			
Sediment (continued)	Potential for high road sediment runoff without comprehensive road management plans. Forested wetland sediment filtering may be compromised by ground-based harvest activity in buffers.		
Stream bank stability	Adequate bank protection likely on Type 1 & 2 Waters. Protection on Type 3, 4, and 5 will vary due to lack of minimum riparian management zone widths.	Adequate bank protection on Type 1-4 Waters, particularly with added wind buffer. Adequate bank protection on Type 5 Waters on unstable slopes, but may not always be adequate on flat ground.	Greater certainty of adequate bank protection on all water types.
Stream flow	Although watershed analysis may result in adequate forest management activity planning related to stream flow over the long term, this is still uncertain and not guaranteed.	Stream flow impacts are more likely to be minimized due to strategies for hydrologic maturity, road management plans, unstable slopes, and riparian management zone widths.	Highest likelihood that stream flow moderation and augmentation will benefit from the combined elements of the riparian strategy.
Less Common Habitat Types			
Oak woodlands	Not currently harvesting these, but no specific provisions about management.	Adequate retention and restoration of existing oak woodlands expected.	Same as Alternative B.
Prairies	No apparent risk, even though no specific provisions.	Same as Alternative A.	Same as Alternative B.
Subalpine and alpine	Little or none that are timbered and/or not already protected.	Same as Alternative A, although potential road management in some of these areas would benefit grizzlies.	Same as Alternative B.
Uncommon Habitat Types			
Caves	No specific protection.	Significant protection of cave habitat.	Same as Alternative B.
Cliffs	No specific protection.	Slightly more protection; potential for some impact to cliff-dependent species.	Same as Alternative B.

Resource	Alternative A No Action	Alternative B - Proposed HCP	Alternative C
Uncommon Habitat Types (continued)			
Very large, old trees	Washington Forest Practices Rules.	Specific retention provision.	Same as Alternative B.
Talus	No specific protection.	Somewhat greater protection than Alternative A; long-term effectiveness of measures uncertain.	Same as Alternative B.
Snags	Washington Forest Practices Rules.	Same as Alternative A.	Same as Alternative A.
Other Resources			
Soil	See Section 4.6.	See Section 4.6.	See Section 4.6.
Air Quality	See Section 4.7	See Section 4.7	See Section 4.7
Water Quality	See Section 4.8	See Section 4.8	See Section 4.8
Cultural Resources	See Section 4.9	See Section 4.9	See Section 4.9
Socio-economic			
Human Resources	See Section 4.10	See Section 4.10	See Section 4.10

Matrix 2b: Summary of environmental consequences in eastern Washington (within HCP planning area)

Resource	Alternative A - No Action	Alternative B Proposed HCP	Alternative C
FEDERALLY LISTED SPECIES' HABITAT			
Spotted Owl	Likely to maintain larger proportion of existing owl habitat and site centers over the short term; but high risk of loss over the long term.	Greater short-term risk to the owl population than Alternative A, but lower long-term risk. Stronger support to owl clusters on federal lands.	Highest certainty to enhance survival and recovery of spotted owls in Eastern Washington Cascades Province.
Amount & Distribution of NRF Habitat	Retains more of the currently existing owl habitat; low certainty as to long-term spatial arrangement and habitat retention.	Removes more of the current habitat, but the spatial arrangement of remaining and future habitat is known. Higher certainty of long-term habitat development and greater chance that the habitat will support territorial owls.	Results in least reduction of current spotted owl habitat. Highest certainty of long-term habitat development and that habitat will support territorial owls.
Impacts to spotted owl site centers	No incidental take. Impacts expected to occur over long term, with losses and no gains to replace.	Impacts expected to occur during first decade. Then habitat development supports remaining sites.	Should cause fewer significant adverse impacts to owl nesting sites over long term.
Future impacts to owl site centers	Contributes little to persistence of owl clusters on federal reserves over long term.	Results in various levels of projected incidental take, but should increase the persistence of owl clusters.	Provides more nesting habitat than Alternative B. Results in various levels of projected incidental take, but should increase the persistence of owl clusters.
Amount and distribution of owl dispersal habitat Amount Distribution	No provision for dispersal habitat beyond what exists in nesting habitat inside owl circles. Low long-term certainty. Widely distributed; high fragmentation.	Greater certainty for long-term maintenance, density and geographic location of dispersal habitat. High long-term certainty. Narrowly distributed; low fragmentation.	Like Alternative B, except more acres provided. High long-term certainty. Widely distributed; low fragmentation.

Resource	Alternative A - No Action	Alternative B Proposed HCP	Alternative C
Spotted Owl (continued)			
Demographic support of population on federal lands	Manages for individual site centers.	Supports owl clusters on federal reserves.	Short-term and long-term support is greater than Alternative A or Alternative B.
Maintenance of species distribution	Maintains owls over greater proportion of range in short term (than Alternative B), but less certain this will be maintained over long term.	Greater short-term risk than Alternative A, but greater long-term certainty associated with the geographic range designed to be maintained.	Guarantees maintenance of owl habitat over widest part of owls' current geographic range.
Impact on range	Moderate short-term range reduction. Large long-term range reduction.	Large short-term, range reduction. Large long-term range reduction.	Small short-term range reduction. Small long-term range reduction.
Risk of catastrophic disturbance	High risk of habitat loss. No replacement of habitat due to natural or human-caused disturbance.	High risk of habitat loss. Guaranteed habitat replacement when loss due to natural or human-caused disturbance.	Same as Alternative B.
Marbled Murrelet			
Conservation Strategy	Does not apply to east side.	Does not apply to east-side.	Does not apply to east-side.
Fish			
No new riparian strategies proposed for eastern Washington.	No change from Forest Resource Plan.	Owl strategy will change spatial distribution and management of late-successional forests, which may affect fish habitat, particularly on Type 5 streams. Forest Resource Plan policy guidance should result in no significant net change from Alternative A.	Same as Alternative B.
OTHER FEDERALLY LISTED SPECIES			
	See Matrix 2a.	*See Matrix* 2a.	*See Matrix 2a.*
CANDIDATE, STATE LISTED AND OTHER SPECIES OF CONCERN			
Spotted bat	Incidental protection only.	Marginally better than AlternativeA.	Same as Alternative B.

Resource	Alternative A - No Action	Alternative B Proposed HCP	Alternative C
CANDIDATE, STATE LISTED AND OTHER SPECIES OF CONCERN (continued)			
Other species	*See Matrix 2a.*	*See Matrix 2a.*	*See Matrix 2a.*
Plants			
No special actions being taken for federally listed and proposed endangered and threatened plant taxa.	Very limited ranges; narrow habitat requirements; restricted to very small areas. Expect plants can be effectively managed through current database process while meeting other objectives. Lack comprehensive inventories.	Same as Alternative A.	Same as Alternative A.
HABITAT			
Conifer-dominated			
Structurally complex forest	Difficult with current data to determine complexity. Estimate 17 percent NRF habitat by year 2096.	Estimate 9 percent NRF by year 2096 (difficult to estimate); greater certainty of amount and distribution than Alternative A.	Greater amounts and better distribution of complex forest than Alternative B and greater certainty than AlternativeA.
Fully functional	Some provided and well-distributed in short term. Over long term, entries and harvest over time may allow removal of most structures required to be fully functional as older forest. Less difference between complex and fully functional than on west side.	Less well-distributed than in Alternative A, but more certain in long term. However, still not guaranteed.	Likely to be more provided, well-distributed, and more certain. However, still not guaranteed.
Interior forest	Some provided within regulatory owl circles although probably not large patches.	Additional interior forest expected beyond what would occur under Alternative A; probably concentrated toward NRF-management areas. May be insufficient for some species across the larger landscape.	Same as Alternative B.
Closed-canopy forest	Expected to provide adequate thermal and hiding cover and other habitat needs.	Basically same as Alternative A.	Basically same as Alternative A.

Resource	Alternative A - No Action	Alternative B Proposed HCP	Alternative C
Conifer-dominated (continued)			
Open, multi-aged stands (more an east-side habitat than west-side)	Relatively common.	Same as Alternative A, though distribution may differ.	Same as Alternative A, though distribution may differ.
Dense-pole forest	Relatively common.	Same as Alternative A.	Same as Alternative A.
Regeneration forest	Difficult to assess the quantity. However, adequate open areas expected.	Same as Alternative A.	Same as Alternative A.
Open forest	Less common where uneven-age management predominates; some expected but difficult to assess potential quantity. Potential loss of quality due to herbicide application.	Same as AlternativeA.	Same as Alternative A.
Wildlife trees (snags, large trees, cavities, and downed logs)	Will meet minimums under state law.	Similar quantity as Alternative A, but higher quality.	Same as Alternative B..
Riparian and Aquatic Systems (including wetlands)			
Riparian and Aquatic Systems (including wetlands)	No change proposed in riparian strategies. No change from Forest Resource Plan.	No change proposed in riparian strategies. Owl strategy will change spatial distribution and management of late-successional forests, which may affect fish habitat, particularly on Type 5 streams. Forest Resource Plan policy guidance should result in no significant net change over Alternative 1.	Same as Alternative B.

Resource	Alternative A - No Action	Alternative B Proposed HCP	Alternative C
Less Common Habitat Types			
Oak Woodlands; Prairies	No specific provisions.	No specific provisions.	No specific provisions.
Subalpine and alpine habitats	Little or no DNR-managed lands in these areas that are timbered; where exists, are in protected status or no harvest planned.	Same as Alternative A.	Same as Alternative B.
Uncommon Habitat Types			
caves, cliffs, talus	No specific provisions.	No specific provisions.	No specific provisions.
OTHER RESOURCES			
Soil	See Section 4.6.	See Section 4.6.	See Section 4.6.
Air Quality	See Section 4.7	See Section 4.7	See Section 4.7
Water Quality	See Section 4.8	See Section 4.8	See Section 4.8
Cultural Resources	See Section 4.9	See Section 4.9	See Section 4.9
Socio-Economic			
Human resources	See Section 4.10	See Section 4.10	See Section 4.10

(Matrix 2b)

Matrix 2c: Summary of environmental consequences in Olympic Experimental State Forest

Resource	Alternative 1 - No Action	Alternative 2 - Unzoned forest (Proposed OESF)	Alternative 3 - Zoned Forest
FEDERALLY LISTED SPECIES HABITAT			
Northern Spotted Owl			
Northern Spotted Owl	Habitat in the OESF area (all ownerships) is predicted to support increasingly more resident owls than currently present. No change in geographic and ecological distribution of owls and their habitat.	Greatest support for owls. Rates of habitat development significantly exceed rates of harvest of habitat. Contributes to broadest geographic and ecological distribution of owls and their habitat. Greatest contribution to overall habitat capability. Some risk of habitat loss from windthrow; trade-off with aggressive effort to expand range and experiment with novel silvicultural prescriptions. Greater potential to gain new knowledge and improve techniques.	Greater support for owls than Alternative 1. Rate of habitat development significantly exceed rates of harvest of habitat. Contributes to broader geographic and ecological distribution of owls and their habitat relative to Alternative 1. Contribution to overall habitat capability, primarily in lower elevation, coastal plain forests in OESF. Greater than three-fold increase in habitat capability on DNR-managed lands.
Abundance and distribution of habitats	Habitat capability declines on DNR-managed lands next 100 years as habitat is redistributed (but it increases across ownerships). No appreciable change in spatial distribution of suitable sites	Habitat quality and quantity increase on DNR-managed land. Overall habitat capability within OESF improves (state and federal); more abundant sites. Expands distribution of suitable sites west and northwest from federal core.	Habitat quality increased on DNR-managed land. Overall habitat capability within OESF improves (within zones and on federal lands) and number of suitable sites increases, although less than under Alternative 2.
Population trends	Forest conditions result in declining population until year 60; begins to climb again as habitat develops on federal lands. None of the alternatives predicted to effect overall size of Olympic Peninsula sub-population in the future.	Current forest conditions result in declining population under all the alternatives until year 60. Stronger recovery in habitat quality after 60 years. Stepwise increase in habitat quality and quantity becomes most significant at 60 years (see habitat evaluations above).	Current forest conditions result in declining population under all the alternatives until year 60. Strongest recovery in habitat quality after 60 years.

Resource	Alternative 1 - No Action	Alternative 2 - Unzoned forest (Proposed OESF)	Alternative 3 - Zoned Forest
Northern Spotted Owl (continued)			
Risk for incidental take of spotted owl sites	Known sites: Technically, no incidental take. But loss of habitat over time and low capability of some existing sites to support pairs long term. Unknown sites: Lowest in the near-term. Future owls: same for all three alternatives (number and location unknown so hard to predict).	Known sites: Landscape-based management allows some harvest of habitat in anticipation of habitat development in landscapes. Higher risk of incidental take during first 60 years than Alternative 3. However, habitat capability increases over life of HCP, stabilizing at higher level than currently exists and providing greater support to owls than Alternative 3. Unknown sites: highest in near term.	Known sites: Potential for low level of take during first 40-60 years. Overall level of take lower into future due to greater habitat capability and management within zones. Unknown sites: slightly greater than Alternative 1.
Marbled Murrelet			
Protection of potential nesting habitat	Known occupied sites and potential habitat protected under take avoidance policy; keeps all future options available. Habitat relationship studies will advance knowledge. No guarantee as to future policies regarding habitat without known sites. No long-term provision to locate new sites. Risk of habitat loss due to disturbance.	Although more habitat lost in short-term than under Alternative 1, there is greater certainty of long-term habitat protection. Habitat relationship studies advance knowledge. Developing long-term conservation plan at landscape-level increases potential effectiveness of habitat locations. Provides greater certain of adequate habitat and breeding site protection than A.	Similar to Alternative 2, except retains all options until long-term plan developed. Highest potential for habitat replacement if loss due to natural disturbance. Highest potential for providing adequate habitat and breeding site protection.
Protection and/or enhancement of reproductive potential	High short-term protection of known sites. No certainty as to long-term protection. No effort to actively locate additional occupied sites beyond habitat relationship study. No effort to distribute habitat in meaningful way across the landscape. Overall, low likelihood of protecting or enhancing reproductive potential at level required over long term.	Maintains most options while collecting information needed to develop long-term plan. Intensive survey effort after habitat relationship study increases likelihood of locating breeding sites. Landscape-level planning increases likelihood of adequate protection of reproductive potential.	Similar to Alternative B, except maintains all options until long-term plan developed. Highest likelihood of successfully supporting reproductive potential.

Resource	Alternative 1 - No Action	Alternative 2 - Unzoned forest (Proposed OESF)	Alternative 3 - Zoned Forest
Other Federally Listed Species			
Aleutian Canada Goose	General protection under FRP and Washington Forest Practices Rules; although inconsistent habitat quality.	Higher protection due to riparian and wetlands strategy.	Same as Alternative 2
Bald Eagle	Adequate protection of existing eagle habitat. Minimal emphasis on developing future habitat.	Higher level of protection and expanded geographic and ecological distribution on the peninsula due to riparian strategy and retention of very large, old trees.	Same as Alternative 2
Peregrine Falcon	Riparian and wetland protections help maintain prey habitat. Little certainty for future and for undetected nest sites.	Increased protection of potential aerie sites and prey habitat.	Same as Alternative 2
Oregon Silverspot Butterfly; Columbian White-tailed Deer; Gray Wolf; Grizzly Bear	Does not apply within OESF planning unit.	Does not apply within OESF Planning Unit.	Does not apply within OESF Planning Unit
CANDIDATE, STATE LISTED, OTHER SPECIES OF CONCERN			
Arthropods			
Arthropods	None of the arthropods discussed are likely to occur in the OESF Planning Units. If Fender's Soliperian Stonefly or Lynn's Clubtail are found, No Action provides adequate protection.	None of the arthropods discussed are likely to occur in the OESF Planning Units. If Fender's Soliperian Stonefly or Lynn's Clubtail are found, Alternative 2 provides substantial protection. Johnson's Hairstreak.	Same as Alternative 2.
Molluscs			
Molluscs	None of the molluscs discussed are likely to occur in the OESF Planning Unit.	None of the molluscs discussed are likely to occur in the OESF Planning Unit.	None of the molluscs discussed are likely to occur in he OESF Planning Unit.

Resource	Alternative 1 - No Action	Alternative 2 - Unzoned forest (Proposed OESF)	Alternative 3 - Zoned Forest
Fish			
Salmon	Moderate to moderately high protection of salmon habitat; low for some elements in some locations.	Moderate to high short-term; high protection long-term as recovery allowed to occur.	Same as Alternative 2.
Bull Trout, Olympic Mud-minnow, Pacific Lamprey, River Lamprey	Adequate protection of spawning and rearing habitats used by these fish.	Same as Alternative 1.	Same as Alternative 2.
Green Sturgeon	Doesn't occur in OESF Planning Unit.	Doesn't occur in OESF Planning Unit.	Doesn't occur in OESF Planning Unit.
Amphibians and Reptiles			
Van Dyke's Salamander; Tailed Frog; Northern Red- legged Frog; Cascades Frog	At least some protection of breeding, foraging, and resting habitat for these species.	Expect substantial protection of breeding, foraging and resting habitat.	Same as Alternative 2.
Larch Mountain and Dnn's Salamander; Spotted Frog; Northwestern Pond Turtle; California Mountain Kingsnake	Not found in the OESF.	Not found in the OESF.	Not found in the OESF.
Birds			
Harlequin Duck	At least some protection of breeding, foraging, and resting habitat for these species.	Expect substantial protection of breeding, foraging and resting habitat; greater certainty as well.	Same as Alternative 2.
Northern Goshawk; Olive-sided Flycatcher	At least some protection of breeding, foraging, and resting habitat for these species.	Additional protection from riparian strategy and emphasis on building older forest component.	Additional protection but more concentrated in specific areas rather than distributed throughout.

Resource	Alternative 1 - No Action	Alternative 2 - Unzoned forest (Proposed OESF)	Alternative 3 - Zoned Forest
Birds (continued)			
Sandhill Crane, Black Tern	Do not occur in the OESF.	Do not occur in the OESF.	Do not occur in the OESF.
Little Willow Flycatcher	At least some protection of breeding, foraging, and resting habitat for these species.	Additional protection of breeding, foraging, and resting habitat due to riparian strategy.	Same as Alternative 2.
Common Loon	Uncommon in the OESF. Adequate nesting and foraging habitat protected.	Uncommon in the OESF.	Uncommon in the OESF. Same as Alternative 2.
Golden Eagle	Provides at least some breeding, foraging and resting habitat.	Provides habitat for all life requisites of the golden eagle; substantially greater than Alternative 1.	Same as Alternative 2.
Vaux's Swift	Will probably leave snags suitable for roosting and nesting.	Provides substantially greater volume of habitat and with greater certainty.	Similar to Alternative 2, although habitat may be less well distributed across the landscape.
Pileated Woodpecker	Incidental and temporary provision of habitat.	Substantially greater provision of habitat and with greater certainty.	Similar to Alternative 2, although habitat may be less well distributed across the landscape.
Western Bluebird and Purple Martin	Uncommon in the OESF. Will likely provide suitable breeding and resting habitat.	Uncommon in the OESF.	Uncommon in the OESF. Same as Alternative 2.
Mammals			
Myotis Bats; Townsend's Big-eared Bats	Minimal protection of bat habitat.	Higher likelihood of providing adequate, protected bat habitat.	Similar to Alternative 2.
Pacific Fisher	Some minimal protection of fisher habitat where it coincides with owl habitat and riparian areas; not guaranteed.	Protection and maintenance of potential fisher habitat more certain and at substantially higher level.	Same as Alternative 2, with somewhat different distribution of habitat.

Resource	Alternative 1 - No Action	Alternative 2 - Unzoned forest (Proposed OESF)	Alternative 3 - Zoned Forest
Mammals (continued)			
Spotted Bat; Western Gray Squirrels; Lynx; California Wolverine and California Bighorn Sheep	Do not occur in the OESF.	Do not occur in the OESF.	Do not occur in the OESF.
Plants			
No special actions being taken for federally listed and proposed endangered and threatened plant taxa.	Very limited ranges, narrow habitat requirements and restricted to very small areas; expected plants can be effectively managed through current database process while meeting other objectives. Lack comprehensive inventories.	Same as Alternative 1.	Same as Alternative 1.
FOREST ECOSYSTEM			
Conifer-dominated			
Structurally complex forest	Estimated 40-50 percent DNR-managed lands will be structurally complex at year 2096.	Estimate 60-70 percent in complex forest by year 2096; well-distributed by landscape planning unit. Greater certainty of quantities than under Alternative 1.	Estimate 60-70 percent structurally complex by year 2096. Concentrated in designated owl zones rather than distributed across landscapes. Greater certainty of quantities than under Alternative 1.
Fully functional	Potential for fully functional forests over age 100 and age 200 that have never been unharvested; no guarantees. Estimate 40-50% over 100 years and 10-15% over 200 years by the year 2096.	Well-distributed across all landscapes. More certain presence than in Alternative 1. Estimate 50-60 percent older forest by year 2096 and 10-15% over 200; some of these natural stands have never been harvested.	Some additional interior forest likely to occur beyond what is expected under Alternative 1; amount uncertain. Estimate 60-70% forest over 100 years, 15 percent over 200 years in 2096. Likely concentrated around strategic locations regarding owls and unstable slope areas.

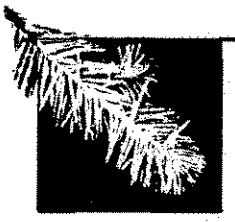
Resource	Alternative 1 - No Action	Alternative 2 - Unzoned forest (Proposed OESF)	Alternative 3 - Zoned Forest
Conifer-dominated (continued)			
Interior forest	Quantity uncertain; greatest potential in unstable slope areas associated with riparian areas.	Potential for highest amount of interior forest due to development of habitat across the landscape as part of unzoned forest strategy; although actual quantity still uncertain.	Somewhat less quantity than Alternative 2 but more than Alternative 1. Amount determined by relationship of nest groves and owl zones.
Closed-canopy forest	Levels will fluctuate with silvicultural activities and natural disturbance. Adequate supply expected short and long term. Effectiveness will depend on distribution across the landscape. 2096 ~ 30-35%.	Adequate supply, though substantially smaller percentage of the landscape than under Alternative 1. Effectiveness will depend on distribution across the landscape. 2096 ~ 5-10%	Similar to Alternative 2, although this alternative provides lowest percentage of closed-canopy forest over the long term. 2096 ~ about 5%.
Dense-pole forest	Quantity decreases over time, retaining about 20 percent of the land in this stage by year 2096. Adequate supply expected.	Greater reduction than Alternative 1, down to about 5-10 percent of the forest mix. Still adequate supply.	Same as Alternative 2.
Regeneration forest	By year 2096, only about 5% or less in this condition.	Retains higher amount of the forest (about 10%) in this condition across the landscape by year 2096.	Same as Alternative 2.
Open forest	No Action will provide about 5% or less open stage at year 2096. Could be loss of quality due to herbicide, though not commonly used now.	About 10-15 percent expected to be in open stage at year 2096.	Same as Alternative 2.
Wildlife Trees (snags, large wildlife trees, cavities, and downed logs)	Will meet minimum protection under state regulations.	Adequate quantity expected. Greater increase in quality than quantity over Alternative 1. Some experimentation to learn more about this component.	Same as Alternative 2.

Resource	Alternative 1 - No Action	Alternative 2 - Unzoned forest (Proposed OESF)	Alternative 3 - Zoned Forest
Riparian and Aquatic (including wetlands)			
Mass wasting and channel-bank instability	Moderate to moderately high level of protection for mass-wasting sites. Lower certainty that interior-core buffers will serve intended purpose.	Same or greater protection than Alternative 1. Greater protection against windthrow. Greater potential for research and monitoring to improve understanding of systems and strengthen management strategies.	Same as Alternative 2.
Windthrow	Variable protection from wind disturbances, ranging from adequate to none.	Greater protection of windthrow-prone riparian areas. Forestry-windthrow interactions will be part of research and monitoring program, creating a potential trade-off in loss of buffer effectiveness for increased knowledge and potential benefits.	Same as Alternative 2
Coarse, woody debris	Potentially sufficient short- and long-term sources of coarse woody debris for streams when FRP fully implemented. Moderate to high protection for long-term recruitment to the floodplain and riparian-forest floor.	Similar to Alternative 1 for interior-core contribution. Increased certainty of adequate supply due to exterior-core buffer. More certain supply of coarse woody debris to riparian floodplain and forest floor over time.	Same as Alternative 2.
Sediment and roads	Moderate level of protection to streams from sedimentation (from mass wasting and road erosion). Hydrologic regime altered by permanent roads.	Moderate to high level of protection to streams from sedimentation (from mass wasting and road erosion). Greater potential for regulating frequency and volume of sediment delivery to streams.	Same as Alternative 2.
Temperature	Potentially adequate shading, although variable due to inconsistent riparian management zone widths.	Increased certainty of adequate shading due to exterior-core buffers in wind-prone areas and emphasis on enhancing conifer component in riparian management zone.	Same as Alternative 2.

Resource	Alternative 1 - No Action	Alternative 2 - Unzoned forest (Proposed OESF)	Alternative 3 - Zoned Forest
Riparian and Aquatic (continued)			
Stream flow	Low potential for regulating road-drainage volumes or water yields associated with timber harvest.	Greatest potential for regulating quantity and timing of surface runoff to streams and for minimizing road-related stream-flow impacts and regulating hydrologic maturity. Potential for new knowledge through monitoring and research.	Greater regulation of water volumes and discharge rates than Alternative 1, but less than Alternative 2.
Nutrient productivity	Expected to provide adequate detrital nutrients to stream channels via the interior-core buffer.	Increased chance to provide adequate detrital nutrients by addition of exterior-core buffers in wind-prone locations and emphasis on enhancing future biodiversity of riparian forests.	Same as Alternative 2.
Microclimate	Inadequate in some areas. Expected to provide at least some of the key parameters on up to at least 94 percent of the streams over time, as current policies become fully implemented.	Increased certainty of providing microclimate parameters due to addition of exterior-core buffer and knowledge from experimental designs.	Same as Alternative 2.
Riparian system functions	Moderate level of protection in most cases.	Greater potential for protection due to more systematic and interdisciplinary approach to designing conservation measures.	Same as Alternative 2.
Less Common Habitat Types			
Oak woodlands; natural prairies	Do not occur in OESF.	Do not occur in OESF.	Do not occur in OESF.
Subalpine and alpine habitats	Little or no timbered DNR-managed lands in subalpine and alpine; no significant impacts expected.	Same as Alternative 1.	Same as Alternative 2.

Resource	Alternative 1 - No Action	Alternative 2 - Unzoned forest (Proposed OESF)	Alternative 3 - Zoned Forest
Uncommon Habitat Types			
Caves	No specific provisions.	Significantly more protection of cave habitats.	Same as Alternative 2.
Cliffs	No specific provisions.	Slightly more protection of cliffs (although cliffs not common in OESF)	Same as Alternative 2.
Talus	No specific provisions.	Somewhat greater protection than Alternative 1; long-term effectiveness of measures uncertain.	Same as Alternative 2.
Very large, old trees	No specific provision.	Significant protection.	Same as Alternative 2.
Snags	Will meet minimum protection under state regulations.	Will meet minimum protection under state regulations.	Will meet minimum protection undedr state regulations.
Other Resources			
Soil	See Section 4.6.	See Section 4.6.	See Section 4.6.
Air Quality	See Section 4.7	See Section 4.7	See Section 4.7
Water Quality	See Section 4.8	See Section 4.8	See Section 4.8
Cultural Resources	See Section 4.9	See Section 4.9	See Section 4.9
Socio-Economic			
Human Resources	See Section 4.10	See Section 4.10	See Section 4.10

3. Environmental Setting



3. Environmental Setting

3.1 Summary of DNR-Managed Lands

DNR manages more than 5-million acres of state-owned lands, including aquatic lands and uplands. Tidelands and beds of marine waters and navigable lakes and streams make up the 2.1 million acres of aquatic lands managed by the department. The 2.9 million acres of uplands primarily consist of lands granted to the state by the federal government at the time of statehood, tax-delinquent timberlands that had reverted to the counties and were transferred to the state, and timberlands purchased to be managed as state forests. These uplands are managed, in trust, for the various beneficiaries. Income is derived from these uplands through leases and the sale of minerals and renewable resources. In addition, DNR manages uplands for Natural Area Preserves, Natural Resource Conservation Areas, Community College Reserves, administrative sites, and recreation areas.

3.1.1 Land Covered by the Proposal

The defined range of the northern spotted owl in Washington State includes lands on the east slopes of the Cascades as well as all of western Washington. The proposed action described in this draft EIS covers DNR-managed uplands within the range of the owl except urban and agricultural lands. Included are federal grant lands, Forest Board lands and Community College Reserves, totaling approximately 1,632,000 acres. Table 3.1.1 indicates the approximate acreage for each category of trust land covered by the proposed draft HCP.

Table 3.1.1: Approximate acreage covered by the HCP by trust category

Trust Category	Acres
Common School	702,000
Agricultural	33,000
Charitable	35,000
University (original)	3,000
University (transferred)	46,000
Normal Schools	46,000
Scientific School	64,000
Capitol	88,000
Transfer	535,000
Purchase	77,000
Community College Forest Reserve Lands	3,000

The lands managed by DNR vary from scattered separate parcels of less than 40 acres to large contiguous blocks in excess of 110,000 acres. Although these lands are distributed throughout the plan area, many parcels are adjacent to or near large blocks of federal ownership along the Cascade and Olympic mountain ranges. The major exception to this pattern occurs in southwestern Washington, where DNR manages more than 250,000 acres that are not near federal ownership.

3.1.2 Land Use

As described earlier, the plan area encompasses federal grant lands, Forest Board lands and Community College Reserves managed by DNR, but it excludes urban and agricultural lands. All but approximately 49,000 acres of DNR-managed land within the proposed HCP planning area are forested. Nonforested land within the plan area includes natural features such as wetlands, ponds, exposed rock and soil, and perennial snowfields. Other land is maintained in a nonforested condition for specific uses such as utility and road rights of way and communication sites. Of 1,583,000 acres of forested land covered by the HCP, approximately 1,520,000 acres are in timber production. Other uses of forested land include old-growth research areas and gene pool reserves that the department has deferred from harvest, riparian management zones that are managed to protect nontimber resources, and recreation sites.

In order to plan efficiently and to consider regional variation, the HCP planning area is divided into nine planning units. These planning units are delineated by clustering water

resource inventory areas (as defined by the Washington Department of Ecology and commonly referred to as WRIAs) that drain to common water bodies (see draft HCP p. I.12 and Maps I-5 - I-13).

The five planning units west of the Cascade crest are referred to as the west-side planning area (see Map 3). Because of the unique history and role of the Olympic Experimental State Forest Planning Unit, it has different alternatives under consideration (see Map 4). The three east-side planning units form the east-side planning area and are included only in the conservation strategies and mitigation for the spotted owl and other federally listed species (see Map 5). The marbled murrelet is not known to cross the Cascade crest into the east-side planning area, and the unlisted species including salmon are not covered by this draft HCP in the east-side planning area.

3.1.3 Adjacent Ownership

DNR-managed lands covered by the draft HCP are interspersed among a variety of other ownerships. The ownership map (see draft HCP) shows the distribution of this land. The following table summarizes the approximate acreage held by various landowners.

Table 3.1.2: Acreage by ownerships within the HCP plan vicinity

(Source - DNR GIS Major Public Lands coverage)

Landowner/Manager/Use	Acres	Percent of plan area
U.S. Bureau of Land Management	5,000	> 0.1
U.S. Department of Defense	123,000	0.6
WA Department of Natural Resources	1,777,000[1]	8.3
WA Department of Fish and Wildlife	100,000	0.5
U.S. Fish and Wildlife Service	19,000	>0.1
U.S. Forest Service Wilderness	2,297,000	10.8
Municipal watershed	101,000	0.5
U.S. National Forest	4,463,000	20.9
U.S. National Park/Rec/Monument	1,919,000	9.0
Other Washington State	10,000	> 0.1
Washington State Parks & Recreation Commission	41,000	0.2
Tribal Lands	1,015,000	4.7
Other (private)	9,488,000	44.4

The pattern of ownership has varied since statehood. An active DNR exchange program has consolidated many scattered parcels of state forest land into larger, more manageable blocks. Exchanges are expected to continue into the future to position assets to benefit the trusts.

3.2 Climate

Washington's climate is controlled by three factors: (1) location on the windward coast of the Pacific Ocean; (2) the north-south Cascade mountain range, which runs through the center of the state; and, (3) the semi-permanent high- and low-pressure regions located over the north Pacific Ocean. These factors combine to produce dramatically different

[1]Approximately 1,632,000 acres of this total are covered by the draft HCP.

conditions within short distances. The Cascade Range, for instance, blocks the initial thrust of Pacific storms into eastern Washington while protecting western Washington from the polar-continental influence. Thus, western Washington has a marine climate and eastern Washington a marine-continental climate.

Successive moisture-laden storms move into the Pacific Northwest during late fall, winter, and early spring. They are intercepted first by coastal ranges (the Olympic Mountains and Willapa Hills) and then by the Cascade mountains, leaving most of eastern Washington in a rain shadow with an almost desert-like climate. From late spring to early fall, the Pacific high pressure area moves progressively farther north, weakening storms and limiting rainfall.

Annual precipitation ranges from 75 inches along the coast to 175 inches along the western slopes of the Olympic Mountains and nearly 100 inches in the Willapa Hills. The rain shadow effect of the Olympic Mountains results in only 16-25 inches of rain on the northeast part of the Olympic Peninsula and in parts of the San Juan Islands. From the Puget Sound lowlands south to the Columbia River, the mean annual precipitation is 40-60 inches. Precipitation increases along the west slopes of the Cascades, reaching 120 inches annually in some places. Striking gradations in precipitation totals are also noted on the eastern slopes of the Cascades, decreasing to an annual mean of 12 inches 40 miles from the crest and down to only 8 inches in the southern part of the central basin.

Prevailing winds are generally southwesterly over the state from late fall to early spring and northwesterly and lighter during the rest of the year. The most intense storms take place in late fall and early winter. Wind velocities range from 50-70 miles per hour or higher along the coast almost every winter. Speeds approaching or exceeding 100 miles per hour have been observed occasionally on coastal ridges. Wind speeds inland are lower during these storms but have been observed at 50-60 miles per hour.

Western Washington has 10-12 lightning storms each year, mostly along the western slopes of the Cascades. Rain usually accompanies lightning storms. There are about 25 lightning storms each year in eastern Washington, usually accompanied by less rain. An outbreak of "dry lightning" typically occurs two to three times each year in eastern Washington and on rare occasions in western Washington.

In western Washington, the sun shines about 24 percent of the time in December. In July, the figure is typically about 61 percent. In eastern Washington, the sun shines 25-30 percent of the time in December and January, but to 80-85 percent in July and August. Frost-free days in western Washington begin in late April and continue to early November, while in eastern Washington the frost-free period begins in late May and ends in late September.

3.3 Forest Disturbance on DNR-Managed Lands

Major disturbance events, both natural and human caused, have defined the current condition of DNR-managed forests within the planning area. Windstorms, which create

chaotic patterns of broken and windthrown trees, have shaped Washington forests throughout the centuries. Examples of notable historic windstorms are the 1921 storm on the western Olympic Peninsula and the Columbus Day storm of 1962, which blew down thousands of acres of mature timber in western Washington. Major ice storms, such as the 1955 freeze, have also changed the structure of stands all over western Washington. Today, numerous timber stands containing trees with crooked boles and forked tops serve as reminders of the millions of treetops killed by this freeze. Fire, both natural and caused by humans, has historically been one of the great shapers of forest composition in both eastern and western Washington. As an example, parts of the 94,055-acre Yacolt Burn State Forest in southwest Washington burned several times between 1902 and 1952. Today, this area is forested with young Douglas-fir trees and a few old remnant trees in riparian areas and ravines.

The control of forest fire this century has played a key role in defining the existing conditions. Fire has been minimized in many areas that formerly burned naturally at fairly regular intervals. In many places this has significantly changed the species in and structural composition of forests. For example, frequent, low-intensity fires once maintained large areas of ponderosa pine. The thick bark of the pine protected it from significant damage while less fire-tolerant trees were killed. By nearly eliminating fire from these areas, species such as grand fir developed dense understories that have excluded pine regeneration. These new stands are more structurally diverse, but their multi-layered canopies are more susceptible to catastrophic fires. These dense stands of relatively low value timber are also susceptible to insects and disease.

Timber harvest is probably the greatest human influence on most forest land in the state. Most DNR-managed forest land has been logged at least once in the last 100 years. Much of the land in the HCP planning area was clearcut logged in the 1920s and 1930s and abandoned in an unreforested state. Remnants of logging railroads and abandoned truck roads are scattered on state land in western Washington and bear witness to the intensity of logging in the early 20th century. Fire scars on residual trees and charred old-growth stumps show the effect of frequent fires in the early 1900s that followed the first logging. Large parts of these forests seeded back naturally from trees that survived the fires and from the hardwoods and other species in unburned riparian areas. After the fires, alder flourished in landscapes once dominated by old-growth conifers. The presence of large conifer stumps in alder stands shows this vegetation change.

Since the 1960s DNR has been using a sustainable harvest approach in managing forest lands. Designated areas are harvested and regenerated each year. Most early regeneration efforts concentrated on establishing Douglas-fir in recently clearcut areas. Today, a mix of species is typically prescribed to conform to the environmental characteristics of a site.

3.4 General Stand Conditions

The majority of the forest on DNR-managed lands covered by the HCP is conifer. Less than 10 percent of the even-aged stands are in hardwood. Approximately 85,000 acres of timber older than 200 years remain on state-managed forest land. Of this, less than

40,000 acres contain forests of the large diameter (4-8 foot) Douglas-fir, western redcedar, and western hemlock that come to mind when thinking about old growth. As noted previously, most DNR-managed lands have been logged at least once in the last 100 years.

DNR categorizes its forest lands as even-aged or uneven-aged (see Map 6). In general, even-aged stands are located in western Washington and are categorized in terms of the dominant age class of trees within a stand. Eastern Washington forest lands are generally categorized in terms of uneven-aged stands and are categorized by the dominant size class, diameter in inches. However, the reader should note that while a dominant age or size class is determined, any acre of an individual stand will contain a mix of age and/or size of trees, just as a mix of tree species will be present within the vast majority of stands.

On the west side, about one-fourth of the even-aged stands are 20 years old or less. More than half of the even-aged stands are 60 years old or less. Table 3.4.1 summarizes by age group the even-aged forests managed by DNR.

Table 3.4.1: DNR-managed lands by age class for even-aged stands

(Source - DNR GIS Land Use Land Coverage data)

Stand Age (years)	**Acres**	**Percent**
1-50	760,000	53.5
51-100	518,000	36.4
101-150	50,000	3.5
151+	93,000	6.6
Total Acres	1,421,000	100

On the east side of the Cascade crest, DNR-managed forest lands are categorized by size, using the diameter in inches of the majority of the trees found per acre. Currently available information for uneven-aged stands describes the volume or number of trees in each of four size classes. Although most uneven-aged stands have trees in more than one size class, Table 3.4.2 summarizes stands by the dominant size class for each stand.

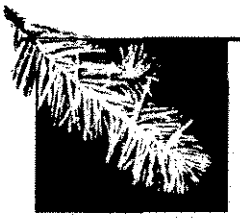
Table 3.4.2: DNR-managed lands by dominant size class for uneven-aged stands

(Source - DNR GIS Land Use Cover data)

Size class (diameter in inches)	Acres	Percent
0-6	22,000	14.2
6-9	11,000	7.1
10-18	71,000	45.8
20+	51,000	32.9
Total Acres	155,000	100

Appendix B provides additional information about the natural features found on DNR-managed lands within the planning area. Soils, vegetative zones, associated plant species and seral stages are described. Chapter 4 of this draft EIS contains detailed information about the existing conditions (also referred to as "affected environment") of the key resources for which impacts of this proposed action are assessed.

4. Affected Environment and Environmental Consequences



4. Affected Environment and Environmental Consequences

4.1 Chapter Organization

This chapter presents information on the affected environment and the environmental consequences related to the proposed HCP, other reasonable action alternatives, and No Action alternatives.

Three resources are discussed and analyzed in detail first. These are the northern spotted owl, the marbled murrelet, and riparian habitat. Each of these is examined by major planning subarea. Information is presented on all three resources within the five west-side planning units (Section 4.2), then the three east-side planning units (Section 4.3), and, finally, the Olympic Experimental State Forest (Section 4.4). There is one exception. Information about marbled murrelets in the OESF is presented in Section 4.2 rather than the OESF section.

Next, Section 4.5 presents the affected environment and evaluations of the environmental consequences of the alternatives (HCP and OESF) to other wildlife and plants. Individual species are discussed in three categories: section 10(a) permit species throughout the range of the spotted owl, federal and state candidate species which may occur within the five west-side planning units and the OESF, and plants (range-wide) listed by the federal government. Since many other species occur in habitats on these lands and are too numerous for individual attention, this subsection ends with a habitat-based assessment of the alternatives.

Other resources, including soils, air and water quality, and cultural resources, are discussed in the context of the full planning area, the range of the spotted owl. The chapter ends with a discussion of the potential social and economic consequences and an overview of potential cumulative effects.

4.2 Five West-Side Planning Units (excluding OESF)

This section presents information on the affected environment and the environmental consequences to the northern spotted owl, marbled murrelet, and riparian habitat within the five west-side planning units. Direct, indirect, and cumulative impacts which may occur under the No Action alternative, Alternative B, and Alternative C are analyzed in detail.

The discussion about marbled murrelets, however, is unique; it addresses all of western Washington, including the OESF Planning Unit. This is done because the same strategies are being applied. The murrelet strategy for the west-side No Action alternative is also the strategy in the OESF No Action alternative. The murrelet strategy under Alternative B is the same applied in OESF Alternative 2 and the murrelet strategy under Alternative C is the same applied in OESF Alternative 3.

4.2.1 Northern Spotted Owl

This chapter describes the affected environment in terms of regional context for the status and conservation of the northern spotted owl and current conditions of habitat and activity centers on DNR-managed lands. The impacts of the three alternatives are analyzed for five criteria: (1) change in amount and distribution of nesting, roosting, and foraging habitat; (2) impacts to current and future spotted owl activity centers; (3) a qualitative comparison of provision of dispersal habitat; (4) qualitative comparisons of demographic support; and, (5) maintenance of species distribution. Readers should refer to the draft HCP for a summary of spotted owl ecology. A summary matrix of the spotted owl alternatives is included for the reader's reference. A summary of the comparison of alternatives is described immediately below, followed by the fully developed analysis.

