United States Department of the Interior

FISH AND WILDLIFE SERVICE

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July 19, 2010

Memorandum

To: Mary Smelcer, Acting District Manager, Medford District Bureau of Land Management, Medford, Oregon.

From: Jim Thrailkill, Field Supervisor, Roseburg Fish and Wildlife Office, Roseburg, Oregon.

Subject: Formal consultation on Summer 2010 timber harvest activities scheduled to occur on public lands administered by the Medford District of the Bureau of Land Management (District) that are likely to adversely affect the northern spotted owl (Reference Number 13420-2010-F-0107).

This document transmits the Fish and Wildlife Service's (Service) biological opinion (Opinion) based on our review of proposed timber harvest and associated activities scheduled to occur on lands administered by the District, and their potential impacts to the threatened northern spotted owl (*Strix occidentalis caurina*) (spotted owl). The Service prepared this document in accordance with section 7 of the Endangered Species Act of 1973 as amended (16 U. S.C. 1531 *et seq.*) (Act). The Service received your consultation request and corresponding Biological Assessment (Assessment) (USDI BLM 2009) dated May 5, 2010, in our office on May 7, 2010.

The enclosed Opinion includes a finding that implementation of the proposed actions would not jeopardize the continued existence of the spotted owl. According to the Assessment, the proposed action will not occur within designated critical habitat for the spotted owl (USDI FWS 2008a).

In accordance with regulation, reinitiation of consultation is required where discretionary federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agencies' action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or

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(4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation of formal consultation. This Opinion and the associated Incidental Take Statement remain in effect for those portions of this proposed action completed by the District prior to October 1, 2020.

If you have any questions regarding this Opinion, please contact me at 541-957-3474; or Cynthia Donegan at 541-957-3469.

cc: Carole Jorgensen, Medford District BLM, Medford, Oregon (e)
Dave Clayton, Rogue River – Siskiyou National Forest, Medford, Oregon (e)
Brendan White, FWS-OFWO, Portland, Oregon (e)
Office Files, FWS-OFWO, Portland, Oregon (e)

Biological Opinion on the
Summer 2010 Timber Harvest Activities Proposed by the Medford District of the Bureau of Land Management that are likely to adversely affect the northern spotted owl
(FWS Reference Number 13420-2010-F-0107)

U.S. Department of the Interior
U.S. Fish and Wildlife Service
Roseburg Field Office
July 19, 2010

Signature: _____
Jim Thrailkill
Field Supervisor

Date Signed: July 19, 2010

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DEFINITIONS (used in this document)

NW Forest Plan Land Use Allocations (USDA FS and USDI BLM 1994a):

AMAs (Adaptive Management Areas) generally follow Matrix guidance (defined below), but encourage adaptive management approaches to forest management.

LSRs (Late-Successional Reserves) are managed to protect and enhance habitat conditions for late-successional and old-growth related species. These reserves are designed to maintain a functional, interacting late-successional and old-growth ecosystem.

KSOACs (Known Spotted Owl Activity Centers): 100-acre Cores (LSR) are the best 100 acres around northern spotted owl activity centers that were documented as of January 1, 1994, on Matrix and AMA lands, and are managed as LSRs.

Riparian Reserves are areas along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive the primary emphasis of land management activities.

Congressionally Reserved Areas require Congressional enactment for their establishment, such as national parks, wilderness, and wild and scenic rivers (USDI BLM 1995, p. 103).

Administratively Withdrawn Areas include areas withdrawn from scheduled timber harvest such as recreation areas, rights-of-way corridors, and timber production capability classification withdrawals (USDI BLM 1995, p. 39).

Matrix consists of those Federal lands not in the categories above. Matrix includes northern and southern General Forest Management Areas. Green tree retention ranges from 6 to 25 trees per acre following regeneration harvest in Matrix lands (USDI BLM 1995, pp. 38-39).

Northern Spotted Owl Sites:

Documented Spotted Owl Sites are defined as locations with evidence of continued use by spotted owls, including breeding, repeated location of a pair or single birds during a single season or over several years, presence of young before dispersal, or some other strong indication of continued occupation. Documented spotted owl sites are tracked in the BLM northern spotted owl database. The majority of the documented sites were established through protocol level surveys completed in the late 1980s and early 1990s. Currently, documented spotted owl sites are recorded in an opportunistic manner, because protocol surveys are generally no longer conducted. Additional site locations have been established through a spotted owl demographic study taking place on portions of the District. All documented sites, except sites found non-nesting through protocol surveys, receive seasonal protection (Appendix A).