Summary of Comparison of Alternatives

The amount and distribution of habitat that would be provided under each alternative is the most influential factor in determining impacts. The level of near-term impacts to spotted owls arises from where and how much habitat will be harvested in relation to known spotted owl sites. The potential for long-term demographic support and maintenance of species distribution derives from the level of habitat that would be managed for, the quality of that habitat, and its proximity to federal reserves. The bulk of spotted owl conservation in Washington State occurs on federal reserves as designated under the President's Forest Plan (USDA and USDI 1994a and 1994b). Thus, the alternatives described in this document are analyzed largely in terms of how they complement the President's Forest Plan. Refer to the discussions under Criterion 4: Demographic Support and Criterion 5: Maintenance of Species Distribution below for a full description of the importance of conservation measures on nonfederal lands in relation to federal lands for the survival of the spotted owl population. A comparison of the alternatives across all the evaluation criteria is summarized in Matrix 4.2.1a.

Matrix 4.2.1a: Comparison of the alternatives by all criteria

Criterion		Alternative A	Alternative B	Alternative C
NRF Habitat	Amount	70,000 acres	81,500 acres	146,100 acres
	Distribution	Dispersed, fragmented	Near federal reserves in western Cascades	Near federal reserves in all planning units
Incidental Take (impacts)	Current Sites	None	81 - 85	31 - 33
	Future Sites[1]	27 - 31	8 - 36	3 - 22
Dispersal Habitat	Amount	70,000 acres	139,500 acres	204,100 acres
	Distribution	Around current spotted owl sites	In large blocks near and between federal reserves	In large blocks near and between federal reserves
Demographic Support	Near term	Contribute at current level	Decreasing contribution due to incidental take	Decreasing contribution due to incidental take, but higher than under Alternative B
	Long term	Declining contribution	Increasing to a moderate contribution near federal reserves	Increasing to a high contribution near federal reserves
Maintenance of Range	Near term	Maintain current range	Contract range to western Cascades near federal reserves	Contract range to west Cascades and Olympic Peninsula near federal reserves
	Long term	Contract range to near federal lands, low connectivity	Maintain connectivity within western Cascades	Maintain connectivity near federal reserves within Cascades, northern Olympic Peninsula

[1] The numbers for future take represent the lowest estimate from our model of the worst-case scenario for population recovery and the highest estimate from the best-case scenario. For Alternative A, sites will not be at risk for incidental take, but are at risk of extirpation. See sections on potential impacts to future sites under each alternative.

Matrix 4.2.1b: Management strategies for HCP (excluding OESF)

	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Spotted Owl			
Nesting, Roosting, and Foraging (NRF) habitat	Within spotted owl site centers (1.8- or 2.7- mile radius), 40% of total acreage is maintained in suitable owl habitat. The remaining area will be harvested. No additional acreage will become habitat.	202,000 acres designated for NRF function in N. Puget, S. Puget, Columbia, Chelan, Yakima, and Klickitat planning units with at least 101,000 acres (50%) developed and maintained at any time. On the west side, two 300-acre nest patches[2] per 5,000 acres (approximate) of NRF are identified and retained until knowledge is acquired allowing provision of adequate nesting structure while managing entire acreage. Balance of acreage may be sub-mature forests.	337,000 acres designated for NRF function in Straits, N. Puget, S. Puget, Columbia, Chelan, Yakima, and Klickitat planning units with 202,000 acres (60%) developed and maintained in a late-seral forest condition at any time.
Dispersal Habitat	No provision for dispersal habitat.	200,000 acres designated for dispersal function in Yakima, N. Puget, S. Puget, Klickitat, and Columbia planning units with at least 100,000 acres developed and maintained at any time.	172,000 acres designated for dispersal function in Yakima, N. Puget, S. Puget, Klickitat, and Columbia planning units with 86,000 acres developed and maintained at any time.
Experimental Areas	No provision for experimental areas.	No provision for experimental areas.	43,000 acres designated for experimental management in S. Coast Planning Unit.

[2] See draft HCP for details of the nature and configuration of these areas for various planning units.

Habitat

DNR estimates that there are presently between 186,000 and 366,000 acres of potential suitable spotted owl habitat on DNR-managed lands within the five west-side planning units. Implementation of Alternative A would result in the retention of 70,000 acres of spotted owl habitat on DNR-managed lands. Management of DNR trust lands under Alternative B would result in the retention and development of at least 81,500 acres of spotted owl habitat. Implementation of Alternative C would result in the retention and development of at least 146,500 acres of spotted owl habitat (see Matrix 4.2.1a). All three alternatives result in a loss of total potential habitat from what occurs on DNR-managed lands in 1996, compared to the amount of habitat that is predicted to be present in the year 2096 (see Table 4.2.14). Given that Alternative A is the No Action alternative, a loss of potential habitat would occur under the current policy of owl circle management.

The largest loss of potential habitat occurs under Alternative A. Most of the loss of potential habitat under Alternatives B and C occurs in areas farther than 4 miles from federal reserves. Both Alternatives B and C result in improved habitat conditions within 4 miles of federal reserves compared to Alternative A. Thus both of these alternatives would make higher contributions to the overall demographic support of the spotted owl population that occurs on federal lands than Alternative A.

Spotted Owl Site Centers

There are presently 145 known territorial spotted owl site centers that influence DNR-managed lands in the five west-side planning units (i.e., these sites occur either on or within a median home range radius of DNR-managed lands). There are a projected 42 additional sites that influence DNR-managed lands that have not yet been surveyed for spotted owls in the five west-side planning units . Alternative B would result in putting an estimated 81-85 of the total 187 known and projected unknown sites at risk for incidental take of resident owls. Alternative C would put an estimated 31-33 sites at risk for incidental take of resident spotted owls. Under Alternative A, DNR would continue a take-avoidance policy. Thus, its management activities would not result in the intentional incidental take of spotted owls. However, Alternative A does not offer the prospect of improving habitat conditions on DNR-managed lands. In the long term, an estimated 27-31 sites have a low chance of persistence due to presently poor habitat conditions and isolation from other sites or clusters of sites (see Matrix 4.2.1a and Table 4.2.18).

Under Alternatives B and C, management of spotted owl habitat would occur within NRF management areas such that at least 50 (Alternative B) or 60 percent (Alternative C) of these areas would be in a spotted owl habitat condition at any one time. Any spotted owl habitat that occurs above target conditions within each WAU (refer to the proposed HCP, DNR 1996a, for details) would be available for harvest. The number of future spotted owl sites that could be negatively affected by such a management strategy in the long term depends on: (1) current population trends; (2) how quickly habitat conditions improve on federal reserves to the point that the population stabilizes; and, (3) where new sites are established relative to DNR NRF management areas and federal reserves. DNR conducted an analysis based on these factors in which it was concluded that Alternative B could result in between 8 and 36 spotted owl sites being at risk of negative biological

impacts over the course of a 100-year HCP. Alternative C could result in between 3 and 22 sites being at risk of negative biological impacts over a 100-year HCP.

An important point to keep in mind however, is that once NRF management areas have reached their target habitat condition, these areas would provide a constant level of support to spotted owls. This is a more certain situation than under Alternative A in which habitat would likely decline in quantity and become increasingly fragmented. While a number of sites may be at risk for negative biological impacts in the future in NRF management areas under either Alternative B or C, the existence of more habitat near federal reserves would contribute to an overall situation in which spotted owls would persist and make reproductive contributions to the population over the long term.

Dispersal Habitat

Alternative A would provide opportunities for dispersal of juvenile spotted owls in the form of NRF habitat retained in spotted owl circles under the current take guidelines. This alternative then would provide habitat through which spotted owls could potentially disperse on 70,000 acres whose location is dependent upon the location of known spotted owl sites. Alternative B would provide dispersal opportunities on 139,500 acres in both NRF management areas (suitable nesting, roosting, and foraging habitat) and in Dispersal management areas (dispersal habitat). Dispersal management areas are located on DNR-managed lands that occur between large areas that will be managed for spotted owl NRF habitat (mostly federal reserves). Alternative C would also provide dispersal opportunities in NRF management areas and in Dispersal management areas. The Dispersal management areas designated in Alternative C are the same as those designated in Alternative B. A total of 204,100 acres of NRF habitat and dispersal habitat would be provided under Alternative C.

Under Alternative A, large portions of DNR-managed lands could be in conditions that are inhospitable to dispersing spotted owls at any one time. In comparison, because of the proximity of NRF management areas to federal reserves, Alternatives B and C both decrease the effective distance that spotted owls would need to disperse between large blocks of federal habitat. They also provide areas that would be managed specifically for dispersal habitat in areas that are important for population connectivity as identified in the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992b). Thus Alternatives B and C both support spotted owl dispersal better than Alternative A. Alternative C provides the highest level of support.

Demographic Support

Over the short term, Alternative A provides a higher level of demographic support than Alternatives B and C. This is because current levels of habitat contributions to all known activity centers would most likely be retained. In the long term, however, Alternative B would provide a higher level of support to the population than Alternative A because habitat will be provided at higher landscape levels at a watershed scale near federal reserves, and because there is a commitment to develop new habitat in areas where habitat levels are presently low but demographic support to the population is important. The nest habitat provisions (see Matrix 4.2.1b), in conjunction with the riparian and marbled murrelet components of Alternative B, result in a projected 51,000 acres of forest

older than 150 years old within NRF areas by the year 2096 (see Table 4.2.10). Therefore, NRF areas in Alternative B would likely be in an adequate condition to contribute individuals to the metapopulation over the course of a 100-year HCP.

Alternative C would provide the most and the highest quality habitat in terms of older forest and high concentrations of large habitat patches near federal reserves. It would lead to a lower impact to spotted owl sites in the near term than in Alternative B, and a higher contribution to the support of a productive owl population in the next 100 years than either Alternatives A or B. Thus, the level of overall, long-term demographic support to the population is highest in Alternative C. Alternative C has the highest probability of providing source habitat to sub-populations at a watershed level and provides NRF areas that support federal reserves in all (of the five west-side) planning units where significant acreage of federal reserves occur. Alternative C would not provide long-term support for spotted owls that are not part of clusters that are associated with the federal reserve system.

Maintenance of Species Distribution

In terms of contributing habitat in a wider range of ecological conditions, providing nesting, roosting, foraging habitat in areas of distributional concern, and maintaining connectivity among federal reserves, Alternative C contributes more to long-term maintenance of species distribution than the other two alternatives. Alternative B provides the next best level of support. Alternative A contributes the most to maintenance of species distribution over the short term, but contributes the least over the next 100 years.

None of the alternatives provide a long-term contribution to the maintenance of spotted owls in southwest Washington or the rest of the Western Washington Lowlands Province. Thus, all of the alternatives will contribute to an eventual contraction of the species range in western Washington. Alternative B would likely lead to the most rapid loss of sites and thus contribute the most to increasing the risk of extirpation of the population from the Western Washington Lowlands Province. Alternative C would provide some prospect for five sites to persist in southwest Washington, but would not provide a much higher chance for the population to recover in this province than Alternative B.

Affected Environment

Spotted Owl Conservation on Federal Lands

Federal land management has a very large influence on the survival of the spotted owl as a species. This is due to the fact that most of the remaining suitable spotted owl habitat occurs on federal lands (USDA and USDI 1994a). In addition, the Endangered Species Act requires that federal agencies undertake activities that lead to the recovery of threatened and endangered species (16 U.S.C. § 1536(a)(1)). Thus, the analysis of impacts of the HCP alternatives to spotted owls contained in this chapter is best understood in the context of conservation measures taken to date on federal lands.

The Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992b) recommended the establishment of a system of Designated Conservation Areas (DCAs) based on the Habitat Conservation Areas proposed by the Interagency Scientific Committee (ISC) report (Thomas et al. 1990). The recovery team intended that this system of "reserves" on federal lands, plus contributions of habitat from nonfederal landowners and managers in key areas, would be sufficient for the recovery of the spotted owl. The DCA system included 58 percent (and thus excluded approximately 42 percent) of currently suitable nesting, roosting, and foraging (NRF) habitat and 55 percent (excluding 45 percent) of known spotted owl site centers on federal lands within reserve areas (including Congressionally Reserved Areas such as national parks and wilderness areas) (USDA and USDI 1994a p. 3&4-220, 240). The authors of the ISC report and the draft recovery plan determined that it was an acceptable risk to allow a decline in the population before it stabilized at some lower level. They hypothesized that the population would stabilize in approximately 50 years after habitat conditions improved in portions of the reserve areas that are now younger forest (Thomas et al. 1990 p. 38-39; USDI 1992b p. 202-211).

The recovery plan has not been approved by the Secretary of Interior. However, a system of Late-Successional Reserves has been established on federal lands within the range of the northern spotted owl under the President's Forest Plan (USDA and USDI 1994b). Under this federal plan, 66 percent of currently suitable NRF habitat and 61 percent of known occupied sites on federal lands would be protected (USDA and USDI 1994a p. 3&4-222, 240). Thus, there is an additional 8 percent of currently suitable habitat and an additional 6 percent of the known occupied sites protected over that proposed under the draft recovery plan.

Under the President's Forest Plan, dispersal habitat on federal lands is to be provided by a network of Riparian Reserves and 100-acre residual habitat areas around spotted owl activity centers in the matrix and Adaptive Management Areas. This approach is a departure from the 50-11-40 rule originally proposed in the ISC report (Thomas et al. 1990) and included in the draft recovery plan. Replacing the 50-11-40 rule with Riparian Reserves and residual owl habitat was considered to provide sufficient connectivity on federal lands by the U.S. Fish and Wildlife Service (USDA and USDI 1994a Appendix G Biological Opinion p. 19-20).

Overall, the Supplemental Environmental Impact Statement (SEIS) Interdisciplinary Team determined that Alternative 9 (which became the President's Forest Plan) had an 83 percent likelihood of providing habitat that is of sufficient quality, distribution and abundance to allow the species population to stabilize, well-distributed across federal lands. However, there was an 18 percent likelihood that the spotted owl population would stabilize with significant gaps in the historic species distribution on federal lands (USDA and USDI 1994a p. 3&4-243). The USFWS determined in its Biological Opinion that Alternative 9 (the President's Forest Plan), results in the same or a lesser amount of "...risk of loss of a well-distributed, reproducing population of spotted owls due to lack of NRF habitat..." as is posed by the draft recovery plan (USDA and USDI 1994a Appendix G Biological Opinion p. 18).

Role of Nonfederal Lands in the Regional Spotted Owl Population

The Northern Spotted Owl Recovery Team stated that in many parts of the owl's range, conserving habitat on federal lands alone would not be adequate for recovery of the species (USDI 1992b p. 91). The Forest Ecosystem Management Assessment Team (FEMAT 1993) acknowledged the need for a nonfederal contribution of habitat in their development of the options that were assessed as part of the process that led to the President's Forest Plan. They stated:

> "In all options, we recognize areas of special concern where current habitat conditions on federal lands are deficient in portions of the owl's range, or where private, state, and federal lands are intermingled or federal lands are absent. In these areas of special concern contributions by nonfederal lands remain important to recovery of the species and should be addressed by the final recovery plan for the northern spotted owl." (USDA and USDI 1994a p. 3&4-244.)

The USFWS is in the process of preparing an environmental alternatives analysis (EAA) on its proposed 4(d) special rule which identifies areas of special concern for the spotted owl on nonfederal lands. In its Biological Opinion for the President's Forest Plan, the USFWS states that nonfederal landowner compliance with take guidelines inside proposed 4(d) special rule areas of concern will not assure the maintenance of dispersal habitat or contribute to an improving condition for the spotted owl population on nonfederal lands (USDA and USDI 1994a Appendix G p. 44-45). The SEIS Interdisciplinary Team stated that "...the 4(d) rulemaking and potential Habitat Conservation Plans are expected to address these issues" (USDA and USDI 1994a p. 3&4-245). As of the writing of this DEIS, the proposed 4(d) special rule EAA has not yet been published.

The role of nonfederal lands for spotted owl recovery is discussed in detail in sections that follow and evaluate the DNR HCP alternatives for contributions to demographic support and maintenance of species distribution. The reader may also refer to Hanson et al. (1993) for a discussion of specific nonfederal landscapes in Washington State that are important for demographic support, demographic interchange and maintenance of species distribution.

Regional Context for Five Western Washington HCP Planning Units

The five western Washington HCP planning units fall within the Western Washington Cascades, Western Washington Lowlands, and Olympic Peninsula spotted owl provinces (USDI 1992a p. 32) (Map 29). The North Puget, South Puget, and Columbia planning units roughly east of Interstate 5 are within the Western Washington Cascades Province. The North Puget, South Puget and Columbia planning units roughly west of Interstate 5, and the South Coast Planning Unit, roughly south of an imaginary line running from the southern end of the Hood Canal west to the Pacific Ocean, are in the Western Washington Lowlands Province. The portion of the South Coast Planning Unit north of an imaginary line running from the southern end of the Hood Canal west to the Pacific Ocean, and the Straits Planning Unit, are within the Olympic Peninsula Province.

Threats. The Northern Spotted Owl Recovery Team (USDI 1992b) described the major known threats to spotted owl populations in each province. (See the draft HCP Chapter III for a more detailed background discussion of each type of threat.) With the exception of the Olympic Peninsula Province (see below), no reassessment of the severity of threats in each province has been done since the writing of the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992b). Severity of threats in each spotted owl province are summarized in Table 4.2.1.

In the northern portion of the Western Washington Cascades Province (north of Mount Rainier) declining habitat, limited habitat, low populations, distribution, and province (or sub-province) isolation were all considered severe threats. In the southern portion of the Western Washington Cascades Province (south of Mount Rainier), declining habitat was considered a severe threat, while in contrast to the northern portion of the province, limited habitat, low populations, distribution, and sub-province isolation were considered moderate threats. Declining population was considered a moderate threat and natural disturbance was considered a low threat in the both the northern and southern portions of the Western Washington Cascades Province.

In the Western Washington Lowlands Province, declining habitat, limited habitat, declining populations, low populations, distribution, province isolation, and predation are all considered severe threats to the population. Natural disturbance was considered a moderate threat.

In the Olympic Peninsula Province, low populations, province isolation, and natural disturbance were considered severe threats. Declining habitat, limited habitat, declining populations, distribution, and predation were considered moderate threats. In 1994, the federal Reanalysis Team (Holthausen et al. 1994) analyzed results from updated population estimates, demographic estimates and modeling of population response to different potential configurations of suitable habitat on the Olympic Peninsula. Their conclusions indicate that low populations and province isolation may not be as severe a threat to the Olympic Peninsula population as the recovery team originally thought. However, the Reanalysis Team also stated that there was enough uncertainty associated with interpretation of demographic results that they could not conclude that the maintenance of a stable population of spotted owls on the peninsula was assured with either retention of significant portions of habitat on federal lands or with the retention of additional habitat on nonfederal lands (Holthausen et al. 1994 p. 1-2).

Table 4.2.1: Threats to the spotted owl population as described in the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992b)

	Declining Habitat	Limited Habitat	Declining Populations	Low Populations	Distribution	Province Isolation	Natural Disturbance	Predation
Western Washington Cascades (north)	Severe	Severe	Moderate	Severe	Severe	Severe	Low	Unknown
Western Washington Cascades (south)	Severe	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Unknown
Western Washington Lowlands	Severe	Severe	Severe	Severe	Severe	Severe	Moderate	Severe
Olympic Peninsula	Moderate	Moderate	Moderate	Severe	Moderate	Severe	Severe	Moderate

Habitat and Reserves Provided on Federal Lands

The following description of habitat and site centers protected in federal reserves is summarized in Table 4.2.2. In the Western Washington Cascades Province, the President's Forest Plan establishes 22 Late-Successional Reserves (LSRs) which encompass a total of 978,182 acres of federal land. An estimated 459,022 acres (47 percent) of the LSR area is suitable spotted owl habitat. There are a total of 156 spotted owl activity centers within these reserves (USDA and USDI 1994a Appendix G part 3 p. 13). There are an additional 354,200 acres of suitable habitat in Congressionally Reserved Areas (not counted in the above acreage) (Table 4.2.2).

There are no federally-designated Late-Successional Reserves or Congressionally Reserved Areas in the Western Washington Lowlands Province. The vast majority of land in this province is privately owned (88 percent). The state of Washington, tribal lands, and U.S. Department of Defense comprise the other ownerships (USDI 1992b p. 106).

In the Olympic Peninsula Province, there are 10 Late-Successional Reserves encompassing a total of 394,460 acres. There are an estimated 205,195 acres (52 percent) of suitable spotted owl habitat and a total of 80 known site centers within these LSRs (USDA and USDI 1994a Appendix G part 3 p. 14). Congressionally Reserved Areas contribute an additional 341,000 acres of suitable habitat to reserved federal lands on the Olympic Peninsula (USDA and USDI 1994a p. 3&4-214).

In the western Washington HCP planning area (not including the OESF Planning Unit) there are a total of 1,372,642 acres of Late-Successional Reserves established by the President's Forest Plan. An additional 2,704,934 acres are in a congressionally reserved status. An estimated 664,217 acres of suitable spotted owl habitat fall within Late-Successional Reserves and an additional 695,200 acres of suitable habitat occur in Congressionally Reserved Areas.

Table 4.2.2: Habitat and spotted owl site centers protected under the President's Forest Plan

Province	Number of LSRs	Acres in LSRs	Acres (%) spotted owl NRF habitat in LSRs	Additional spotted owl habitat in Congressionally Reserved Areas	Number of spotted owl sites protected[3]
Western Washington Lowlands	0	0	0	0	0
Western Washington Cascades	22	978,182	459,022	354,200	156
Olympic Peninsula	10	394,460	205,195	341,000	80
Totals	32	1,372,642	664,217	695,200	236

The SEIS Team that analyzed the President's Forest Plan estimated the amount of late-successional forest that could develop over time on federal reserves. Within reserves, the overall trend is that the amount of forest greater than 80 years old will increase in the next 150 years such that on average 80 percent of the area of federal reserves will be covered by forests older than 80 years old (USDA and USDI 1994a p. 3&4-42, 43). The SEIS team combined their estimates for Washington and Oregon reserve lands so there is not a separate estimate for Washington or for each spotted owl province in Washington. Applying the 80 percent average to the area of federal reserves (Congressionally Reserved Areas plus designated Late-Successional Reserves) in the western Washington HCP planning area results in a projected total of 3,240,463 acres of forest with mature and late-successional forest characteristics in 150 years.

Current Conditions on DNR-managed Lands for The Five West-Side Planning Units

This section describes current habitat conditions on, and spotted owl use of, DNR-managed lands in the five west-side planning units (not including the OESF). Methods for estimating habitat and rationale for describing habitat distribution are discussed. The information in this section provides background data that is useful for understanding the subsequent analysis sections.

Amount and Distribution of Suitable Spotted Owl Habitat

Methods: Amount

The amount of suitable spotted owl habitat currently on DNR-managed lands in the five west-side planning units is estimated using two methods. Suitable spotted owl habitat is

[3] This total only includes sites within LSRs. There are additional sites within Congressionally Reserved Areas which were not tabulated in the FSEIS for the President's Forest Plan.

defined as any forest type that meets some or all of the life needs of the spotted owl including nesting (breeding), roosting (resting), and foraging (feeding). Given the data available for assessing the amount of suitable habitat on all of the lands it manages, DNR was not able to distinguish everywhere between habitat that may only serve a roosting and foraging function versus higher quality habitat that also provides a nesting function. Thus "suitable spotted owl habitat" in this chapter refers to a mix of habitat qualities that provide for some or all of the life needs of the spotted owl. This definition does **not** include habitat that only meets a dispersal function. Two methods are used because there is no reliable means of predicting which method is more accurate. We suspect that the real amount of habitat that occurs on DNR-managed lands likely lies somewhere in between the amounts predicted by each method. The level of impact to each component of the affected environment differs depending on which habitat estimation method is used. Thus, for most of the analyses described below, two numbers derived from each method are given.

The first estimation method consists of using age class of the primary tree species in a stand as a surrogate for potential habitat. Elevational limits for spotted owl use appropriate to each spotted owl province were also applied (Stearns 1991). Two ranges of age classes are assigned as potential spotted owl habitat. Forests that are between 70 and 200 years old are assumed to contain at least the characteristics of sub-mature habitat.[4] Sub-mature habitat in western Washington contains the structural elements necessary to support roosting and foraging functions, and may occasionally be used for nesting (Hanson et al. 1993; DNR 1996a p. IV-22). Depending on past harvest or disturbance history of a stand, forests in this age range can have the residual structure and large enough trees to provide roosting and foraging functions. The older age classes within the 70-200 year range are, on average, more likely to contain the elements of sub-mature habitat and may contain some nest structure. Younger stands in this age class range that originated from natural disturbance events or from harvest methods that left some residual structure are also likely to contain the characteristics of sub-mature habitat. Those stands that originated from clearcut harvest are not likely to meet the sub-mature habitat definition. This method likely overestimates the amount of sub-mature habitat to the extent that clearcut-originated stands are included. It likely underestimates the amount of habitat in areas where forest stands younger than 70 years old originated from natural disturbance and contain enough residual structure to provide habitat function. This situation is known to occur on DNR-managed lands in the South Coast Planning Unit. Stands that are older than 200 years are assumed to contain elements of nesting habitat as well as roosting and foraging habitat. The acreage of DNR-managed forest lands in stands 200 years old and older is likely a good minimum estimate of the amount of high quality habitat available to support a nesting function.

[4] The use of 70 years as a minimum for sub-mature habitat is based on a field assessment by DNR foresters and wildlife biologists of average forest conditions on DNR-managed lands in western Washington and ages of forest stands that met the sub-mature habitat definition. As is described in the text following the footnote, there are situations in which a 70-year-old stand will not meet the sub-mature definition. There are also situations in which stands younger than 70 years will contain the structural elements of sub-mature habitat. For assessing average conditions for the five west-side planning units, the analysts believe that 70 years is an adequate minimum.

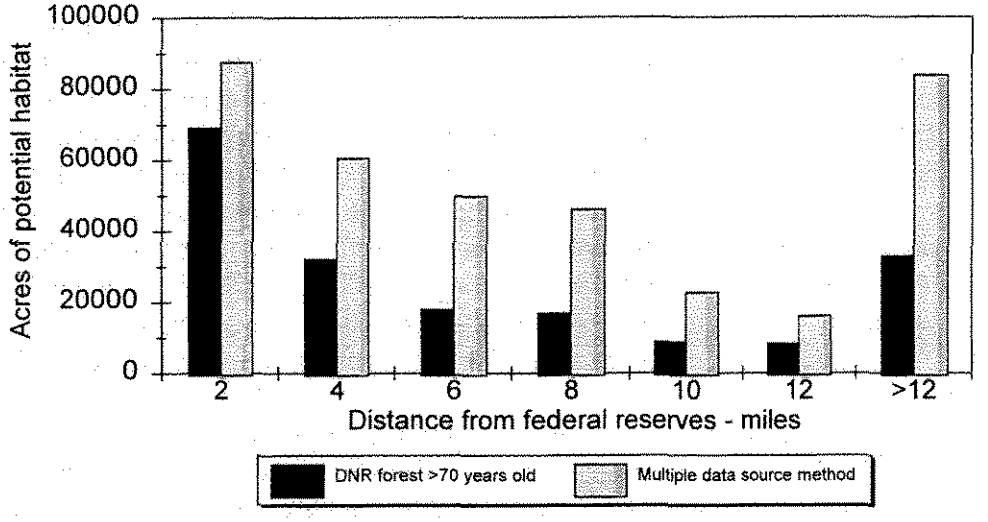
The second method for estimating the amount of currently suitable habitat consists of combining data from several sources to achieve full coverage for all ownerships in the state. These sources include field-verified habitat maps from both DNR and USFS habitat mapping efforts, age class data (same as used above) for DNR-managed lands in western Washington, and satellite data that was classified by Pacific Meridian Resources (Green et al. 1993) into forest types for other purposes than identifying spotted owl habitat. The same elevational limits were applied to this method as were applied to the first method. GIS technology was used to compare each data source to the field-typed data for its accuracy in predicting whether a forest stand could be classified as habitat or non-habitat. Different age classes and different combinations of satellite classifications were tested against field-typed data to find the most accurate match. The data source that most accurately predicted habitat and non-habitat in each planning unit was then used for areas not covered by field-verified habitat typing. The accuracy of data sources used as surrogates for field-typed habitat data on DNR-managed lands ranged from 65 percent in the South Coast Planning Unit to 79 percent in the South Puget Planning Unit. For the five west-side planning units, age class data proved to be a more accurate predictor of field-typed data than did satellite data. For the South Puget, South Coast, and Columbia planning units, stands that were 60 years old and older most closely matched field-assessed suitable habitat. In the North Puget Planning Unit, age class data for stands 50 years old or older was the most accurate. In the Straits Planning Unit, age class data for forests 80 years old and older was the most accurate predictor of field-typed suitable habitat.

There are three limitations to this method. The first is that only 20 percent (approximately 240,000 acres) of DNR-managed lands in the five west-side planning units have been reliably field-typed; thus there was only a small sample as the basis of comparison for other data sources. The second is that habitat typing in the field was not recorded in a standardized way. All field-typing was done as part of the regulatory process and was done prior to DNR's HCP process. Some DNR field staff recorded a differentiation between Types A, B, and C habitat while others only recorded forest lands as habitat or non-habitat. In order to achieve the largest sample size possible, DNR analysts decided to combine data that differentiated between quality of habitat types with data that was only a binary habitat versus non-habitat distinction. What was used as a basis of comparison then can be within a range of quality from marginal roosting and foraging habitat to high quality nesting habitat. In addition, more acres of habitat for which the type (A, B, or C) was recorded is Type C habitat than Type A or B habitat. This means that the "calibration" for suitable habitat used by this method is biased toward more marginal habitat types. Thus, a large proportion of acres identified as suitable spotted owl habitat by surrogate sources (i.e., different age class ranges) is likely to be marginal habitat. This potential needs to be kept in mind when interpreting the results of habitat estimations using this method. The third limitation stems from the use of age class as a surrogate of habitat. As mentioned above, young stands that have abundant residual structure can be used by spotted owls. Some stands that are younger than the age classes used as a habitat surrogate in any particular planning unit and that have abundant residual structure would not be counted as habitat. In such cases, age class data will underestimate the amount of suitable spotted owl habitat.

Methods: Distribution of Habitat

Another important criterion for describing the current condition of habitat on DNR-managed lands is the distribution of habitat across the landscape. Habitat occurrence was broken out by 2-mile distance bands from federal reserve lands (Figure 4.2.1). This method of describing distribution of habitat was chosen to reflect the fact that federal reserves provide the largest blocks of currently suitable spotted owl habitat in the western Washington spotted owl provinces. Given that federal reserves are to be managed for late-successional forest into the future, current habitat conditions are expected to improve in terms of overall amount of habitat and in terms of decreasing fragmentation of existing habitat patches. In assessing the overall contribution of DNR-managed lands to demographic support of the population, describing the amount of habitat in relationship to federal reserves provides a picture of how habitat on DNR-managed lands adds to existing large habitat blocks on federal reserve lands. Two-mile distance bands were selected because they represent approximate median home range radii for spotted owls in western Washington. The median annual home range radius for pairs tracked for a minimum of
9 months is 2.0 miles in the western Washington Cascades and 2.7 miles in the western Washington lowlands and Olympic Peninsula (Hanson et al. 1993). Thus the 0-2-mile distance band would capture habitat likely used by spotted owls located on the interface of federal reserves and DNR-managed lands in the western Washington Cascades and the 2-4-mile distance band would capture the remainder of habitat likely to be used by spotted owls with activity centers on the interface between federal reserves and DNR-managed lands on the Olympic Peninsula.

Figure 4.2.1: Acres of potential spotted owl habitat on DNR-managed lands in the five west-side planning units



Results

Using age class data resulted in an estimate of 186,000 acres of potentially suitable spotted owl habitat on DNR-managed lands within the five west-side planning units (Table 4.2.3). Employing the second method of multiple data sources that most closely predict habitat based on field-typed habitat data resulted in an estimate of 366,000 acres of currently suitable habitat on DNR-managed lands in the five west-side planning units (Table 4.2.4). Based on the above discussion of limitations of the multiple data source method of estimation, it is likely that this method includes more marginal habitat than the age class method which counts habitat as stands that are at least 70 years old or older. Using forest stands that are 70 years old or older may more accurately represent the current amounts of sub-mature and old forest habitat types on DNR-managed lands than the multiple data source method. The multiple data source method probably gives a more accurate picture of the total amount of suitable habitat including more marginal habitat types. However, this method will also probably capture more habitat that occurs in younger stands with adequate residual structure than does the method using only stands 70 years old or older.

The distribution of current potential habitat on DNR-managed lands in distance bands from federal reserves in the five west-side planning units is described in Figure 4.2.1 and Tables 4.2.3 and 4.2.4.

Table 4.2.3: Distribution of potential spotted owl habitat estimated by forest stands 70 years old and older on DNR-managed lands in the five western Washington planning units by distance band from federal reserves

Distance from federal reserves (miles)	Acres DNR-managed lands	Acres DNR-managed lands in forest between 70 and 200 years old	% DNR-managed lands in distance band in forest between 70 and 200 years old	Acres DNR-managed lands in forest older than 200 years	% DNR-managed lands in distance band in forest older than 200 years	Total% DNR-managed lands in distance band in forest older than 70 years	% of total habitat on DNR-managed lands within distance band
0.0 - 2.0	254,534	46,198	18.1	22,845	9.0	27.1	37.1
2.1 - 4.0	171,062	23,809	13.9	8,324	4.9	18.8	17.3
4.1 - 6.0	140,215	16,863	12.0	1,090	0.8	12.8	9.7
6.1 - 8.0	122,052	15,275	12.5	1,569	1.3	13.8	9.1
8.1 - 10.0	85,210	8,610	10.1	171	0.2	10.3	4.7
10.1 - 12.0	71,916	8,037	11.2	194	0.3	11.5	4.4
> 12.1	337,702	32,185	9.5	633	0.2	9.7	17.7
Totals	1,182,691	150,977	12.8	34,826	2.9	15.7	100.0

There are a total of 1,182,691 acres of DNR-managed forest lands within the five west-side planning units. Thus, approximately 16 percent of DNR-managed lands contain potentially suitable spotted owl habitat as estimated by combining both 70-200-year old age classes and 200-year-plus age classes. Thirty-seven percent of the total amount of currently suitable habitat on DNR-managed lands lies within 2 miles of federal reserve lands. Another 17 percent lies between 2-4 miles, giving a total of 54 percent of potentially suitable habitat that occurs within 4 miles of federal reserve lands. Only 3 percent of DNR-managed lands is covered by forests 200 years old and older, most of which occurs within 4 miles of federal reserves.

Table 4.2.4: Distribution of potential spotted owl habitat estimated by the multiple data source method on DNR-managed lands in the five western Washington planning units by distance band from federal reserves

Distance from federal reserves (miles)	Acres of DNR-managed lands	Acres DNR-managed lands in potential spotted owl habitat	% DNR-managed lands in potential spotted owl habitat within distance band	% total habitat on DNR-managed lands within distance band
0.0 - 2.1	254,534	87,439	34.3	23.9
2.1 - 4.0	171,062	60,592	35.4	16.5
4.1 - 6.0	140,215	49,717	35.6	13.6
6.1 - 8.0	122,052	46,086	37.7	12.6
8.1 - 10.0	85,210	22,673	26.6	6.2
10.1 - 12.0	71,916	16,052	22.3	4.3
> 12.1	337,702	83,702	24.8	22.9
Totals	1,182,691	366,261	31.0	100.0

Using the multiple data source method results in an estimated 31 percent of DNR-managed lands in potentially suitable habitat, compared to 16 percent using forests older than 70 years as potential habitat. Nearly 24 percent of all potential habitat (using the multiple data source method) lies within 2 miles of federal reserves and 40 percent of all potential suitable habitat lies within 4 miles of federal reserves.

DISPERSAL HABITAT ON DNR-MANAGED LANDS

DNR silviculturalists estimate that the structural characteristics of dispersal habitat can be attained in managed forests in western Washington starting in stands that are 35-45 years old. These characteristics include stands that are dominated by conifer species, have at least 70 percent canopy closure, and contain trees with an average dbh of 11 inches (see DNR 1996a p. IV-22). There are currently 787,000 acres of DNR-managed forest lands in the five west-side planning units that are 40 years old or older. However, not all of DNR-managed forest lands are located in areas that would provide a dispersal function even if they contained the characteristics of dispersal habitat. These are areas where there are currently no spotted owl activity centers or no available habitat (present or potential) to which spotted owls could disperse. In addition, under current management practices DNR does not intentionally plan its harvest rotations on a spatial scale to meet landscape requirements for dispersal habitat. There are broad portions of DNR-managed lands that would not meet a 50 percent coverage of forest stands that are at least 40 years old and

have been managed specifically to produce the stand characteristics of dispersal habitat. Thus, any benefit to dispersing spotted owls from the current distribution of forest stands that meet the stand level definition for dispersal habitat is incidental.

One potential indicator of the current dispersal capabilities of DNR-managed lands is the percentage of the areas designated to be managed for dispersal habitat that are in forests stands 40 years old or older. Lands designated for a dispersal function in Alternatives B and C are placed where DNR manages lands between federal reserves or other large areas to be managed for older forests. While these areas do not represent all DNR-managed lands that could potentially serve a dispersal function (see analyses under criteria (3) and (5)), they provide a good assessment of current conditions on lands that are very likely being used or may be used in the future by dispersing juvenile spotted owls. There are a total of 115,851 acres of DNR-managed lands designated for a dispersal role in three of the five west-side planning units (for both Alternatives B and C). A total of 77.9 percent (90,212 acres) of the designated dispersal areas are presently in forests that are 40 years old or older. By planning unit, the percentage of dispersal areas in forests 40 years old and older is as follows: North Puget Planning Unit - 51 percent; South Puget Planning Unit - 55 percent; and Columbia Planning Unit - 82 percent.

SPOTTED OWL USE OF DNR-MANAGED FOREST LANDS

There are 145 territorial spotted owl site centers that are either on DNR-managed lands or potentially use DNR-managed lands in the five west-side planning units (WDFW 1995c). Territorial sites are considered to be those classified as either status 1, status 2 or status 3 sites by the Washington Department of Fish and Wildlife. Status 1 sites are those at which spotted pairs have been confirmed. Status 2 sites are those at which the presence of two resident birds has been confirmed, but the pair status of the two birds has not been confirmed. For the purposes of this analysis, status 2 sites are counted as "pair" sites. Status 3 sites are those at which one resident spotted owl has been confirmed. These are the only sites discussed in this analysis. Status 4 sites are also recorded in the WDFW database, but the resident (i.e., territorial) status of spotted owls located at these sites has not been confirmed. In landscapes that have been well-surveyed, status 4 sites are not likely to be territorial sites that were simply missed through incomplete surveys. However, in landscapes that have not been well surveyed, it is possible that status 4 sites could actually be territorial sites. The present analysis did not attempt to estimate the number of status 4 sites that occur in landscapes that are considered to not be thoroughly surveyed.

DNR-managed lands that are within the radius of a circle that most closely approximates a median annual home range of spotted owl pairs for a particular spotted owl province are considered to be potentially used by the owl pairs or territorial single owls that have been recorded at activity centers. This radius is 2.7 miles for the Olympic Peninsula and western Washington lowlands and 2.0 miles for the western Cascades (Hanson et al. 1993).

The distribution of site centers by distance band from federal reserves is shown in Table 4.2.5 and Figure 4.2.2. Almost 80 percent of the spotted owl sites that affect DNR-managed lands occur on or within 2 miles of federal reserves.

Figure 4.2.2: Distribution of territorial activity centers affecting DNR-managed lands in the five west-side planning units

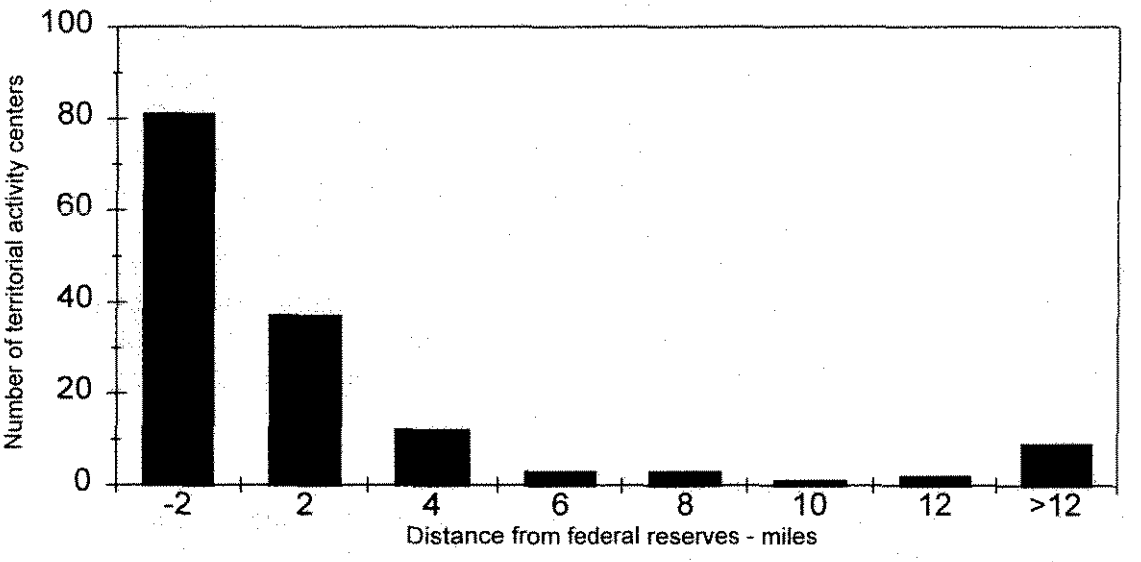


Table 4.2.5: Number of territorial spotted owl activity centers within a median home range radius of DNR-managed lands in distance bands from federal reserves

Distance from federal reserves (miles)	Number of territorial pair and single activity centers	Percent of total number of activity centers within distance band
-2.0 - 0.0[5]	79	54.4
0.0 - 2.0	36	24.8
2.1 - 4.0	12	8.3
4.1 - 6.0	3	2.0
6.1 - 8.0	3	2.0
8.1 - 10.0	1	0.7
10.1 - 12.0	2	1.4
> 12.1	9	6.2
Totals	145	100

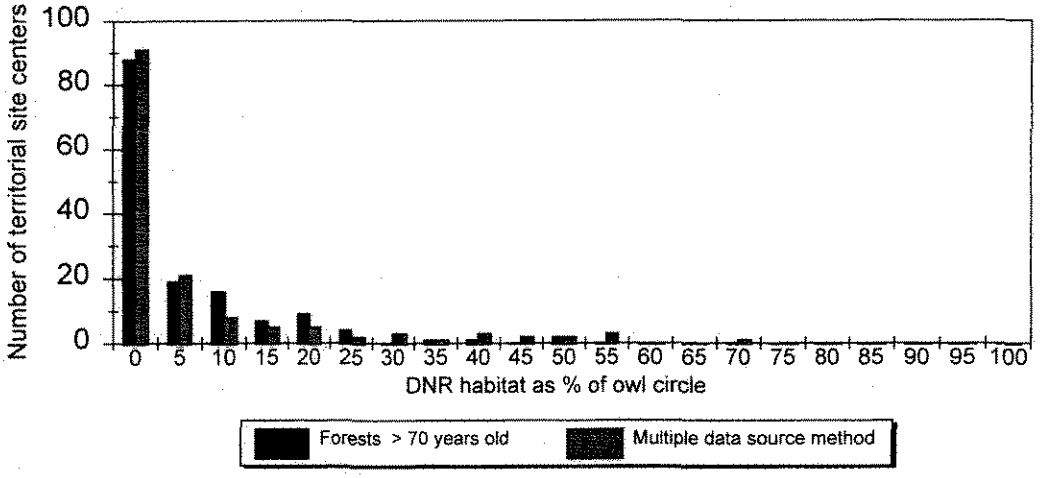
Contribution of habitat to individual site centers

DNR-managed lands currently contribute between 64,900 (forests greater than 70 years old) and 89,700 (multiple data source method) acres of suitable habitat to known territorial spotted owl activity centers that are within a median home range radius of DNR-managed lands in the five west-side planning units. The mean contribution of habitat per activity center using forests older than 70 years as habitat is 705 acres. The mean contribution of habitat per activity center using the multiple data source method is 849 acres.[6] The distribution of amount of habitat per activity center using both methods is shown in Figure 4.2.3. There are between 4 and 12 site centers to which DNR-managed lands contribute 40 percent or more of the total area of median home range-sized circle, depending on the estimation method used. Over 70 percent (between 107 and 112 activity centers) of the 145 spotted owl circles which overlap DNR-managed lands include habitat on DNR-managed lands that amounts to between 0-10 percent of the total area of the circle.

[5] This distance band is for activity centers located on federal reserve lands and within 2.0 miles of DNR-managed lands.

[6] These acreage figures were calculated on a per site basis, i.e., by counting habitat in individual owl circles separately. Some habitat contributes to more than one spotted owl activity center.

Figure 4.2.3: Amount of habitat on DNR-managed lands within territorial spotted owl circles in the five west-side planning units



Evaluation of Alternatives for Their Impact on the Northern Spotted Owl - Five Western Washington Planning Units

Evaluation Criteria

Alternative A (the No Action alternative), Alternative B, and Alternative C are evaluated for their impacts to spotted owls using five criteria. These are: (1) change in the amount and distribution of nesting, roosting and foraging habitat over 100 years; (2) impacts to spotted owl activity centers over the next 100 years; (3) qualitative comparison of provision of dispersal habitat; (4) contribution to demographic support of the spotted owl population in the five west-side planning units; and, (5) contribution to maintenance of species distribution in the five west-side planning units. The discussions of contribution to demographic support to the population and maintenance of species distribution are *synthesized and the information presented in items 1, 2 and 3.*

Criterion 1: Change in Amount and Distribution of Nesting, Roosting, and Foraging Habitat

The purpose of this criterion is to assess the change in (1) the overall amount of suitable spotted owl nesting, roosting, and foraging habitat on DNR-managed lands; and, (2) the distribution of suitable habitat on DNR-managed lands relative to federal reserves as a result of implementing each alternative. The two estimation methods previously described are used as the basis for comparing amounts of suitable habitat that would be retained on DNR-managed lands under implementation of each alternative. The results of

forest growth and harvest models are used to predict amounts of spotted owl habitat under one potential set of management regimes for Alternatives A and B. Harvest modeling was not conducted for Alternative C. Rationales for predicting both amount and distribution of habitat that are specific to each alternative are discussed in a short methods section under each alternative.

AMOUNT

Alternative A

Under Alternative A, management for spotted owls will continue on a circle-by-circle basis. Harvest of suitable spotted owl habitat will generally occur within spotted owl circles down to 40 percent of the area of the circle. A full discussion of incidental take and associated habitat requirements is included in this DEIS. Habitat outside of spotted owl circles will eventually be harvested. For those circles that are already below 40 percent, no new habitat will be developed. Given that DNR would not manage its lands to develop any new spotted owl habitat (i.e., the incentive under Alternative A is to not allow forests within spotted owl circles to reach an age where they would be considered suitable spotted owl habitat because this would put more acres under constraint from harvest), any habitat within spotted owl circles that is lost due to natural or human-caused disturbance will not be replaced. In addition, under Alternative A DNR would have the opportunity to decertify (change to historic status) existing spotted owl circles through a 3-year survey protocol. Any suitable habitat on DNR-managed lands within spotted owl circles that would be decertified would be available for harvest. The amount of suitable habitat lost depends on the number of circles decertified over the next 100 years.

Methods. In order to assess how much spotted owl habitat would be retained under Alternative A, the following simplifying assumptions are made. The first major assumption is that the rescinded federal take guidelines (USDI 1990) as followed under present Board of Natural Resources policy will continue to be applied to DNR-managed lands for the next 100 years. These guidelines are generally interpreted to mean that the amount of habitat within a specified radius of an established spotted owl site center must remain above 40 percent of the area of the circle. This radius is currently 1.8 miles for the Western Washington Cascades Province and 2.7 miles for the Western Washington Lowlands Province and the Olympic Peninsula Province (Frederick 1994). Some further generalizations are made about how these guidelines will be applied under Alternative A. If the amount of habitat is at or below 40 percent, no landowner or manager can harvest habitat (unless they have an incidental take permit). Thus, it is assumed that any habitat on DNR-managed lands that is within spotted owl circles with 40 percent habitat or less would be unavailable for harvest. It is also assumed that if more than 40 percent of a circle has extant habitat within a federal reserve, other landowners or managers would not generally "take" owls, or put the site at risk for taking owls, by harvesting habitat on their lands. In reality, a case-by-case assessment of incidental take would consider the proximity of nonfederal habitat to the site center and the amount of habitat within a 0.7-mile core of the site center (USDI 1990). DNR's habitat databases do not allow for a high level of confidence in the accuracy of assessing habitat conditions within a 0.7-mile core of all known spotted owl locations. Thus the assessment of when implementation of incidental take guidelines would prohibit or allow harvest of habitat is based on whether or not the overall habitat level within an owl circle is at 40 percent. It is further assumed

that if a circle has more than 40 percent habitat and the majority of the habitat is divided among multiple landowners and there is less than 40 percent habitat on federal reserves, whatever habitat exists on DNR-managed lands would not be harvested. This assumption is based on a scenario in which other landowners or managers would harvest habitat on their lands such that the overall level would decrease to 40 percent before DNR harvested habitat on the lands it manages.

The second major simplifying assumption is that owl sites known in 1996 will remain static throughout the life of the analysis time frame (100 years). This assumption is made because it is difficult, if not impossible, to predict when and how owl sites will move over time. In reality, owl sites will move and any habitat that is no longer within a regulatory circle will become available for harvest. Thus the amount of habitat predicted to be retained over the next 100 years by following the rescinded federal take guidelines based on known locations of spotted owl site centers is likely an overestimate.

The third simplifying assumption is that no habitat will be lost to disturbance or attrition over the next 100 years. Again, it is difficult to predict how much could be lost to such factors. Thus the amount of habitat predicted to remain within known spotted owl circles is again overestimated using this assumption.

The fourth major assumption is that there are probably spotted owls that presently use DNR-managed lands that have not yet been discovered due to lack of surveys. Because the amount of spotted owl habitat that would be retained under Alternative A depends on **both** the number of known spotted owl sites **and** the number of undiscovered sites that may presently affect DNR-managed lands that have not yet been surveyed for spotted owls, it is assumed that at some point during the analysis period, these unknown sites would be discovered through surveys. The method for estimating the number of unknown sites is described immediately below.

Thirty-one percent of DNR-managed lands (515,900 acres) in the entire HCP planning area outside of the OESF have not been surveyed for spotted owls. Of this, the multiple data source method of habitat classification shows that 110,800 acres are spotted owl habitat. The method used to estimate the number of unknown spotted owls using unsurveyed DNR-managed forests follows that of Holthausen et al. (1994). Their estimate for the Olympic Peninsula was done by dividing the number of known owl sites by the estimated proportion of land area that was surveyed. Their estimate is equivalent to that obtained using the following relationship:

$$\frac{\text{acres surveyed land}}{\text{acres unsurveyed land}} = \frac{\text{number of known owls}}{\text{number of unknown owls}}$$

There are several assumptions implicit to this calculation. The weakest of these assumptions is that all unsurveyed lands are equally likely to support spotted owls. In fact, this is far from true. Many unsurveyed lands lack adequate habitat to support spotted owls. Unsurveyed areas may have forests too young to function as spotted owl habitat or may lie in areas where forests are highly fragmented. Another weak

assumption is that the survey effort is unbiased with respect to spotted owl habitat. Spotted owl surveys are conducted where there is a reasonable possibility for the presence of spotted owls. To overcome these weaknesses two analyses were performed which, in combination, allow the elimination of some unsurveyed lands from the above calculation.

The objective of the first analysis was to describe the typical landscape conditions surrounding known spotted owl site centers. The amount of owl habitat is tabulated within an exclusive home range radius for all known site centers in the HCP planning area, excluding the OESF. It was thought that an examination of exclusive home ranges rather than median home ranges would yield a better model for predicting the occurrence of spotted owls. The exclusive home range radius was calculated by reducing the area of the median annual home range by 30 percent. This same method was used by USDA (1992) and is based on the average proportion of overlap between annual home ranges of spotted owl pairs. The exclusive home range radii for the Western Washington Cascades, Western Washington Lowlands and Olympic Peninsula (same radius for both provinces), and Eastern Washington Cascades provinces were 1.67, 2.26, and 1.51 miles, respectively. The results of this analysis are given in Table 4.2.6. In all provinces, 90 percent of known site centers had approximately 20 percent or more owl habitat within an exclusive home range radius. This indicates that areas on the order of an exclusive home range that have less than 20 percent habitat are very unlikely to support territorial spotted owls. This concurs with an analysis by Bart and Forsman (1992) which showed that spotted owls are very rarely found in landscapes dominated by younger forest (less 80 years old). In their study, all measures of owl abundance were significantly lower on areas with less than 20 percent older forest.

Table 4.2.6: Analysis of spotted owl habitat within an exclusive home range radius of all known territorial site centers in the HCP planning area

Habitat classification based on the multiple data source method. Olympic Peninsula excludes the OESF Planning Unit.

Province	mean (percent habitat)	median (percent habitat)	90th percentile (percent habitat)	n
Western Cascades	43	45	20.5	431
Olympic Peninsula, Washington Lowlands	46	48	18	242
Eastern Cascades	45	44	19	291

The objective of the second analysis was to describe spotted owl habitat conditions in and around DNR-managed lands. A binary habitat grid was constructed from the multiple

data source habitat classification.[7] Grid cells were 1 acre in size. Grid cells classified as habitat were set to one and cells classified as nonhabitat were set to zero. A circular analysis window with a radius equal to the exclusive home range radius was moved across the habitat grid from cell to cell. At each grid cell the focal sum of habitat within the analysis window was calculated. In this way, the amount of owl habitat within an exclusive home range radius of every DNR-managed acre was determined. The analysis window looked at all lands: federal, tribal, private, and DNR-managed. The end result of this analysis is a map which shows DNR-managed lands that have 1 percent habitat within an exclusive home range radius, 2 percent habitat within an exclusive home range radius, 3 percent habitat, and so on.

Using the results of the two analyses, all unsurveyed DNR-managed lands with less than 20 percent habitat within an exclusive range radius from the estimate for unknown site centers are eliminated. To maintain the proportional relationships of the calculation the same elimination process was done for surveyed lands. Hence, the relationship used to estimate the number of unknown spotted owls was:

$$\frac{\text{acres surveyed land with greater than 20 percent habitat within an exclusive home range radius}}{\text{acres unsurveyed land with greater than 20 percent habitat within an exclusive home range radius}} = \frac{\text{number of known owls}}{\text{number of unknown owls}}$$

To arrive at the number of unknown owls then, rearrange the above equation is rearranged as follows:

$$\text{number of unknown owls} = \frac{\text{acres of unsurveyed land}^{8} \times \text{known owls}}{\text{acres of surveyed land}}$$

The above methodology results in a projection of 42 territorial activity centers that are on or within a median spotted owl home range radius of DNR-managed lands in the five west-side planning units (36 in the Western Washington Cascades Province and six in the Western Washington Lowlands and Olympic Peninsula provinces excluding all lands in the OESF Planning Unit).[9]

[7] The age class method was not used. This is because the intent was to calculate the amount of habitat on other ownerships surrounding DNR-managed lands. DNR does not have access to age class data for other ownerships or management jurisdictions. The data layer developed using the multiple data source method is the only data available for all ownerships.

[8] Assume acres of unsurveyed and surveyed lands includes the process for eliminating areas with less than 20 percent habitat within an exclusive home range radius.

[9] For the western Washington Cascades, there are 124 known sites on 319,430 acres of surveyed lands with greater than 20 percent habitat within an exclusive home range radius. This works out to 0.0004 sites per acre. Multiplying 0.0004 by 91,995 (the acres of unsurveyed lands with greater than 20 percent habitat within an exclusive home range radius) yields an estimate of 36 spotted owl sites on unsurveyed

The acreage of habitat that would be included within spotted owl circles for these undiscovered activity centers is estimated by multiplying the average contribution of habitat on DNR-managed lands to current site centers (448 acres using forests older than 70 years as habitat and 619 acres for the multiple data source method[10]) by the number of undiscovered activity centers. This estimate rests on an assumption that habitat on unsurveyed lands occurs in a similar distribution and configuration to that on surveyed lands. These elements were not analyzed in detail on unsurveyed lands. This procedure results in an estimate of an additional 18,816 acres of habitat within spotted owl circles (forests older than 70 years as habitat) or 25,998 acres (multiple data source method).

Results. Following the above four sets of assumptions (general application of incidental take guidelines, static owl circles, no loss of habitat to disturbance, and habitat retained at projected unknown sites), an evaluation of the amount of suitable spotted owl habitat that would be retained under Alternative A can be made. There are an estimated 60,090-81,427 acres of suitable spotted owl habitat within known spotted owl regulatory circles (circles of 1.8-mile radius in the western Washington Cascades and 2.7 miles in the western Washington lowlands and the Olympic Peninsula). Of this, between 32,420 and 41,584 acres[11] of habitat are within circles that currently have less than 40 percent habitat. It is assumed that these acres will be unavailable for harvest. Between 4,995 and 5,934[12] acres of habitat on DNR-managed lands are within circles in which the 40 percent habitat requirement is met entirely within federal reserves. It is assumed that the habitat on DNR-managed lands within these circles will be available for harvest because incidental take would not likely occur as a result of removal of habitat on DNR-managed lands. For the remaining acres of suitable habitat on DNR-managed lands (i.e., those that are within circles that have more than 40 percent total habitat currently, but that habitat is split among multiple landowners and managers), it is assumed DNR will stay in compliance with take guidelines and thus the habitat will be unavailable for harvest. For projected sites that may occur within 2 miles of federal reserves, it is assumed that approximately 20 percent of these sites would have more than 40 percent of their median home range circles in habitat on federal lands and that in these circles, habitat on DNR-managed lands would be available for harvest. It is also assumed that any habitat on DNR-managed

---

lands. In the western Washington lowlands, there are 21 sites on 100,610 acres of surveyed lands with greater than 20 percent habitat within an exclusive home range radius giving 0.0002 sites per acre. Multiplying 0.0002 by 30,619 acres yields an estimate of six sites on unsurveyed lands.

[10] These acreage figures do account for overlap of circles which is why they are smaller than the figures cited previously.

[11] In this instance, this lower figure is the habitat estimate based on the multiple data source method and the higher acreage figure is the estimate based on forests older than 70 years. This is because there are more spotted owl activity centers with less than 40 percent habitat based on using forests older than 70 years as a surrogate for habitat on DNR-managed lands (76) versus using the multiple data source method (67) for habitat on DNR-managed lands.

[12] For acres of habitat on DNR-managed lands that are within spotted owl circles with more than 40 percent habitat in federal reserves, using forest older than 70 years gave a higher acreage estimation for DNR-managed lands than did the multiple data source method. This is again an exception to the overall pattern.

lands within projected owl circles that occur farther than 2 miles from federal reserves would be retained to comply with take guidelines.

For the purposes of analysis, the 42 projected unknown sites were distributed by distance band in proportion to the distribution of acres of unsurveyed lands that had more than 20 percent habitat within an exclusive home range radius and the proportion of known sites that occur within each distance band. The results of the "moving window" analysis for unsurveyed lands described above were broken out by distance band to estimate where unknown site centers might occur. Analysis started with the assumption that the distribution of known sites would serve as a good predictor of how projected unknown sites influencing unsurveyed lands might be distributed, then examined the distribution by distance band of unsurveyed lands that would likely support spotted owl sites to assess whether the number of unknown sites that would occur in each distance band if distributed in the same proportion as known sites could be supported by the habitat patterns occurring on and around unsurveyed lands. Based on the distribution of habitat that could support owls on unsurveyed lands, it is reasonable to assume that site center distribution is proportional to the distribution of known sites is reasonable. The results of this distribution of projected unknown site centers are in Table 4.2.7.

Table 4.2.7: Distribution of projected unknown spotted owl site centers that may influence unsurveyed DNR-managed lands and known sites that influence DNR-managed lands

Distance from Federal Reserves (miles)	Number of projected unknown site centers that influence DNR-managed lands	Number of known sites that influence DNR-managed lands	Total known and projected site centers that influence DNR-managed lands
0.0 - 2.0[13]	33	115	148
2.1 - 4.0	4	12	16
4.1 - 6.0	1	3	4
6.1 - 8.0	1	3	4
8.1 - 10.0	0	1	1
10.1 - 12.0	1	2	3
>12	2	9	11
Totals	42	145	187

After subtracting acres of habitat that would be available for harvest from spotted owl circles in which DNR would not likely be required to provide habitat,[14] an additional 15,700 acres (age class older than 70 method) to 21,700 acres (multiple data source method) of habitat would be retained around projected unknown sites. A total of between 69,600 (age class older than 70) and 98,100 (multiple data source method) acres of habitat would be within spotted owl circles and unavailable for harvest.

In summary, 37 percent of the 186,000 acres of suitable spotted owl habitat on DNR-managed lands (forests 70 years old and older) and 27 percent of the 366,00 acres of habitat (using the multiple data source method) would remain to contribute to spotted owl activity centers. Under Alternative A, the rest of the suitable habitat outside of spotted owl regulatory circles on DNR-managed lands would not be managed specifically for spotted owl habitat. There are an additional 52,089 acres of DNR-managed forest lands

[13] Includes sites that may be (projected sites) or are known to be on federal reserves and within 2 miles of DNR-managed lands.

[14] The amount of habitat that is subtracted from what we estimate to be retained around unknown sites is 3,136 acres using forests older than 70 years as habitat and 4,333 acres using the multiple data source method. These acreage figures were calculated by assuming that 20 percent of the unknown sites within 2 miles of federal lands would have more than 40 percent habitat on federal reserves. Thus seven sites multiplied by an average contribution of habitat from DNR-managed lands of 448 acres (age class older than 70 years) or 619 acres (multiple data source method).

that are older than 70 years old that will be managed as off-base lands (i.e., no harvest will take place on these lands) for reasons other than compliance with spotted owl take guidelines. These reasons include compliance with Washington Forest Practices Rules and DNR's Forest Resource Plan for riparian management zones and unstable slope protection and deferral of potential marbled murrelet habitat. (Lands managed by DNR as Natural Area Preserves and Natural Resource Conservation Areas are included in the calculation of off-base lands because they contribute habitat. They are not, however, legally included under the terms of the proposed HCP. See draft HCP Chapter 1, section on "Lands Covered," and the Implementation Agreement.) These acres of off-base lands older than 70 years may or may not contribute habitat to spotted owls, depending on their spatial arrangement. Large contiguous blocks of older forest managed to avoid take of marbled murrelets for example, could contribute functional habitat to spotted owls. Older forests in narrow riparian leave areas probably would not make a significant contribution to the life needs of the spotted owl. For the purposes of analysis it is assumed that any benefit to spotted owls from these off-base lands will be incidental. The change in the amount of suitable spotted owl habitat under Alternative A is summarized in Tables 4.2.8. and Table 4.2.9.

Table 4.2.8: Change in amount of potentially suitable spotted owl habitat on DNR-managed lands in the five west-side planning units under Alternative A (using forests 70 years old and older as habitat estimation method)

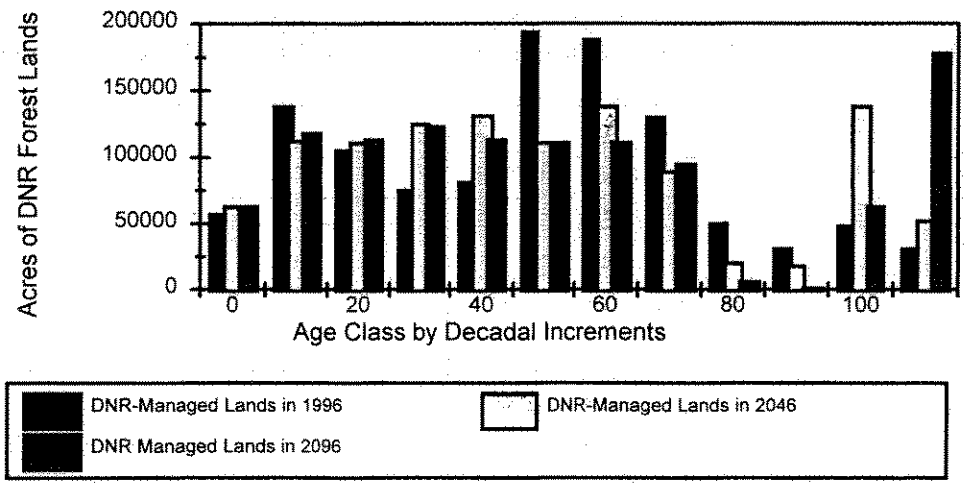
A.	Total estimated acres of potential suitable habitat in 1996	186,000
B.	Estimated acres of potential suitable habitat unavailable for harvest within known spotted owl circles in 1996	54,300
C.	Estimated acres of potential suitable habitat within projected unknown spotted owl circles that are unavailable for harvest	15,700
D.	Total acres potential suitable habitat to be retained under Alternative A (B. plus C.)	70,000
E.	Acres present potential suitable habitat not to be managed for spotted owls (A. minus D.)	116,000

Table 4.2.9: Change in amount of potentially suitable spotted owl habitat on DNR-managed lands in the five west-side planning units under Alternative A (using multiple data source method of habitat estimation)

A.	Total estimated acres of potential suitable habitat in 1996	366,000
B.	Estimated acres of potential suitable habitat unavailable for harvest within known spotted owl circles in 1996	76,400
C.	Estimated acres of potential suitable habitat within projected spotted owl circles that are unavailable for harvest	21,700
D.	Total acres potential suitable habitat to be retained under Alternative A (B. plus C.)	98,100
E.	Acres present potential suitable habitat not to be managed for spotted owls (A. minus E.)	267,900

DNR modeled one potential set of harvest regimes for its lands for the next 100 years under Alternative A. Age class distributions in 1996, 2046 and 2096 are shown in Figure 4.2.4. The model predicts that there will be approximately 253,000 acres of forests older than 70 years by the end of the analysis period (100 years) under Alternative A. DNR estimates that there would be approximately 70,00 acres of forests older than 70 years inside spotted owl circles by 2096. Thus, there could be 183,000 acres of forests older than 70 years outside of spotted owl circles by 2096. However, modeling of Alternative A includes the maintenance of marbled murrelet habitat. Because of the uncertainty associated with continuation of a policy that defers harvest of potential marbled murrelet habitat on DNR-managed lands for the next 100 years, it is difficult to rely on the presence of this projected older forest habitat for potential use by spotted owls.

Figure 4.2.4: Age Class Distribution on DNR-managed lands from 1996 to 2096 - Alternative A



Alternative B

Under Alternative B, DNR would manage approximately 163,000 acres of its lands in the five west-side planning units as NRF management areas. DNR has proposed to maintain at least 50 percent of the area of its designated NRF management areas for nesting, roosting, and foraging habitat at any one time. The scale of measurement for the 50 percent requirement is on DNR-managed lands within a watershed administrative unit. Thus, 81,500 acres of DNR-managed lands should be in NRF habitat at any one time. DNR proposes to manage approximately 20,400 acres in high quality nesting habitat, arranged in 300-acre patches, and the remaining 61,100 acres in sub-mature quality habitat or better. Another element of Alternative B is that it allows for degradation of existing old forest habitat to sub-mature habitat as long as the nest habitat patch requirement is met. In addition, any new habitat that is developed need only meet the structural characteristics of sub-mature habitat.

This arrangement of high quality nest habitat and sub-mature habitat is proposed for the initial "research" phase of the HCP (DNR 1996a p. IV.1). The 20,400 acres of nest habitat patches are deferred from harvest during the research phase of the proposed HCP. During this period DNR would conduct research to: (1) refine stand-level definitions of nest habitat in managed landscapes; (2) acquire a better understanding of what constitutes an adequate distribution of nesting structure at the landscape level; and, (3) develop silvicultural techniques to produce forest stands with sufficient nesting structure (DNR 1996a p. IV.1). DNR's goal is to provide nest habitat in a managed landscape (DNR 1996a p. IV.1). Because DNR does not specify the duration of its research phase, it is difficult to predict the specific outcome of DNR's proposed research program. The language in the draft HCP however, commits DNR to provide an amount and configuration of spotted owl nesting habitat that is consistent with the results of research findings regarding both stand and landscape requirements for successful nesting. Any

change in level of nesting habitat would have to be approved by the U.S. Fish and Wildlife Service (DNR 1996a p. IV.7). Further, any change that resulted in an increased level of take would require that DNR and U.S. Fish and Wildlife Service go through an amendment process (DNR 1996b). Based on these commitments, it is assumed for the purposes of analysis that over the term of its permit period under Alternative B, DNR would provide at least the same level of nesting habitat in the landscape as it would provide during the research phase.

The projected change in age class distribution on DNR-managed lands under Alternative B over the next 100 years is shown in Figures 4.2.5-4.2.7. (These figures include age class distribution in DNR-designated dispersal areas. Dispersal habitat is discussed under Criterion 3 below.) The projected change in age class distribution for NRF management areas only is shown in Figure 4.2.8. The change in amount of potentially suitable spotted owl habitat is summarized in Tables 4.2.10 and 4.2.11.

Figure 4.2.5: Age class distribution within five west-side planning units under Alternative B - 1996

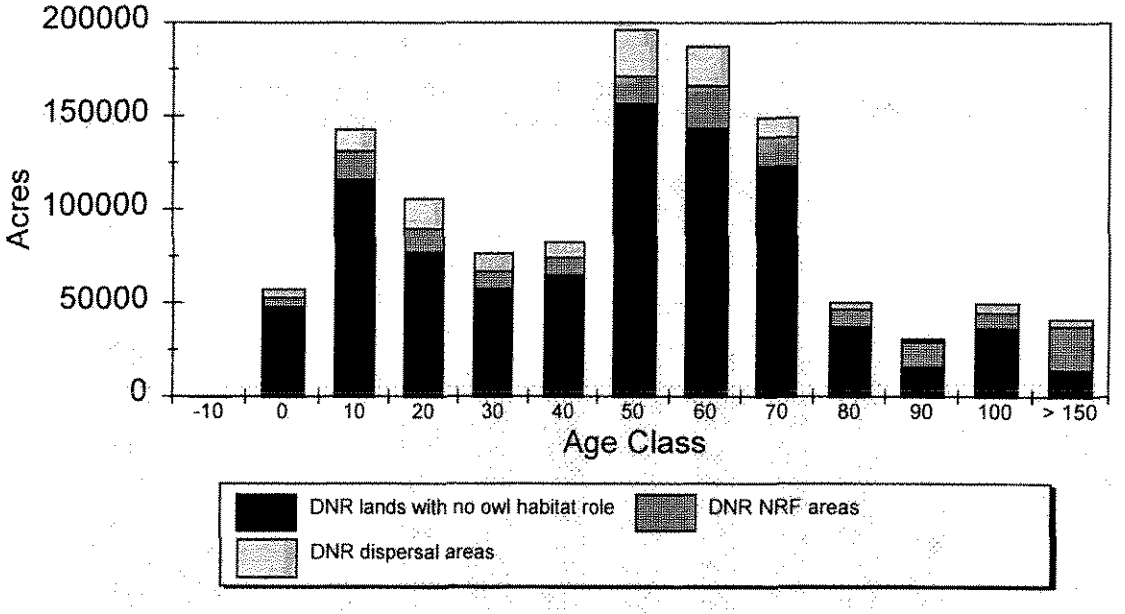


Figure 4.2.6: Age class distribution within five west-side planning units under Alternative B - 2046

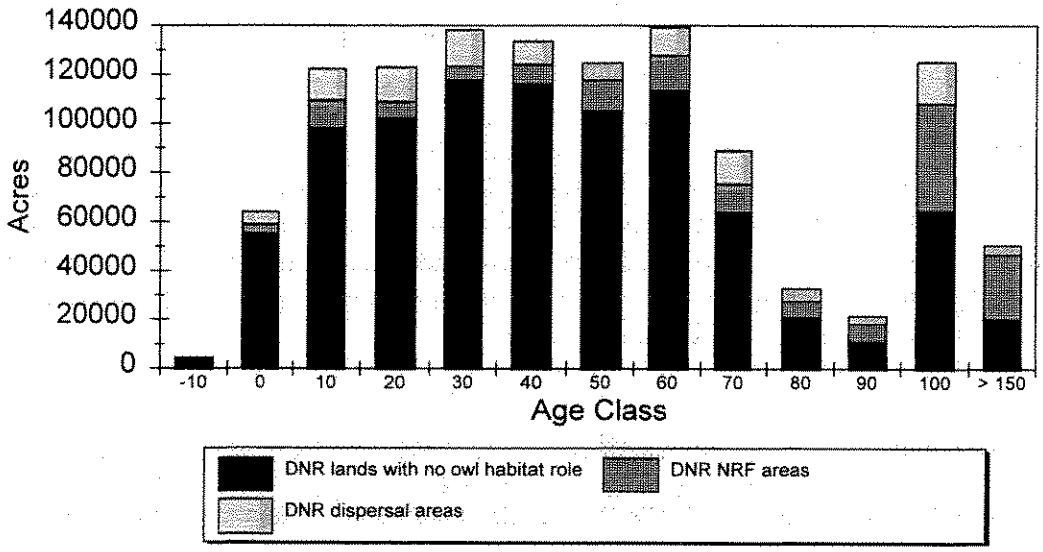


Figure 4.2.7: Age class distribution within five west-side planning units under Alternative B - 2096

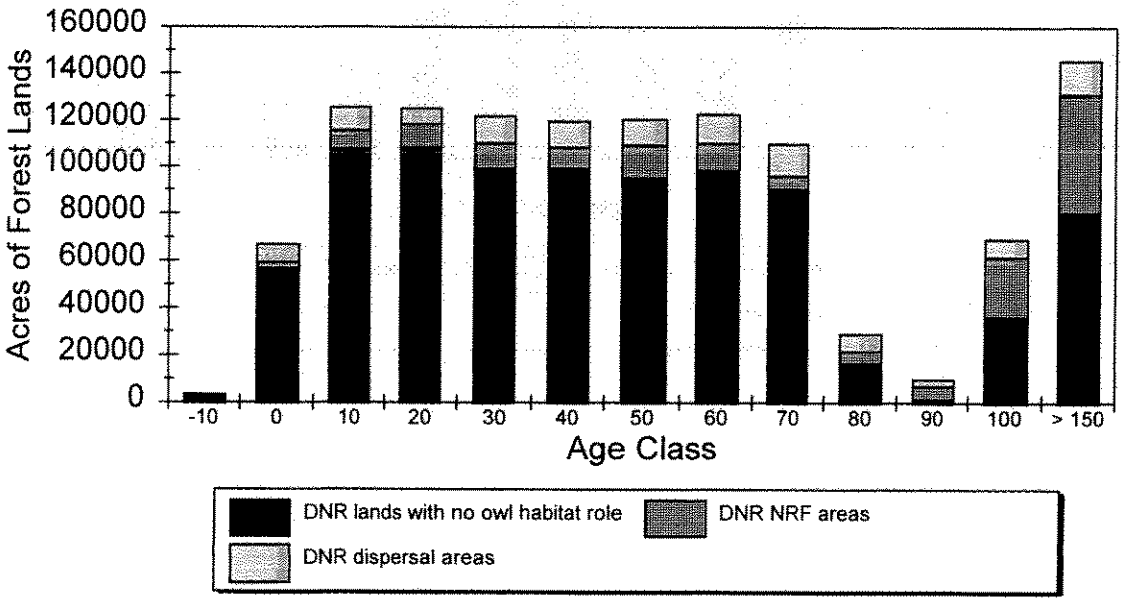
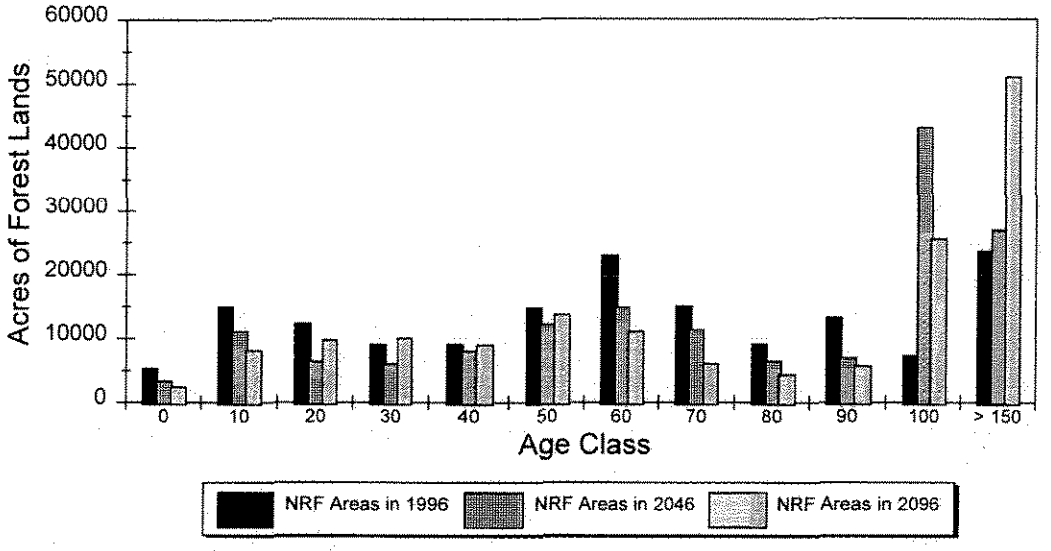


Figure 4.2.8: Age class distribution within DNR NRF areas from 1996 to 2096 - Alternative B



As discussed for Alternative A, there are between 186,000 and 366,000 acres of potentially suitable nesting, roosting, and foraging habitat currently on DNR-managed lands. Management of DNR-managed lands under Alternative B will result in the development and maintenance of at least 81,500 acres of suitable nesting, roosting and foraging habitat within proposed NRF management areas in the five west-side planning units. DNR modeled forest growth and one potential set of harvest regimes that will meet the conservation commitments made in its proposed HCP, including requirements of the marbled murrelet, riparian, and multispecies conservation strategies. The results of DNR's model predict the existence of 94,859 acres of forest older than 70 years within NRF areas by the year 2046, 27,000 acres of which will be older than 150 years. By the year 2096 the model shows the existence of 92,694 acres of forest older than 70 years, 51,000 acres of which will be in forest stands older than 150 years old. Nesting, roosting, and foraging habitat maintained within NRF management areas under Alternative B should occur in a size and spatial arrangement useful to spotted owls because of the 50 percent area requirement within watershed administrative units. This is a defensible assumption because of the proximity of NRF areas to federal reserves and because the average amount of habitat on NRF management areas within a WAU is 1,350 acres. Given the distribution of DNR-managed lands designated as NRF areas, most habitat patches are likely to either be contiguous or occur within a median home range distance of other habitat patches. Presently, 143,000 acres of NRF management areas (out of a total of 163,000) have 20 percent or more habitat within an exclusive home range radius (see previous description of the "moving window" analysis. These conditions will only improve as habitat develops on adjacent federal reserves and in NRF management areas that are currently below their target condition.

The model shows the presence of 211,000 acres of forests older than 70 years in areas that will not be managed intentionally for spotted owl NRF habitat (including dispersal areas) in the year 2046; 23,700 of which will be older than 150 years. In the year 2096, the model predicts that there will be 271,500 acres of forest older than 70 years in areas outside of designated NRF management areas; 94,926 acres of which will be older than 150 years. Under Alternative B, between 117,513 and 281,046 acres of current potentially suitable habitat would not be managed specifically for spotted owls. Between 31,700 and 39,100 acres of this occurs within known spotted owl circles, so is likely functioning as spotted owl habitat.

While there is a net gain of over 150,000 acres of forests older than 70 years outside of NRF management areas over the 100-year analysis period, it cannot be said with confidence what the benefit of these stands will be to spotted owls outside of NRF areas. Their value will depend to a large degree on spatial arrangement, proximity to sources of colonization,[15] and past disturbance history of the stands. Larger contiguous blocks have a higher habitat value than older forest that occurs in small patches or narrow strips. Stands that are distant and isolated from occupied and reproductively successful owl sites would not have a high probability of becoming occupied themselves. Stands with past harvest or natural disturbance history that left little structural complexity (i.e., a few large snags, large live trees and down woody debris) would not likely function as spotted owl habitat. For stands within NRF management areas, management regimes would be applied that are designed to retain and/or create structural features used by spotted owls. There is no such commitment for DNR-managed lands outside of NRF areas. These uncertainties should be kept in mind when considering the acres of forests older than 70 years outside of NRF management areas. The change in amount of potentially suitable spotted owl habitat on DNR-managed lands under Alternative B is summarized in Tables 4.2.10 and 4.2.11.

[15] See discussion of source and sink dynamics in section on demographic support, p.-64

Table 4.2.10: Change in amount of suitable spotted owl habitat expected by the year 2096 for the five west-side planning units under Alternative B (habitat estimated as forests 70 years old and older)

A. Within NRF Management Areas	
Expected Suitable Habitat:	
Acres potential habitat in 1996	68,487
Net acres to be developed to meet HCP goal of 81,500 acres	13,013
Additional expected acres suitable habitat based on forest growth and harvest model	11,194
Total:	**92,694**
Acres suitable habitat in forests older than 150 years by 2096	51,000
B. Outside NRF Management Areas	
Net Change in Potential Suitable Habitat	
Acres of forests older than 70 years outside of NRF areas in 1996	117,513
Acres of forests older than 70 years with potential incidental benefit to spotted owls in 2096	271,500
Net gain in acres of forests older than 70 years with potential incidental benefit to spotted owls by 2096	153,987

Table 4.2.11: Change in amount of potential suitable spotted owl habitat under Alternative B in the five west-side planning units using the multiple data source method of habitat estimation

A. Within NRF Management Areas	
Expected Suitable Habitat:	
Acres potential habitat in 1996	84,954
Net acres to be developed to meet HCP goal of 81,500 acres	- 3,454
Additional expected acres suitable habitat[16] based on forest growth and harvest model	11,194
Total:	**92,694**
Acres of NRF management areas in forests older than 150 years by 2096	51,000
B. Outside NRF Management Areas	
Net Change in Potential Suitable Habitat	
Acres of habitat outside of NRF areas in 1996	281,046
Acres of forests older than 70 years with potential incidental benefit to spotted owls in 2096	271,500
Net loss in acres of forest with potential incidental benefit to spotted owls by 2096	9,546

[16] Potential suitable habitat in terms of the forest growth model is considered forest older than 70 years. For forest stands within NRF management areas, DNR's growth model took into account silvicultural regimes that would theoretically produce the structural characteristics of sub-mature habitat (Hanson et al. 1993) by the time a stand reached 70 years of age.

Implementation of Alternative B would result in a decrease of 63-77 percent from the amount of potential habitat present in 1996 if just habitat to be managed for spotted owls is considered. Considering the total acres of forest older than 70 years that would exist in 2096, Alternative B would result in a increase of 83 percent from current acres of forests older than 70 years.

Alternative B results in the retention of 11,900 more acres of habitat that would be managed specifically for spotted owls than Alternative A when using forests 70 years old and older to estimate habitat. This alternative results in a decrease of 16,600 acres using the multiple data source method of estimating habitat.

Alternative C

Under Alternative C, DNR would manage 243,496 acres of its lands in NRF management areas in the five west-side planning units. An additional 80,253 acres of designated NRF management areas occur in the Straits Planning Unit (Map 17). In this alternative, DNR would manage 60 percent of its lands designated as NRF management areas in suitable nesting, roosting, and foraging habitat at any one time.

No degradation of existing old forest habitat is allowed in this alternative and, any habitat that is developed in WAUs in which there is less than 60 percent habitat will be developed into old forest habitat. Thus, Alternative C seeks to improve habitat quality over time. Alternative C does not contain the nest habitat patch component that is contained in Alternative B. There are also 43,000 acres of experimental areas designated in the South Coast Planning Unit (Map 18). These experimental areas would be established as 4-mile management buffers around five known spotted owl site centers on DNR-managed lands. They would be managed with the goal of learning how to maintain successfully reproducing spotted owls in actively managed landscapes. The site centers contained within these experimental areas would actually be part of the incidental take permit to reflect the risk posed by conducting research activities within spotted owl home ranges.