Known Spotted Owl Activity Center (KOACs) are small LSRs representing the best 100 acres associated with known spotted owl activity centers in Matrix and AMAs (as of January 1, 1994). The criteria for mapping these areas are identified on pages C-10 and C-11 of the Northwest Forest Plan (NWFP) Standards and Guidelines (USDA FS and USDI BLM 1994a)

Computer Generated ("G") Sites are estimated utilizing the Methodology for Estimating the Number of Northern Spotted Owls Affected by Proposed Federal Actions (USDI/USDA 2008), a process used to estimate effects to spotted owls in areas where survey information is not available. The methodology relies on known spotted owl locations, derived from spotted owl surveys, as the foundation for generating a map of likely of spotted owl locations.

Provincial Home Range is defined, for purposes of this document, as a circle located around an activity center and represents the area that spotted owls are assumed to use for nesting and foraging in any given year. The home ranges of adjacent spotted owl pairs may overlap. Provincial home range radii vary based on the physiographic province in which they are located: Klamath Mountains Province = 1.3 miles (approximately 3,400 acres), and Cascades West Province = 1.2 miles (approximately 2,900 acres).

Core Area is a 0.5-mile radius circle (encompassing approximately 500 acres) around a spotted owl nest or center of activity used to delineate the area presumably most heavily used by spotted owls during the nesting season; it is included in the provincial home range circle. Core areas represent the areas which are more readily defended by territorial spotted owls and generally do not overlap the core areas of adjacent spotted owl pairs.

Nest Patch is the 300-meter radius area around a known or likely spotted owl nest site; it is included in the core area.

Northern Spotted Owl Habitat:

The District identifies spotted owl habitat based on the following definitions.

Nesting, Roosting, and Foraging (NRF) Habitat for the spotted owl consists of habitat used for nesting, roosting, *and* foraging. Spotted owl NRF habitat also functions as dispersal habitat. Generally, this habitat is multistoried, 80 years old or more (depending on stand type and structural condition), and has sufficient snags and down wood to provide opportunities for nesting, roosting, and foraging. The canopy closure generally exceeds 60 percent, but canopy closure or age alone does not qualify a stand as spotted owl NRF habitat. Other attributes of NRF habitat include: a high incidence of large trees with various deformities (e.g., large cavities, broken tops, mistletoe infestations, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly (Thomas et al. 1990). Spotted owl NRF habitat in southwest Oregon is typified by mixed-conifer forest, recurrent fire history, patchy habitat components, and a relatively high incidence of woodrats, a high quality spotted owl prey species in the area. Forsman et al. (1984) described some of the differences in NRF habitat within the Klamath Mountains Province, that are typical of large parts of the Medford District:

> "Eighty-one percent of all nests in northwestern Oregon were in cavities, compared to only 50 percent in the Klamath Mountains. These differences appeared to reflect regional differences in availability of the different nest types. Dwarf mistletoe infections in Douglas-fir (and numerous debris platforms that were associated with dwarf mistletoe infections) were common in the mixed coniferous forests of the Klamath Mountains and the east slopes of the Cascades, but did not occur in western Oregon."

Habitat Capable is forest land that is currently not spotted owl habitat but can become spotted owl NRF or dispersal habitat in the future, as trees mature and the canopy fills in.

Dispersal-only (dispersal) is a subcategory of "all dispersal" habitat for spotted owls. Thomas et al. (1990), defined dispersal habitat as forested habitat more than 40 years old, with canopy closure more than 40 percent, average tree diameter greater than 11 inches, and flying space for spotted owls in the understory, but lacking other components found in spotted owl NRF habitat. Dispersal habitat provides temporary shelter for spotted owls moving through the area between spotted owl NRF habitat and some opportunity for spotted owls to find prey, but does not provide all of the requirements to support a spotted owl throughout its life.

Forest Management Treatment Types within Spotted Owl Habitat:

Forest stands in southwest Oregon are often multiple-aged with multiple canopy levels that have resulted from previous harvesting or from past natural stand disturbance such as repeated historic low intensity fire (USDI FWS 1992a, Vol. II, 2-37). Effects of individual forest management activities have been determined by the District following these descriptions.

Treat and Maintain Spotted Owl NRF or Dispersal Habitat means an action or activity will occur within spotted owl NRF or dispersal habitat, but will not change the habitat classification, post treatment. Affected stands of spotted owl NRF habitat will retain at least 60 percent canopy cover, large trees, multistoried canopy cover, standing and down dead wood, diverse understory adequate to support prey, and may have some mistletoe or other decay. Spotted owl dispersal habitat will continue to provide at least 40 percent canopy cover, flying space, and trees 11 inches diameter at breast height (dbh) or greater, on average.

Downgrade Spotted Owl NRF Habitat means to alter the function of spotted owl NRF habitat to an extent that it no longer supports nesting, roosting, and foraging behavior, but will retain enough tree cover to support spotted owl dispersal.

Remove Spotted Owl Habitat means to alter known spotted owl NRF or dispersal habitat to an extent that it no longer supports spotted owl nesting, roosting, foraging, or dispersal.

CONSULTATION HISTORY

The Sampson Cove and Swinning (formerly called the Plateau Thin) timber harvest actions were analyzed in the Service's October 2003 Biological Opinion (FWS reference # 1-15-03-F-511). This Biological Opinion was withdrawn on November 2, 2005 in response to the Ninth Circuit opinion in *NEDC* v. *Allen/USFWS* (*NEDC I*), No. 05-1279 (D. Or.).

The Sampson Cove and Swinning (formerly called the Plateau Thin) and Twin Ranch timber harvest actions were analyzed in the Service's August 2006 Biological Opinion (FWS reference # 1-15-06-F-162). This Biological Opinion was withdrawn in March, 2007 in response to the Ninth Circuit opinion in *ONRC v. Allen,* No. 05-35830 (9th Cir.).

The Sampson Cove and Swinning (formerly called the Plateau Thin) and Twin Ranch timber harvest actions, as well as other projects, were included in a programmatic biological assessment submitted to the Service in October, 2008. Subsequently, the Service and District staffs engaged in discussions regarding the analysis of the proposed action in the context of the Service's 2008 Northern Spotted Owl Recovery Plan (USDI FWS 2008b) (Recovery Plan); specifically, how the activities included in the proposed action may affect forest stands that meet the definition of

"older, structurally complex, multi-layered conifer forests," as defined in recovery action 32. During the interim, the District submitted a request for informal consultation to the Service (received in our office on November 25, 2009) that included a suite of vegetation management activities (from the 2008 Assessment) the District had determined not likely to adversely affect spotted owls, and which did not involve recovery action 32 defined stands. The Service issued a letter of concurrence (Tails # 1342-2009-I-0093) for these activities to the District on December 23, 2009. The Service and the District are continuing to discuss potential modifications to the other projects included in the 2008 biological assessment.

Table 1. Consultation History of Proposed Harvest Projects

Project	BA FY 04-08	BA FY 06-08	BA DA BA FH[1]	Name of original project (if sale was previously consulted under another name)
Sampson Cove	X	X	X	
Swinning	X	X	X	Plateau thin
Twin Ranch		X	X	

[1] District Analysis and Biological Assessment of Forest Habitat (USDI BLM 2008).

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

As described in the Assessment, which is herein incorporated by reference, the proposed action includes six individual timber harvest projects, which include up to 2,907 acres of harvest and up to 1.5 miles of new road construction (Table 2). All projects included in the proposed action are planned to occur within the matrix land use allocation, as defined in the Northwest Forest Plan (NWFP) (USDA FS and USDI BLM 1994a). According to the Assessment, the District has planned the projects included in the proposed action to provide a sustainable supply of timber and forest products while managing for a healthy forest ecosystem. The District will utilize a combination of cable and tractor yarding systems to implement timber harvest operations. All proposed harvest units will receive post harvest fuels treatments, designed to reduce potential increases in fuel loading. These activities include fuels reduction treatments, such as biomass removal, selective slashing, hand pile burning, as well as follow-up maintenance under burns planned to occur within 7-10 years post-harvest. All fuels reduction treatments will occur within the footprint of the individual timber harvest units.