DNR's goal under Alternative C would be to develop and maintain 146,100 acres of suitable nesting, roosting, and foraging habitat within NRF management areas over the life of the HCP. This does not include the habitat that may be maintained or developed in the experimental management areas in the South Coast Planning Unit. The change in amount of potential nesting, roosting, and foraging habitat on DNR-managed lands is summarized in Tables 4.2.12 and 4.2.13.

Table 4.2.12: Change in amount of suitable spotted owl habitat expected by the year 2096 for the five west-side planning units under Alternative C (habitat estimated as forests 70 years old and older)

A. Within NRF Management Areas	
Expected Suitable Habitat:	
Acres potential habitat in 1996	80,497
Net acres to be developed to meet HCP goal	65,603
Total acres spotted owl habitat by 2096	**146,100**
B. Outside NRF Management Areas	
Acres of forests older than 70 years outside of NRF areas in 1996	105,503
Acres of forests older than 70 years with potential incidental benefit to spotted owls in 2096	447,300

Table 4.2.13: Change in amount of suitable spotted owl habitat expected by the year 2096 for the five west-side planning units under Alternative C (multiple data source method used to estimate habitat)

A. Within NRF Management Areas	
Expected Suitable Habitat:	
Acres potential habitat in 1996	98,430
Net acres to be developed to meet HCP goal	47,670
Total acres spotted owl habitat by 2096:	**146,100**
B. Outside NRF Management Areas	
Acres of forests older than 70 years outside of NRF areas in 1996	267,570
Acres of forests older than 70 years with potential incidental benefit to spotted owls in 2096	447,300

Implementation of Alternative C would result in the maintenance and development of 146,100 acres of nesting, roosting, and foraging habitat on DNR-managed lands. This is a decrease of 21 to 60 percent of total present amount of habitat estimated to be on DNR-managed lands in 1996. This is 64,600 more acres of habitat to be maintained and developed than in Alternative B and between 48,000 and 76,500 acres more habitat than would be retained in Alternative A. Under Alternative C, between 105,503 and 267,570 acres of current potentially suitable habitat would not be managed specifically for spotted owls. Between 11,166 and 25,844 acres of this potential habitat currently occurs within known spotted owl circles which is a good indication that it is actually functional spotted owl habitat. The remaining acres may or may not be functional spotted owl habitat. Other provisions of the HCP under Alternative C have been modeled and could result in the retention of 447,300 acres) of forest older than 70 years outside of NRF areas, but it is difficult to predict what proportion of this potential habitat would occur in a configuration that would be useful to spotted owls.

Change in Distribution of Habitat

Projections for the amount of habitat that would occur within each distance band from federal reserves were made as follows. For Alternative A, it was assumed (as described above) that habitat on DNR-managed lands that is within circles in which over 40 percent of the habitat was on federal lands would be available for harvest. This amount of habitat

was subtracted from where these sites actually occur to give a spatially accurate estimate of habitat within distance bands from federal reserves. The acres of habitat estimated to be unavailable for harvest from projected unknown sites was added to acres of habitat within known owl circles for each distance band (for distribution of unknown sites refer to Table 4.2.7). It was then assumed that the remaining acres of habitat on DNR-managed lands within owl circles known to occur in 1996 and projected to be located on unsurveyed lands would be standing in 2096; i.e., none of it would be lost to natural disturbance, nor did the regulatory requirements change, nor did the habitat condition improve on any of the ownerships within an owl circle.

For Alternative B it is assumed that on average, 50 percent of the NRF areas within each distance band would be in a suitable habitat condition in 100 years. For Alternative C, it was assumed that 60 percent of the NRF areas within each distance band would be in a suitable habitat condition in 100 years. The growth models run for Alternative B indicate that it is likely that habitat conditions will be met or exceeded by the year 2096. Similar model results were not available to make that assessment for Alternative C.

Table 4.2.14: Change in distribution of potential spotted owl habitat as estimated by forests older than 70 years from 1996- 2096 for Alternatives A, B, and C

	Acres habitat in 1996[17]				Acres habitat in 2096		
Distance from federal reserves - miles	Total acres potential habitat on DNR-managed lands	Alt. A	Alt. B	Alt. C	Alt. A (% change)[18]	Alt. B (% change)	Alt. C (% change)
0.0 - 2.0	69,042	44,556	43,235	63,844	44,556 (-35.5)	62,788 (-9.1)	115,768 (+67.7)
2.1 - 4.0	32,133	13,470	10,670	14,901	13,470 (-58.1)	16,340 (-49.1)	27,337 (-14.9)
4.1 - 6.0	17,953	3,732	1,419	1,419	3,732 (-79.2)	1,976 (-89.0)	2,372 (-86.8)
6.1 - 8.0	16,844	2,474	333	333	2,474 (-85.3)	488 (-97.1)	586 (-96.5)
8.1 - 10.0	8,782	1,313	0	0	1,313 (-85.0)	29 (-99.7)	35 (-99.6)
10.1 - 12.0	8,230	528	0	0	528 (-93.6)	0 (-100.0)	0 (-100.0)
> 12	32,819	4,362	0	0	4,362 (-86.7)	0 (-100.0)	0 (-100.0)
Totals	**185,803**	**70,435**	**65,657**	**80,497**	**70,435 (-62.1)**	**81,621 (-56.1)**	**146,098 (-21.4)**

Alternative A

Implementation of Alternative A would result in a decrease of approximately 62 percent of potentially suitable spotted owl habitat (forests 70 years old and older) in the five west-side planning units. The smallest decrease occurs in the 0-2-mile distance band. Potential habitat in each distance band from 4-6 miles outward decreases by 80 percent or more. As discussed in the above section on change in amount of habitat for Alternative A, DNR models do predict there would be forests older than 70 years outside of spotted circles. It is, however, difficult to predict how much of this would actually function as spotted owl habitat.

[17] This tabulation of habitat acreage includes habitat within known and projected unknown spotted owl circles for Alternative A and within NRF areas for Alternatives B and C.

[18] Percent change refers to change in amount of habitat within the distance band under that alternative in 2096 compared to total amount of habitat existing within the distance band in 1996.

Alternative B

Implementation of Alternative B would result in a decrease of 56 percent of the total amount of potentially suitable habitat compared to what is estimated to exist in 1996. There is a 9 percent decrease in the 0-2-mile distance band compared to much larger decreases in the farther distance bands. Alternative B would provide at least 16 percent more habitat when compared to Alternative A (DNR harvest model indicates that there could be more than the target amount of habitat within NRF management areas by 2096). For DNR-managed lands within 4 miles of federal reserves, Alternative B would provide 36 percent (approximately 21,000 acres) more habitat than Alternative A. This increase in habitat within 4 miles of federal lands suggests a higher contribution to demographic support of the federal population under Alternative B than Alternative A. This issue is discussed further under Criterion 4: Demographic Support.

Alternative C

Under Alternative C, the amount of habitat on DNR-managed land within NRF management areas within 2 miles of federal reserves would increase by 67.7 percent from the total amount of habitat on DNR-managed land within 2 miles of federal reserves -- from 69,042 to 115,768 acres. Implementation of Alternative C would result in an increase of 41,930 acres or 41 percent compared to the amount of potentially suitable habitat on DNR-managed lands within 4 miles of federal reserves in 1996. For lands farther than 4 miles from federal reserves, there would be a decrease of 81,635 acres or 96 percent of potential habitat that occurs on DNR-managed lands in 1996.

Compared to Alternative A, Alternative C would increase the amount of habitat within 4 miles of federal reserves by 85,080 acres. Compared to Alternative B, Alternative C would provide 64,000 more acres of habitat within 4 miles of federal reserves. The increase in habitat provided in Alternative C over Alternative B arises from the establishment of NRF management areas in the Straits Planning Unit and a higher percentage of habitat required within NRF areas (60 versus 50 percent).

All three alternatives result in a loss of total potential habitat from what is on DNR-managed lands today, compared to the amount of potential suitable habitat predicted to be present in the year 2096. Given that Alternative A is the No Action alternative, a loss of potential habitat would occur under the current policy of owl circle management. The largest loss of total potential habitat over the next 100 years would occur under Alternative A. Most of the loss of potential habitat under Alternatives B and C as compared to the total amount of potential habitat on DNR-managed lands in 1996 occurs in areas farther than 4 miles from federal reserves. The implications of this redistribution are discussed below, in the sections on demographic support and maintenance of species distribution of the spotted owl population.

Criterion 2: Impact of Alternatives to Present and Future Spotted Owl Sites

In this section, the impacts of each alternative to individual spotted owl site centers are assessed. The potential for incidental take of spotted owls that may occupy known site centers and spotted owls that are unknown but may presently occupy sites that influence unsurveyed DNR-managed lands is evaluated. The potential impact to spotted owl site centers that may become established in the future as habitat conditions improve on federal reserves and in NRF management areas proposed under Alternatives B and C is also analyzed.

The concept of take is applied as a part of assessing the potential impacts to spotted owls under this criterion. Take is defined in the Endangered Species Act as actions which "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct" involving threatened or endangered species (16 U.S.C. § 1532(18)). Incidental take is defined as "any taking otherwise prohibited, if such taking is incidental to and not the purpose of, the carrying out of an otherwise lawful activity" (50 C.F.R. § 17.3 (1994)). Management activities undertaken through implementation of any of the alternatives analyzed in this DEIS have the potential to cause incidental taking through harassment or harm of spotted owls. DNR would not engage in activities that involve pursuit, hunting, shooting, trapping, wounding, killing, capturing[19] or collecting spotted owls, or any activities that are legally understood as direct take under any of the alternatives.

Harassment is further defined in the Code of Federal Regulations as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (50 C.F.R. § 17.3 (1994)). Harm is defined as "an act which actually kills or injures wildlife. Such an 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" (50 C.F.R § 17.3 (1994)).

The U.S. Fish and Wildlife Service considers timber harvest and any related activities that disturb the breeding and nesting function of spotted owls during the breeding season to result in incidental harassment. U.S. Fish and Wildlife Service guidelines specify that timber harvest or any related activities within a 70-acre core surrounding a nest site or site center of a spotted owl pair during the reproductive period could constitute harassment (60 Fed. Reg. 9491 (1995)).

The U.S. Fish and Wildlife Service bases its interpretation of the concept of harm for spotted owls on research that supports the conclusions that (1) reduced amounts of nesting, roosting, and foraging habitat in the landscape result in lower spotted owl abundance and productivity rates (Hayes et al. 1989; USDI 1990; Bart and Forsman

[19] Temporary capturing may occur as part of any radio-telemetry or banding studies needed to carry out the research commitments of Alternatives B and C. Such activities would be covered under a recovery permit issued by the U.S. Fish and Wildlife Service along with the incidental take permit.

1992); and, (2) significant reduction of nesting, roosting and foraging habitat within a median home range distance of a spotted owl pair or territorial single could significantly increase the risk of death or injury to individual owl pairs or resident singles (60 Fed. Reg. 9491 (1995)). Harm then, arises from impairment of essential behavior patterns - breeding, feeding, and sheltering - due to lack of sufficient habitat in an owl's home range that provides nesting, roosting, and foraging functions. U.S. Fish and Wildlife Service guidelines for avoiding harm to spotted owls recommend the retention of a minimum of 40 percent of the area of a median home range-sized circle around the site centers of territorial pairs and resident single owls in suitable nesting, roosting, and foraging habitat (USDI 1990). The median home range radius for the Western Washington Cascades Province is 1.8 miles, and 2.7 miles for the Western Washington Lowlands Province and the Olympic Peninsula Province (Frederick 1994). A second U.S. Fish and Wildlife Service guideline for avoidance of harm is to retain 500 acres of suitable habitat within a 0.7-mile core of territorial spotted owl site centers (USDI 1990).

General Methods for Assessing Incidental Take

General methods for assessing impacts to spotted owl site centers are as follows. The potential for incidental take to occur is assessed for Alternatives B and C because both of these alternatives involve applications for incidental take permits. Forest management under Alternative A would continue a take-avoidance policy of surveying proposed timber sales for spotted owl occupancy and assessing habitat conditions within 1.8/2.7 miles of any discovered occupied sites. Management activities under Alternative A may have impacts to spotted owls and spotted owl site centers (e.g., no replacement of habitat over the long term), but would not likely result in incidental take as long as current policy is followed. Analysis of impacts of Alternative A therefore assumes that there would be no incidental take as defined under the Endangered Species Act.

Impacts to spotted owl activity centers under Alternatives B and C are assessed as follows. First, GIS was used to draw a 1.8 or 2.7 mile radius circle around known territorial spotted owl activity centers. The amount of habitat within each circle was then estimated using the multiple data source method described above (see p. 4.2.1 - x-x) above) for all land ownerships within each circle. The amount of habitat on DNR-managed lands in each circle was also estimated using forest stands older than 70 years old and the resulting acreage substituted for the acreage derived from the multiple data source method only on DNR-managed lands. Thus two figures for total amount of habitat and amount of habitat on DNR-managed lands were derived for each owl circle. To estimate impacts to each activity center, it was asssumed that under Alternatives B and C, all habitat that currently exists on DNR-managed lands within known spotted owl circles outside of NRF management area will be harvested over the term of the HCP. The rescinded USFWS guidelines (USDI 1990) were generally followed for a biological estimation of when harm or harassment occurs to spotted owls. For the purposes of this analysis, spotted owls were deemed at risk of incidental take when (1) harvest of habitat on DNR-managed lands within a spotted owl circle reduces the habitat level from above 40 percent to below 40 percent; and, (2) harvest of habitat on DNR-managed lands occurs within owl circles that are already below a 40 percent habitat level. It was also assume that incidental take may occur in the future when harvest of habitat on DNR-managed

lands by itself would not reduce habitat levels below 40 percent but less than 40 percent of the total amount of habitat within a circle is in a management status that can be expected to provide spotted owl habitat for the long term (federal reserves). In such cases, other landowners may have harvested habitat within the circle down to a 40 percent level before DNR harvests habitat on its trust lands. Under implementation of Alternative B, DNR would be allowed to further reduce habitat levels below 40 percent as part of its incidental take permit.

Because of limitations in the spatial resolution and accuracy of our habitat data, DNR cannot assess with confidence when harvest of habitat on DNR-managed lands reduces the habitat level in the 0.7-mile core area to below 500 acres. Assessment of disturbance of a 70-acre core is also not quantitatively undertaken for these reasons. However, the overall potential for harassment based on the management guidelines contained within each alternative can be assessed. It is acknowledged that this analysis of take-assessment is general. A rigorous take-assessment would require a site-by-site analysis using field-verified data of both amount and arrangement of habitat, proximity of habitat proposed for harvest to the site center, and occupancy data that was up to date. The data available to the DEIS analysts do not permit this detailed an assessment.

The above described methods are directly applied to spotted owl site centers that would not be influenced by NRF management areas proposed in Alternatives B and C. Methods for assessing potential take of current and future spotted owls that are on or within a median home range radius of NRF management areas proposed in Alternatives B and C involve additional assumptions and methods due to the management strategies included in each of these alternatives. These additional methods and assumptions are described in the sub-sections for each alternative.

Alternative A

Management of DNR-managed lands that are used by spotted owls would continue on a site-by-site basis in Alternative A. There are 145 territorial spotted owl activity centers on or within 2.0/2.7 miles of DNR-managed lands in the five west-side planning units. The habitat conditions within these circles and ownership at activity centers are summarized in Tables 4.2.15 - 4.2.17.

Table 4.2.15: Summary of habitat conditions within a median home range radius of spotted owl activity centers that influence DNR-managed lands: total amount of habitat within spotted owl circles

Percent total habitat in 2.0/2.7-mile radius spotted owl circles	Number of territorial activity centers using forests older than 70 years as habitat estimation method for DNR-managed lands (percent of total sites that influence DNR-managed lands)	Number of territorial activity centers using the multiple data source method for estimating habitat (percent of total sites that influence DNR-managed lands)
0.0 - 10.0	pairs 5 singles 7 (8%)	pairs 5 singles 4 (6%)
10.1 - 20.0	pairs 8 singles 3 (7%)	pairs 11 singles 3 (10%)
20.1 - 30.0	pairs 14 singles 4 (12%)	pairs 13 singles 5 (12%)
30.1 - 40.0	pairs 27 singles 5 (22%)	pairs 22 singles 4 (26%)
40.1 - 50.0	pairs 27 singles 2 (20%)	pairs 23 singles 3 (18%)
50.1 - 60.0	pairs 21 singles 5 (18%)	pairs 26 singles 6 (22%)
60.1 - 70.0	pairs 11 singles 0 (7%)	pairs 11 singles 0 (7%)
70.1 - 80.0	pairs 5 singles 1 (4%)	pairs 7 singles 2 (6%)
80.1 - 90.0	none	none
90.1 - 100	none	none
totals	pairs 118 singles 27 all 145	pairs 118 singles 27 all 145

Table 4.2.16: Summary of habitat conditions within a median home range radius of spotted owl activity centers that influence DNR-managed lands: amount of habitat on DNR-managed lands within spotted owl circles

Percent habitat on DNR-managed lands within 2.0/2.7-mile radius spotted owl circles	Number of territorial activity centers using forests older than 70 years as habitat estimation method for DNR-managed lands (percent of total sites influencing DNR-managed lands)	Number of territorial activity centers using the multiple data source method for estimating habitat (percent of total sites influencing DNR-managed lands)
0.0 - 10.0	pairs 87 singles 19 (73%)	pairs 94 singles 16 (76%)
10.1 - 20.0	pairs 18 singles 4 (15%)	pairs 10 singles 2 (8%)
20.1 - 30.0	pairs 9 singles 3 (8%)	pairs 4 singles 6 (7%)
30.1 - 40.0	pairs 2 singles 0 (1%)	pairs 2 singles 2 (3%)
40.1 - 50.0	pairs 1 singles 0 (0.6%)	pairs 5 singles 0 (3.4%)
50.1 - 60.0	pairs 1 singles 1 (1.4%)	pairs 3 singles 0 (2%)
60.1 - 70.0	pairs 0 singles 0 (0%)	pairs 0 singles 1 (0.6%)
70.1 - 80.0	none	none
80.1 - 90.0	none	none
90.1 - 100	none	none
totals	pairs 118 singles 27 all 145	pairs 118 singles 27 all 145

Table 4.2.17: Landowner/manager status at territorial activity centers that are on or within 2.0/2.7 miles of DNR-managed lands in the five west-side planning units

Landowner or manager	Number of territorial activity centers located on lands of each owner or manager	
DNR	pairs	25
	singles	9
U.S. Forest Service	pairs	75
	singles	11
National Park Service	pairs	8
	singles	6
Private	pairs	9
	singles	4

Under Alternative A, DNR would retain habitat that contributes to known spotted owl activity centers and to those that are discovered through surveys in the future. To the extent that spotted owl habitat is lost to natural or human-caused disturbance, long-term contribution of habitat from DNR-managed lands would decline because no new habitat would be developed to replace habitat lost to disturbance. Management of DNR-managed lands would not provide for any habitat outside of known spotted owl circles. In addition, loss of habitat could occur when a spotted owl site center moves and thus the associated circle delineating the area to kept in a 40 percent habitat condition moves. Habitat that was in the original circle would become available for harvest and the total amount of suitable spotted owl habitat would decline. In general, the impact to the spotted owl population from DNR management activities under implementation of Alternative A would be to support known site centers at the current level of habitat contribution over the short and medium term, and a likely decrease in the level of support of the population over the long term. There will most likely be no increased level of support from DNR-managed lands to the spotted owl population over the long term and thus no increased contribution to the recovery of the spotted owl population.

It is difficult to predict how long the current distribution of known site centers as shown in Tables 4.2.5 and 4.2.7 may persist into the future. Any loss of current site centers under Alternative A would likely be the result of one or a combination of four factors: (1) attrition of quality and quantity of habitat from natural disturbance; (2) loss and fragmentation of habitat from timber harvest that is done in accordance with USFWS take guidelines; (3) lack of new habitat development at sites that are already marginal; and, (4) random environmental or demographic events that lead to extirpation of individual activity centers and small clusters. The operation of the first three factors would make current activity centers more susceptible to loss from random events.

In order to make some predictions about the impacts to spotted owl site centers over the long term, some general assumptions must be made about the potential for habitat conditions to improve and the likelihood that sites would persist given habitat conditions and proximity to other site centers. Under Alternative A, DNR-managed lands would not be managed to develop any additional spotted owl habitat. Private forest landowners without approved HCPs (at the time of this writing) in which a contribution of nesting, roosting, and foraging habitat will be made to known activity centers are assumed not to contribute any more habitat from their lands than exists today. We also assume that habitat on U.S. Forest Service lands to be managed as matrix under the President's Forest Plan will be harvested within the next 10-20 years.

Site centers with less than 20 percent total habitat in a median home range-sized circle are either not likely to be occupied or if they are occupied, are not likely to remain viable for a long period into the future. This assertion is based on the work of Bart and Forsman (1992) that showed that landscapes with less than 20 percent habitat had substantially lower owl densities and reproductive output than landscapes with more than 60 percent habitat. In addition, analysis of habitat conditions around known spotted owl site centers in Washington State shows that 90 percent of known sites have more than 20 percent habitat within an exclusive home range radius.

Spotted owl sites that currently include between 20 and 40 percent habitat within a median home range-sized circle are probably existing in less than optimal habitat conditions and would have varying likelihoods of persistence depending on the quality of habitat in proximity to their site centers, proximity of the site to large clusters of productive site centers, and potential for habitat conditions to improve over time. Sites with between 20 and 30 percent habitat may have intermittent occupancy, but may not have reproductive outputs that contribute to a stable population (Bart 1995). Sites with less than optimal habitat conditions that are in close proximity to large clusters of site centers and/or in areas where forest management plans provide for improving habitat conditions might be expected to have a moderate likelihood of long-term persistence. Conversely, sites with between 20 and 40 percent habitat within a median home range radius might be expected to have a low likelihood of persistence if they occur in areas with little chance of improving habitat conditions and/or they are isolated from potential sources of recolonization.

Finally, sites with 40 percent habitat or more and that are part of medium to large clusters of site centers and are supported by large blocks of suitable habitat (or the potential for habitat conditions to improve) might be expected to have a high likelihood of persistence into the future. However, even sites with good habitat conditions that are isolated from medium to large clusters of spotted owl sites could be vulnerable to extirpation from random events over the long term (Thomas et al. 1990; USDI 1992b; Lamberson et al. 1994).

Using these general assumptions, some gross estimates can be derived of the number of spotted owl site centers that currently influence DNR-managed lands that might persist into the future under Alternative A (Table 4.2.18). Approximately half of the known site

centers that currently influence DNR-managed lands have a high likelihood of persistence based on current habitat condition, proximity to large clusters of owls and large block of extant habitat, and future potential to improve or maintain habitat conditions. Approximately 30 percent of known sites have a moderate likelihood of persistence but are more vulnerable to extirpation given current habitat conditions. Approximately 20 percent of known sites are not likely to persist into the future given current low levels of habitat and/or isolation from large clusters and large blocks of habitat.

Table 4.2.18: Estimates of likelihood of long-term persistence of known spotted owl site centers under Alternative A

Current Situation of Site Center	Number of Site Centers (percent of total)		Likelihood of persistence over the next 100 years
	Habitat as forests > 70 years old	Multiple data source method	
More than 40 percent habitat within median home range radius circle and in close proximity to large clusters of owls/large blocks of habitat	71 (49%)	74 (51%)	High
Between 20 and 40 percent habitat within median home range radius circle but in close proximity to federal reserves (current or future large blocks of habitat)	47 (32%)	40 (28%)	Moderate
Less than 20 percent habitat within median home range circle **or** distant from federal reserves or other owl clusters; **or** site within Forest Service matrix	27 (19%)	31 (21%)	Low
Totals	145	145	

This estimate can be seen as a "background" level of change in number of known site centers under Alternative A given the above assumptions about land management on other lands. The reader may refer back to Table 4.2.18 when comparing levels of estimated incidental take under Alternatives B and C. While DNR forest management activities would not lead to incidental take of owls at these sites, the fact that habitat conditions would likely not improve on DNR-managed lands could contribute to the eventual extirpation of some sites with presently marginal amounts of habitat.

Future Site Centers. Under Alternative A, we would not expect new site centers to influence DNR-managed lands where they are intermingled only with private lands nor

would federal lands be expected to be managed for late seral forest conditions. One might, however, expect there to be new site centers on federal reserves that are adjacent to DNR-managed lands. At what point in the future new sites begin appearing depends on how quickly favorable habitat conditions develop on federal reserve lands, and how quickly the spotted owl population responds to improving habitat conditions.

There are federal reserve lands that currently lack sufficient habitat to support spotted owls but will likely support new sites as habitat conditions improve over the next 100 years. Under Alternative A, DNR would not manage its lands to develop new spotted owl habitat in addition to what currently exists within spotted owl circles. Whether or not any future spotted owls that establish territories on federal reserves use habitat on DNR-managed lands depends on whether any habitat remains on those lands.

Recent analyses of demographic data collected from across the range of the spotted owl indicate that the population is declining at a rate of between 0.66 and 8.4 percent per year (Burnham et al. 1994). DNR developed a model for estimating when the portion of the owl population that is supported by federal reserves may begin to stabilize and recover. This model is based on a range of scenarios that use the upper end of the 95 percent confidence interval for the combined demographic data from the Cle Elum and Olympic demographic study areas to estimate population growth rates in western Washington and some assumptions about when habitat conditions on federal reserves would improve to the point that they were supporting a stable population (see section below on take of future activity centers under Alternative B for a full explanation of the model). The results of this model are variable and indicate that the population could continue to decline for anywhere from 5-50 years. The number of spotted owl site centers that could influence DNR-managed lands adjacent to federal reserves may not recover to their current numbers for over 100 years, or they could begin to exceed current numbers of site centers within 10-12 years (see Tables 4.2.23 and 4.2.26), depending on different scenarios for when federal reserves can provide habitat to support a stable population.

If the population on federal reserves begins to recover within the next decade or two, it is possible that habitat would remain on DNR-managed lands to make a contribution to the support of these new sites. On the other hand, if the population continues to decline for several more decades, it is likely that the number of sites influencing DNR-managed lands will never increase from the number of known sites and unknown sites that may presently influence unsurveyed lands.

Alternative B

Under Alternative B, DNR would manage approximately 163,000 acres of its lands for spotted owl habitat in areas that are in close proximity to federal reserve lands. Of the 145 known territorial spotted owl activity centers that influence DNR-managed lands, designated NRF management areas in the proposed HCP would contribute habitat to 66 of them (55 pairs and 11 singles). DNR-managed lands would no longer be managed for spotted owl habitat within the remaining 79 circles (65 pairs and 14 singles).

Impacts to Spotted Owl Site Centers Outside of NRF Management Areas. There are currently between 32,000 and 39,000 total, non-overlapping acres of potential habitat on DNR-managed lands within a median home range-sized circle of the 79 site centers that fall outside of proposed NRF areas. DNR-managed lands contribute an average of between 630 and 640 acres of habitat per site center to these circles.

The results of assessment of incidental take of spotted owls at site centers outside of NRF management areas are summarized in Table 4.2.19. Using the multiple data source method for estimating habitat on DNR-managed lands, there are seven owl circles in which DNR-managed lands make no contribution of habitat. Using forests older than 70 years old as a surrogate for habitat, there are 13 circles in which DNR-managed lands currently have no habitat. Management of DNR-managed lands under Alternative B would not further impact these site centers.

There are 23 spotted owl circles outside of the proposed NRF management areas in which DNR-managed lands contribute between 0.1 and 0.9 percent of the area of the circle in habitat (use of both methods of habitat estimation yield the same number of activity centers in this case). Nine (using both age class only method and multiple data source method) of these spotted owl circles would remain above the 40 percent habitat level if DNR removed all habitat on its trust lands. These nine site centers would not likely be negatively impacted by harvest of habitat on DNR-managed lands alone. The other 13-14 owl circles currently have less than 40 percent habitat. While harvest of habitat on DNR-managed lands in these circles may not have a large negative impact to the resident owls, it would contribute to the deterioration of the viability of the sites. These sites are thus considered to be at risk for incidental take of resident owls in this analysis.

Using the age class only method for estimating habitat, there are 46 spotted owl circles in which habitat on DNR-managed lands constitutes 1 percent or more of the area of the circle. In 11 of these, DNR harvest of habitat would not reduce the total amount of habitat below 40 percent. In another five circles, DNR harvest would reduce the total amount of habitat below 40 percent. In the remaining 30 owl circles, DNR harvest of habitat would further reduce habitat from levels already below 40 percent. In the last two situations, involving 35 site centers, management of DNR-managed lands under Alternative B would likely result in incidental take of territorial spotted owls. In circles where harvest of habitat on DNR-managed lands alone would not bring the habitat level below 40 percent given present habitat conditions, incidental take of spotted owl at these sites may occur in the future if other landowners have reduced the habitat level to 40 percent before DNR harvests habitat on its trust lands. This could occur at three sites where federal reserves do not contain more than 40 percent of the total habitat.

The total assessment of the number of site centers at which incidental take could occur outside of NRF management areas, under Alternative B using the age class only habitat estimation method, is 51 (Table 4.2.19). This includes 13 circles in which habitat levels are already below 40 percent but removal of habitat from DNR-managed lands would further reduce the habitat level by less than 1 percent.

Using the multiple data source method for estimating habitat, there are spotted owl circles in which habitat on DNR-managed lands constitutes more than 1 percent of the area of the circle. In 14 of these circles, harvest of habitat on DNR-managed lands alone would not reduce the total amount of habitat below 40 percent. In four of these 14 circles, less than 40 percent of the circle is in habitat on federal reserves, so incidental take of spotted owls at these sites could occur in the future. In four circles, harvest of habitat on DNR-managed lands would by itself reduce habitat levels below 40 percent. In the remaining 33 circles, harvest of habitat on DNR-managed lands would further reduce the amount of habitat from levels already below 40 percent.

The total assessment of the number of site centers at which incidental take of spotted owls could occur using the multiple data source method of estimating habitat is 55 (see Table 4.2.19). This includes 14 sites activity centers in which there is less than 40 percent total habitat and harvest of habitat on DNR-managed lands would remove less than an additional 1 percent of the habitat.

Table 4.2.19: Assessment of territorial spotted owl site centers for risk of incidental take outside of proposed NRF management areas under Alternative B

Condition of circle/level of habitat contribution from DNR-managed lands	Number of territorial site centers		Impacts to spotted owls from DNR management under Alternative B
	Habitat using forests 70 years old and older	Habitat estimated using multiple data source method	
NA/No habitat on DNR-managed lands	11	5	No incidental take
More than 40 percent total habitat/0.1 to 0.9 percent habitat on DNR-managed lands	9	9	No incidental take
More than 40 percent total habitat and more than 40 percent habitat occurs on federal reserves/DNR manages less habitat than the margin above 40 percent	8	10	No incidental take
Less than 40 percent total habitat/ 0.1 to 0.9 percent habitat on DNR-managed lands	13	14	Potential incidental take, but impacts not likely to be large
More than 40 percent total habitat/DNR manages more habitat than the margin above 40 percent[20]	5	4	Incidental take
More than 40 percent total habitat and **less** than 40 percent habitat occurs on federal reserves/DNR manages less habitat than the margin above 40 percent	3	4	Potential incidental take in the future
Less than 40 percent total habitat/**more** than one percent habitat on DNR-managed lands	30	33	Incidental take
Totals:			
No incidental take	28	24	
Incidental take	51	55	

[20] Harvest of all habitat on DNR-managed lands would reduce total amount of habitat in the circle below 40 percent.

Impacts to Spotted Owls and Spotted Owl Site Centers on or Within 2.0 Miles of Proposed NRF Management Areas. There are 66 territorial spotted owl site centers that are either on or within 2 miles of DNR-managed lands that are designated for NRF habitat management under Alternative B (there are no designated NRF management areas in the Western Washington Lowlands or Olympic Peninsula spotted owl provinces). There are between 33,000 and 50,000 acres of habitat on NRF management areas within a median home range-sized circle of these site centers. The average contribution of habitat from DNR-managed lands per spotted owl site center for circles that overlap NRF management areas is between 800 and 1,100 acres.

NRF areas would be managed to provide for at least 50 percent nesting, roosting, and foraging habitat measured within the WAU in which a NRF area is located. Under Alternative B, harvest of habitat would be allowed in NRF areas in WAUs in which there is more than 50 percent habitat in both NRF management areas and federal reserves (see DNR 1996a p. IV-8). There are currently 35 WAUs in which NRF management areas have less than 50 percent habitat. No harvest of habitat would occur in these WAUs until there is habitat in excess of 50 percent. There are 13 WAUs in which habitat levels are above 50 percent and adjacent federal reserve lands also have in excess of 50 percent habitat. Harvest of habitat in excess of 50 percent would be allowed in NRF management areas in these WAUs. There are 16 WAUs in which NRF management areas have more than 50 percent habitat, but federal reserves have less than 50 percent habitat. Harvest would not be allowed in NRF management areas in these WAUs unless the amount of habitat exceeds its current levels or habitat levels on federal reserves exceed 50 percent (DNR 1996a p. IV.5). DNR growth models predict that NRF management areas will exceed habitat goals by 2046 (see Figure 4.2.8).

Methods: Near-Term Impacts. Both near-term and potential long-term impacts to known site centers (i.e., the potential for incidental take of spotted owls to occur at these sites) are assessed. In order to assess impacts of management within NRF areas to individual site centers under Alternative B, the following assumptions are made. For near-term impacts, a simplifying assumption is made that site center location will remain static. The results of an assessment of long-term susceptibility of known site centers to incidental take is then incorporated into a model for predicting take of future activity centers. For near-term impacts we assume that harvest would only occur in NRF areas in WAUs in which habitat is available based on an assessment of conditions in 1996. This harvest would likely take place over a relatively short period of time (i.e., in the first decade). The potential for incidental take is then determined based on whether or not harvest of excess habitat in the WAUs in which it is available would decrease the current amount of habitat in individual owl circles below 40 percent. This method of assessing near-term incidental take does **not** reflect the requirements that DNR would have to meet under Alternative B, i.e., DNR would not be required to meet both a 50 percent habitat goal on NRF areas within a WAU and a 40 percent habitat requirement within spotted owl circles. It is simply a way to estimate how many sites could be at risk for take of spotted owls as a result of implementing the management guidelines for suitable spotted owl habitat within NRF management areas in Alternative B.

Results: Near-term Impacts. The projected near-term impacts to spotted owl site centers whose median home range-sized circle includes NRF management areas are summarized in Table 4.2.20. There are 36 site centers whose median home range radius circle falls within WAUs in which there is currently more than 50 percent suitable habitat in NRF areas. Harvest of this habitat in the near term could affect these 36 currently known site centers.[21] DNR's draft HCP recommends, but does not require, that any harvest of habitat that exceeds the 50 percent target take place away from known site centers first (DNR 1996a p. IV.8). If these recommendations were followed, the level of incidental take may be lower than if harvest of all habitat occurred within a median home range radius of known site centers. If DNR were to harvest all habitat available within NRF management areas under Alternative B within 2 miles of known site centers, the following impacts could occur. DNR's harvest of habitat would have the potential to reduce the total amount of habitat in 10 circles from above 40 percent to below 40 percent. In another five, harvest would further reduce the amount of habitat from levels already below 40 percent. In 21 cases, harvest of habitat on DNR NRF areas would not reduce the total amount of habitat below 40 percent. Thus, we expect there to be the potential for 15 site centers to be at risk for incidental take of spotted owls during the first approximately 10 years of the HCP under Alternative B.

It should be noted that the proposed HCP prohibits harvest of spotted owl habitat within 0.7 miles of known site centers during the breeding season. The 36 site centers that occur in WAUs in which suitable habitat is available for harvest would not be at risk for harassment of resident owls under this provision as long as the site locations were known at the time of harvest. Given that DNR does not propose to conduct surveys within NRF management areas, the protection of these sites from harassment would only occur if a site was happened upon accidentally during timber sale layout or another party conducted surveys in the vicinity of planned timber sales.

[21] The assessment of near-term impacts was made using only the multiple data source method for estimating amounts of habitat within known territorial spotted owl circles.

Table 4.2.20: Assessment of incidental take of territorial spotted owls at site centers affected by management of DNR NRF areas under Alternative B in the near term

Effect of DNR harvest of habitat in owl circles in NRF areas that have greater than 50 percent habitat	Number of site centers affected	Impact to spotted owls occupying site centers
Reduce habitat level from above 40 percent to below 40 percent	10	Incidental take
Further reduce amount of habitat from levels already below 40 percent	5	Incidental take
Harvest of habitat would not reduce amount of habitat below 40 percent of circles	21	Not likely to harm
Totals	36	

Methods: Long-term Impacts. In the long term, harvest activities could affect spotted owls at all currently known site centers within 2 miles of NRF areas. The number of spotted owls that have established territories that use habitat within NRF management areas will change over time. The location of nesting and roosting sites (one or the other is usually mapped as the site center) will also change over time. Thus, estimating potential incidental take in the long term is a speculative process. However, it is still useful to attempt to get a picture of the magnitude of potential impacts to spotted owls over the long term. This task is accomplished in a two step process. The first step is to project the number of known sites that would be at risk for incidental take of resident spotted owls if all NRF management areas were at their target habitat condition. The second step is to construct a model to predict how the number of owls using sites in NRF management areas would change over time given what we know from (1) demographic modeling; (2) probable changes in habitat conditions on federal reserves and other nonfederal lands; and, (3) population dynamics in general. The results of these two analyses constitute one means to assess the level of incidental take that could occur as a result of DNR management activities in NRF management areas. The reader should keep in mind that while the following analysis and discussion are based on an informed use of current knowledge, there is much information missing that would allow for a truly accurate assessment of future incidental take of spotted owls on DNR-managed lands.

For the first step in assessing long-term impacts, it is assumed that harvest of excess habitat would be occurring in all WAUs because habitat will have developed on both federal reserve lands and NRF management areas, i.e., there will always be more than 50 percent of NRF areas in each WAU in habitat, and habitat conditions on adjacent federal reserves will have improved to the point that DNR would not be required to maintain

more than 50 percent habitat on its NRF lands. Based on this assumption, it is further assumed that on average, 50 percent of NRF areas within each owl circle will always be covered by suitable habitat. This means that for owl circles in which NRF areas currently have less than 50 percent habitat, habitat conditions will improve and for owl circles in which there is more than 50 percent habitat, habitat will be harvested to bring the level down to 50 percent. The potential for site centers to be at risk for incidental take of resident spotted owls is determined to occur in two cases: (1) when harvest would occur in owl circles that are already below 40 percent habitat levels; or, (2) when harvest of habitat down to 50 percent of NRF areas within a circle would bring that circle from above 40 percent total habitat to below 40 percent habitat.

If all NRF areas within known spotted owl circles were on average covered by 50 percent habitat, the impacts that would be expected to spotted owls occupying these sites are as follows. Using the multiple data source method for estimating habitat on NRF areas within known owl circles, there would be two owl circles in which habitat levels would decrease from above 40 percent total habitat to below 40 percent habitat and five owl circles in which habitat levels would be further reduced from levels already below 40 percent. A total of seven known site centers could be at risk for incidental take of spotted owls a result of DNR management activities within NRF areas under Alternative B. There would be 28 owl circles in which habitat levels would decrease but the overall level would stay above 40 percent, 14 owl circles in which habitat levels would remain the same as they are today, and 17 circles in which habitat conditions would improve from current conditions. We would not consider any of these site centers to be at risk for incidental take of spotted owls.

Using forests older than 70 years to estimate habitat on DNR-managed lands yields the following results. There would be five owl circles in which harvest of habitat on NRF management areas would reduce the total amount of habitat below 40 percent, and 11 circles in which habitat levels would be reduced from levels already below 40 percent. Thus, 16 known spotted owl site centers would be at risk for incidental take of spotted owls occupying those sites as a result of DNR management activities within NRF areas. There would be 24 circles in which habitat levels would decline but remain above 40 percent, 18 circles in which habitat levels would increase, and eight in which habitat levels would stay the same.

Table 4.2.21: Assessment of incidental take of known territorial spotted owls affected by management of DNR NRF areas under Alternative B assuming 50 percent habitat levels on NRF areas within spotted owl circles

Effect of DNR management activities on habitat levels in owl circles that include NRF areas	Number of site centers (using forests older than 70 years as habitat)	Number of site centers (using the multiple data source method for estimating habitat)	Impact of management activities to spotted owls
Reduce total habitat levels from above 40 percent to below 40 percent	5	2	Incidental take
Further reduce total amount of habitat from levels already below 40 percent	11	5	Incidental take
Reduce total amount of habitat but levels remain above 40 percent	24	28	Not likely to harm
Increase total amount of habitat in circle	18	17	Improve chances of long-term viability of site
Total amount of habitat remains the same as 1996 conditions	8	14	No impact from DNR activities
Totals	66	66	

Under Alternative B, habitat conditions will improve in areas that currently do not support spotted owls. As NRF areas in WAUs with little or no habitat develop more habitat, these areas would be available for use by spotted owls that might otherwise be displaced from harvest in areas where the 50 percent target has been exceeded. Also, because NRF management areas are proposed for lands that are in close proximity to federal reserves, new territories are likely to be established either on federal reserves or in NRF areas as habitat conditions improve. Conversely, as the location of suitable habitat in NRF areas changes over time (i.e., when habitat levels exceed 50 percent in some areas, some forest would become available for harvest) it is possible that future spotted owls will be negatively impacted. Another important factor is that the spotted owl population is likely in a state of decline (Burnham et al. 1994; USDA and USDI 1994a), so assuming that site centers present in 1996 will exist 20-30 years from now is not necessarily accurate.

To account for the dynamic nature of the spotted owl population and landscapes within NRF management areas and how this may impact future take of spotted owls that use these landscapes, the following analysis was conducted.

Three simplifying assumptions were made. The first assumption is that after the first decade, spotted owl habitat on DNR-managed lands outside of NRF management areas will be insufficient to support territorial spotted owls. The estimated incidental take of spotted owls according to the above analysis for owl circles outside of NRF management areas will occur during the first decade. This assumption focuses the current analysis on site centers with median home range-sized circles that include NRF management areas.