According to the Assessment, the proposed action avoids older and more structurally complex, multi-layered conifer forests, identified as important to the recovery of spotted owls in recovery action (RA) 32 of the Recovery Plan for the Northern Spotted Owl (USDI FWS 2008b). District field biologists conducted on-the-ground investigations with a purpose of identifying forest stands that meet the definition of RA 32 using the January 2010 draft Medford Bureau of Land Management and Rogue River-Siskiyou National Forest (Forest) methodology. This methodology represents an interagency effort by District, Forest and Service staff intended for use in identifying forest stands that meet the definition of RA 32.

Table 2. Proposed Action.

Project Name	Number of Timber Harvest Acres	Number of Road Construction Miles	Land Use Allocation	Treatment Type
Klamath Mountains Physiographic Province				
Illinois Watershed				
Deer North	229	0.3	Matrix	CT,DM,UR,MGS,GS,RH[1]
East West Junction	382	1.1	Matrix	CT,DM,UR,MGS,GS,RH[1]
Little Butte Creek Watershed				
DF Restore	370	0	Matrix	RH,MGS,GS[1]
Cascades West Physiographic Province				
Bear Creek Watershed				
Sampson Cove	747	0	Matrix	UR,MGS,GS[1]
Klamath Watershed				
Swinning	550	0	Matrix	CT,UR,MGS[1]
Rogue Upper Watershed				
Twin Ranch	629	0.1	Matrix	CT,RH,SR,DM,SH[1]
Total	2,907	1.5		

[1] Density Management (DM), Commercial Thinning (CT), Understory Reduction (UR), Modified Group Selection (MGS), Group Selection (GS), Regeneration Harvest (RH), Structural Retention for Stand Regeneration (SR), Shelterwood (SH).

Timber Harvest

Commercial Thinning: typically prescribed for even-aged stands with a single canopy layer. In these stands, growth rates are beginning to decline due to competition. These treatments would thin stands by spacing the residual trees based on the crown radius of the healthiest dominant and co-dominant trees to achieve an average relative density of 35 percent with some variation for site differences (range between 25 and 45 percent relative density).

Density Management: typically prescribed for uneven-aged stands for the primary purpose of widening the spacing of residual trees to promote growth and structural development of the remaining stand. These treatments thin stands by spacing the residual trees based on the crown radius of the healthiest dominant and co-dominant trees to achieve an average relative density of 35 percent with some variation (between 25 and 45 percent relative density) for site differences.

Understory Reduction Treatments: primarily thin (the smallest diameter trees) from below to achieve a target canopy closure of 60 percent in stands of spotted owl NRF habitat, and 40 percent in stands of spotted owl dispersal habitat. The prescription for these areas includes the retention of the most vigorous, large trees in patches, while thinning lower and intermediate tree layers in an effort to accelerate development of multi-layered tree structure**.**

Modified Group Selection: the removal of trees (usually Douglas-fir) that are competing with vigorous pines and non-tanoak hardwoods with greater than 30 percent live crown ratio. Typically, openings created by these treatments would be between one quarter to one half acre in

size, with the occasional openings of up to one acre in size if the pines and non-tanoak hardwoods require more release.

Group Selection: used in small patches (less than three acres), which lack conifer regeneration because of intense conifer, hardwood or brush competition or in areas where the overstory trees are showing signs of declining health (stagnating growth patterns, dead, dying, or diseased). A "regeneration opening" would be created by cutting and removing large hardwoods and/or conifers, potentially burning hardwoods on site when yarding is not feasible. Openings created would be planted with conifer seedlings and young stand management treatments would occur as needed.

Regeneration Harvest: Northern General Forest Management Area guidelines described in the 1995 Medford District Resource Management Plan (USDI BLM 1995) will be followed. Prescriptions consist of the retention of six to eight large conifers per acre.

Structural Retention for Stand Regeneration T**reatments:** retain 16 to 25 large, green conifers greater than 20 inches dbh per acre across the natural range of diameters present in a particular treatment stand. Trees greater that six inches diameter at breast height would be removed between the trees selected for retention. Two large hardwoods per acre will be retained. Douglas-fir/Tanoak series stands containing an established and competitive tanoak component would retain nine to 16 large trees per acre.