The second assumption relies on the concept of source-sink population dynamics. Across their range spotted owls occupy habitat that varies in quality. Source sub-populations are those which occupy areas of high quality habitat where natality exceeds mortality. Sink sub-populations occupy areas of lower quality habitat were mortality exceeds natality. In general, source sub-populations are net exporters of individuals and sink sub-populations are net importers (see Criterion 4: Demographic Support for a more detailed discussion of source and sink dynamics). It is anticipated that the average owl habitat conditions on federal reserves will eventually support a source sub-population of spotted owls, and that the average habitat conditions on DNR-managed lands will support a sink sub-population. Habitat conditions on federal lands are, and will continue to be, the most important factor determining the size and distribution of the spotted owl population in the western Washington planning units. Federal reserves account for 55 percent of the spotted owl habitat on all ownerships in the five west-side planning units. In contrast, DNR manages 6-14 percent of the total habitat in these planning units. Habitat conditions on federal reserves will improve over time. Overall levels of habitat on DNR-managed lands would decline under all HCP alternatives. Thus, federal reserves are considered the "source" population for spotted owls that use NRF management areas now and in the future.

Third, it was assumed that the results of Burnham et al. (1994) provide a reasonable approximation of λ, the population's rate of change. There are two demographic study areas that apply to Washington spotted owl provinces - the Olympic Peninsula study area and the Cle Elum study area. The values for λ were averaged for these two study areas to give a rate of population change of .9356. This equates to an annual rate of decline of 6.4 percent. As discussed in the FSEIS for the President's Forest Plan (USDA and USDI 1994a p. 3&4-233), such a rapid rate of decline seems inconsistent with observations from population density studies. The average of the 95 percent confidence interval for this rate is 0.8789 to 0.9922. The upper limit, which equates to annual rate of decline of 0.8 percent, may be a somewhat lower rate of decline than what is actually occurring, but is likely closer to reality than the mid-point. We use .992 as the value for λ in the following analysis.

A model was constructed to predict the change in the number of owl activity centers over time. In the model, the number of activity centers is multiplied by λ each year. This yields the number of activity centers expected in the next year. The initial value of λ is assumed to be 0.992. The value of λ increases over time as habitat develops on federal

lands. Five scenarios were developed to relate λ to changes in federal habitat. Each scenario specifies a set of conditions which determine the point in time when the population should be stable, i.e., $\lambda = 1.0$. Beyond this point in time λ continues to increase at the same rate until federal lands reach their maximum habitat capability.

The first scenario is based on projections of the Interagency Scientific Committee and the Northern Spotted Owl Recovery Team (Thomas et al. 1990; USDI 1992b as discussed in USDA and USDI 1994a p. 3&4-228). Both groups projected that habitat and owls would continue to decline for up to 50 years before reaching a new equilibrium. Under this scenario, $\lambda = 1$ at year 50. The other four scenarios are based on projection of habitat development in USDA and USDI (1994a p. 3&4-43). According to this projection, federal reserves should be 75 percent late-successional forest in 50 years and 80 percent late-successional forest in 100 years. Eighty percent was believed to be the maximum proportion of late-successional forest that might develop on federal reserves. The four scenarios differ in forest age and amount of habitat necessary to support a stable spotted owl population. There are no data available with which to accurately determine the landscape characteristics that might support a stable spotted owl population, so a range of plausible values were used in the model. For the initial number of spotted owl site centers the number of known and projected unknown centers (that might occur on unsurveyed lands) that occur on or within a median home range radius of NRF management areas and that have not been lost through incidental take at the end of the first decade was used. This estimate is 74 site centers (66 known sites, plus 30 projected unknown sites, minus 15 sites at which owls are lost to incidental take at known sites, minus seven sites that are lost to incidental take at projected unknown sites).

Results. The results of the modeling exercise were variable (see Table 4.2.22). The population could continue to decline for between 5-50 years. The present number of site centers (known plus unknown) estimated to use habitat in NRF management areas (96) could be reached anywhere between year 24 and sometime beyond year 100. According to DNR growth models for Alternative B, NRF management areas would have met or exceeded habitat goals by year 50.

Table 4.2.22: Alternative B - projections of the number of spotted owl site centers with owl circles overlapping NRF management areas in the five west-side planning units

See text for explanation of scenarios. At year 1, λ = .992. Federal reserves start at 47 percent of their area in habitat (USDA and USDI 1994a, Appendix G part 3 p. G - 13).

Scenario	$\lambda = 1$ at t =	Number of activity centers that use NRF areas at time (years) =										
		0	10	20	30	40	50	60	70	80	90	100
Interagency Scientific Committee	50 yrs	74	69	65	62	61	60	61	62	65	68	73
USDA and USDI (1994a) owl habitat at >= 120 yrs at 60 percent of landscape	42 yrs	74	69	65	63	62	63	64	67	71	77	85
USDA and USDI (1994a) owl habitat at >= 80 yrs at 60 percent of landscape	23 yrs	74	69	67	68	70	76	85	96	109	123	139
USDA and USDI (1994a) owl habitat at >= 120 yrs at 50 percent of landscape	10 yrs	74	71	73	82	100	131	[22]---	---	---	---	---
USDA and USDI (1994a) owl habitat at >= 80 yrs at 50 percent of landscape	5 yrs	74	73	85	116	---	---	---	---	---	---	---

The proportion of these site centers that would be subject to incidental take starting in 2046 would vary, depending on how they are situated in relation to federal reserves and how this distribution relative to federal reserves changes over time. Those site centers that have a large proportion of habitat within a median home range-sized distance in federal reserves would probably not be at risk for incidental take of resident spotted owls. Site centers that are situated where NRF management areas constitute the majority of the land area in that circle would probably not be at risk for take of spotted owls because the

[22] In the remainder of the table "---" is used to indicate that the number of site centers estimated by the model beyond this point in time is probably too large to be realistically supported by NRF management areas and surrounding ownerships. The number of site centers is shown one decade beyond the estimate of the number of sites that currently occur in NRF management areas.

average habitat level would be managed to remain at 50 percent. Spotted owls whose site centers are situated such that federal matrix lands and/or other ownerships that do not provide habitat make up a large proportion of the home range could be taken by DNR harvest activities under Alternative B. Any site center that is located in a landscape in which DNR habitat provides the margin of habitat that keeps the site viable could be subject to repeated incidental take as habitat in NRF areas becomes available for harvest over the course of the HCP.

One means of predicting the proportion of future sites that would be subject to incidental take is to apply the proportion of known site centers that would be taken, assuming that 50 percent of the NRF areas within them were in a suitable habitat condition. In other words, the current distribution of site centers that would be vulnerable to take is viewed, based on the assumption that habitat levels in NRF areas within their circles would be at 50 percent, and use this as an approximation of the proportion of activity centers that would be similarly vulnerable in the future. For Alternative B, this proportion was 11 percent using the multiple data source method for estimating habitat, and 24 percent when forest older than 70 years was used to estimate habitat.

In two of the scenarios modeled, the number of territorial owls that use NRF management areas never exceeds the number of sites estimated to presently use these areas. In the other three scenarios, the present number is exceeded by years 24, 38, and 70 respectively. Obviously, the number of spotted owls that would be subject to potential take would differ depending on which scenario most closely resembles the actual population situation. It is fairly safe to assume that the number of owls influencing NRF areas will not increase indefinitely. The low end of an estimate then would be defined by the worst-case scenario in which the population does not stabilize for 50 years. The number of spotted owls sites established on or near NRF areas would decrease to 60 and then increase to 73 by the end of the analysis period. Based on the proportion of known sites that would be at risk for take of spotted owls at a 50 percent habitat level, between eight and 18 sites would be at risk for take of spotted owls at the highest population level during the analysis period.

The high end of an estimate would be delimited by the maximum number of spotted owl home ranges that could overlap NRF management areas given a rapid recovery of the population (e.g., the population growth rate exceeds 1 within 10 years). It is very speculative to assign a definite number of sites because many factors determine population density. For the sake of analysis however, one might consider that a doubling of the current number of sites might approximate the maximum number that would eventually occur in NRF management areas. In the two most optimistic scenarios for attaining a stable population, the number of sites influencing NRF areas would reach 150 at year 36 or 54. If the population remained at this level for the remainder of the analysis period, then between 17 and 36 sites could be at risk for harm starting at the point at which excess habitat is available for harvest, which would be in approximately 50 years. However, the proportion of sites that could be at risk for take of spotted owls could differ from the proportion of known sites that are at risk as the population increases much beyond current levels.

In summary, the number of sites that may be at risk for take of spotted owls, or biologically negative impacts in the future due to timber harvest within NRF management areas, will depend to a large degree on what the actual demographic situation is in western Washington and how soon the population stabilizes due to improving habitat conditions on federal reserves. Where new sites are established in relation to federal reserves will also affect the number of sites that could be vulnerable to negative impacts from allowing habitat to be harvested once it exceeds the specified target level. An important point to keep in mind however, is that once NRF management areas are at their habitat goal (50 percent), these areas would provide a constant level of habitat to support spotted owls. This is a more certain situation than provided under Alternative A, in which habitat would likely decline in quantity and become increasingly fragmented. While a number of sites may be at risk for take of spotted owls in the future under Alternative B, the existence of more habitat near federal reserves as a result of implementing Alternative B would most likely contribute to those sites persisting and making reproductive contributions to the population over the long term. The same claim cannot be made of Alternative A.

Management of DNR trust lands under Alternative B would result in a total estimated 66-70 out of 145 known spotted owl site centers that would be at risk for take of spotted owls in the five west-side planning units (45-48 percent) in the near term. This includes all site centers estimated to be at risk for take of spotted owls outside of NRF management areas, and those site centers that would be at risk for take of spotted owls in the first decade as a result of harvesting habitat above target levels in NRF areas (see Tables 4.2.19 and 4.2.20). An additional 15 projected unknown site centers could be at risk for incidental take under Alternative B. This results in a total estimate of 81-85 known and projected unknown site centers out of 187 total known and projected site centers that are at risk for incidental take of spotted owls in the near term.

For DNR-managed lands outside of NRF areas, implementation of Alternative B would result in a higher level of impact to spotted owls than Alternative A. The harvest of habitat at these sites in Alternative B would likely take place in the first 10-20 years. Most of the sites that would be lost or impaired are farther than 4 miles from federal reserves. Thus, this alternative would contribute to a rapid decrease in the number of spotted owls contributing to the population in areas distant from the boundaries of federal lands in the western Cascades. Support to the population in the northeastern portion of the Olympic Peninsula (Straits Planning Unit) would also decrease, though many of these sites are in close proximity to habitat on federal lands, so the overall impact to the population is not as high as it is in areas with little federal land and little prospect for the development of habitat in the future.

Alternative C

Under Alternative C, DNR would manage approximately 146,100 acres of its trust lands for owl nesting, roosting, and foraging habitat. Of the 145 currently known territorial spotted owl site centers that are on or within a median home range of DNR-managed lands in the five west-side planning units, 108 would be within a median home range radius of NRF management areas under Alternative C. The remaining 37 are farther

from the proposed NRF areas and probably would not benefit from habitat on these lands. Currently, there are 49,000-55,500 acres of potential suitable spotted owl habitat in NRF areas that fall within median home range-sized spotted owl circles. NRF areas contribute an average of between 450 and 510 acres of non-overlapping habitat per spotted owl circle.

Impacts to Known Spotted Owl Site Centers That Fall Outside of NRF Management Areas. Methods used for assessing potential incidental take of spotted owls at site centers outside of NRF areas are the same for Alternative C as for Alternative B. The results of the assessment of take for spotted owls at these 37 site centers are summarized in Table 4.2.23 and described immediately below.

Using the multiple data source method for estimating habitat yields the following results. There are three spotted owl circles in which harvest of habitat on DNR-managed lands would reduce the overall level of habitat from above 40 percent to below 40 percent. These site centers would most likely be at risk for take of spotted owls under Alternative C. There are an additional 14 circles in which habitat levels are currently below 40 percent, and DNR manages habitat that amounts to more than 1 percent of the area of the circle. Harvest of habitat on DNR-managed lands in these circles would likely result in incidental take of any resident spotted owls occupying these site centers. There are six spotted owl circles in which current habitat levels are already below 40 percent and DNR manages habitat that amounts to less than 1 percent of the area of the circle. Harvest of habitat on DNR-managed lands in these cases would result in incidental take, as legally defined, although the biological impacts are not likely to be significant.

There are five territorial spotted owl circles in which harvest of all available habitat on DNR-managed lands would not reduce the total habitat below 40 percent. In one of these five circles, more than 40 percent of the circle is in habitat on federal reserves, so even future harvest of habitat on DNR-managed lands would not likely result in incidental take. In three of these five circles, DNR manages habitat that amounts to less than 1 percent of the area of the circle, but less than 40 percent of the area of each of these circles is in habitat that is in a federal reserve. Thus, harvest of habitat on DNR-managed lands could result in take if it is harvested after other landowners or managers have already harvested habitat down to the 40 percent level. However, even though take may technically occur in this situation, it is unlikely that the effects of harvest of habitat that is less than 1 percent of the circle would be biologically significant. In the last of these five circles, DNR manages more than 1 percent of the area of the circle in habitat. It is possible that if this habitat is harvested after other landowners or managers have harvested habitat down to the 40 percent level, harvest of habitat on DNR-managed lands could result in take of spotted owls occupying these sites.

There are nine spotted owl circles in which DNR-managed lands currently have no habitat. Management under Alternative C would have no effect on these circles compared to Alternative A.

Using forests older than 70 years as the habitat estimation method yields the following assessment of incidental take. There are no territorial spotted owl circles in which harvest of all available habitat on DNR-managed lands would reduce the overall habitat level below 40 percent. There are 15 circles in which the current habitat level is below 40 percent and DNR manages habitat that amounts to more than 1 percent of the area of the circle. Harvest of habitat on DNR-managed lands in these circles would likely result in incidental take of resident spotted owls at these site centers. There are six circles in which overall habitat levels are currently below 40 percent and DNR manages habitat that amount to less than 1 percent of the area of the circle. Take would technically result from harvest of habitat on DNR-managed lands in these circles, but the biological impact is not likely to be significant.

There are three circles in which current levels of habitat are currently above 40 percent and DNR manages an amount of habitat that is less than current margin above 40 percent. In one of these circles, more than 40 percent of the habitat occurs on federal reserve lands: it is not likely that harvest of habitat on DNR-managed lands would result in incidental take of resident spotted owls at this site. In another of these three circles, DNR manages habitat that amounts to more than 1 percent of the area of circle and there is less than 40 percent of the circle in a federal reserve status. It is possible that if other landowners or managers harvest habitat down to the 40 percent level before DNR harvests habitat on its trust lands, DNR's harvest activities could result in incidental take. In the last of these three circles, DNR manages habitat that amounts to less than 1 percent of the area of the circle. While less than 40 percent of the circle is in habitat that is in any long-term reserve status, and the same possibility of future take occurs in as in the previous circle, it is not expected that harvest of habitat on DNR-managed lands in this circle would have a significant biological impact.

There are 13 known site centers on DNR-managed lands which have no habitat. Management under Alternative C would have the same effect on these circles as Alternative A.

Table 4.2.23: Assessment of risk of incidental take of resident owls at site centers located outside of proposed NRF management areas under Alternative C

Condition of circle/level of habitat contribution from DNR-managed lands	Number of territorial site centers		Impacts to spotted owls from DNR management under Alternative C
	Habitat as forests 70 years old and older	Habitat based on multiple data source method	
NA/No habitat on DNR-managed lands	13	9	No incidental take
More than 40 percent total habitat/0.1 to 0.9 percent habitat on DNR-managed lands	1	3	Not likely to be incidental take
More than 40 percent total habitat and more than 40 percent habitat occurs on federal reserves/DNR manages less habitat than the margin above 40 percent	1	1	No incidental take
Less than 40 percent total habitat/ 0.1 to 0.9 percent habitat on DNR-managed lands	6	6	Potential incidental take, but impacts not likely to be significant
More than 40 percent total habitat/DNR manages more habitat than the margin above 40 percent[23]	0	3	Incidental take
More than 40 percent total habitat and less than 40 percent habitat occurs on federal reserves/DNR manages less habitat than the margin above 40 percent.	1	1	Potential incidental take in the future
Less than 40 percent total habitat/more than one percent habitat on DNR-managed lands.	15	14	Incidental take
Totals	15 22 37	12 25 37	No incidental take Potential incidental take All

[23] Harvest of all habitat on DNR-managed lands would reduce total amount of habitat in the circle below 40 percent.

Assessment of Impacts to Spotted Owl Site Centers That Are on or Within 2.0/2.7 Miles of NRF Management Areas. The methods used to assess near- and long-term impacts to spotted owl site centers that are either on or within a median home range radius of NRF areas are conceptually the same for Alternatives C and B. However, under Alternative C, DNR would manage NRF areas within a WAU for 60 percent suitable habitat coverage instead of 50 percent, so all calculations are based on this 60 percent requirement.

Near-Term Impacts to Known Spotted Owl Site Centers. There are currently four WAUs in which NRF areas currently have more than 60 percent habitat, and adjacent federal reserve lands also have more than 60 percent habitat. There are nine known territorial spotted owl circles that overlap these four WAUs. These circles could be impacted because habitat would be immediately available for harvest within WAUs with more than 60 percent habitat on both DNR NRF areas and federal reserves. Of the nine circles that overlap WAUs in which habitat would be available for harvest, two already have less than 40 percent of their total area in habitat. Harvest of any habitat on DNR NRF areas within either of these circles would further reduce habitat levels below 40 percent, and thus subject resident spotted owls to incidental take. In the remaining seven circles, the amount of habitat available for harvest is small compared to the total amount of habitat within the circles. Harvest of habitat that is in excess of the 60 percent target for Alternative C on NRF areas in any of these seven circles would not reduce the overall amount of habitat in each circle below 40 percent. Thus, only two site centers are at risk for incidental take of spotted owls in the near term under Alternative C.

Table 4.2.24: Assessment of incidental take of territorial spotted owls affected by management of DNR NRF areas under Alternative C in the near term

Effect of DNR harvest of habitat in owl circles in NRF areas that have greater than 60 percent habitat.	Number of territorial site centers affected	Impact to spotted owls
Reduce total habitat level in circle from above 40 percent to below 40 percent	0	Incidental take
Further reduce amount of habitat from levels already below 40 percent	2	Incidental take
Harvest of habitat would not reduce amount of habitat below 40 percent of circles	7	Not likely to harm
Totals	9	

Long-Term Impacts to Known Spotted Owl Site Centers. In the long term, harvest activities could affect all currently known site centers within 2.0/2.7 miles of NRF areas. If all NRF areas within known spotted owl circles were, on average, covered by 60

percent habitat, the impacts that would be expected to these activity centers are as follows. Using forests older than 70 years as a surrogate for habitat, there are three spotted owl circles in which harvest of habitat from present levels to 60 percent coverage on NRF lands would decrease the overall amount of habitat from above 40 percent to below 40 percent. Spotted owls occupying the associated site centers would likely be subject to incidental take. There are six circles in which harvest of habitat in NRF areas would further decrease the overall amount of habitat from a level already below 40 percent. Spotted owls occupying these six associated sites would also likely be subject to incidental take. There are 18 circles in which harvest of habitat would occur on DNR NRF areas to bring current levels to 60 percent of those NRF areas, but this harvest would not bring the overall level of habitat in the circles below 40 percent. Spotted owls occupying these sites would not likely be taken. There are 20 circles in which habitat levels would not change under Alternative C. There are 61 circles in which overall habitat conditions would improve as a result of DNR developing and maintaining 60 percent of NRF areas in spotted owl habitat. Thus, using forests older than 70 years as habitat, there would be nine of 108 known territorial spotted owl site centers that are on or within a home range radius of NRF areas that would be at risk for incidental take of spotted owls.

Using the multiple data source method for estimating habitat gives the following assessment of impacts. There are no spotted owl circles in which harvest of habitat from present levels to 60 percent coverage on NRF lands would decrease the overall amount of habitat from above 40 percent to below 40 percent. There are two territorial spotted owl circles in which harvest of habitat in NRF areas would further decrease the overall amount of habitat from a level already below 40 percent. Spotted owls occupying these two associated sites would likely be subject to incidental take. There are 25 territorial spotted owl circles in which harvest of habitat would occur on DNR NRF areas to bring habitat from current levels to 60 percent of those NRF areas, but this harvest would not bring the overall level of habitat in the circles below 40 percent. Spotted owls occupying these sites would not likely be taken as a result of DNR harvest activities. There are 21 circles in which habitat levels would not change under Alternative C. There are 61 circles in which overall habitat conditions would improve as a result of DNR developing and maintaining 60 percent of NRF areas in spotted owl habitat. Thus, using the multiple data source method of estimating habitat levels, two out of a total of 108 known territorial spotted owl site centers would be at risk for incidental take of spotted owls under Alternative C.

Table 4.2.25: Assessment of incidental take of territorial spotted owls occupying known site centers affected by management of DNR NRF areas under Alternative C assuming a 60 percent habitat level

Effect of DNR management activities on habitat levels in owl circles that include NRF areas	Number of site centers (forests 70 years and older as habitat estimation method)	Number of site centers (multiple data source method of habitat estimation)	Impact of management activities
Reduce total habitat levels from above 40 percent to below 40 percent	3	0	Incidental take
Further reduce total amount of habitat from levels already below 40 percent	6	2	Incidental take
Reduce total amount of habitat but levels remain above 40 percent	18	25	Not likely to harm
Increase total amount of habitat in circle	61	60	Improve chances of long-term viability of site
Total amount of habitat remains the same as 1996 conditions	20	21	No impact from DNR activities
Totals	9	2	Incidental take
	99	106	No incidental take

There are 42 site centers projected to occur on or within a median home range radius of unsurveyed DNR-managed lands. Based on the estimated distribution of these sites and the distribution of NRF areas under Alternative C, it is further estimated that 31 of these sites occur on or within a median home range radius of NRF management areas. The remaining 11 sites likely fall outside of NRF areas. Based on the proportion of known activity centers that will be incidentally taken inside (2-8 percent) and outside NRF areas (59-65 percent) under Alternative C, it is estimated that between 7 and 10 projected unknown site centers would be at risk for incidental take of resident spotted owls.

The methods used to predict when the maximum number of spotted owl activity centers that may use DNR NRF areas would come into existence for Alternative C are the same as used for Alternative B. An initial estimate is made of the number of activity centers whose median home range-sized circle overlaps DNR NRF areas of 137 (108 known sites plus 31 unknown sites minus 2 sites at risk for take of spotted owls in the near term). The

initial rate of population growth (λ) is still 0.992. The results of the population change model are summarized in Table 4.2.26.

Table 4.2.26: Alternative C - projections of the number of spotted owl activity centers with owl circles overlapping NRF management areas in the five west-side planning units

See text for explanation of scenarios. At year 1, λ = .992. Federal reserves start at 47 percent of their area in habitat (USDA and USDI 1994a Appendix G part 3 p. G-13).

Scenario	$\lambda = 1$ at t =	Number of activity centers that use NRF areas at time (years) =										
		0	10	20	30	40	50	60	70	80	90	100
Interagency Scientific Committee	50 yrs	137	127	120	115	113	112	112	115	120	126	136
USDA and USDI (1994a) owl habitat at ≥ 120 yrs at 60 percent of landscape	42 yrs	137	128	121	117	115	116	119	124	132	143	158
USDA and USDI (1994a) owl habitat at ≥ 80 yrs at 60 percent of landscape	23 yrs	137	128	125	125	130	141	157	177	201	228	[24]--
USDA and USDI (1994a) owl habitat at ≥ 120 yrs at 50 percent of landscape	10 yrs	137	131	136	152	185	243	---	---	---	---	---
USDA and USDI (1994a) owl habitat at ≥ 80 yrs at 50 percent of landscape	5 yrs	137	136	158	215	341	---	---	---	---	---	---

To arrive at a gross estimate of the number of future activity centers that would be subject to incidental take, the proportion of known activity centers that overlap NRF areas in Alternative C that would be taken as a result of maintaining habitat levels at 60 percent of

[24] In the remainder of the table "---" is used to indicate that the number of projected activity centers beyond this point in time is too large to be realistically supported by NRF areas and surrounding ownerships. Number of activity centers is shown one decade beyond the estimate of maximum NRF capacity.

NRF areas (between 2 and 8 percent, see Table 4.2.25) is applied to the range of number of sites overlapping NRF areas that might exist according to the above modeled scenarios. In the worst-case scenario for population recovery, 136 sites would have territories that overlap NRF areas by the end of the analysis period. Between three and eight of these sites could be at risk for take of spotted owls. This would define the minimum number of sites at risk for take of spotted owls. If it is conjectured that the population would recover under the best case scenario ($\lambda = 1$ in 10 years), the number of sites influencing NRF management areas could double by year 52 to 274. This could be a reasonable maximum number of sites with territories that overlap NRF areas. In this case, year 50 would see the highest number of sites that would be potentially at risk for take of spotted owls. If the percentage of known sites that are at risk for take of spotted owls (applied with less confidence given substantially higher number of potential sites) is applied, there would be between five and 22 sites that could be at risk for take of spotted owls. As in Alternative B, the number of times that these activity centers would be "taken" depends on the rate at which habitat develops and the rate at which DNR would harvest it. Given that Alternative C requires a higher standard for habitat development (old growth versus sub-mature) and given that more habitat is required to meet target conditions in NRF areas in a WAU (60 percent versus 50 percent), fewer opportunities are expected for these sites to be taken over the time frame of the HCP than for the sites that are vulnerable to take in Alternative B.

In summary, Alternative C would result in a total estimate of between 24-26 known site centers that are at risk for take of spotted owls, or between 16-17 percent of the total 145 known site centers in the five west-side planning units (see Tables 4.2.23 and 4.2.24). An additional seven projected unknown site centers may also be at risk for take of spotted owls, bringing the total estimate of known and projected site centers that would be at risk for take of spotted owls to 31-33 out of 187 total known and projected site centers in the near term. (These totals do not include the numbers generated in the discussion of long-term take.)

Alternative B results in the highest amount of incidental take as a result of DNR management activities. Alternative C results in lower levels of incidental take compared to Alternative B but higher levels compared to Alternative A. Management of DNR trust lands under Alternative A (No Action) would not result in incidental take of spotted owls. The long-term impact from DNR management activities to the current population would derive from attrition of habitat quality, loss of habitat from natural or human-caused disturbance, shifting locations of spotted owl site centers, and lack of management commitment to develop new habitat. As described in the assessment of impacts to site centers under Alterative A, there are 27-31 sites that have a low probability of long-term persistence. While spotted owls occupying these site centers would not be at risk for incidental take as a direct result of DNR management activities under Alternative A, the reader should keep in mind when comparing take levels in Alternatives B and C that there is a background level of a potential loss of sites.

Criterion 3: Dispersal Habitat - A Qualitative Comparison Among Alternatives

Juvenile spotted owls must disperse from their parents' territory to establish their own territories and engage in reproductive activity. Adults may also disperse to establish new territories if they have been displaced by logging, competition from barred owls, or if one member of a pair has died. In order to disperse successfully, spotted owls need sufficient cover to avoid predators and adequate opportunities to forage to avoid starvation. Evidence suggests that juveniles prefer mature and old-growth forest for roosting (Miller 1989) and that the risk of predation during dispersal is high in open and fragmented landscapes (Forsman et al. 1984; Johnson 1993). In the current overall landscape, large areas exist between patches of suitable nesting, roosting, and foraging habitat. Dispersing juveniles must frequently cross such landscapes in order to establish new territories. The persistence of the overall spotted owl population is dependent on successful movement of juvenile spotted owls among clusters, or sub-populations (see discussions of demographic support and maintenance of species distribution below) (USDI 1992b). Dispersal habitat, as a category distinct from nesting, roosting, and foraging habitat, describes forest types that are thought to provide adequate cover and forage for dispersing juveniles, but does not contain the structural characteristics required to support resident spotted owls (i.e., large contiguous patches of structurally complex mid- to late seral forest) (Thomas et al. 1990).

For this criterion, the alternatives are compared for their provision of dispersal habitat as a separate category from nesting, roosting, and foraging habitat. They are also compared in terms of total area capable of supporting owl dispersal including nesting, roosting, and foraging habitat. The alternatives are discussed qualitatively in terms of whether or not they provide for the management of dispersal habitat in areas that are important for movement of juveniles in order to maintain population connectivity.

Alternative A

DNR-managed lands under Alternative A would not be managed specifically to provide a dispersal habitat function, though there are likely portions of the landscape that presently do so by default and may continue to do so in the future. These areas include habitat that is maintained within spotted owl circles for the purpose of avoiding incidental take. In areas outside of known owl circles, there would be no intentional timing or spatial constraints on harvest to provide stands with characteristics of dispersal habitat at adequate spacing. In addition, there are many areas in which spotted owl circles do not overlap DNR-managed lands where population connectivity is important. For these two reasons, there would likely be large gaps on DNR-managed lands where forest would not provide a dispersal function. Thus, under Alternative A, DNR-managed lands would only contribute to the facilitation of movement of juvenile spotted owls from their natal territories to areas where they could establish new territories in an incidental manner. The consequences of not providing dispersal habitat for maintenance of species distribution are discussed under Criterion 5 below.

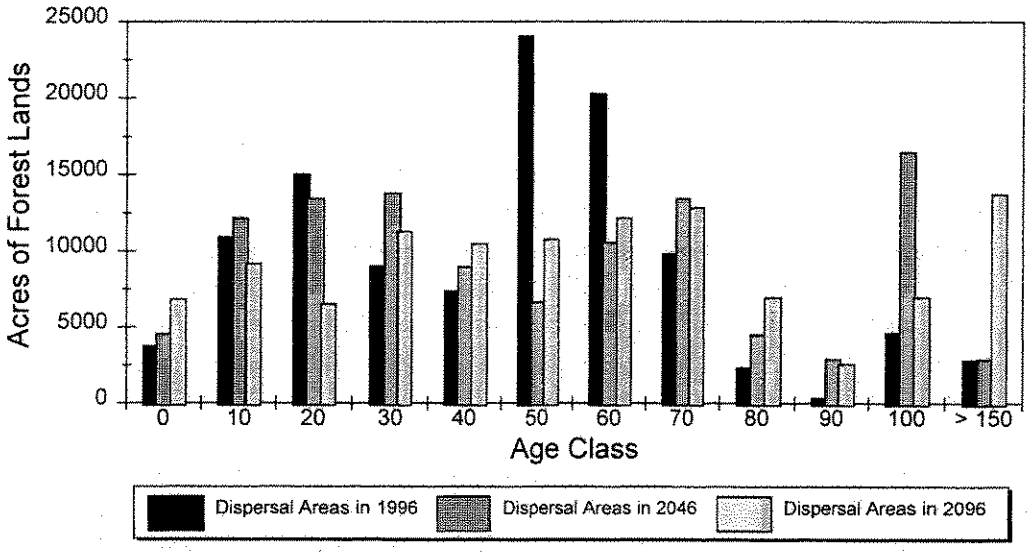
Alternatives B and C

In addition to providing nesting, roosting, and foraging habitat, Alternatives B and C would establish areas in forests which would be managed to provide spotted owl dispersal habitat. Alternatives B and C are identical in their provision of dispersal habitat areas and standards for managing those areas in the west-side planning units. These alternatives would provide 115,851 acres of Dispersal management areas in the five west-side planning units (Dispersal management areas occur in the North Puget, South Puget, and Columbia planning units but not in the Straits or South Coast planning units (see Maps 12-14). Both Alternatives B and C would provide 50 percent of DNR-managed lands designated for a dispersal function within a WAU in stand conditions that meet the characteristics of dispersal habitat as defined in the draft HCP (DNR 1996a p. IV.11,12). A total of 57,925 acres of Dispersal management areas would be managed to provide dispersal habitat conditions at any one time.

The age class distributions of forests within Dispersal management areas under Alternative B in 1996, 2046 and 2096 are shown in Figure 4.2.9. If we use forest stands that are 40 years old or older as an estimate for dispersal habitat, Dispersal management areas are above the target amount of habitat throughout the analysis period under Alternative B. There are approximately 72,000 acres of forests 40 years old and older in 1996. This acreage drops to 66,000 acres by 2046 and increases to 76,500 acres by 2096.[25] As shown in Figure 4.2.9, approximately half of the forests older than 40 years in years 2046 and 2096 would be in stands older than 100 years. These age class distributions can be applied to Alternative C even though that alternative was not explicitly modeled, because the areas designated for dispersal habitat and management of forests for dispersal habitat are the same in Alternatives B and C.

[25] While there may be 72,000 acres of forests older than 40 years in 1996, we do not know from this data whether or not these acres are distributed such that 50 percent of Dispersal management areas within a WAU are covered by stands with the structural characteristics of dispersal habitat. DNR's forest growth and harvest model, however, takes into account the constraints on stand management required to meet the goals set in Alternatives B and C. Thus, stands that are 40 years old and older by 2046 and 2096 should contain the stand structure and spatial arrangement specified in DNR's draft HCP.

Figure 4.2.9: Age class distribution within DNR dispersal areas from 1996 to 2096 - Alternative B



The Dispersal management areas established in Alternatives B and C in the North Puget, South Puget and Columbia planning units generally match, and in some cases exceed, the recommendations for dispersal landscapes described in the Final Draft Recovery Plan for the Northern Spotted Owl (USDI 1992b). In the North Puget Planning Unit, DNR-managed lands surrounding the Finney Block that are farther than 2 miles from federal reserves are designated as Dispersal management areas. This region was identified as important for movement of juvenile spotted owls between the Finney Block to spotted owl conservation areas on federal lands to the north, east and south (USDI 1992b p. 117). In the South Puget Planning Unit, Alternatives B and C provide dispersal areas between Late-Successional Reserves on the Gifford Pinchot National Forest and Late-Successional Reserves on the Mineral Block to the west. The Final Draft Recovery Plan for the Northern Spotted Owl identified this as an important nonfederal landscape to facilitate dispersal between designated conservation areas (DCAs) in the main stem of the Cascades and the Mineral Block. Alternatives B and C also provide a dispersal area between the Cedar River watershed (City of Seattle) and the Late-Successional Reserves directly north of Mount Rainier National Park. This Dispersal management area is surrounded by other nonfederal lands that are not to be managed for any owl functions and thus provides a western link between lands to be managed for spotted owl nesting, roosting, and foraging habitat to the north and south. In the Columbia Planning Unit, Alternatives B and C provide a Dispersal management area in the Columbia Gorge area south of federal reserves in the Gifford Pinchot National Forest. This area was identified in the recovery plan as important for connectivity between owl populations in the Oregon and Washington Cascades (USDI 1992b p. 120). The dispersal areas identified in

Alternatives B and C are also consistent with recommendations of the Washington Forest Practices Board Spotted Owl Science Advisory Group (SOSAG)(Hanson et al. 1993). None of the alternatives provide for dispersal habitat in southwest Washington, which the SOSAG and the recovery team did recommend in conjunction with nesting, roosting, and foraging habitat (USDI 1992b; Hanson et al. 1993). The impact of not providing either NRF habitat or dispersal habitat in southwest Washington is discussed under Criterion 5: maintenance of species distribution.

Given that there are no provisions for dispersal habitat in Alternative A, Alternatives B and C obviously contribute to the facilitation of dispersal of juvenile spotted owls at a higher level than Alternative A. The establishment of NRF management areas in Alternatives B and C would provide habitat that can be used by dispersing spotted owls. Because NRF management areas occur within 2 miles of federal reserves, and DNR-managed lands designated as NRF management areas would be covered in 50 or 60 percent suitable habitat, the effective distance between areas with large blocks of suitable habitat is shortened.

Alternative C establishes NRF management areas in the Straits Planning Unit that would facilitate dispersal of juvenile spotted owls among clusters in that planning unit. In addition, the 60 percent habitat requirement in NRF management areas within WAUs would provide more overall habitat and larger contiguous patches of habitat. Thus, Alternative C provides an overall higher contribution to the facilitation of dispersal than Alternative A or B. Both Alternatives B and C would also contribute habitat that may incidentally facilitate dispersal of spotted owls, through the provisions for riparian habitat and marbled murrelet habitat in areas outside of designated Dispersal management areas and NRF management areas. The total amount of habitat that may be used by dispersing spotted owls is compared among alternatives in Table 4.2.27.

Table 4.2.27: Comparison of provision of dispersal habitat among alternatives for the five west-side planning units assuming that both Dispersal and NRF management areas have reached their target levels of habitat

Alternative	Dispersal habitat in Dispersal management areas (acres)	Suitable nesting, roosting, and foraging habitat[26] (acres)	Total habitat useful to spotted owls for dispersal (acres)
A	0	70,000	70,000
B	58,000	81,500	139,500
C	58,000	146,100	204,100

Criterion 4: Demographic Support to the Population

Demographic support refers to the contribution of individual spotted owl territories and clusters of territories to the maintenance of the overall spotted owl population. Analysis here concerns assessing the relative contribution of each of the alternatives to demographic support of the spotted owl population because nonfederal lands play a role in decreasing the risk to the spotted owl population from extirpation in large portions of its range. This section first discusses why nonfederal lands make a significant contribution to demographic support of the population and then describes the relative contributions that DNR-managed lands would make under each of the alternatives.

The importance of nonfederal lands to demographic support of the population derives from (1) the fact that there are risks to the population on federal lands given current federal land management plans; and, (2) there are portions of the owl's range in which federal lands alone are not sufficient for recovery of the population. Each of these reasons is discussed in turn.

Risk to the Population on Federal Reserves

Harvesting of habitat and concomitant loss of a portion of occupied territories will continue on federal matrix (non-reserve) lands under the President's Forest Plan (USDA and USDI 1994a, 1994b). Analyses of the most recent demographic data indicate that the population is experiencing a period of decline (Burnham et al. 1994). It is possible that the population will continue to decline for some time, perhaps 50 years, before habitat conditions improve to the point where the population stabilizes (USDI 1992b; USDA and

[26]Suitable nesting, roosting, and foraging habitat for Alternative A counts only habitat within known and projected unknown spotted owl circles. For Alternatives B and C, suitable habitat refers to habitat within designated NRF management areas.

USDI 1994a). Much controversy remains in the scientific community concerning the degree of risk of extinction to the northern spotted owl population during this period of habitat recovery or "demographic transition" (see Doak 1992; USDA and USDI 1994a p. 3&4-229-235). The SEIS team that analyzed the President's Forest Plan (USDA and USDI 1994a) cited strong evidence for believing that the owl population has not yet, nor is likely on the verge of passing a demographic threshold beyond which it could not recover. They nonetheless believe it is prudent to take the results from the demographic study areas of a declining population seriously and they suggest "...a conservative approach to spotted owl management..." and continued research and monitoring of the spotted owl population (USDA and USDI 1994a p. 3&4-235).

In addition, the results of two spatially explicit spotted owl population simulators indicate that the response of the spotted owl population to different amounts and configurations of habitat proposed for federal lands (including the President's Forest Plan) is highly dependent on the assumptions made about life history parameters (fecundity rates, adult survival rates, survival rates of dispersing juveniles, and rates of juvenile emigration from study areas). Depending on parameters used to initialize the models, the results indicate that the population could decline substantially or decline slowly and then stabilize (Raphael et al. 1994). A second model indicates that the population could behave unpredictably in areas with substantially less than 60 percent habitat during the period of habitat recovery (Lamberson et al. 1994 p. 194). The results of these models are based on several inputs for which empirical knowledge is uncertain, such as assumptions of juvenile dispersal ecology which is admittedly little understood (Lamberson et al. 1994 p. 193) and juvenile emigration rates for which there is little data (see Holthausen et al. 1994). Given this uncertainty and potential risk surrounding the spotted owl population over the next
50 years, it is likely that reproductive input to the population from nonfederal clusters, especially those with which there is the potential for demographic interchange with clusters supported on federal lands, is very important to buffer against unanticipated population declines on federal reserves.

The Role of Nonfederal Lands in Spotted Owl Recovery

In general, nonfederal lands that are intermingled with, or are adjacent to, federal reserves are important for providing nesting, roosting, and foraging habitat to support clusters of owls that occur largely on federal reserves. Many of the owls with site centers on federal land likely use nonfederal land to meet part of their habitat needs. There are 171 territorial site centers on federal reserves designated under the President's Forest Plan in Washington State that have DNR-managed land in some portion of their median home range-sized circle (DNR 1995d; WDFW 1995c). Results of spatially explicit population modeling indicate that increasing cluster size above 15-25 pairs, especially above 20 pairs, increases the likelihood that the cluster will be self-sustaining for 50-100 years (Thomas et al. 1990; Lamberson et al. 1992; Lamberson et al. 1994). The majority of the Late-Successional Reserves established in the Western Washington Cascades and Olympic Peninsula provinces currently support clusters of less than 20 activity centers (USDA and USDI 1994a Appendix G part 3 p. G-15 - G-16). Most of these reserves also have less suitable habitat than they are capable of supporting (USDA and USDI 1994a p.

3&4-43). Thus, contributions of activity centers and habitat that are on adjacent nonfederal lands provide important support to the population in terms of increasing cluster size and providing habitat for small to medium clusters centered on federal lands.

Results from population models have also shown that even large clusters of spotted owls have an uncertain fate if they occur in areas with less than an optimum amount of habitat to support that cluster (Lamberson et al. 1994 p. 193).[27] In the western Washington Cascades, two of the 22 Late-Successional Reserves currently support clusters larger than 20 pairs. One of these reserves has 58 percent suitable habitat and the other has 48 percent suitable habitat (USDA and USDI 1994a Appendix G part 3 p. G-15). Both of these levels are less than amount of habitat that these reserves could support (USDA and USDI 1994a p.3&4-43). In the Olympic Peninsula Province, one of 10 Late-Successional Reserves currently supports clusters of more than 20 activity centers. This LSR has 52 percent suitable habitat. Lamberson et al. (1994) suggest that one way to increase short-term occupancy rates of clusters with less than optimal amounts of habitat is to increase their effective size by preserving suitable habitat in adjacent areas.