Shelterwood Treatments: retain 12 to 25 green trees per acre greater than 20 inches dbh to provide protection for newly planted and natural seedlings in areas that experience growing season frost. The spatial distribution of trees would be more uniformly distributed. After harvest, canopy closure will equal 20-30 percent.

Fuels Reduction

Biomass Removal: the removal of any dead or living vegetation in a fuel treatment unit that is less than or equal to eight inches in diameter for conifers, and less than or equal to 12 inches for hardwoods. On slopes of less than 35 percent, mechanized, low ground pressure machinery will cut, skid, haul or chip the biomass materials. On slopes greater than 35 percent, biomass materials will be cable yarded. As described in the Assessment, the District does not consider decadent woody material, such as large snags and pre-existing down wood biomass material. These features will be retained within harvest units.

Selective Slashing: understory vegetation density will be reduced by cutting and spacing of conifers less than eight inches diameter at breast height and hardwoods less than 12 inches dbh. Retained vegetation would be spaced 14 to 45 feet apart. Untreated vegetation groups ranging in size from 0.1 to two acres will be retained in each treatment unit.

Hand Piling and Burning: typically used when under-burning is not possible due to heavy fuel loads. Sticks one to six inches in diameter and longer than two feet will be piled by hand.

Understory Burning (under-burning): used where the objective is to maintain greater than or equal to 80 percent of the overstory. Typically, burning occurs between fall and spring outside of the breeding season for spotted owls.

Project Design Criteria

Project design criteria (PDC) are conservation measures developed to reduce impacts to listed species. PDC may include implementation of seasonal restrictions that reduce impacts during critical breeding seasons of listed species, retention of known nest trees and/or restricting activities within a certain distance of known sites to reduce impacts of disturbance. According to the Assessment, mandatory PDC will be applied to all activities associated with the proposed action. Recommended PDC will be incorporated during project implementation when practical. Detailed descriptions of the PDC are provided in Appendix A.

Monitoring

This consultation incorporates annual monitoring of projects that have adverse effects to listed species. The Level 1 team has agreed to use a Project Implementation and Monitoring Form developed by the Service, most recently updated in March 2004 (Appendix B). The District shall monitor the extent of habitat affected by the proposed actions to ensure that those effects are consistent with description of the proposed action, the effects analysis, and incidental take limits presented herein. The District will report all projects for which the District has reached an effects determination of "likely to adversely affect" listed species for the preceding fiscal year to the Service by November 31 of that year, using the monitoring report form found in Appendix A, unless otherwise scheduled by Level 1 team agreement.

DESCRIPTION OF THE ACTION AREA

The action area has been defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402) (USDI FWS 1992b). For the purposes of this Opinion, the action area includes all treatment units, as well as all areas subject to increased ambient noise levels caused by activities associated with the proposed action (see the disturbance distances described below in the *Description of the Proposed Action* section of this document). The term analysis area is also used in this document to describe the larger geographic area within which the action area occurs, and at which scale the District conducted the effects analysis for the proposed action.

According to the Assessment, activities included in the proposed action are planned to occur within the Klamath Mountains and Cascades West Physiographic Provinces in southwest Oregon, and are dispersed among five section seven (hydrologic unit) watersheds (watersheds). Federal public lands managed by the District generally occur in a checkerboard pattern, with alternating sections of private lands.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATION

The following analysis relies on four components to support the jeopardy determination for the spotted owl: (1) the *Status of the Species*, which evaluates the spotted owls range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the spotted owl in the action area, the factors responsible for that condition, and the role of the action area in the spotted owl survival and recovery; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the

spotted owl; and (4) *Cumulative Effects*, which evaluates the effects of future, non-federal activities in the action area on the spotted owl.

In accordance with the implementing regulations for section 7 and Service policy, the jeopardy determination is made in the following manner: the effects of the proposed federal action are evaluated with the aggregate effects of everything that has led to the spotted owls current status and, for non-federal activities in the action area, those actions likely to affect the spotted owl in the future, to determine if, given the aggregate of all of these effects, implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the spotted owl.

The following analysis places an emphasis on using the range-wide survival and recovery needs of the spotted owl, and the role of the action area in meeting those needs as the context for evaluating the effects of the proposed federal action combined with other relevant effects. In short, a non-jeopardy determination is warranted if the proposed action is consistent with maintaining the role of habitat and the spotted owl population in the action area for the survival and recovery of the spotted owl.