The Interagency Scientific Committee (Thomas et al. 1990), the Northern Spotted Owl Recovery Team (USDI 1992b) and the FEMAT (1993) all recognized that nonfederal lands play a role in the long term recovery of the spotted owl population. The recovery team identified several areas where nonfederal lands are needed in addition to federal lands to support medium to large clusters of spotted owls. In the Western Washington Cascades Province, these areas include nonfederal lands on the north, south and east sides of the Finney Block (a portion of the Mount Baker-Snoqualmie National Forest that is completely surrounded by nonfederal lands) in the North Cascades, nonfederal lands in the checkerboard ownership area of the I-90 corridor, in the Siouxon area directly adjacent (on the west side) to the Gifford Pinchot National Forest, and in the Columbia River Gorge south of the Gifford Pinchot National Forest.[28] In the Olympic Peninsula Province, the recovery team identified the Hoh-Clearwater Block on DNR-managed lands west of the central core of the Olympic National Park and Olympic National Forest Service lands as important to recovery. These lands are discussed as part of the Olympic Experimental State Forest (see Section 4.4.3 of this DEIS). For the Western Washington Lowlands Province, the role of nonfederal lands are discussed in the next section in terms of distribution concerns.

[27] While this optimum amount of habitat is not known, the work of Bart and Forsman (1992) suggests that landscapes that have more than 60 percent habitat support reproductively successful spotted owl populations at a relatively high density.

[28] In addition to being important for demographic support, the recovery team identified some of these areas for distribution concerns. Maintenance of species distribution is discussed in the next section.

DNR HCP Alternatives and Demographic Support: Background

Management of DNR forest lands under each of the HCP alternatives will result in different amounts and configurations of spotted owl nesting, roosting, and foraging habitat. A useful way in which to think about how well each alternative contributes to demographic support of the population is in terms of metapopulations and source and sink dynamics. Wildlife populations that occur in many semi-isolated sub-populations which are connected through immigration and emigration are called metapopulations (Levins 1970; Gilpin and Hanski 1991). Sub-populations that exist in high quality habitat conditions that allow for population growth can be thought of as occurring in source areas. Source areas produce more individuals than can be supported given their carrying capacity and these individuals must emigrate to survive. Habitat patches in which quality is low and mortality rates exceed productivity are called sink areas. Sub-populations in sink areas would become extirpated without periodic immigration of individuals from source areas.

The overall population growth rate for metapopulations is determined by the proportion of the population that occurs in source areas versus the proportion of the population that occurs in sink areas, the spatial relationships among source and sink areas, and the difference between population growth rates in source areas versus sink areas. As long as source areas are located such that juveniles can successfully disperse to sink areas and the mortality rate in sink areas is not so high that few juveniles survive to reproduce within sink habitat patches, the overall population should remain stable. Another important dynamic occurs when sink areas have population growth rates that are not substantially smaller than one and when they are in close proximity to source areas. Under this set of conditions, sink areas contribute individuals to source populations, thus enhancing the overall genetic and demographic stability of the population.

When sink areas become isolated from source areas, they can become highly vulnerable to extirpation. If sink areas from which sub-populations have been extirpated remain isolated from source areas, sub-populations can disappear from entire geographic regions. Further, the location of source areas and sink areas are dynamic as habitat conditions change over time. For example, forests mature in marginal areas such that sink areas eventually become source areas, or habitat patches are degraded through logging or natural disturbance such that source areas become sink areas. If a number of sub-populations in sink areas disappear without eventual input and reestablishment from source areas, the total number of habitat patches that are subject to changing habitat conditions (i.e., the number of sink areas that have a chance of becoming source areas) and that support the entire metapopulation through time could decrease. The metapopulation would then likely be more vulnerable to extirpation.

While there is no empirical data of population rates for clusters that occur on federal lands and DNR-managed lands, one can make some generalizations about habitat conditions and configurations on DNR-managed lands and their relationship to federal reserves under each of the alternatives, and how these configurations could contribute to metapopulation dynamics and demographic support to the population. In general, areas with larger contiguous habitat patches which support clusters of 20 or more spotted pairs

will have a high likelihood of being self-sustaining (Thomas et al. 1990; Lamberson et al. 1992; Lamberson et al. 1994; Raphael et al. 1994). One might hypothesize that over time such habitat blocks have the potential to act like source areas more often than they would act like sink areas because higher percentages of habitat in the landscape and less fragmentation appear to be associated with higher productivity, higher rates of occupancy, lower vulnerability to competition and predation, and less disruption to social dynamics (Bart and Forsman 1992; Carey et al. 1992; USDI 1992b; Johnson 1993; Lemkhul and Raphael 1993; Bart 1995.)[29]

Habitat conditions should improve in federal reserves over time as forests mature and suitable habitat blocks become larger and less fragmented. Many of these areas will likely act as source areas. There will obviously be variations in habitat quality on federal reserves due to differences in elevation, latitude, and unpredictable environmental variations (such as weather-induced changes in prey populations) such that these areas will not always uniformly act as sources. However, for reasons stated above, federal reserves should have a high probability of serving as sources more often than sinks.

Currently, DNR-managed lands that are within 4 miles of federal reserves, and thus likely provide habitat to spotted owls that are part of or have the potential to interact with clusters on federal land, probably act more often like sink areas than source areas. This assessment is based on the fact that the estimation of the amount of DNR-managed lands in suitable habitat within 4 miles of federal reserves is between 24 and 35 percent (see Tables 4.2.1 and 4.2.2). Suitable habitat patches on DNR-managed lands are also fragmented. This combination of habitat conditions would not likely support source sub-populations. As was discussed above, sink sub-populations can still provide demographic support to the population. Owl activity centers on DNR-managed lands probably do provide individuals to the federal source population, at least occasionally. A more mathematically-oriented explanation of the population parameters governing demographic support from DNR-managed lands can be found in Section 4.3.1.

Alternative A

DNR-managed lands under Alternative A would provide no more habitat than is required to meet the 40 percent take guidelines. Individual spotted owl territories would be supported at less than optimal habitat conditions under these guidelines. Habitat at a landscape level is likely to become more fragmented, and the ability of DNR-managed lands to contribute more habitat to existing owl sites or support larger clusters of activity centers than they do now would be limited, if not impossible. For the near term, activity centers that currently provide support to the federal population will continue to do so. While contribution of any juveniles to the population from sites on DNR-managed lands constitutes support to the entire metapopulation and is important during periods of overall population decline or in areas with low population density, the habitat conditions that would result from implementation of Alternative A would not likely contribute to an

[29] This can only be stated hypothetically because there is still much to be learned about the relationship between spotted owl habitat characteristics and successful reproduction (USDI 1992b; USDA and USDI 1994a).

improving demographic situation over the long term. In addition, because the overall levels of habitat on DNR-managed lands would decline near federal reserves, it is likely that DNR-managed lands near federal lands would continue to act as sink areas rather than ever developing into source areas. It is also possible that the difference in population growth rates between source and sink areas could become larger as habitat conditions on DNR-managed lands deteriorate over time. In other words, the mortality rate in sink areas could increase from current levels. If mortality rates in sink areas are too high, these areas can actually serve as a drain on the population.

Under Alternative A, the total amount of habitat on DNR-managed lands within 2 miles of federal reserves would decrease from between 27 and 34 percent to 18 percent of DNR-managed lands in the distance band. The total amount of habitat on DNR-managed lands within 4 miles of federal reserves would likely decrease from between 24 and 35 percent to 14 percent.

In the five west-side planning units, only 18 of 145 activity centers whose median home range-sized circles includes DNR-managed lands occurs farther than 4 miles from federal reserves. The remaining 127 territorial sites occur within 4 miles of federal reserves and thus have a high potential for making reproductive contributions to the population. Under Alternative A, DNR-managed lands would contribute the present amount of habitat or less to all 145 activity centers. The full range of sites that have varying probabilities of contributing to the population would be retained. However, as activity centers move and their associated regulatory circles move, or as circles become decertified, the level of habitat contribution to the population will decline. Habitat that is lost to attrition (e.g., snags and down woody debris decay over time without new input) or natural disturbance will also not be replaced.

Alternative B

Under Alternative B, DNR would manage NRF management areas such that 50 percent of these areas within each WAU would be in habitat at any one time. The majority of NRF management areas are within 2 miles of federal reserves, some NRF areas occur within 4 miles of federal reserves, and a small percentage fall in the 4-6 mile distance band from federal reserves (see Table 4.2.14). There are no designated NRF management areas in the Straits or South Coast planning units. Most known spotted owl activity centers that influence DNR-managed lands occur within 2 miles of federal reserves (see Table 4.2.5).

Under Alternative B, the total amount of habitat on DNR-managed lands within 2 miles of federal reserves would decrease from between 27 and 34 percent to 24.7 percent. Habitat on DNR-managed lands within 4 miles of federal reserves would decrease from between 24 and 35 percent to 18.7 percent of total DNR-managed lands in the 0-2 and 2-4 mile distance bands.

NRF management areas would contribute to 66 known activity centers, the vast majority of which occur within 4 miles of federal reserves. NRF management areas on DNR trust lands in the five west-side planning units occur in all of the areas identified by the

recovery team (USDI 1992b) as important for demographic support, with the exception of southwest Washington.

Alternative B would provide 18,232 acres more habitat than Alternative A on DNR-managed lands within 2 miles of federal reserves. It would provide 21,102 more acres of habitat than projected under Alternative A on DNR-managed lands within 4 miles of federal reserves in the five west-side planning units (see Table 4.2.14). However, this amount will still represent an overall decrease from current conditions in the total amount of habitat on DNR-managed lands. Most of the decrease in habitat from current conditions under Alternative B is attributable to the lack of NRF management areas in the Straits Planning Unit. If we look at the percentage of DNR-managed lands within 4 miles of federal reserves that would be in habitat over the long term in the North Puget, South Puget and Columbia planning units under Alternative B, overall habitat conditions should improve from a current 22.4 percent of DNR-managed lands in habitat to 24.3 percent of DNR-managed lands in habitat.

While Alternative B would provide more habitat throughout the life of the HCP than Alternative A, neither of these alternatives would likely significantly improve DNR-managed lands as potential source areas for spotted owls that would interact with the federal population. The fact that Alternative B allows for the degradation of old forest habitat to sub-mature habitat except for approximately 20,000 acres of nest habitat patches also leads us to conclude that the overall habitat conditions provided in NRF areas for this alternative would not likely provide source conditions. However, the habitat that Alternative B would provide is more certain over time and likely to be less fragmented than under Alternative A. This is because Alternative B provides a commitment to maintain and develop habitat over time at a constant level, and because the required level of 50 percent of NRF management areas within a WAU would result in larger contiguous blocks of habitat than would a 40 percent circle guideline. Thus, we might expect that the difference between population growth rates would not be large between federal reserves and NRF management areas. Therefore, NRF areas would be in an adequate condition to contribute individuals to the metapopulation.

Alternative C

Under Alternative C, DNR would manage NRF management areas such that 60 percent of these areas in each WAU in which they occur would be maintained in nesting, roosting, and foraging habitat. NRF management areas are designated in the North Puget, South Puget, Columbia planning units (same as Alternative B) and within 2.7 miles of federal reserves in the Straits Planning Unit.

The total amount of habitat on DNR-managed lands within 2 miles of federal reserves would increase from between 27 and 34 percent to 45 percent. The amount of habitat on DNR-managed lands within 4 miles of federal reserves in the five west-side planning units is projected to reach 33.6 percent. This would be an increase using the lower present habitat estimation of 24 percent, and a slight decrease from present conditions using the higher habitat estimation figure of 35 percent.

Under Alternative C, NRF management areas would contribute habitat to 108 of the 145 known activity centers in the five west-side planning units, most of which occur within 4 miles of federal reserves.

Alternative C would provide 71,212 more acres of spotted owl nesting, roosting, and foraging habitat than Alternative A on DNR-managed lands within 2 miles of federal reserves. It would provide 88,079 more acres of habitat than Alternative A on all DNR-managed lands within 4 miles of federal reserves. Implementation of Alternative C would provide the highest degree of contribution toward demographic support to the population because of higher overall habitat levels within 4 miles of federal reserves than would be provided under Alternatives A and B, and because NRF management areas are designated on a high percentage (75 percent) of all DNR-managed lands within 2 miles of federal reserves. It is possible that at a 60 percent habitat level on NRF areas on a WAU-by-WAU basis, that some DNR-managed lands could act as source areas to the metapopulation even though overall, DNR-managed lands within 2 miles of reserves would only reach 45 percent total habitat.

DNR-managed lands farther than 4 miles from federal reserves do not have as much of an opportunity to make a significant contribution to the demographic support of the federal population than lands that are within 4 miles of federal reserves. This is simply because spotted owls that have established territories on the outer edge of federal reserves would not likely use habitat that is farther than 4 miles from their activity centers. Activity centers that are located farther than the dispersal capability of juvenile spotted owls from federal clusters have a low likelihood of contributing individuals to the main portion of the population supported on federal reserves. Conversely, activity centers that are located at great distances from federal reserves are not likely to be recolonized by dispersing juveniles from federal reserves. This is especially true of activity centers located farther than 12 miles from federal reserves, as this is farther than the mean distance that most (67 percent) juvenile spotted owls are known to successfully disperse (Thomas et al. 1990 Appendix P). Dispersal distances of juvenile spotted owls have been recorded at distances up to 76 miles though these occurrences are rare (WFPB 1995a). Juveniles dispersing from intermediate distances do have an opportunity to contribute demographic support to the population, though the probability of successful dispersal is likely to decrease the farther the birds have to disperse through low quality habitat.

While the number of known site centers to which DNR-managed lands would make a contribution decreases from Alternative A (145) to Alternatives B (66) and C (108), those sites to which DNR-managed lands would make a contribution would be supported with more habitat over time and with more certainty that habitat would be maintained and developed throughout the term of the HCP. The results of our modeling show that if the population stabilizes sooner than 50 years, NRF areas could support more sites than they do at present. The amount and quality of habitat that would contribute to spotted owl site centers would be higher in Alternative C than in Alternatives A and B. Alternative C would require development of new habitat to old-forest characteristics, while Alternative B would allow degradation of old-forest habitat to sub-mature. Thus, the ability of NRF management areas to support source populations is probably lower in Alternative B than

in Alternative C. However, DNR's forest growth and harvest model of Alternative B does predict the existence of over 50,000 acres of forest older than 150 years by the end of the planning period within NRF management areas. There are presently only 32,000 acres of forests older than 200 years on all DNR-managed lands within the entire five west-side planning units. This amount of older forest may provide more high quality nesting habitat than currently exists within NRF areas and would likely provide more opportunities for successful nesting than would be provided under Alternative A.

Criterion 5: Maintenance of Species Distribution

Maintaining the distribution of the spotted owl population throughout the range of ecological conditions and geographic locations in which the owl has historically resided is important to conservation of the species because it reduces the risk of widespread extirpation (USDI 1992b). The Northern Spotted Owl Recovery Team (USDI 1992b) cited four reasons why a well-distributed population reduces the risk of extirpation. The first is that any substantial reduction in the range would reduce the number of local populations contributing to the whole population (the metapopulation). The fewer local populations, the higher the chance that large portions of the metapopulation could become extinct, and thus the higher chances that the entire population could go extinct. The second reason is that range reduction reduces the kinds of environments (i.e., forest types) that the spotted owl inhabits, thus subjecting the population to extirpation from random environmental events such as rapid change in climatic conditions, catastrophic loss of habitat from fires, insects, disease or volcanic eruption. With a well-distributed population it is unlikely that the entire population would be lost to a small number of such random environmental events. Third, the elevational and geographic fringes of a species' range are often where a species makes the most rapid adaptations to different environments. Thus, losing the population at these fringes could inhibit the spotted owl's evolutionary capabilities. Fourth, the geographical and elevational fringes of the range may prove to be important in the face of climate change. The northern part of the range and higher elevation habitats would be important if climate change produced a warmer regional climate in the Pacific Northwest. If, however, climate change produced local cooling pockets in the Pacific Northwest (Smith 1990), lower elevation habitats and the southern portion of the owl's range would become important to the owl's survival as a species. Maintaining species distribution thus requires that clusters of breeding owls are maintained throughout the range of ecological conditions and geographic extent, and that connectivity is maintained between sub-populations throughout the range.

The recovery team identified several areas that are of key distributional concern to the spotted owl population in the western Washington provinces. Nonfederal lands play a role in all of these areas. In the Western Washington Cascades Province, the I-90 corridor is important for maintaining population connectivity between the north and south Cascades. The Siouxon area was identified as important because nonfederal lands provide low- elevation habitat (important because this habitat type is uncommon on federal lands) and they support a cluster of owls in the western portion of the province. The Columbia Gorge area south of the Gifford Pinchot National Forest is important for population connectivity between the Washington and Oregon Cascades. The Mineral Block area is

important because it constitutes the westernmost cluster of spotted owls in the Washington Cascades and may serve as an important demographic link between the Olympic Peninsula population and the Washington Cascades.

In the Western Washington Lowlands Province, nonfederal lands in southwest Washington were identified as particularly important because of the lack of federal lands to support spotted owls (USDI 1992b p. 109). Low population density, limited habitat, limited and isolated distribution of site centers, and province isolation all pose severe threats to the spotted owl population in this province (USDI 1992b p. 107). The Western Washington Lowlands Province represents 40 percent of the spotted owl's historic range in the state (Hanson et al. 1993). Loss of the entire sub-population in this province would obviously represent a large truncation of the range of the spotted owl in Washington. The recovery team also raised the concern that loss of the southwest Washington population could demographically isolate the Olympic Peninsula sub-population from the rest of the spotted owl's range (USDI 1992b p. 109). This concern was analyzed in some detail by the federal Reanalysis Team (Holthausen et al. 1994) in their examination of the role of nonfederal lands in maintaining a stable sub-population on the Olympic Peninsula. While the results of the Reanalysis Team's work indicate that province isolation may not be as severe a threat as the recovery team originally thought for the Olympic Peninsula, they retained a tone of caution in interpreting the results of existing demographic data (Holthausen et al. 1994 p. 1-2). Given the uncertainty surrounding the status of the spotted owl population described in the above section on demographic support, it is prudent to still consider the reestablishment of population connectivity in southwest Washington as an important factor in maintaining species distribution throughout the historic range of the spotted owl in Washington (see also Buchanan et al. 1994 p. 19-20).

The DNR HCP Alternatives and Maintenance of Species Distribution

For maintenance of species distribution, each of the alternatives is discussed in terms of the following: geographic extent of nesting, roosting, and foraging habitat that would be provided under each alternative; the certainty with which habitat would be provided over time; contribution to maintaining nesting, roosting and foraging habitat in a range of elevational gradients; and maintaining population connectivity.

Alternative A

Alternative A would contribute to the maintenance of species distribution in the following way. It would retain habitat within known spotted owl circles on DNR-managed lands at the level required to meet incidental take guidelines. Currently, DNR-managed lands contribute habitat to spotted owl activity centers throughout the historic range of the owl in Washington.

However, over the next 100 years, the level of habitat contribution to known and future activity centers is expected to decline. Thus, current levels of contribution to maintenance of species distribution will also likely decline. Activity centers in the Western Washington Lowlands Province are, in general, isolated from large clusters of activity centers and are existing under less than optimal habitat conditions. Without a

commitment to maintain and develop new habitat to support these activity centers, they will not likely persist over the next 100 years.

Alternative A does not make a significant long-term contribution to maintaining population connectivity. This is due to the lack of provisions to manage for dispersal habitat in areas identified by the recovery team as important for demographic interchange.

Alternative B

Alternative B contributes to the maintenance of species distribution in the following ways. First, it would provide a steady amount of habitat near federal reserves in the North Puget, South Puget, and Columbia planning units. Because most federal land is positioned at higher elevations than DNR-managed lands, the fact that there will be nesting, roosting, and foraging habitat within 2 miles of federal reserves, a wider elevational gradient of habitat would be provided than by federal reserves alone. Second, NRF management areas are designated in the Siouxon, Columbia Gorge, and Finney areas, which were identified by the recovery team as important for distributional concerns (see above). Third, Alternative B has designated Dispersal management areas in places where DNR-managed lands occur between and among federal reserves to facilitate movement of juveniles among those reserves.

Alternative B does not designate NRF areas in the South Coast Planning Unit or in the portion of the Columbia Planning Unit that falls within the Western Washington Lowlands Province. There are 18 territorial spotted owl activity centers that occur in the Western Washington Lowlands Province, 11 of which occur in the South Coast Planning Unit and seven of which occur in the Columbia Planning Unit. Thirteen of these 18 activity centers have median home range-sized circles that overlap DNR-managed lands. Thus, a large proportion of the remaining activity centers in the Western Washington Lowlands Province occur on or near DNR-managed lands. By not designating NRF areas in the South Coast Planning Unit or in the western portion of the Columbia Planning Unit, Alternative B leaves a significant gap in DNR's contribution to the maintenance of species distribution in Washington State.

Alternative C

Alternative C contributes to maintenance of species distribution in the following ways. First, it would extend the elevational gradient of suitable habitat from federal reserves in the North Puget, South Puget, Columbia, and Straits planning units[30] (Maps 12, 13, 14, and 17). Second, Alternative C designates NRF management areas in the Siouxon, Columbia Gorge, and Finney areas, which the recovery team identified as important for distribution concerns (same NRF areas as in Alternative B). Third, Alternative C would provide dispersal habitat on DNR-managed lands that fall between federal reserves, thus facilitating movement of juveniles among federal reserves (same dispersal areas as in Alternative B; see Maps 12 through 14).

[30] NRF areas extend 2.7 miles from federal reserves in the Straits Planning Unit.

A fourth way in which Alternative C contributes to the maintenance of species distribution is through the designation of experimental spotted owl management areas on DNR-managed lands in a 4-mile radius around five known spotted activity centers. The intent of these areas is to learn more about the habitat characteristics of second-growth forests in which spotted owls successfully nest. This provision of Alternative C could allow at least five activity centers supported by DNR-managed lands to persist for at least the short term. However, in addition to the demographic and environmental uncertainty associated with small clusters and isolated activity centers, the experimental nature of the management areas designated under Alternative C could pose additional risks to these activity centers. Alternative C would put these sites on the incidental take permit, in case of incidental take from experimental silvicultural treatments within the management areas. Thus, Alternative C does not provide any long-term certainty for support of spotted owl activity centers on DNR-managed lands in southwest Washington.

Alternatives B and C would require DNR to manage forests such that the amount of habitat types in mid- to low elevation areas would be extended beyond what would be provided on federal reserves alone. Because each of these alternatives commits DNR to maintaining and developing habitat in specific landscapes for the term of an HCP, there is more certainty associated with the ability of DNR-managed lands to continue to contribute middle and low elevation habitat than Alternative A. Alternative A would provide habitat in a wider geographic range, but at lower quality (i.e., more fragmented) and with less certainty over the long term. Alternative C contributes habitat at a higher level and adds NRF areas in the Straits Planning Unit. Thus Alternative C makes a stronger contribution of nesting, roosting, and foraging habitat that would support maintenance of species distribution than Alternative B.

Alternatives B and C both provide dispersal habitat in areas that are important for population connectivity. Alternatives B and C provide the same amount of dispersal habitat in the same locations. Alternative A has no provision for dispersal habitat and thus does not contribute as well as Alternatives B and C to maintaining connectivity among federal reserves.

Cumulative Effects

The purpose of this section is to discuss the impacts of the alternatives in the context of other significant actions affecting spotted owls in the five western Washington planning units. These actions are the President's Forest Plan, the proposed 4(d) special rule for the spotted owl, and other HCPs.

The President's Forest Plan

A description of spotted owl habitat provided on federal lands in the President's Forest Plan appears in the affected environment section (p. 4.2.1- x). In addition, the role of federal reserves in terms of population recovery and maintenance is discussed both in the affected environment section and in the background for the demographic support criterion.

The single most important action affecting northern spotted owls is the implementation of the President's Forest Plan, but as of February 1996, the plan's implementation was not proceeding as was originally anticipated. Spotted owl habitat slated for protection under the plan has been authorized for harvest under an emergency 2-year salvage timber program (Pub. L. No. 104-19, 109 Stat 240 (1995)). To date, there are several timber sales planned within Late-Successional Reserves in the Olympic and Mount Baker-Snoqualmie National Forests. It is currently unknown how many sales will eventually be sold and how much habitat this law will allow to be removed. Analysis of the DNR HCP alternatives was conducted assuming that the President's Forest Plan would provide the level of protection for spotted owls described in FEMAT (1993) and the FSEIS for the plan (USDA and USDI 1994a). If these assumptions cannot be substantiated in light of Public Law 104-19 or any other substantial departure from the original President's Forest Plan, this analysis may need to be reconsidered.

Given the extent of habitat provided on federal reserves, the role of nonfederal lands in most parts of Washington State are to provide demographic support to the bulk of the owl population on federal lands and to facilitate dispersal among reserves. If the level of protection provided under the President's Forest Plan were to decrease, the role of nonfederal lands in spotted owl recovery would become much larger.

The Proposed 4(d) Special Rule

Pursuant to section 4(d) of the Endangered Species Act, special rules may be promulgated with respect to a particular federally listed species. Such special rules may permit incidental take so long as they meet the conservation needs of the listed species. U.S. Fish and Wildlife Service proposed a 4(d) special rule for the spotted owl in light of the significant protection provided the spotted owl through the President's Forest Plan (60 Fed. Reg. 9484 (1995)). This proposal would retain the application of incidental take restrictions in certain areas of nonfederal ownership while relaxing them in others. The proposal designates six Special Emphasis Areas (SEAs) in Washington State. Incidental take restrictions are also to apply to nonfederal lands within 2 miles of spotted owl sites on federal reserves for the next 2 years. In addition, 70-acre cores would be retained around nest sites outside of SEAs. The last relevant provision is that landowners still retain the opportunity to seek relief from incidental take prohibitions through habitat conservation plans.

Five of the six SEAs are in or overlap the western Washington HCP planning area - the Finney, I-90 corridor, Siouxon, Mineral Block and Columbia Gorge areas. The western Olympic Peninsula SEA is in the OESF Planning Unit. There is a large degree of overlap between DNR- designated NRF management areas under Alternatives B and C and the SEAs. NRF areas outside of SEAs within 2 miles of federal reserves also overlap with provisions of the proposed rule.

Under Alternative A, circle-by-circle management would continue on DNR-managed lands within SEAs. USFWS, in proposing its 4(d) special rule, took into account "...emerging, nonfederal landowner Habitat Conservation Plans" (60 Fed. Reg. 9484 (1995)). In its Biological Assessment of the President's Forest Plan, USFWS stated that

simply abiding by incidental take prohibitions within SEAs would not meet conservation goals for the spotted owl (USDA and USDI 1994a Appendix G). DNR's HCP proposal is the largest in area in Washington. Thus, the ability of the proposed 4(d) special rule to complement the President's Forest Plan in achieving recovery of the spotted owl would need to be reassessed in light of the lack of an HCP on DNR-managed lands.

Under Alternative B, management of DNR NRF areas would increase the amount of habitat available to spotted owls (both NRF and dispersal) compared to the amount provided under Alternative A. In addition, suitable spotted owl nesting, roosting, and foraging habitat would be provided within 2 miles of federal reserves outside of SEAs in the western Cascades. Given that this provision of the proposed rule is to last for 2 years and then be re-examined, the amount of habitat provided by Alternatives A and B under a proposed 4(d) special rule may not be significantly different. If USFWS retained take prohibitions around "federal circles" that use DNR-managed lands for more than a decade, Alternative B would provide more support to these sites than Alternative A.

Alternative C would provide more habitat to support spotted owls within SEAs than either of the other two alternatives. It would also provide support to the federal population in the Straits Planning Unit, which would exceed the overall protection to the population provided under the combination of a proposed 4(d) special rule and Alternative B or A.

None of the alternatives, in conjunction with the proposed 4(d) special rule, provide habitat that would lead to an improving situation for spotted owls in southwest Washington.

Other HCPs

To date, the only HCP that has been approved in the vicinity of the five west-side planning units is on the timberlands of Murray Pacific Corporation in Lewis County (Beak Consultants, 1993, 1995). The Murray Pacific HCP is a multispecies plan that includes provisions for spotted owl dispersal habitat. Murray Pacific lands fall between the Gifford Pinchot National Forest and the Mineral Block. They also own lands within the Mineral Block. The Mineral Block is a disjunct portion of the Gifford Pinchot National Forest that constitutes the westernmost Late-Successional Reserve in the Western Washington Cascades Province. The dispersal habitat provisions of the Murray Pacific HCP provide connectivity between the western Washington Cascades population and a cluster of spotted owls that reside mostly on U.S. Forest Service land in the Mineral Block. The Northern Spotted Owl Recovery Team identified connectivity in this area as a recovery priority for nonfederal lands (USDI 1992b).

Under Alternative A, the Murray Pacific HCP would provide the only dispersal link between the main stem of federal reserves in the western Cascades and the Mineral Block. If either Alternative B or C were implemented, DNR-managed lands would also provide dispersal habitat in the same vicinity, but to the north of the Murray Pacific ownership (see Map 13). Thus, either Alternative B or C would improve the ability of juvenile owls to disperse between the Mineral Block and the main stem of the Gifford

Pinchot National Forest compared to what would occur only with the Murray Pacific HCP.

There are several other HCPs proposed within the five west-side planning units, including the recently released draft Plum Creek HCP. However, none of these proposed HCPs are near enough to completion allow accurate assessment of their cumulative impacts in light of the proposals contained within this document.

4.2.2 Marbled Murrelet

This section is subdivided into two sections. The first briefly summarizes the affected environment for the marbled murrelet. The second describes the environmental consequences of implementing the alternatives to the marbled murrelet.

Two action alternatives, Alternatives B and C, are considered in detail along with the No Action alternative, Alternative A. For the OESF, Alternatives 1, 2, and 3 are identical to Alternatives A, B, and C respectively. The alternatives differ in the way they define potential nesting habitat, the methods used to protect occupied sites, the number of occupied sites potentially protected, the operative time lines of each alternative, the amount of information gathered on the species, and the overall conservation strategy used.

A detailed discussion of the environmental consequences of each alternative can be found in Section 4.2.2.2 and a summary of the environmental consequences of each alternative is provided in Table 4.2.34.

4.2.2.1 Affected Environment

This section presents information on the marbled murrelet and its habitat requirements that will be used as the base line against which to measure the impacts of the alternatives. The draft HCP contains a detailed description of the marbled murrelet, including a review of its taxonomy, physical characteristics, geographical distribution, behavior, nesting habitat, and a thorough discussion of habitat status in Washington and threats to the species (see HCP, Chapter III).

An analysis of the amount of murrelet habitat remaining in western Washington completed by DNR for the draft EIS on Forest Practices rule proposals indicated there were 916,611 acres of old-growth and 868,317 acres of mature forests in western Washington below 3,500 feet in elevation and within 66 miles of saltwater (WFPB 1995a). The analysis also indicated that of this habitat, approximately 62,200 acres of old-growth and 64,656 acres of mature forests exists on state-managed lands out of a total of 130,104 acres of old-growth and 165,312 acres of mature forest on state and private ownerships. Therefore, as much as 7 percent of the total potential marbled murrelet habitat in Washington (both federal and nonfederal) exists on state-managed lands. In addition, of the habitat on nonfederal ownerships, approximately 48 percent of the old-growth and 39 percent of mature forests are located on state-managed lands. This habitat represents a significant amount of the old-growth and mature forest nesting habitat available to the marbled murrelet.

Habitat Status in Washington. Estimates of the amount of potential marbled murrelet nesting habitat in Washington have been made using satellite data developed by the Washington Department of Fish and Wildlife (WDFW) and modified by DNR (see Raphael et al. 1995; WFPB 1995a; data developed by Eby and Snyder 1990 and updated by Collins 1993). These estimates were based on broad definitions of old-growth and large-saw forests. The amount of potential nesting habitat by ownership based on these estimates is shown in Table 4.2.28.

Current Habitat Protection

Estimates of the amount of murrelet habitat present on various land ownerships in western Washington were derived from a GIS analysis completed for the draft EIS on Forest Practices rule proposals for the marbled murrelet (WFPB 1995a). This analysis used Landsat data from 1988 that has been updated to reflect remaining habitat as of 1994. Old growth in this study was defined as stands with greater than or equal to eight dominant trees per acre greater than or equal to 32 inches diameter at breast height (dbh) associated with the presence of greater than or equal to 12 co-dominant trees per acre with a diameter greater than 16 inches. The presence of a multi-layered canopy, snags and down logs were also criteria. In addition, to be considered marbled murrelet habitat, old-growth stands had to be located within 66 miles of marine waters and below 3,500 feet in elevation. These limits were chosen because studies in Washington have shown that 99 percent of the breeding sites have been located within these zones (WFPB 1995a).

For all ownerships, old-growth habitat estimated to be present in western Washington from this analysis was 916,611 acres. Potential nesting habitat is protected in Olympic and North Cascades National Parks, wilderness areas, state parks, federal wildlife refuges, and through the President's Forest Plan. Within 66 miles of the coast and below 3,500 feet in elevation in Washington, approximately 342,832 acres of old growth exists within national parks, 440,088 acres in wilderness areas or areas included in the President's Forest Plan, 702 acres in state parks, and 26 acres in federal wildlife refuges (WFPB 1995a). In summary, 783,648 acres of potential nesting habitat in western Washington may receive some protection by these land designations. Some of this habitat may not be protected on tribal lands. Old growth on tribal lands was estimated to be 3,609 acres. A small amount of habitat was also located on other federal and state ownerships where guidelines concerning the protection of this habitat are unknown. These estimates indicate that approximately 86 percent of the old-growth forests in western Washington is located on federal lands with the majority of this habitat receiving protection. Habitat without current regulatory protection includes 62,200 acres of old growth on DNR-managed lands and 67,154 acres of old growth on private lands. Therefore, approximately 7 percent of the old-growth habitat in western Washington is managed by DNR and an additional 7 percent is located on private lands.

President's Forest Plan

The Secretaries of Agriculture and Interior adopted the President's Forest Plan in April 1994 (USDA and USDI 1994a). Marbled murrelets and their habitat on federal lands were specifically considered in this plan. Potential marbled murrelet nesting habitat, defined as stands dominated by conifers that were at least 21 inches dbh and characterized by a multi-story canopy, are specifically considered in this ecosystem approach to the management of late-successional forests (FEMAT 1993). In this plan, it was estimated that approximately 94 percent of the 969,200 acres of potential nesting habitat estimated to be available on federal land in western Washington is protected by the plan's Late-Successional Reserves (304,800 acres), Adaptive Management Areas (56,600 acres), and Riparian Reserves (13,200 acres) or through Congressionally or Administratively Withdrawn Areas (534,100 acres) (FEMAT 1993). These are much higher estimates of habitat protected than those developed by the GIS analysis for the Washington Forest Practices Rules (WFPB 1995a).

Two separate assessments were made by the President's Forest Plan Marbled Murrelet Working Team of the effectiveness of providing protection for marbled murrelets. One assessed only the sufficiency of habitat to provide for a well-distributed population on federal lands for 100 years and resulted in an 80 percent likelihood of such an outcome. The second assessment examined the probability of having a viable population of marbled murrelets on federal lands for 100 years with all factors (such as habitat on state and private lands, at-sea conditions, etc.) influencing murrelets considered and resulted in a 60 percent likelihood.

The analysis team stated that in some parts of the range of the marbled murrelet, nonfederal lands are key to maintaining the existing distribution of marbled murrelets and providing for potential recovery of the species and ..."management and development of murrelet habitat on private and state lands could provide for a higher viability rating and an increased likelihood that the ecosystem plan adopted on federal lands will maintain marbled murrelets for the long-term" (FEMAT 1993).

U.S. Fish and Wildlife Service Critical Habitat

On January 27, 1994, USFWS originally proposed designation of marbled murrelet critical habitat in Washington, Oregon and California (59 Fed. Reg. 3811 (1994)). From the comments received regarding the first designation and additional information available, the service amended the proposed designation of critical habitat on August 10, 1995. Comments from the public on this second proposal were due October 10, 1995.

Critical habitat is defined in section 3(5)(A) of the Endangered Species Act as the specific areas within the geographical area occupied by the species on which are found those physical and biological features essential to the conservation of the species, or which require special management considerations or protection. Critical habitat receives consideration under section 7 of the act with regard to actions carried out, authorized, or funded by a federal agency. As such, designation may affect nonfederal lands only where such a federal nexus exists. Federal agencies must ensure that their actions do not result in the destruction or adverse modification of critical habitat.

Application of the selection criteria in the designation of critical habitat resulted in the proposed designation of many of the mapped Late-Successional Reserves within marbled murrelet zones 1 and 2, as described in the Forest Ecosystem Management Assessment Team report (FEMAT 1993). Application of these criteria also resulted in the designation of nonfederal lands, where federal lands alone were judged to be insufficient in providing suitable nesting habitat for the recovery of the species. A proportion of DNR-managed lands were proposed for critical habitat designation where federal lands were limited or nonexistent. DNR-managed lands in southwest Washington are particularly important. Some private lands were proposed as critical habitat because they also provided essential elements. These designations included areas in the lowlands of northern Washington and land supporting known occupied sites in southwest Washington.

In western Washington, critical habitat designations included Congressionally Withdrawn Areas (1,800 acres), Late-Successional Reserves (1,220,200 acres), DNR-managed lands (426,800 acres) and private lands (2,500 acres). U.S. Fish and Wildlife Service stated that

any lands within critical habitat that are included in a habitat conservation plan that addresses the conservation of the marbled murrelet will be subsequently excluded from critical habitat designation while an HCP approved by USFWS is in effect. According to state regulations, when critical habitat is designated by the federal government, actions within these areas automatically become Class IV-Specials and a SEPA checklist is required. Much of state-managed and private land designated in the USFWS critical habitat rule are also being included in potential habitat conservation plans.

U.S. Fish and Wildlife Service Spotted Owl Proposed 4(d) Special Rule

Restrictions on "take" are currently imposed in all of the northern spotted owl's range. On February 7, 1995, the USFWS proposed a rule using section 4(d) of the Endangered Species Act, to impose "take" prohibitions only where USFWS finds it necessary and advisable. Under the proposed rule, the incidental take of spotted owls in the course of timber harvest and related activities on specified nonfederal lands in Washington and California would not be prohibited. The proposal does not include the marbled murrelet but could result in the loss of some old-growth habitat in areas designated for the rule. A final 4(d) special rule has not been adopted at this time.

U.S. Fish and Wildlife Service Draft Recovery Plan

The marbled murrelet was federally listed as threatened in Washington, Oregon and California on September 28, 1992 (57 Fed. Reg. 45328 (1992)) due to the high rate of nesting habitat loss and fragmentation, plus mortality associated with net fisheries and oil spills (Marbled Murrelet Recovery Team 1995). A Draft Marbled Murrelet Recovery Plan for the marbled murrelet was published by USFWS in July 1995. Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. The plan states that the next 50 years will be the most critical period for marbled murrelet conservation efforts because significant amounts of additional mature/large-saw forest habitat will not develop until after the year 2040 (FEMAT 1993). Populations in the Pacific Northwest are likely to continue to decline as a result of low reproduction and additional factors such as gill net mortality, oil spills, and predation that have increased adult mortality (Marbled Murrelet Recovery Team 1995). The plan states that the weight of evidence indicates the major factors in murrelet population decline are the loss of nesting habitat and poor reproductive success in the habitat that does remain. This poor reproductive success is apparently due in large part to increased vulnerability of nests to predators in highly fragmented landscapes (Marbled Murrelet Recovery Team 1995).

The plan states that there is little opportunity for an increase in marbled murrelet productivity as a result of forest maturation in the near future, and that any further substantial reduction in occupied nesting habitat would hamper efforts to stabilize the population and recover the species (Marbled Murrelet Recovery Team 1995). The plan concludes that: (1) recovery of the marbled murrelet will require additional nonfederal lands, with several key areas occurring on state and private lands (Marbled Murrelet Recovery Team 1995); (2) maintaining a well-dispersed marbled murrelet population is

an important component of recovery; and, (3) each segment of the species range should be managed to maintain viable populations (Marbled Murrelet Recovery Team 1995).

The Marbled Murrelet Recovery Team outlined several interim recovery objectives in the draft recovery plan. The primary objective of the plan is to stabilize population size at near current levels throughout the three-state area while gathering the necessary information to determine specific delisting criteria, such as population size goals and habitat needs for each marbled murrelet conservation zone. To achieve this overall objective, the plan states it would be necessary to achieve the objectives of: (1) maintaining and/or increasing the productivity of the population as reflected by total population size, the adult:juvenile ratio and nesting success; and, (2) removing and/or minimizing threats to survivorship, including mortality from gill net fisheries and oil spills. Actions needed to achieve these goals will be to: (1) secure habitat by designating reserves and critical habitat in both the marine and terrestrial environment, develop habitat conservation plans and protect occupied sites; (2) develop and implement landscape management strategies within marbled murrelet conservation zones to stabilize populations and improve habitat conditions; (3) monitor populations and survey potential breeding habitat to identify nesting areas; (4) implement short-term actions to stabilize and increase the population including maintaining habitat distribution and quality, maintaining suitable habitat in large continuous blocks, maintaining buffer areas, decreasing adult and juvenile mortality, increasing recruitment, and initiating research to determine the impacts of disturbance in both marine and terrestrial environments; (5) implement long-term actions to stop the population decline and increase population growth by increasing the amount, quality and distribution of suitable nesting habitat, decreasing fragmentation, protecting recruitment habitat, providing replacement habitat through silvicultural techniques, and improving marine habitat quality; and, (6) conduct research and monitoring to refine survey and monitoring protocols, examine limiting factors, and gather data necessary to develop specific delisting criteria and appropriate landscape management strategies (Marbled Murrelet Recovery Team 1995).

Habitat Conservation Plans

Section 10 of the ESA provides owners of nonfederal land with an alternative to the take prohibition. It allows 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. USFWS must find that the taking would not appreciably reduce the likelihood of the survival and recovery of the species. No habitat conservation plans have been finalized in Washington State that specifically protect occupied sites of marbled murrelets. Section 10 efforts and cooperative agreements may, in the future, release protection on some portion of occupied sites and unoccupied suitable habitat in Washington.

Washington State Forest Practices Rules

Most of the potential benefits to marbled murrelets resulting from the implementation of Washington State Forest Practices Rules by state and private landowners would be from timber harvesting rules (WAC 222-30) regarding Forest Practices Riparian Management Zones (RMZs), forested wetlands, wildlife reserve tree management (WAC 222-30-020), and shade requirements to maintain stream temperatures (WAC 222-30-040).

Of these rules, the guidelines regarding Forest Practices RMZs would be expected to have the most benefits in providing some degree of marbled murrelet nesting habitat protection because of Forest Practices RMZ widths prescribed for different stream classes. Additional benefits to murrelets could occur from rules regarding forested wetlands. For forested wetlands, landowners are encouraged to leave a portion (30-70 percent) of the wildlife reserve tree requirement for the harvested area within a wetland. Wildlife reserve tree management may also provide some limited nesting habitat for marbled murrelets. In some cases, where larger trees (greater than 32 inches dbh) are left to provide shade requirements to maintain stream temperatures (WAC 222-30-040), some marbled murrelet nesting habitat may be protected, but these rules do not specify tree sizes to be retained to meet shade requirements. Since all of these rules are not specifically designed to protect marbled murrelet habitat, minimal protection to breeding habitat or the population can be expected from these actions.

Washington State Forest Practices Rule Proposals for Marbled Murrelets

In the "Notice of Intent to Prepare and Request for Comments on Scope of EIS" dated April 8, 1994, the Forest Practices Board indicated that two marbled murrelet rule alternatives were proposed in addition to a No Action alternative. The alternatives under consideration are Alternative 1, the Occupied Stand Approach and Alternative 2, the Watershed Administrative Unit (MM-WAU) Approach. A final rule has not been adopted at this time.

Private Lands

It is estimated that 7 percent of the old-growth habitat in western Washington is available on private lands (WFPB 1995a). Some protection to suitable habitat and occupied sites may occur in the future if some private landowners develop habitat conservation plans that include the marbled murrelet. Demographic support or protection to occupied sites is expected to be minimal over time since most landowners will be harvesting their timber long before it becomes suitable marbled murrelet habitat.

Table 4.2.28: Old-growth, large-saw, and small-saw forests below 3,500 feet and less than 66 miles from marine waters by ownership

Source: DNR GIS, November 1994.

Ownership	Old-growth (acres)	Large-saw (acres)	Small-saw (acres)
Federal	798,231	710,347	352,853
State	62,950	64,656	173,131
Local	1,162	3,227	2,659
Tribal	3,607	1,302	5,614
Private	67,154	100,656	335,232
Total	933,104	880,188	869,489

Status of Habitat on DNR-Managed Lands

From data in Hamer et al. (1994b), DNR derived another estimate of potentially suitable nesting habitat for the lands it manages, assuming that (1) marbled murrelets would use a stand that contains at least eight trees per acre that are greater than or equal to 32 inches dbh; (2) at least 40 percent of such trees are Douglas-fir, western hemlock, western redcedar, or Sitka spruce; and, (3) the stand contains at least two nesting platforms per acre. This definition was derived from minimum conditions of occupied murrelet stands in Washington. Using forest growth models incorporating site index and assumptions of how managed stands versus unmanaged stands grow, DNR estimated the age at which a stand would develop eight trees greater than or equal to 32 inches dbh. Data from Hamer et al. (1994b) indicate that in unmanaged low-elevation stands, three trees per acre that are greater than or equal to 30 inches dbh would produce at least two platforms per acre. The platform per acre criterion is thus captured by the tree size and density criteria. Using this platform density criterion as the primary variable in defining habitat, DNR ran computer models summing the acres of habitat having four trees per acre that were greater than or equal to 32 inches in diameter. Four trees per acre and a 32 inch criterion was used because the information was already available and not expected to be significantly different than the three trees per acre criterion.

DNR's computerized geographic information system database was queried to assess how many acres of DNR-managed land met the minimum definition of murrelet habitat (greater than or equal to four trees per acre greater than or equal to 30 inches dbh) within 52.25 miles of marine water. The estimate was between 55,773 and 63,614 acres, depending on whether growth was assumed to be for a managed stand or a natural stand.

This represents 3.4-3.8 percent of all DNR-managed forest lands in the area covered by the HCP. However, combining old-growth and large-saw estimates from the WDFW results in an estimate of 126,606 acres of potential murrelet habitat on DNR-managed land (WFPB 1995a).

The 2-year murrelet habitat relationship study currently under way on DNR-managed lands will result in the most accurate picture yet of how much actual potential nesting habitat exists.

Habitat trends

The amount of available murrelet nesting habitat has been decreasing. Murrelets nest almost exclusively in low-elevation old-growth and mature forests within 40 miles of marine waters, although they have been observed as far as 66 miles inland. About 10 percent of pre-settlement old growth remains in western Washington (Norse 1990; Booth 1991) but most of this habitat is found at higher elevations and may be unsuitable for marbled murrelets. For example, 45 percent of the old-growth forest on federal lands in western Washington lies above 3,500 feet (WFPB 1995a). Logging, urbanization, and agricultural development have all contributed to the loss of this habitat.

The Forest Ecosystem Management Assessment Team (FEMAT 1993) estimated that management under the President's Forest Plan is expected to result in retention of 97 percent of the remaining 980,000 acres of potential murrelet habitat on federal lands in Washington (USDA and USDI 1994a; Perry 1995). Although there are currently no federal restrictions on logging of murrelet nesting habitat on nonfederal lands, landowners are still liable for take of murrelets under the Endangered Species Act. To avoid risk of taking, DNR began a voluntary deferral of timber harvesting in potential murrelet habitat in 1992. The Forest Practices Board is developing a rule for murrelet habitat on state and private lands under the Washington Forest Practices Act.

Current State and Federal Habitat Protection Measures Considered in the Assessment of the Alternatives

Some potential nesting habitat for the marbled murrelet is protected in Washington on several types of federal and state ownerships. This section describes how these protection measures were used when assessing and comparing the alternatives.

The analysis of the alternatives considered the benefits of habitat protection from the President's Forest Plan, current forest practices rules, reserves, and federal ESA regulations. In the analysis, it was assumed that the President's Forest Plan would protect a maximum of approximately 86 percent (WFPB 1995a) of existing or potential marbled murrelet habitat on federal lands in Washington State within various types of reserves. This estimate is lower than that provided by the Forest Ecosystem Management Assessment Team. The amount of land reserved in the President's Forest Plan within the range of the northern spotted owl was estimated by FEMAT to represent 75 percent of known marbled murrelet nesting habitat in Oregon, Washington, and California.

However, as Perry (1995) states, not all of these lands may be suitable for murrelets because the estimates were largely based on interpretations of satellite imagery that have

not been thoroughly ground-verified. Multiple GIS and Landsat imagery data with different forest classification categories were used from various agencies throughout the three-state-area to develop these estimates. Therefore, the accuracy of the products in estimating the amount of murrelet habitat in each area is unknown. For example, Table IV-27 of FEMAT 1993 reports that 605,600 acres of marbled murrelet habitat is available on the Olympic Peninsula while 562,700 acres of nesting, roosting and foraging (NRF) habitat are estimated to be available for spotted owls, despite the fact that much of NRF habitat for owls is often younger aged forests (Cummins et al. 1993) and unsuitable for murrelet nesting. Therefore, the estimate of marbled murrelet habitat for this area should be much lower than the estimate of NRF habitat available for the owl. Additionally, the estimates refer to quantity of habitat, not quality, which may depend on proximity to the coast, landscape context, stand size, and other factors that are not well understood.

The possible benefits of current Washington Forest Practices Rules (described previously) were considered and analyzed for each criterion. This analysis also assumed that the effect of ESA regulation would be to protect all occupied sites that are currently known in Washington. Presently there is no ESA requirement to survey potential habitat to locate additional sites and no specific guidelines developed to define what constitutes take for marbled murrelets in terms of habitat modification. It is not possible to predict how much habitat ESA regulations may protect in the future. Although DNR may choose to conduct surveys for marbled murrelets because of ESA requirements, it was not possible in the analysis to predict what surveys would be conducted or how extensive or intensive these surveys may be. Therefore, it was assumed that, at a minimum, known occupied sites would be protected by these federal regulations. It was estimated that approximately 1,814 acres of old-growth and 1,633 acres of mature forest would be protected in currently known occupied sites on private and state-managed lands in western Washington as of 1994 (WFPB 1995a). Although known sites may not be equivalent to currently occupied sites, because murrelets appear to exhibit high site fidelity (Divoky and Horton 1995) it is likely that most of these sites are still occupied. Approximately 43 percent of this acreage is located on DNR-managed lands in western Washington.

Although marine influences also affect the population, after assessing the evidence in both environments, the Marbled Murrelet Recovery Team (1995) states that the weight of the evidence indicates that the major factors in murrelet decline from historical levels are loss of nesting habitat and poor reproductive success in the remaining habitat. In addition, in a review of biological and ecological information on the marbled murrelet by Ralph et al. (1995a), they conclude that the ultimate fate of the marbled murrelet is largely tied to the fate of its reproductive habitat, primarily old-growth forests or forests with an older tree component.

Ninety percent of all old growth on DNR-managed lands is located below 3,500 feet in elevation. In addition, 89 percent of old growth on DNR-managed lands is located within 40 miles of the ocean (WFPB 1995a). Because the majority of potential nesting habitat on DNR-managed lands is located low in elevation and close to the ocean, this habitat, in conjunction with federal lands, likely plays an important role in contributing to the maintenance of murrelet populations in western Washington. In addition, old-growth and

mature forests on DNR-managed lands in southwest Washington, the Puget trough, and the near-coastal areas of the Olympic Peninsula often provide the only habitat available in these areas for the marbled murrelets and thus are critical in supporting and maintaining populations in these areas.

The length of time that suitable habitat is protected will also affect marbled murrelet populations. Adult marbled murrelets are thought to be long-lived birds (Beissinger 1995) that show a high fidelity to nesting areas (Divoky and Horton 1995), returning to the same stands to nest year after year. Divoky and Horton (1995) state that the loss or degradation of occupied breeding habitat would likely result in displaced breeders attempting to prospect for alternate breeding sites. In areas with little habitat available, this could result in birds being prevented from breeding, birds attempting to breed in sub-optimal habitat, increased risks of predation, and disruption of breeding activities for an unknown number of years. In areas with little or no alternate habitat available within a reasonable distance of the disturbed site, birds may be unable to locate suitable habitat to successfully reproduce.

Additional habitat from the development of protected recruitment habitat in Late-Successional Reserves in the President's Forest Plan is not expected to yield supplementary marbled murrelet habitat for 50 years or more (Marbled Murrelet Recovery Team 1995). No other source of additional suitable breeding habitat is expected to be available to the marbled murrelet within the next half century. The most optimistic estimate of the age that a typical western hemlock stand on a high quality growing site can be expected to begin producing minimal suitable nesting habitat is 78 years (Table 4.2.29). For poorer growing sites, the age is likely to be 116 years or more. Therefore, the long-term protection of current nesting habitat to help support current populations and prevent further population declines will be important to the short- and long-term persistence of the species.

4.2.2.2 Criteria for Assessing the Alternatives

This section presents the scientific and analytical basis for comparing the alternatives. The discussion is structured around two assessment criteria: the amount of potential nesting habitat protected by each alternative and the likelihood that an alternative would protect or enhance the reproductive potential of the population in conjunction with federal conservation efforts. This section defines these two criteria, outlines what standard measures were used to assess each criteria and reviews the qualitative and quantitative procedures used to measure the effect of each alternative on marbled murrelets. The significance and importance of each criteria and how they can affect the biology and ecology of the marbled murrelet are also discussed.

Criterion 1 - Quantitative: Amount of potential nesting habitat protected by each alternative

This criterion makes a quantitative assessment of the amount of habitat included in each alternative, and the time frame that this protection is provided, to determine if enough habitat is available to protect the majority of breeding sites, make a significant long-term contribution to federal conservation strategies, and increase the probability that the population would persist in conjunction with federal conservation efforts.

Measure: Quantitative GIS analysis of the amount of acreage protected by each alternative within each west-side planning unit, by each inland distance zone, and a qualitative assessment of the length of time that the protection would be provided.

Background Information Relevant to All Alternatives

The number of marbled murrelets protected and the health of the population will be directly related to the amount of habitat that is included under each of the alternatives and the length of time that this habitat is retained and available on the landscape for breeding birds. The eventual size, trend, and stability of the population in Washington will likely be affected by the total amount of habitat protected on state-managed lands combined with habitat protected by the President's Forest Plan, current forest practices rules, ESA protection, and other reserves.

The President's Forest Plan, national parks, and Administratively and Congressionally Withdrawn Areas will protect approximately 783,648 acres of potential nesting habitat (WFPB 1995a). The potential release for harvest of the so-called "318 sales" under Public Law (salvage rider bill) could affect the amount of habitat protected by the President's Forest Plan. In Washington State, these 318 sales include 15 sale units in the Olympic National Forest and 20 sale units in the Mt. Baker National Forest that are believed to be occupied by marbled murrelets. At this time, the Service does not expect occupied habitat from these sales to be harvested. A small amount of additional habitat would also be protected by the forest practices rules discussed previously. No habitat is currently protected by the spotted owl proposed 4(d) special rule, as this process is not yet complete. Little habitat has been protected by other HCPs completed to date, although none of the lands covered by these HCPs currently have occupied stands.

The Marbled Murrelet Recovery Team (1995) states that additional habitat essential for the conservation of the marbled murrelet occurs on nonfederal lands in Washington, but that these could be managed for the murrelet without further regulation if surveys for murrelets were required prior to timber harvest and occupied sites were protected from timber harvest operations. When all factors (including at-sea conditions and the condition of nonfederal lands) affecting the species were taken into account in a second assessment of population viability by the Marbled Murrelet Working Group of the President's Forest Plan, the assessment team rated the plan as having a 60 percent likelihood that murrelet populations on federal lands would be stable and well-distributed after 100 years (FEMAT 1993). In addition, they stated that the management and development of murrelet habitat on nonfederal lands could provide for a higher viability rating and an increased likelihood that the ecosystem plan adopted on federal lands would maintain marbled murrelets for the long term (FEMAT 1993). DNR-managed lands contain approximately 43 percent of the old-growth and mature forests found on nonfederal lands in western Washington.

Criterion 2 - Qualitative: Likelihood that the alternative would protect or enhance the reproductive potential of the population in conjunction with federal conservation efforts which would lead to the long-term persistence and adaptation of the species in Washington

This criterion makes a qualitative assessment whether enough protection is provided to the population to increase the likelihood that successful reproduction is maintained or increased, adult survival is maintained or increased, breeding sites are not disturbed during the breeding season and decrease the likelihood of reduced genetic variability and isolation of occupied sites. Criterion 2 also assesses whether a population source for the colonization of future sites in unoccupied suitable habitat would be provided.

Measure: Qualitative assessment of the degree and length of time that occupied sites are protected. The assessment included the degree that occupied sites were protected from disturbances due to forest management activities, further degradation and modification of breeding habitat, further fragmentation of breeding habitat (edge effects), loss of habitat due to windthrow, microclimatic changes to the stand, and nest predation.

Background Information Relative to All Alternatives

Maintaining a threatened or endangered species depends on determining its rate of population change and correcting the factors that limit population growth. Unfortunately, the amount of data available on murrelet population trends, demography, and biology is still limited. Demographic modeling using the best available information on the marbled murrelet can give indications of likely population trends and can indicate which components of the life history are most likely to significantly affect population growth and stability. Once identified, these limiting factors can be used to indicate what management tools would have the greatest benefits to the species.

Demographic models developed by Beissinger (1995) indicate that the marbled murrelet population is likely declining at a rate of approximately 7 percent per year in Washington, Oregon and California based on juvenile ratios from offshore marine counts. Beissinger found population changes were most sensitive to adult survivorship and stated that because of the murrelet's habit of flying long distances inland to nest in old-growth forests, it probably faces higher adult mortality risks than other seabirds. In addition, he noted that all measures of productivity of the population from field data appear to be low and that this poor reproductive success could be due to high nest failure rates due to predation (Nelson and Hamer 1995a) or a low proportion of adults attempting to breed, perhaps because they are unable to find suitable nests. This information indicates that management directed at increasing adult survivorship, nesting success, and the proportion of adults that are breeding in any 1 year would likely substantially improve conditions and increase the stability of the population over time. Therefore, protection of the reproductive potential of the population and reduction of adult mortality should be given a high priority.

Even with no further loss of habitat, the adult population can be expected to equilibrate and will likely stabilize at a smaller population size than present. Increases in juvenile:adult ratios could result from these declines in the after-hatch year portion of the

population, without any actual increase in reproduction or survival. If these non-equilibrium conditions exist, the recent juvenile:adult ratios observed in the marine environment and used in the Beissinger model may be overestimates of the actual reproduction occurring in the population.

The number of breeding sites protected by each alternative (analyzed in Criterion 1) and the silvicultural and wildlife management techniques used to provide protection to occupied sites would likely directly determine the number of pairs of breeding birds protected and the reproductive success of these birds and, therefore, affect the reproductive potential of the whole population. The methods employed to protect and retain these forests would determine the total amount of habitat retained over time, especially in regions prone to loss of older forests by fire and windthrow. If breeding sites are not located and protected using the best knowledge available, the likely result would be continuing population decline.

Once these breeding sites are located, if long-term protection or enhancement measures are not taken to meet the needs of breeding birds, the likely result would be increased risks of nest predation and adult mortality, continued reproductive failures, continued disturbances to breeding sites, and a decreased likelihood of persistence of the population even with the benefits from federal conservation efforts. If the necessary protective measures are not provided to breeding sites on state-managed lands to ensure reproductive success, the likelihood of the success of the President's Forest Plan in maintaining murrelet populations over time would decrease. In addition, the likelihood that USFWS recovery objectives would be attained for each of the conservation zones in Washington would also be lower.

Plans that consider and solve problems in the distribution of habitat on a landscape scale, and provide increased protection for those areas where populations or habitat levels are low, would likely have a better chance of long-term success. Plans that identify areas where the isolation of breeding colonies could be a problem, or that have the flexibility to recommend the development of habitat in areas where little suitable habitat exists, would be more likely to protect populations over time. Strategies that can provide additional habitat over time to replace habitat that may be lost to catastrophic events and fill gaps in the distribution of suitable nesting habitat allowing birds an opportunity to colonize new stands will have a higher likelihood of success. The Draft Marbled Murrelet Recovery Plan identified southwest Washington (southern portion of conservation zone 2) and near-coastal areas of western Washington Puget trough (western portion of conservation zone 1) as areas nearly devoid of suitable habitat and having little or no federal ownerships to offer habitat and population support from federal conservation efforts (Marbled Murrelet Recovery Team 1995). The plan states that habitat remaining in these portions of the conservation zones will be extremely important in maintaining murrelet populations in these areas and maintaining a well-dispersed population. The plan identified maintaining a well-dispersed population as an important component of recovery and that each segment of the species range should be managed to maintain viable murrelet populations within each zone (except zone 5 near Mendocino, California).

Forest fragmentation leading to smaller stand sizes with decreased interior forest conditions can cause indirect changes in intact forests, such as changes in microclimatic conditions, forest structure, and amount of cover. Fragmentation results in increased forest edge (Harris 1984). Interior portions of old-growth forests generally have lower temperatures and higher humidity conditions than those areas closer to the forest edge. This may be an important factor to the marbled murrelet, a thickly plumaged seabird adapted to diving for food in cold waters. Interior forest conditions would also be expected to provide more protection to nests and young from wind and rain storms than locations closer to the forest edge (Ralph et al. 1995a).

Ralph et al. (1995a) concluded that exposure to avian nest predators may be influenced by the size of the stand and the placement of nests relative to the edge of a stand. Paton (1994) reviewed literature on songbirds and found that artificial nests are subject to greater predation within 50 meters (165 feet) of the forest edge, although none of the studies were conducted in western coniferous forests. Working in coniferous forests in British Columbia, Bryant (1994) found artificial nests placed on the ground or in shrubs near the edge of the stand were more frequently preyed upon than those in the center of the stand. He also found corvids on Vancouver Island to be more common along the edge of forests than in the interior. Nelson and Hamer (1995a) found that successful marbled murrelet nests were farther than 55 meters (182 feet) from the forest edge and were better concealed than unsuccessful nests. Increases in corvid abundance (Marzluff 1994) and increased habitat modifications leading to an increase in corvid foraging effectiveness may be leading to a decrease in the nesting success of marbled murrelets (Nelson and Hamer 1995a). Some studies in the Pacific Northwest have not found corvids to be an open- or edge-related species (Carey et al. 1991). Although more work needs to be done, it is likely that predation is a factor limiting this population and influencing the selection of nesting habitat and reproductive success (Ralph et al. 1995a). In addition, since the marbled murrelet is very social at breeding sites and shows colonial or semi-colonial nesting behavior, larger stands can contain more birds overall, although there is no evidence that density changes as a function of stand size (Miller and Ralph 1995).

The Marbled Murrelet Recovery Team (1995) identified decreasing fragmentation by increasing the size of suitable stands to provide a larger area of interior forest condition as a primary recovery action. The team stated that suitable nesting habitat maintained in larger contiguous blocks would provide more nesting and hiding opportunities, provide for multiple nesting sites for individual pairs of birds over time, facilitate nesting for multiple pairs of birds, and promote increased social contact. They also noted that interior forest conditions may be important to reduce nest predation and adult mortality, increase protection of nests from windstorms and environmental changes, and reduce loss of habitat from windthrow and fire.

The Forest Practices Board Science Advisory Group (SAG) on marbled murrelets made recommendations to the Washington Forest Practices Board regarding murrelet protection on nonfederal lands in Washington in 1993 (Cummins et al. 1993). They concluded that the creation of abrupt forest openings adjacent to occupied stands may result in negative impacts to the suitability of marbled murrelet nesting habitat related to changes such as increased wind velocity, solar radiation, temperature, tree mortality, canopy cover and

decreases in humidity near stand edges. One of the selection criteria in the designation of critical habitat by the USFWS was the presence of large contiguous blocks of habitat. The Marbled Murrelet Working Team that drafted the guidelines for protection of marbled murrelets in the President's Forest Plan designated large contiguous blocks of habitat (Late-Successional Reserves) as the primary means of protecting occupied sites and breeding potential on federal lands.

Nest site disturbance from forest management activities should be another important consideration in any alternative designed to protect marbled murrelet nesting habitat. After a review of available information and listening to comments and recommendations from scientists on potential disturbances to marbled murrelets, the Science Advisory Group on marbled murrelets concluded that alcids are particularly susceptible to human disturbances during early incubation due to risks of nest abandonment and during the first few days following hatching, due to increased vulnerabilities to predation. They also noted that some field biologists felt that murrelets may also be more susceptible to disturbance during the first few days prior to fledging (Cummins et al. 1993). Other sensitive periods include the first few days following hatching. The SAG report states that disturbances that would be of major concern, especially to alcids, are noises that are loud, abrupt, and unpredictable in nature, such as blasting. Posing less risk would be low volume, chronic background noises. They noted that disturbances visible to a nesting bird in conjunction with loud noises would be considered a greater risk than a single disturbance event. The combination of sound, volume, topography, and levels of background noise will probably determine the level of disturbance to nesting marbled murrelets.

The Draft Marbled Murrelet Recovery Plan (Marbled Murrelet Recovery Team 1995) identified the need to evaluate the effects of disturbance in more detail in both the marine and terrestrial environments. The team stated that disturbances near murrelet nest sites that flush incubating or brooding adults from the nest may expose adults and young to increased predation, or result in accidental loss of eggs or nestlings by falling or being knocked out of nests. Human activities that result in an increase in the number of predators near nesting areas could also lead to a greater likelihood of nest predation (Marbled Murrelet Recovery Team 1995). Predation rates on alcid nests are often higher in areas where predators have been introduced, habitat has been modified, or where birds are disturbed by human activities (Gaston 1992; Murray et al. 1983; Nettleship and Birkhead 1985). Ralph et al. (1995a) suggests management of occupied sites should include adjusting the timing of human disturbances to avoid disruption of murrelet activity such as courtship, mating, and nesting. They also recognized that additional information was needed which documented the likelihood and kinds of human activities that may have detrimental effects on murrelet nesting success.

Throughout the next sections, "protected" refers to habitat that would fall under a particular alternative (deferral or protection) and "unprotected" refers to habitat that would not be provided for in an alternative.

Procedures Used for the Analysis of Alternatives Under Criterion 1

The first criterion (Criterion 1) used for analysis of the three alternatives for marbled murrelets was defined as the amount of potential nesting habitat protected by each alternative. To measure the acreage of potential nesting habitat protected by each alternative, a geographic information system (GIS) analysis was conducted. A direct measure of potential nest platform abundance and the number of dominant trees per acre for each stand on DNR-managed lands within the range of the marbled murrelet was not available for this analysis. DNR's GIS data does not specifically include the stem density or potential nest platform density information needed to classify whether a stand is potential murrelet habitat. Therefore, another measure (described below) that is directly related to the variable "stems per acre" was used to classify murrelet habitat.

Research results by Hamer et al. (1994b p. 43) indicated that conifer trees with a diameter between 30-39 inches (dominant tree) in unmanaged (fully stocked) low-elevation stands could be expected to have a mean of 0.66 potential nest platforms per tree. Conifer trees below this diameter rarely contained any potential nest platforms. Therefore, on average, a stand containing three trees per acre with a dbh greater than 30 inches would result in a forest structure with a minimum of two platforms per acre. The relationship between tree size and platform density was not available for managed stands but platforms are most likely less abundant in these stands. To derive estimates of murrelet habitat, it was assumed a similar relationship existed for managed stands. This assumption helps prevent an underestimate of the total potential habitat available. Even with this assumption, estimates of the amount of habitat available in each planning unit are very similar to estimates obtained in a GIS analysis estimating the amount of marbled murrelet habitat available on DNR-managed lands (WFPB 1995a) and a GIS analysis using Landsat Thematic Mapper data conducted by DNR for the Olympic Experimental State Forest (OESF).

The ages at which forest stands would likely develop at least three dominant trees per acre were estimated using forest stand inventory data from DNR's Forest Resources Division. Two separate estimates were made: one for stands dominated by Douglas-fir, and one for stands dominated by western hemlock (Tables 1 and 2). If a stand was not dominated by either Douglas-fir or western hemlock, western hemlock estimates were used. By using forest stand inventory data, it was possible to calculate the average age at which stands, for each site index (a measure of site quality and growth potential) and stand type (managed or fully stocked stands), would reach minimum suitable habitat conditions (three dominant trees per acre).

Fully stocked and managed stands represent two different sets of assumptions about stand development. "Managed" is interpreted to mean a stand grown at 50 percent of full stocking from time of crown closure until age 35. Managed stands, because of the lower stocking level and uncrowded conditions for tree growth, would reach suitable habitat conditions at an earlier age than fully stocked stands. Similarly, stands with lower site indexes (poorer growing conditions) would take longer to develop into suitable habitat (Tables 1 and 2). Information on age estimates for each site index and stocking level were only available for four and eight dominant trees per acre. Foresters developing these estimates stated that there would be no significant difference in the stand age estimates

for four stems per acre and the three stems per acre used in the Alternatives B and C definition of suitable habitat as a surrogate for two platforms.

Table 4.2.29: Age (years) when four and eight trees per acre, 32 inches dbh and larger occur in fully stocked and lower stocked managed stands in coastal Douglas-fir stand types

Higher site index values indicate better growing conditions for trees.

Site Index	Full Stock 4 stems/acre	Full Stock 8 stems/acre	Managed 4 stems/acre	Managed 8 stems/acre
150+	72	80	54	64
150	98	108	78	88
140	106	116	89	99
130	144	154	101	110
120	192	202	130	140
110	240	260	160	180

Table 4.2.30: Age (years) when four and eight trees per acre 32 inches dbh and larger occur in fully stocked and lower stocked managed stands of coastal western hemlock stand types

Higher site index values indicate better growing conditions for trees.

Site Index	Full Stock 4 stems/acre	Full Stock 8 stems/acre	Managed 4 stems/acre	Managed 8 stems/acre
140	78	88	58	68
130	88	98	68	78
120	98	108	78	88
110	107	117	88	98
100	116	126	98	108
90	138	148	107	117
80	161	180	116	126

Therefore, the average age that a stand would reach suitable habitat conditions was determined based on when stands developed four trees per acre greater than or equal to 32 inches dbh. At this stocking density and tree size, stands begin to develop a minimum of two potential nest platforms per acre. Because the No Action alternative uses two different inland distance criteria to define habitat, the GIS analysis was partitioned into two inland distance zones. The total amount of marbled murrelet habitat estimated to be available in each inland zone was multiplied by the proportion of habitat that is currently being deferred by DNR to obtain final estimates of habitat available. Under Alternative A, the two zones included stands that were: (1) *0-40 miles inland:* 100 percent of sales are currently deferred by DNR that meet the criterion of having four trees per acre greater than or equal to 32 inches dbh; and, (2) *40-52.25 miles inland:* 33 percent of sales that meet the criterion of having four trees per acre greater than or equal to 32 inches dbh are currently deferred by DNR. Therefore, out of the total acreage of habitat in this zone, 33 percent were calculated to receive deferral.

To estimate the amount of habitat that would be included in Alternatives B and C, the four stems per acre criterion was again used, since the HCP alternatives also use a minimum of two platforms per acre as a criterion in its definition of suitable marbled murrelet habitat. Therefore, the GIS analysis counted the acreage in all stands between 0-50 miles inland that were greater than or equal to 5 acres in size and were greater than or equal to the age at which these stands would have four trees per acre greater than or equal to 32 inches dbh. The total amount of marbled murrelet habitat estimated to be available in each inland zone was multiplied by the current estimates of occupancy rates (percent of stands surveyed and found to be occupied) for each planning unit to obtain final estimates of habitat available. Only one inland distance zone was used to define habitat for the two HCP alternatives: *0-50 miles inland:* Only occupied stands are deferred and protected. These stands would all meet the criterion of having two potential nest platforms per acre and being greater than or equal to 5 acres in size. Current estimates of occupancy rates for each planning unit were used to estimate the amount of habitat expected to be occupied and protected in each planning unit as surveys are conducted.

Estimates of occupancy rates used to calculate the proportion of protected habitat anticipated under Alternative B were obtained from results of marbled murrelet surveys conducted by DNR in four of the six west-side planning units. These planning units were the Olympic Experimental State Forest (OESF), Straits, South Coast, and Columbia planning units. Two years of surveys have been completed by DNR in the OESF and Straits planning units, while only 1 year of surveys were completed in the South Coast and Columbia planning units. A second year of surveys will be conducted in the South Coast and Columbia units in 1996. It is likely that occupancy rates could be expected to increase after the second year of survey are completed in these planning units. Occupancy rates for the North Puget and South Puget planning units were obtained from survey results reported by Hamer et al. (1994b).

Occupancy rates from DNR data were calculated using only survey data from stands where the habitat was defined by DNR as high (old-growth or mature forest with an average density of two or more suitable potential nest platforms per acre) or medium quality (sub-mature forest habitat with an average density of two or more suitable

potential nest platforms per acre). Data from low-quality stands that were surveyed by DNR were not used because they did not meet the criterion of having at least two potential nest platforms per acre. Low-quality habitat was defined by DNR as young forest habitat with at least one suitable potential nest platform present in the stand. In addition, occupancy of a stand was defined according to the current definition used by the Pacific Seabird Group Marbled Murrelet Survey Protocol (Ralph et al. 1994a). This definition only considered stands occupied if birds were observed at or below the forest canopy. The Washington Department of Fish and Wildlife definition of occupancy includes birds observed over the top of the canopy within 1.25 tree heights. A tree height is considered the height of the average dominant tree in the area.

The amount of habitat protected in Alternative C in the near term would include all marginal marbled murrelet habitat identified by the habitat relationship studies and all surveyed unoccupied habitat identified by the intensive surveys. Therefore, the amount of habitat protected by Alternative C is estimated to be similar to the estimate of the total amount of habitat available for Alternative B before occupancy rates are taken into account (Table 4.2.30).

GIS Habitat Analysis Results

The total amount of potential marbled murrelet nesting habitat on DNR-managed lands for each planning unit is shown in Table 4.2.30 before deferral and occupancy rates are taken into account for Alternatives A and B. These estimates may fall below the actual amount of habitat because they are based on the age of the primary tree species in a forest stand and ignore the secondary tree species, which can provide additional trees per acre greater than or equal to 32 inches dbh.

Further, these estimates do not account for stands where a small patch of murrelet habitat may prompt a decision to restrict timber harvest for the entire stand. On the other hand, these estimates may include some hardwood-dominated stands that would not be considered marbled murrelet habitat because murrelets are not known to use hardwoods as nest trees, and some high-elevation conifer stands not typically used by murrelets. Stands dominated by hardwoods may be less likely to contain enough conifer nesting habitat for the marbled murrelet. It was not possible to select and remove these hardwood stands from the analysis. Acreage calculated for the alternatives did not include any elevational limit. Because the analysis only included stands dominated by Douglas-fir or western hemlock, elevation was accounted for by not including stand types located at higher elevations that would be dominated by silver fir or mountain hemlock. The majority of marbled murrelet habitat is found in western hemlock forest types (Table 4.2.30). Very little habitat is available in Douglas-fir forest types for any DNR planning unit.

Table 4.2.31: Estimated acreage of marbled murrelet habitat on DNR-managed lands by stand type and planning unit before deferral and occupancy rates are taken into account for each alternative

Two inland distance zones are shown for the No Action alternative. Estimates were derived using the age at which stands would be expected to produce two potential nest platforms per acre (4 stems per acre ≥32 inches dbh) for each stand type and site index (see Tables 4.2.28 and 4.2.29 for age estimates).

		No Action Alternative		Alternatives B and C
Planning Unit	**Species**	**Acres 0-40 mi.**	**Acres 40-52.25 mi.**	**Acres 0-50 mi.**
OESF	DF	20	0	20
Straits	DF	61	0	61
South Coast	DF	554	0	554
Columbia	DF	487	418	750
North Puget	DF	309	2	312
South Puget	DF	138	0	138
Total Douglas-fir		**1569**	**420**	**1835**
OESF	WH	45642	0	45642
Straits	WH	353	0	353
South Coast	WH	2829	0	2829
Columbia	WH	1559	66	1625
North Puget	WH	6945	208	7153
South Puget	WH	1122	105	1227
Total West. Hemlock		**58450**	**379**	**58829**
Total Acreage Overall		**60019**	**799**	**60,664**

Under the No Action alternative, 60,019 acres of habitat are located between 0-40 miles inland and 799 acres (of which 264 acres or 33 percent are likely to be deferred) are located between 40-52.25 miles inland. After deferral rates are taken into account, No Action would defer the harvest of 60,283 acres of marbled murrelet habitat (Table 4.2.31) for an unknown period of time.

Table 4.2.32: Estimated acres of marbled murrelet habitat on DNR-managed lands for No Action (Alternative A) taking into account deferral rates for each inland zone currently implemented by DNR

Planning Unit	Total Acres 0-40 mi.	Estimated Acres Deferred	Total Acres 40-52.25 mi.	Estimated 33% Deferred	Total Acres Deferred
OESF	45,662	45,662	0	0	0
Straits	414	414	0	0	0
S. Coast	3,383	3,383	0	0	0
Columbia	2,046	2,046	484	160	160
N. Puget	7,254	7,254	210	69	69
S. Puget	1,260	1,260	105	35	35
TOTAL	**60,019**	**60,019**	**799**	**264**	**60,283**

Alternatives B and C include 60,664 acres of habitat estimated to be available between 0-50 miles inland (Table 4.2.30). Seventy-five percent of all the marbled murrelet habitat found on state-managed lands for either HCP alternative is located within the OESF Planning Unit and 12 percent is located in the North Puget Planning Unit. After occupancy rates for each planning unit are taken into account, Alternative B is estimated to protect 38,442 acres of marbled murrelet habitat (Table 4.2.32). Alternative C, because it retains all suitable habitat until a long-term conservation plan is developed, would protect approximately 60,664 acres (Table 4.2.30) of habitat for at least a 10-year period. Once the long-term plan is developed it is impossible to predict what proportion of the marginal and suitable unoccupied habitat would be protected over time under Alternative C.

Table 4.2.33: Estimated acres of marbled murrelet habitat protected on DNR-managed lands for Alternative B taking into account the expected stand occupancy rates (percent of stands surveyed and found to be occupied) for each planning unit

Occupancy rates were obtained from actual surveys conducted on state-managed lands or rates were obtained from research conducted by Hamer et al. (1994b).

Planning Unit	Total Acres 0-50 miles	Percent Occupancy	Total Acres Protected
OESF	45,662	72.5	33,105
Straits	414	2.9	12
South Coast	3,383	60	2,030
Columbia	2,375	7.3	173
North Puget	7,465	40	2,986
South Puget	1,365	10	137
Total	**60,664**		**38,442**

4.2.2.3 Environmental Consequences to the Marbled Murrelet

This section describes the probable consequences to the marbled murrelet and its habitat of implementing the three alternatives presented in this DEIS. This discussion includes descriptions of the direct physical and biological consequences of each alternative and the cumulative effects of these actions.

No population viability model has been constructed for the marbled murrelet; therefore, accurate population size estimates and specific information regarding the amount of habitat needed to support or maintain various population levels is lacking. For the purpose of this DEIS, precise quantitative effects of the alternatives on the murrelet population cannot be specified. This evaluation should not be viewed as precise analyses of likelihoods of persistence; rather, it provides the decision makers and the public with the best assessment of the potential consequences of the alternatives. This assessment should provide enough information for the USFWS to predict whether the alternatives (two of which include permission to incidentally take the marbled murrelet) provide sufficient habitat conditions and management considerations to support the Washington population in conjunction with expected conditions on federal lands.

Assessment of Criterion 1 - Quantitative: Amount of potential nesting habitat protected by each alternative

This criterion makes a quantitative assessment of the amount of habitat included in each alternative, and the time frame that this protection is provided, to determine if enough habitat is available to protect the majority of breeding sites, make a significant long-term contribution to federal conservation strategies, and increase the probability that the population would persist in conjunction with federal conservation efforts.

Measure: Quantitative GIS analysis of the amount of acreage protected by each alternative within each west-side planning unit, by each inland distance zone, and a qualitative assessment of the length of time that the protection would be provided.

ALTERNATIVE A

Under the No Action alternative, currently known occupied sites on DNR-managed lands would be protected in compliance with the ESA requirements. As of 1993, the area of nonfederal lands under ESA restrictions due to presence of known occupancy included approximately 1,814 acres of old-growth and 1,633 acres of mature forest habitat (WFPB 1995a). However, known sites involve only a fraction of the potential suitable habitat that DNR and other land managers must consider in order to avoid a possible violation of the ESA. ESA compliance under the No Action alternative is achieved through the Board of Natural Resources take-avoidance policy, which, at present approximates a "no take" approach. However, the No Action alternative contains no permanent provisions that would ensure that a take-avoidance policy would continue, or that plans for the management of suitable but unoccupied habitat for the benefit of the marbled murrelet would be developed.

An estimated 60,283 acres of habitat on DNR-managed lands in western Washington would be deferred by this alternative for an unknown period of time (Table 4.2.31). Approximately 60,019 acres would be deferred between 0-40 miles inland and 264 acres would be deferred between 40-52.25 miles inland. One hundred percent of the suitable habitat on DNR-managed lands in the 0-40 mile inland distance zone and 33 percent of the suitable habitat in the 40-52.25 inland distance zone would be deferred based on current DNR habitat protection guidelines. If this deferral were to continue through time, the No Action alternative would defer a large amount of suitable habitat that could be used to develop future conservation plans for the marbled murrelet. This approach could have tremendous benefits to marbled murrelets if some provisions could be made to guarantee the long-term deferral would continue. Long-term deferral would keep all future options available for the species' protection.

In the near term under this alternative, DNR would conduct habitat relationship studies to assist the Board of Natural Resources in assessing the risk of take. These studies would provide more precise information to determine what constitutes high quality habitat for marbled murrelets in each planning unit. These studies would help minimize the harvest of occupied sites and further define the areas that are likely to contain additional breeding sites. It is likely that these studies would identify some marginal habitat types that could be made available for harvest while deferring higher quality habitat. However, there is no guarantee that the Board would not change their risk-aversion policy and allow harvest in

higher quality habitats at some time in the future. It is unknown what level of risk the Board may choose once these studies are completed.

Although the amount of habitat estimated to be deferred by this alternative appears high, because of the uncertainties regarding future decisions to be made by the Board, there are no guarantees that marbled murrelet habitat would continue to be deferred and protected over time under the No Action alternative. Under this alternative, DNR would not attempt to locate additional murrelet breeding sites once the habitat relationship studies are completed in each planning unit. The surveys conducted in the study make up only a small sample of stands within each planning unit. Although identified occupied sites would be protected by ESA requirements, the location of the majority of other breeding sites on the landscape in each planning unit would not be known. No intensive surveys designed to cover all suitable habitat within each planning unit would be conducted. Therefore, even if desired, there would be little opportunity to protect these sites from disturbances due to forest management activities occurring on the adjacent landscape and no opportunity to enhance or increase the level of habitat protection of breeding sites since their locations are unknown.

Even for occupied sites that are located and protected by the ESA, the No Action alternative has no short- or long-term provisions to clearly delineate or protect these breeding areas. No site-specific management plans or protection guidelines exist for occupied sites. Loss and degradation of suitable habitat due to windthrow, fire, and riparian protection strategies that are not designed to protect murrelet habitat would be expected to continue. The No Action alternative contains no provisions to minimize or reduce disturbances to breeding areas from road maintenance and forest management activities, especially since the locations of the majority of occupied sites are unknown. This alternative does not develop a long-term conservation and monitoring plan designed specifically for marbled murrelet habitat to ensure its persistence on DNR-managed lands over time.

There is no certainty that any protection or habitat improvement measures would be provided to occupied sites except those sites that are already located and protected by ESA. This alternative would not ensure the protection of sufficient amounts of suitable nesting habitat to marbled murrelet populations over time, since it does not include provisions to: (1) survey for occupied sites; (2) develop a long-term protection plan; or, (3) continue deferral of harvesting suitable murrelet habitat. This lack of certainty leads to a lower likelihood that the No Action alternative would provide and retain enough suitable nesting habitat to maintain viable marbled murrelet populations on DNR-managed lands in western Washington. Over time, this alternative is likely to lead to increased disturbance of breeding sites, and a decrease in interior forest conditions resulting in reduced protection of nests from windstorms and environmental changes, increased loss of habitat due to windthrow, and an increase in the number of nest predators and nest predation due to forest fragmentation. It is possible that a reduction in the range of the marbled murrelet could occur with impacts most severe in southwest Washington and the near-coastal areas of the Olympic Peninsula. Under this alternative, marbled murrelets would have a high likelihood of being extirpated from DNR-managed lands.