Analytical Framework for the Adverse Modification Determination

This Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Endangered Species Act to complete the following analysis with respect to critical habitat.

The following analysis relies on four components to support the adverse modification determination: (1) the *Status of Critical Habitat*, which evaluates the range-wide and provincial condition of designated critical habitat for the spotted owl in terms of primary constituent elements (PCEs), the factors responsible for that condition, and the intended recovery function of the critical habitat overall, as well as the intended recovery function of critical habitat outside the action area at the provincial and unit scales; (2) the *Environmental Baseline*, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the *Effects of the Action*, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the PCEs and how that will influence the recovery role of affected critical habitat units; and (4) *Cumulative Effects*, which evaluates the effects of future, non-Federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

In accordance with Service policy and guidance, the adverse modification determination is made in the following manner: the effects of the proposed Federal action on critical habitat are evaluated with the aggregate effects of everything that has led to the current status of the critical habitat range-wide and, for non-Federal activities in the action area, those actions likely to affect the critical habitat in the future, to determine if, given those aggregate effects, the critical habitat would remain functional (or retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve the intended recovery role for the species with implementation of the proposed Federal action.

The following analysis places an emphasis on using the intended range-wide and provincial scale recovery functions of spotted owl critical habitat and the role of the action area relative to those intended functions as the context for evaluating the effects of the proposed Federal action with other relevant effects. In short, a non-adverse modification determination is warranted if the proposed action is consistent with maintaining the intended recovery role of spotted owl critical habitat in the action area. The adverse modification determination is made at the provincial scale of the spotted owl critical habitat.

STATUS OF THE SPECIES

Spotted Owl

Legal Status

The spotted owl was listed as threatened on June 26, 1990, due to widespread loss and adverse modification of suitable habitat across the owl's entire range and the inadequacy of existing regulatory mechanisms to conserve the owl (USDI FWS 1990a). Originally, the Service's recovery priority number for the spotted owl was 6C, on a scale of 1C (highest) to 18 (lowest) (USDI FWS 1983). This number reflects a high degree of threat, a low potential for recovery, and the owl's taxonomic status as a subspecies. The "C" reflects conflict with development, construction, or other economic activity. During the 5-year review of the species (USDI FWS 2004), the recovery priority number was changed to 3C.

Life History

Taxonomy
The spotted owl is one of three subspecies of spotted owls currently recognized by the American Ornithologists' Union. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutiérrez 1990, Barrowclough et al. 1999, Haig et al. 2004), morphological (Gutiérrez et al. 1995), and biogeographic information (Barrowclough and Gutiérrez 1990). The distribution of the Mexican subspecies (*S. o. lucida*) is separate from those of the northern and California (*S. o. occidentalis*) subspecies (Gutiérrez et al. 1995). Recent studies analyzing mitochondrial DNA sequences (Haig et al. 2004, Chi et al. 2004, Barrowclough et al. 2005) and microsatellites (Henke et al., unpubl. data) confirmed the validity of the current subspecies designations for northern and California spotted owls. The narrow hybrid zone between these two subspecies, which is located in the southern Cascades and northern Sierra Nevadas, appears to be stable (Barrowclough et al. 2005).

Physical Description
The spotted owl is a medium-sized owl and is the largest of the three subspecies of spotted owls (Gutiérrez et al. 1995). It is approximately 46 to 48 centimeters (18 inches to 19 inches) long and the sexes are dimorphic, with males averaging about 13 percent smaller than females. The mean mass of 971 males taken during 1,108 captures was 580.4 grams (1.28 pounds) (out of a range 430.0 to 690.0 grams) (0.95 pound to 1.52 pounds), and the mean mass of 874 females taken during 1,016 captures was 664.5 grams (1.46 pounds) (out of a range 490.0 to 885.0 grams) (1.1 pounds to 1.95 pounds) (P. Loschl and E. Forsman, pers. comm. cited in USDI FWS 2008b). The spotted owl is dark brown with a barred tail and white spots on its head and breast, and it has dark brown eyes surrounded by prominent facial disks. Four age classes can be

distinguished on the basis of plumage characteristics (Forsman 1981, Moen et al. 1991). The spotted owl superficially resembles the barred owl (*Strix varia*), a species with which it occasionally hybridizes (Kelly and Forsman 2004). Hybrids exhibit physical and vocal characteristics of both species (Hamer et al. 1994).