If a large percentage of the occupied sites on DNR-managed lands are not located and protected over time under the No Action alternative and these sites are degraded or lost, this could lead to the majority of the population being primarily dependent on federal habitat. In the short term, such dependency would likely lead to lowered reproductive success, decreased adult survivorship, and population declines of the marbled murrelet in western Washington.

There would be a higher risk that USFWS recovery goals for conservation zones in western Washington may not be achieved. It is likely that larger gaps in the distribution of the species habitat would develop. There is no certainty provided by the No Action alternative that sufficient protection would be provided to breeding habitat to make a significant long-term contribution to federal conservation strategies (President's Forest Plan). Instead, this alternative would likely decrease the probability that the President's Forest Plan would provide for sufficiency of habitat to sustain a viable well-distributed population of marbled murrelets on federal lands over a 100-year period.

ALTERNATIVE B

Under Alternative B, DNR would protect all occupied sites located by the habitat relationship studies conducted in each planning unit, and conduct intensive surveys on all the acres within each planning unit that are expected to contain 95 percent of the remaining occupied sites with the highest probabilities of occupancy. All take would be avoided during the 2-year habitat relationship studies. The planning unit-by-planning unit approach is intended to minimize the amount of nesting habitat that might be lost. Five percent of all the potential occupied sites on DNR-managed lands does not equate to 5 percent of all sites, nor to 5 percent of the population. Where federal lands are present, only a fraction of the existing sites might be located on DNR-managed land. Additionally, since any take of occupied sites would occur in habitat with the lowest probabilities of occupancy (lowest habitat quality), these sites would likely contain a lower density of nesting sites than high quality stands identified and intensively surveyed for occupancy.

It is estimated that DNR may manage 7 percent of the old-growth habitat in western Washington. If it is assumed that this habitat supports 7 percent of the population in Washington, and that 5 percent of the occupied sites on DNR-managed lands may be taken over time, it is possible to roughly estimate the proportion of the population likely to be affected by Alternative B. Multiplying these percentages together, it is estimated that the population could be reduced by a maximum of four-tenths of 1 percent (0.35 percent) under Alternative B in the short term. However, all occupied sites found during the habitat relationship studies and those currently known will also be protected. In addition, the alternative places all the impact of habitat removal in the lower quality habitat expected to contain fewer birds and lower reproductive success. Therefore, the percent of the population affected is expected to be less than four-tenths of 1 percent.

The sites lost would be those located in the lower quality habitat that would not be surveyed intensively under Alternative B. This lower quality habitat would be a part of the future harvest plan. For all remaining occupied sites known or located during the

implementation of the alternative, a management plan would be developed for each occupied site that will be designed to protect remaining habitat from fire, windthrow and disturbances. These plans would design management strategies to improve habitat conditions at these sites to increase nest success and decrease adult and juvenile mortality. The information base to develop these management strategies will be derived from a cooperative research program that will take place over a 7-10 year period. At the end of this period, when the habitat relationship studies and intensive surveys are completed, a long-term conservation plan would be developed to protect all occupied sites. This plan may include provisions for protecting unoccupied suitable habitat or some occupied sites in marginal habitat when needed to meet biological objectives for the population or landscape-level planning needs described in the plan (more uniform distribution of habitat or breeding sites, prevention of isolation). Although provisions for maintaining unoccupied suitable habitat are not specifically described in the long-term plan, there is a high likelihood that a significant amount of suitable unoccupied mature and old-growth habitat will be available and protected due to the HCP conservation strategies planned for the northern spotted owl and riparian ecosystem. For example, the OESF HCP has plans to protect as much as 25 percent of the landscape in riparian zones and 20 percent of the landscape will be retained in an old-growth condition for spotted owls.

All the higher quality murrelet habitat that is found to be occupied by marbled murrelets would be protected by Alternative B over a 10-year period. After the 10-year period, a long-term conservation plan will be developed that implements a strategy to protect and improve the conditions at all occupied sites located. The time frame for this long-term plan is not specified but will likely be a period of 50-100 years to attain the objectives of a landscape approach.

As noted above, the amount of suitable unoccupied habitat that would be protected specifically for marbled murrelets after the long-term plan is developed in 10 years is not specified, but may be significant. An estimated 38,442 acres of occupied habitat located 0-50 miles inland would be protected under Alternative B. Because a small percentage of occupied sites may be taken when harvest of marginal habitat occurs, the actual amount of habitat protected may be somewhat less than this figure. Assuming 5 percent of the occupied sites taken under Alternative B would include 5 percent of the 38,442 acres of occupied habitat on DNR-managed land, then approximately 1,922 acres of occupied habitat may be harvested under Alternative B. This assumes that 5 percent of the occupied sites would equal 5 percent of the occupied habitat area. If stand size is found in the habitat relationship studies to be positively related to stand occupancy, then any occupied sites taken may include stands of smaller size. This would result in a lower harvest level.

Most of the harvest would likely occur in the OESF Planning Unit (1,655 acres), where the majority of habitat on DNR-managed lands remains. This area has a higher percentage of potential nesting habitat still available on USFS and national park lands than anywhere else in Washington. This area includes 60 percent more nesting habitat on federal ownerships than in the western Cascades (FEMAT 1993). The harvest estimate for the OESF is likely an overestimate considering that many stands of suitable unoccupied

murrelet habitat would not be harvested because of the protection provided to riparian ecosystems and the spotted owl within the scope of the HCP. In many cases interior and exterior buffers planned along streams in the OESF will help protect additional murrelet habitat. These buffers will range in width from 150-300 feet (each side) depending on stream type and whether one or both buffers are applied. The exterior buffer is open to the harvest of one-third of the volume present and thus has less value to marbled murrelets over time. It is estimated that up to 25 percent of the forested areas of the OESF may be managed as riparian buffers over the long term. The OESF owl protection strategy objectives are to attain or maintain 20 percent of DNR-managed lands in old-growth forests and 40 percent in young forests in each of 11 landscape planning units. After 100 years, it is estimated that an average of 34 percent of the DNR-managed landscape may consist of old-growth forest at any one time. Therefore, the riparian and owl protection strategies may provide a significant amount of additional suitable but unoccupied habitat and replacement nesting habitat for marbled murrelets over time.

The next highest harvest of occupied habitat would occur in the North Puget Planning Unit, where it is estimated there would be a potential loss of 149 acres of occupied habitat (5 percent of 2,986 acres). This area also includes riparian protection and owl protection strategies within the scope of this HCP that will protect additional areas of unoccupied suitable marbled murrelet habitat.

Alternative B would protect approximately 54 percent less habitat than the No Action alternative. The difference in the inland distance criteria used by these two alternatives (52.25 versus 50 miles) results in approximately 154 fewer acres of habitat being protected under Alternative B compared to the No Action alternative. More importantly, most of the protection provided by Alternative B remains throughout the life of the proposed long-term plan, approximately 100 years. Long-term protection provides more certainty that breeding habitat would be available for breeding birds through time.

Some future options for the protection of habitat would be lost under Alternative B as some marginal habitat as defined by the habitat relationship study is harvested (including some occupied sites), and as some suitable unoccupied habitat is harvested in planning units outside of southwest Washington before the long-term plan is developed. These actions would reduce the options available for consideration in developing the long-term conservation plan. Harvest under this alternative could result in the loss of some occupied sites that may have been important in maintaining a more uniform distribution of occupied sites on the landscape, preventing the isolation of some breeding sites, and providing potential replacement habitat for breeding sites lost to natural disturbance events.

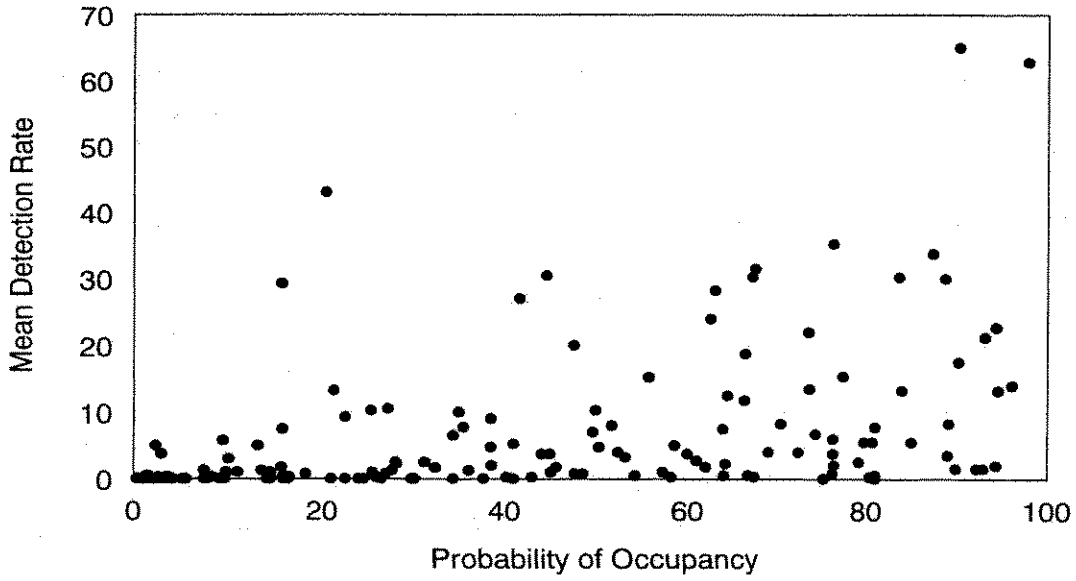
Loss of some occupied sites in marginal habitat may be significant in some areas such as southwest Washington and near-coastal areas of the Olympic Peninsula where very few breeding sites remain to support local populations. Survival of populations in these areas may be completely dependent on a few remaining patches of suitable habitat. Harvest of any of these remaining sites may greatly reduce the likelihood that local populations would persist over time in these areas. Alternative B's long-term plan should address the issue of providing suitable but unoccupied habitat to replace habitat loss to natural

disturbances or specifically plan to develop suitable habitat in areas specified in the Draft Recovery Plan. A worst case analysis would indicate it is possible that Alternative B would result in the harvest of a maximum of 5 percent of the occupied sites, thus potentially eliminating nesting habitat for 5 percent of the population on DNR-managed lands. In addition, there is some risk that any habitat models developed could result in some error so that more than 5 percent of the occupied sites are taken over time. Significant effects on populations would only be expected to occur in planning units with higher occupancy rates (larger numbers of occupied sites) such as the OESF, South Coast and North Puget planning units.

Alternative B proposes to minimize the impact to marbled murrelet populations through the loss of potential nesting habitat in two important ways. First, the habitat relationship studies employed to identify the small percentage of occupied sites in marginal habitat that may be taken under this alternative use a statistical model that calculates the probability that a site may be occupied by marbled murrelets. Only sites with the lowest probabilities of occupancy would be available for harvest. Hamer et al. (1994b) found that the probability of occupancy of a site is directly related to the number of murrelet detections recorded at a site, with a higher number of detections more likely to be recorded at sites with higher probabilities of occupancy (Figure 4.2.10). This model may not fully capture the relationship between the number of detections and probability of occupancy. For example, anecdotal evidence suggests that murrelets may be less likely to vocalize when entering or leaving a stand with low numbers of murrelets, making detection less likely (K. Flotlin, personal communication). Although the exact relationship between the number of murrelet detections recorded at a site and the numbers of birds using a site is unknown, it is generally accepted that a higher number of detections indicate that a larger number of birds are using an area. Therefore, by only harvesting stands with the lowest probability of occupancy, Alternative B minimizes the effect on the population by concentrating the protection given to occupied sites to those sites that support the majority of the population. Although a maximum of 5 percent of the occupied sites may be taken in marginal habitat, the actual percentage of the population affected is likely to be much smaller.

Figure 4.2.10: Mean detection rates (number of birds detected per survey morning) of marbled murrelets at 151 sites surveyed in western Washington compared to the calculated probability that each site is occupied by marbled murrelets

The probability of occupancy for each site was derived using a logistic regression model which predicts occupancy based on the vegetation characteristics of the forest that were measured at each site.



Second, specific guidelines outlined for the development of a long-term conservation plan (see draft HCP for more details) and protection strategies for occupied sites would include the objectives of examining the entire landscape within a planning unit. This would help determine which sites are in most need of protection and enable land managers to consider landscape-level problems in distribution. Landscape-level planning would prevent the isolation of breeding colonies, help maintain a well-distributed population, and could lead to the protection of all occupied sites in certain critical planning units with low populations and little remaining habitat. These primary conservation plan objectives should ensure that any reduction in breeding habitat or population size is minimized to the greatest extent practicable. They would also help ensure that all population-level factors such as isolation and genetic diversity are considered, and that full consideration is given to the protection of sites important in maintaining a population on DNR-managed lands in conjunction with expected habitat conditions on federal lands.

The two most significant benefits of Alternative B are the certainty of protection of occupied sites over time, and the objective of locating up to 95 percent of the breeding sites in each planning unit. Once the locations of these sites are known, specific management plans and recommendations can be made for each site to improve habitat conditions over time. These habitat improvements would be designed to stabilize or increase reproduction and decrease adult and juvenile mortality at breeding sites. In addition, management plans would be designed to reduce the additional loss of murrelet habitat through fire and windthrow. Riparian protection strategies that were not developed specifically to benefit murrelets could be modified in these plans under certain circumstances to improve habitat conditions at occupied sites. Once these occupied sites are located, protection from the disturbance of adjacent timber and road management activities can be provided. Management plans may include designs to reduce gaps in the distribution of habitat through the retention of unoccupied but suitable habitat or through plans to develop new habitat. With all these protective actions and planning efforts, it is expected that the population would increase over the long term.

The long-term conservation plan developed by DNR would include information on the location of occupied sites, the distribution of habitat in each planning unit, current research results, landscape-level analysis and considerations, and the site-specific management plans developed by DNR. This process should result in a comprehensive, detailed landscape-level plan that would help meet the recovery objectives of the USFWS, contribute to the conservation efforts of the President's Forest Plan, and make a significant contribution to maintaining and protecting marbled murrelet populations in western Washington over the life of the HCP. The development of this type of plan would not be possible without conducting the intensive surveys to locate the majority of occupied sites and the research being conducted under Alternative B.

Because Alternative B locates and protects the majority of occupied sites on DNR-managed lands, this alternative has a higher likelihood, when compared to the No Action alternative, of ensuring: (1) a population size adequate to prevent extinction from random population fluctuations and marine influences; (2) prevention of extinction in some regions by locating and providing immediate protection to these sites; and, (3) buffering

against catastrophic events through the development of a long-term landscape-level conservation plan. This is especially true for those areas where significant additional support is provided by federal conservation plans. Under Alternative B, areas such as southwest Washington will have a higher likelihood of maintaining murrelet populations compared to the No Action alternative, but will likely experience difficulties in maintaining viable populations over time unless additional efforts and specific strategies are developed in a long-term plan that addresses these areas. Although some small reduction in the population of marbled murrelets on DNR-managed lands can be expected under Alternative B, this reduction would be minimized with full consideration given to population-level concerns. This small reduction in population size would be offset by the significant benefits of locating and providing long-term protection to the majority of occupied sites and helping conduct research to determine how to protect the breeding potential of the population.

The information gained in the near term under Alternative B would result in less risk of isolating nesting colonies and less disruption to annual breeding cycles and reproductive success than under the No Action alternative. Alternative B would provide significant support to the President's Forest Plan and benefit federal recovery efforts. Under Alternative B, all six of the actions listed by the Draft Marbled Murrelet Recovery Plan (Marbled Murrelet Recovery Team 1995) to achieve recovery of the species would be implemented. Alternative B would likely lead to a higher probability compared to the No Action alternative that the President's Forest Plan would provide for sufficiency of habitat to sustain a viable well-distributed population of marbled murrelets on federal lands over a 100-year period.

ALTERNATIVE C

The conservation strategy for the marbled murrelet proposed under Alternative C is similar to Alternative B except that all suitable habitat, even marginal habitat or habitat known to be unoccupied, is retained until a long-term conservation plan is developed. Approximately 60,664 acres of occupied nesting habitat and suitable unoccupied habitat would be protected by Alternative C over a 10-year period. The amount of suitable unoccupied habitat that would be protected after the long-term plan is developed in 10 years is not specified.

The retention of this habitat would benefit the development of a long-term plan, possibly provide for future nesting habitat for the murrelet and keep all conservation options open for the species. No occupied sites would be lost in the interim during the development of the long-term plan. The uniformity in the distribution of habitat on the landscape would be maximized and the potential for isolating breeding colonies minimized. Alternative C has an even higher chance than Alternative B of ensuring that as habitat is lost to natural events and potential catastrophic influences, sufficient habitat is available to support remaining populations. Therefore, Alternative C has the highest likelihood of protecting the majority of breeding sites and more certainty in maintaining an adequate amount of habitat over time to make a significant contribution to federal recovery and conservation efforts. Alternative C has the greatest chance of increasing the probability that the President's Forest Plan would provide for sufficient habitat to sustain a viable well-distributed population of marbled murrelets on federal lands over a 100-year period. This

alternative has the highest likelihood that the population would persist for the long term on DNR-managed lands and in western Washington in conjunction with federal conservation strategies.

Assessment of Criterion 2 - Qualitative: Likelihood that the alternative would protect or enhance the reproductive potential of the population in conjunction with federal conservation efforts which would lead to the long-term persistence and adaptation of the species in Washington

This criterion makes a qualitative assessment whether enough protection is provided to the population to increase the likelihood that successful reproduction is maintained or increased, adult survival is maintained or increased, breeding sites are not disturbed during the breeding season and decrease the likelihood of reduced genetic variability and isolation of occupied sites. Criterion 2 also assesses qualitatively whether a population source for the colonization of future sites in unoccupied suitable habitat would be provided.

Measure: Qualitative assessment of the degree and length of time that occupied sites are protected. The assessment includes the degree that occupied sites were protected from disturbances due to forest management activities, further degradation and modification of breeding habitat, further fragmentation of breeding habitat (edge effects), loss of habitat due to windthrow, microclimatic changes to the stand, and nest predation.

ALTERNATIVE A

A significant advantage of the No Action alternative is the deferral of harvest of the majority of suitable marbled murrelet habitat to 52.25 miles inland. These deferrals in the early stages of this alternative contain a significant amount of habitat that could help protect breeding sites from disturbances due to forest management activities, prevent further degradation and fragmentation of breeding sites, help prevent the isolation of breeding sites and possibly reduce predation effects on adults and young.

If these deferrals of habitat were continued through time, there would be more certainty that the No Action alternative would help protect the reproductive potential of the population. Although the majority of timber harvest of suitable marbled murrelet habitat is currently deferred under the No Action alternative, there is no certainty that the Board of Natural Resources would continue with this mode of operation. The Board could choose to change their current take-avoidance/risk-management approach and allow harvest of some proportion of this habitat at any time. In addition, because this alternative does not include provisions to locate additional breeding sites or identify the location of the majority of these sites once the habitat relationship studies are completed, it is not able to afford protection to these sites from disturbance, provide habitat enhancement measures, reduce fragmentation, assess the isolation of occupied sites, or protect specific breeding sites from the risks of windthrow and fire. Information regarding the location of breeding sites would not be available for managers to attempt to reduce predation affects through habitat enhancement or through the use of more direct methods.

Implementation of the No Action alternative has the potential to reduce potential murrelet population because this alternative contains no provisions for protection of future breeding sites in the event potential breeding habitat should be lost. Under the No Action

alternative, DNR would not actively locate additional occupied sites after the habitat relationship studies are completed. This alternative does not contain plans to develop methods to delineate the boundaries of occupied sites once they are located. Therefore, the location of only a small sample of occupied sites would be known and the actual areas used by murrelets within these stands would be difficult or impossible to determine. The No Action alternative contains no additional protection to known occupied sites other than the minimal protection afforded by the Endangered Species Act (ESA) and current Washington Forest Practices Rules. As discussed in the section under "Current Habitat Protection," current forest practices rules regarding the protection of riparian and wetland areas and wildlife trees are not designed to directly address marbled murrelets and may actually be detrimental depending on how these rules are applied in the field.

Since the majority of locations of occupied sites would remain unknown under this alternative, no opportunities exist for providing needed protection to these sites. No habitat improvement or habitat enhancement is planned for any occupied site. There are no strategies to reduce the fragmentation level at occupied sites over time or to speed the development of suitable habitat adjacent to, or within, fragmented occupied sites. There are no considerations or plans for the provision of interior forest conditions at known occupied sites over time.

Because the locations of the majority of occupied sites on the landscape would likely not be known under the No Action alternative, no opportunities are available to locate important gaps in the distribution of occupied sites and work toward eliminating these distribution problems or reducing the isolation of breeding colonies. The Draft Marbled Murrelet Recovery Plan recommends that viable populations be maintained within each segment of the species' range and identifies southwest Washington (southern end of conservation zone 2) and the Puget trough (western portion of conservation zone 1) as areas important to recovery efforts because they contain small amounts of suitable habitat and contain little or no federal ownership to offer support from federal conservation efforts (Marbled Murrelet Recovery Team 1995). The No Action alternative does not attempt to specifically locate or improve the habitat conditions at these important remaining breeding sites and offers no longer term strategy to replace or increase the amount of available habitat within these areas as recommended in the recovery plan. DNR manages significant amounts of land within these areas that have the potential to provide substantial short- and long-term benefits and support to these remaining populations.

More support from federal conservation efforts will be provided in the northeastern portion of recovery zone 2 (western Olympic Peninsula) and eastern portion of conservation zone 1 (north Cascade Range) because of the presence of large areas of USFS and national park lands. It is expected that the amount of suitable habitat on USFS-managed lands will actually increase over time (replacement habitat) as managed under the President's Forest Plan.

The No Action alternative does not include provisions to reduce predation at breeding sites, reduce adult and juvenile mortality at inland sites, increase breeding habitat and

nesting opportunities, maintain the microclimate of nesting habitat, prevent disturbances to occupied sites, or reduce losses of suitable habitat to windthrow or fire.

Some disturbance protection to known occupied sites could be expected from adoption of a final forest practices rule on marbled murrelets, but currently no final rule has been chosen. It is not known how the final rule may be modified and the locations of many sites might not be known. Reduction of disturbance to occupied sites that are located by the habitat relationship studies could be expected because of ESA regulations. However, since the locations of the majority of breeding sites will not be known under this alternative, harvest of unsuitable habitat adjacent to deferred habitat could be expected to occur over time, potentially disturbing a large number of breeding sites.

This alternative has no provisions to encourage cooperative research projects on the marbled murrelet to collect the information necessary to develop protection strategies and enhancement measures for breeding sites. Without such information, protective areas might be established around breeding sites with no assurance that reproductive success, adult survivorship, or the proportion of adults breeding in any year would be maintained or enhanced. Populations could continue to decline if managers simply delineated breeding sites without an understanding of the needs of the population or how reproductive success and adult mortality relate to habitat conditions.

The No Action alternative, when compared to Alternatives B and C, has the lowest likelihood of protecting or enhancing the reproductive potential of the population to a level that would lead to the long-term persistence and adaptation of the species in Washington in conjunction with federal conservation strategies. Operating under the No Action alternative would decrease the likelihood that successful reproduction and adult survival are maintained or increased. The No Action alternative would continue practices which create a higher risk of isolating occupied sites, and contain no long-term plan for providing suitable unoccupied habitat or marginal habitat as a source of habitat for future populations. No special considerations or protection strategies are provided to those portions of conservation zones specifically designated as important to recovery efforts by the Draft Marbled Murrelet Recovery Plan. It has a low likelihood of contributing significantly to federal conservation efforts since recovery plan objectives and the protection guidelines developed for the President's Forest Plan are not used to protect or enhance occupied sites. No landscape-level considerations are made to protect the population and any protection afforded to the population may only be short term.

ALTERNATIVE B

Alternative B differs significantly from the No Action alternative in that its short-term purpose is to maintain options while collecting information needed to develop a long-term management plan with a goal to protect 95 percent of the breeding sites located on DNR-managed lands. After completion of the habitat relationship study within a planning unit, DNR would initiate an intensive survey effort. Concentration of the occupancy survey effort in the highest quality habitat would ensure the most efficient and cost-effective survey effort, and increase the chance of locating the majority of breeding sites. Alternative B would lead to location and protection of the majority of the breeding sites within this higher quality habitat. Five percent of the occupied sites with the lowest

probability of occupancy (lowest habitat quality) would probably not be protected. All occupied sites currently known or located during the habitat relationship study would be protected regardless of the habitat quality.

Under Alternative B, on-site management plans would be developed for each breeding site found. Management plans would identify the specific needs for each breeding site, such as high risk for loss of habitat due to windthrow potential or fire, fragmentation, disturbance, or lack of interior forest conditions. Management plans would help reduce or eliminate these problems and suggest ways to enhance habitat conditions. Management plans developed for each occupied site would include provisions to protect or enhance interior forest conditions to reduce predation at the nest sites and maintain forest microclimate and structure. Silvicultural methods would be employed to speed the development of suitable habitat and increase the amount of suitable habitat while reducing fragmentation. Recruitment habitat found within occupied stands would be maintained and developed to decrease fragmentation and increase the size of breeding sites. In areas where few breeding sites exist and the longer term outlook for murrelet is poor, habitat areas could be recommended for development to increase the amount of suitable habitat to support local populations. In southwest Washington, options for the future will be preserved by retaining high quality suitable, but unoccupied habitat.

Management plans may utilize buffers to minimize edge effects and maintain interior forest conditions by minimizing windthrow and microclimatic changes in the stand interior. Interior forest conditions may help reduce predation of adults and nestlings by providing camouflage and cover for the nest and for adults visiting the nest site. Some nest predators may not be as numerous in interior forest conditions as they are in edge-related habitat. These buffers may give additional protection that would lead to reduced predation of adults and young at the nest sites and maintenance of the microclimatic conditions which maximize nesting success and suitable nesting habitat conditions.

Once the breeding sites within each planning unit are known, a long-term plan would be drafted for the entire planning unit that would then have the ability to take into consideration the entire landscape condition and juxtaposition of occupied sites to each other. Under Alternative B, after the 10-year interim period, DNR would assemble a team of scientists with expertise in conservation biology and ornithology to develop a long-term landscape-level conservation plan. This landscape-level planning ability would allow an analysis and consideration of ways to avoid the isolation of breeding sites, identify areas with suitable unoccupied habitat, identify gaps in murrelet distribution, and allow long-range planning. Breeding populations would have a higher likelihood of being maintained in southwest Washington, the Puget trough, and near the coast on the Olympic Peninsula due to efforts to locate and protect occupied sites in these areas within a reasonable time frame. Alternative B would better enable biologists to assess and maximize the degree of habitat protection overlap between the marbled murrelet and other old-growth-dependent species such as the spotted owl and assess the degree of added protection provided by riparian protection plans. This strategy would likely reduce the total amount of habitat needed for old-growth-dependent species.

The long-term planning provided in Alternative B should create conditions with a higher likelihood that displaced breeding birds could locate additional suitable nesting habitat within the same watershed or adjacent watershed unit, within a shorter time period after loss from timber harvest, fire, or other catastrophic event. A shorter time period would likely result in less disruption to the breeding cycle and, possibly, better reproductive performance. Alternative B attempts to accomplish this goal with a long-term conservation plan. Alternative B would also help prevent isolation of occupied stands because attempts would be made to survey other suitable habitat within the same planning unit within a short period of time to determine occupancy.

Alternative B would allow and encourage cooperative research on the marbled murrelet to collect information over the interim period to better provide substantial and verifiable protective measures to occupied sites. Such research would not be prioritized under the No Action alternative. With this information, DNR could assess the potential for breeding and survival success of marbled murrelets, allowing more efficient planning and habitat conservation. The resulting research information could then be used to develop new methods and techniques to: (1) protect occupied sites from disturbance and harmful habitat modifications; (2) use silvicultural methods to increase the quality of nesting habitat; and, (3) reduce predation of juveniles and adults at breeding. This research will allow managers to understand more clearly the needs of the population or how reproductive success and adult mortality relate to habitat conditions thus providing them with tools to improve breeding conditions and breeding success for these birds over time.

The proposed actions under Alternative B are more consistent with recovery actions outlined in the Draft Marbled Murrelet Recovery Plan (Marbled Murrelet Recovery Team 1995) than those of the No Action alternative. Recovery actions to protect breeding sites were discussed earlier under possible methods used by DNR to protect occupied sites. Alternative B's near-term strategy to locate and protect occupied sites may greatly benefit the species since the recovery team has stated that the next 50 years will be a critical time for the marbled murrelet since little additional suitable habitat is expected to develop within LSRs (Late-Successional Reserves) before that time.

Because the locations of the majority of occupied sites on the landscape would be known under this alternative, opportunities will exist to identify important gaps in the distribution of occupied sites and work toward eliminating these distribution problems and reduce the isolation of breeding colonies as recommended by the Draft Marbled Murrelet Recovery Plan (Marbled Murrelet Recovery Team 1995). The draft recovery plan also recommended that viable populations be maintained within each segment of the species range and identifies southwest Washington (southern end of conservation zone 2) and the Puget trough (western portion of conservation zone 1) as areas important to recovery efforts because they contain small amounts of suitable habitat and contain little or no federal ownership that will offer support from federal conservation efforts (Marbled Murrelet Recovery Team 1995). Alternative B attempts to specifically locate, protect, and improve habitat conditions at these important remaining breeding sites. The long-term plan to be developed in Alternative B includes objectives of protecting all occupied sites in certain critical planning units with low populations and little remaining habitat and preventing the isolation of breeding colonies. Although not specifically stated in the

description of the long-term plan, plans may include developing habitat to replace or increase the amount of available habitat within these critical areas to attain the long-term plan objectives. Increasing the amount of habitat available and providing replacement habitat are both recommended recovery objectives. DNR manages significant amounts of land within these areas that have the potential to provide substantial short- and long-term benefits and support to these remaining populations.

More support from federal conservation efforts will be provided in the northeastern portion of recovery zone 2 (western Olympic Peninsula) and eastern portion of conservation zone 1 (north Cascade Range) because of the presence of large areas of USFS and national park lands. It is expected that the amount of suitable habitat on USFS-managed lands will actually increase over time (replacement habitat) as managed under the President's Forest Plan.

Alternative B has a high likelihood of providing significant support to the interior forest conditions being planned and managed for on federal lands under the President's Forest Plan. It would also better provide for the interior forest conditions being sought by the Draft Marbled Murrelet Recovery Plan.

The amount of disturbance protection provided under Alternative B would be greater than under the No Action alternative because more occupied sites would be located within a short period of time and because DNR would develop management plans for these sites. Management plans would be designed to minimize disturbances to breeding sites. Therefore, this alternative has a high likelihood of offering sufficient protection to breeding birds from nest-site disturbances.

Compared to the No Action alternative, Alternative B has: (1) a higher likelihood of preventing population declines and maintaining or enhancing reproductive potential of the population; (2) higher likelihood of protecting breeding sites from disturbances; and, (3) a higher likelihood of making a significant contribution and support to the President's Forest Plan and federal recovery efforts which would increase the likelihood of the long-term persistence and adaptation of the species in Washington. Alternative B would also decrease the likelihood that catastrophic events would eliminate remaining breeding in areas with few existing breeding sites because the majority of occupied sites would be located and protected.

ALTERNATIVE C

Alternative C would provide similar enhancement of breeding potential to Alternative B, except that under Alternative C there would be no harvest of suitable unoccupied murrelet habitat in any planning unit (as compared to just southwest Washington for Alternative B) or marginal habitat within a planning unit until a long-term conservation plan is developed for the unit. This approach would reserve all options for the final planning team to develop a long-term conservation plan that can utilize all available habitat options and have the best likelihood of success. These considerations may specifically include replacement habitat for marbled murrelets in areas where gaps in the distribution of breeding sites exist or in areas near a breeding site that has the potential of being isolated on the landscape as recommended for certain conservation zones

delineated by the USFWS in the Draft Marbled Murrelet Recovery Plan (Marbled Murrelet Recovery Team 1995). If an area was to lose the only remaining breeding sites to windthrow, fire, or other environmental effects, providing replacement habitat in these areas would help prevent the risk of a complete absence of suitable nesting habitat over time. These areas of concern include southwest Washington (southern end of conservation zone 2) and the Puget trough (western portion of conservation zone 1). These areas are considered important to recovery efforts because they contain small amounts of suitable habitat and contain little or no federal ownership.

The proposed actions under Alternative C are even more consistent with recovery actions outlined in the Draft Marbled Murrelet Recovery Plan (Marbled Murrelet Recovery Team 1995) than those of Alternative B because of the provisions for suitable unoccupied habitat as replacement habitat and objectives to develop suitable habitat in critical areas over time. Except for southwest Washington where the expected results of Alternatives B and C are similar, Alternative C has a higher likelihood than Alternative B of protecting the reproductive potential of the population because there will be an increased likelihood of providing for interior forest conditions due to the additional suitable unoccupied habitat that would be available and maintenance of marginal habitat. In addition, Alternative C has a higher likelihood that displaced breeding birds could locate additional suitable nesting habitat within the same watershed or adjacent watershed, within a shorter time frame than Alternative B due to the retention of marginal or suitable unoccupied habitat for long-term planning.

Therefore, Alternative C has the highest likelihood that the reproductive potential of the population would be maintained or increased in conjunction with federal conservation efforts which would lead to the long-term persistence and adaptation of the species in Washington. Alternative C has the highest likelihood that adult survival would be maintained or increased, breeding sites are not disturbed during the breeding season, and that population sources are provided for the colonization of future habitat. Alternative C has the lowest likelihood of reducing genetic variability of the population and contributing to the isolation of occupied sites.

The provisions under Alternative C to replace murrelet habitat over time and reserve suitable but unoccupied habitat as part of a landscape-level long-term conservation plan would significantly support federal recovery for this species.

Table 4.2.34: Summary of the environmental consequences of the No Action and Habitat Conservation Plan alternatives according to the two biological criteria

Criteria	Alternative A No Action	Alternative B Proposed HCP	Alternative C
Amount of nesting habitat protected by each alternative in near term	60,283 acres of potential nesting habitat deferred over an unknown time period.	38,442 acres of occupied nesting habitat protected over a 10 year period. Suitable, unoccupied habitat protected in southwest Washington.	60,664 acres of occupied nesting habitat and suitable unoccupied habitat protected over a 10-year period.
Likelihood of long-term protection	No certainty that sufficient habitat is available to maintain populations over time, protect breeding sites, or contribute to federal conservation efforts.	High likelihood that sufficient habitat and protection is provided to support a viable population and assist with federal conservation efforts over the long term.	Highest likelihood that sufficient habitat and protection is provided to support a viable population and assist with federal conservation efforts over the long term.
Likelihood that the alternative would protect or enhance the reproductive potential of the population	Lowest likelihood of protecting or enhancing the reproductive potential of the population at a level leading to long-term persistence of the population.	High likelihood of protecting or enhancing the reproductive potential of the population leading to long-term persistence of the population.	Highest likelihood of protecting or enhancing the reproductive potential of the population leading to long-term persistence of the population.

Cumulative Effects

This analysis of the alternatives considered for conservation of marbled murrelet habitat on DNR-managed lands includes a brief review of the context of this action regarding other state and federal regulations and conservation efforts that may also provide protection to the species. A review of these actions will provide the necessary information to discuss the cumulative effects of this action within this region. The region analyzed for this discussion includes conservation zones 1 and 2 as defined in the Draft Marbled Murrelet Recovery Plan (Marbled Murrelet Recovery Team 1995). The Puget Sound Zone (zone 1) extends south from the U.S.-Canadian border along the east shore of Puget

Sound to Port Townsend, there turning westward along the north shore of the Olympic Peninsula to a point west of Port Angeles near Lake Crescent. The zone extends inland a distance of 50 miles. This zone bisects the Olympic Peninsula. The Western Washington Coast Range Zone (zone 2) extends from a point west of Port Angeles near Lake Crescent west to Cape Flattery, and south to the Columbia River. The zone extends inland a distance of 50 miles from the Pacific Ocean shoreline. The region within these zones includes lands managed by the U.S. Forest Service, U.S. Department of the Interior, private entities, tribal ownership and state-managed lands.

ALTERNATIVE A

Appreciable differences exist between the No Action alternative (Alternative A) and Alternatives B and C in the cumulative effects on the regional population of marbled murrelets. Assuming continued implementation of the President's Forest Plan, significant impacts to the regional population are likely to occur from the implementation of Alternative A because:

(1) Although 60,283 acres of potential nesting habitat is deferred, this deferral occurs over an unknown time period and is subject to change according to future decisions made by the Board of Natural Resources. There is no certainty that long-term protection will be provided to habitat or populations over time. Therefore, the likelihood of specific long-term protection being given to the marbled murrelet is the lowest of all three alternatives considered. Given that DNR manages as much as 7 percent of the total potential marbled murrelet habitat in Washington State (including federal and nonfederal ownerships). Of the habitat on nonfederal ownerships, approximately 48 percent of the old-growth and 39 percent of mature forests are located on state-managed lands. This habitat represents a significant amount of the old-growth and mature forest nesting habitat available to the marbled murrelet and, if not protected, would likely have significant negative impacts to the regional population. This is especially true for the southern portion of conservation zone 2 (southwest Washington) where a substantial amount of DNR-managed lands exist but federal lands are absent, suitable habitat is extremely limited and populations are low.

(2) Occupied sites are not specifically located. Therefore, little or no protection is afforded these sites since the majority of the breeding locations are unknown. It will be difficult or impossible to provide any protection to these areas unless they are located and mapped.

(3) Efforts to protect and enhance the reproductive potential of the population and improve habitat quality and distribution (habitat enhancement) are not a part of the alternatives objectives. This alternative has the lowest likelihood of protecting or enhancing the reproductive potential of the population.

(4) No research is conducted to determine how best to protect habitat and breeding sites, maintain or increase the reproductive potential of the population, or reduce adult and juvenile mortality. Because the level of biological knowledge on the murrelet is still minimal, research is considered one the highest priorities by the Marbled Murrelet Recovery Team (1995). It will be impossible to protect a species unless specific management strategies can be developed to provide this protection. These management strategies will be impossible to develop without additional research.

(5) No considerations are planned for providing replacement habitat over time or developing new habitat in areas with significant gaps in the distribution of breeding sites. Because Alternative A does not attempt to locate the majority of occupied sites or plan to implement a landscape-level protection strategy for these areas, this alternative has the lowest likelihood of maintaining viable populations over time in western Washington. This would be especially true in southwest Washington.

(6) Although, in the long term, federal conservation efforts would result in a larger amount of suitable high quality habitat (interior forest conditions) than currently available, it is not known how long Alternative A would continue to provide protection to habitat to help sustain populations until this federal habitat is available. The recovery team estimated it would take a minimum of 50 years before any of this federal habitat began to be suitable.

(7) Alternative A has a low likelihood of contributing significantly to federal conservation efforts since recovery plan objectives and the protection guidelines developed for the President's Forest Plan are not used to protect or enhance occupied sites.

Protection provided by the spotted owl proposed 4(d) special rule, additional habitat conservation plans, and from the proposed Washington State Forest Practices rule proposals for marbled murrelets is not yet known since these plans and processes have yet to be finalized. Therefore, the cumulative effects of these processes could not be analyzed. It is unknown if the results of these plans or rules will significantly add to the protection of the regional marbled murrelet population or not. USFWS critical habitat designations (61 Fed. Reg. 26256 (1996)) became final in May, 1996. Federal lands in reserve status under the President's Northwest Forest Plan provide the majority of lands that fall under critical habitat considerations. DNR-managed lands are currently designated to provide over 99 percent of the nonfederal critical habitat. The Service will conduct an assessment of the effects of DNR's proposed HCP on the critical habitat designation in its Biological Opinion. Additional protection to marbled murrelet populations from current forest practices rules and private land management policies is expected to be minimal. In addition, implementation of the Salvage Rider may result in a loss of 15 occupied sites on the Olympic Peninsula and 20 sites on the Mt. Baker National Forest, reducing the number of nesting opportunities for the marbled murrelet and further impacting the regional population. However, at this time, the Service does not expect harvesting in occupied habitat to occur as a result of the Salvage Rider. More detailed descriptions of these state, federal and private actions or plans are provided below.

ALTERNATIVES B AND C

The differences between the implementation of Alternative B and C in the cumulative effects on the regional population of marbled murrelets is expected to be similar. Therefore, they have been analyzed together in the following discussion. Assuming continued implementation of the President's Forest Plan, significant impacts to the regional population are not expected from the implementation of Alternative B or C because:

(1) the majority of habitat removal occurs in the area where there is the highest acreage of potential nesting habitat on federal lands;

(2) all *known* occupied sites are protected;

(3) impacts to the population are minimized by harvesting those potential occupied sites with the lowest probabilities of occupancy (marginal habitat) expected to contain the least number of individuals;

(4) it is estimated that only four-tenths of 1 percent of the Washington population may be affected;

(5) efforts to protect and enhance the reproductive potential of the population and improve habitat quality and distribution (habitat enhancement) are made high priorities;

(6) research on the marbled murrelet is made a high priority as called for in the Draft Marbled Murrelet Recovery Plan. This research will be used to develop specific management strategies that can be used to further protect and enhance breeding habitat and the reproductive capability of the population, reduce mortality to juveniles and adults, protect habitat from windthrow and fire, and develop silvicultural prescriptions to develop new habitat;

(7) additional suitable but unoccupied marbled murrelet habitat will be available from the implementation of protection strategies in the HCP for the northern spotted owl and riparian ecosystem;

(8) in the long term, federal conservation efforts would result in a larger amount of suitable high quality (interior forest conditions) than currently available. These two alternatives provide certainty that current populations will be protected during the interim until this habitat is available. The recovery team estimated it would take a minimum of 50 years before any of this federal habitat began to be suitable; and,

(9) both alternatives contribute significantly to federal conservation efforts since recovery plan objectives and the protection guidelines developed for the President's Forest Plan are used to protect or enhance occupied sites.

In addition, locating the majority of occupied sites and implementing landscape-level protection strategies for these areas would result in a higher likelihood of maintaining viable populations over time in western Washington. Alternative B provides interim protection to suitable but unoccupied habitat in southwest Washington. Alternative C provides additional interim protection to suitable unoccupied habitat in all planning units and the long-term plan will include provisions for developing new habitat over time.

Therefore, range-wide impacts of the proposed actions (Alternatives B and C) are not expected. The net effect of the issuance of an incidental take permit and the implementation of Alternative B or C on the regional marbled murrelet population is expected to be minimal and significantly lower than under the No Action alternative.