Current and Historical Range

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USDI FWS 1990b). The range of the spotted owl is partitioned into 12 physiographic provinces (see Figure 1) based on recognized landscape subdivisions exhibiting different physical and environmental features (Thomas et al. 1993). These provinces are distributed across the species' range as follows:

- Four provinces in Washington: Eastern Washington Cascades, Olympic Peninsula, Western Washington Cascades, Western Washington Lowlands
- Five provinces in Oregon: Oregon Coast Range, Willamette Valley, Western Oregon Cascades, Eastern Oregon Cascades, Oregon Klamath Mountains
- Three provinces in California: California Coast, California Klamath, California Cascades

The spotted owl is extirpated or uncommon in certain areas such as southwestern Washington and British Columbia. Timber harvest activities have eliminated, reduced or fragmented spotted owl habitat sufficiently to decrease overall population densities across its range, particularly within the coastal provinces where habitat reduction has been concentrated (Thomas and Raphael 1993).

Behavior

Spotted owls are territorial. However, home ranges of adjacent pairs overlap (Forsman et al. 1984, Solis and Gutiérrez 1990) suggesting that the area defended is smaller than the area used for foraging. Territorial defense is primarily effected by hooting, barking and whistle type calls. Some spotted owls are not territorial but either remain as residents within the territory of a pair or move among territories (Gutiérrez 1996). These birds are referred to as "floaters." Floaters have special significance in spotted owl populations because they may buffer the territorial population from decline (Franklin 1992). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutiérrez 1996).

Spotted owls are monogamous and usually form long-term pair bonds. "Divorces" occur but are relatively uncommon. There are no known examples of polygyny in this owl, although associations of three or more birds have been reported (Gutiérrez et al. 1995).

Habitat Relationships

<u>Home Range</u>. Home-range sizes vary geographically, generally increasing from south to north, which is likely a response to differences in habitat quality (USDI FWS 1990b). Estimates of median size of their annual home range (the area traversed by an individual or pair during their normal activities (Thomas and Raphael 1993)) vary by province and range from 2,955 acres in the Oregon Cascades (Thomas et al. 1990) to 14,211 acres on the Olympic Peninsula (USDI FWS 1994). Zabel et al. (1995) showed that these provincial home ranges are larger where flying squirrels are the predominant prey and smaller where wood rats are the predominant prey. Home ranges of adjacent pairs overlap (Forsman et al. 1984, Solis and Gutiérrez 1990),

suggesting that the defended area is smaller than the area used for foraging. Within the home range there is a smaller area of concentrated use during the breeding season (~20% of the home-range), often referred to as the core area (Bingham and Noon 1997). Spotted owl core areas vary in size geographically and provide habitat elements that are important for the reproductive efficacy of the territory, such as the nest tree, roost sites and foraging areas (Bingham and Noon 1997). Spotted owls use smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman et al. 1984, Sisco 1990).

Although differences exist in natural stand characteristics that influence home range size, habitat loss and forest fragmentation effectively reduce habitat quality in the home range. A reduction in the amount of suitable habitat reduces spotted owl abundance and nesting success (Bart and Forsman 1992, Bart 1995).

Habitat Use. Forsman et al. (1984) reported that spotted owls have been observed in the following forest types: Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandis*), white fir (*Abies concolor*), ponderosa pine (*Pinus ponderosa*), Shasta red fir (*Abies magnifica shastensis*), mixed evergreen, mixed conifer hardwood (Klamath montane), and redwood (*Sequoia sempervirens*). The upper elevation limit at which spotted owls occur corresponds to the transition to subalpine forest, which is characterized by relatively simple structure and severe winter weather (Forsman 1975, Forsman et al. 1984).

Roost sites selected by spotted owls have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978, Forsman et al. 1984, Solis and Gutiérrez 1990). These habitats are usually multi-layered forests having high canopy closure and large diameter trees in the overstory.

Spotted owls nest almost exclusively in trees. Like roosts, nest sites are found in forests having complex structure dominated by large diameter trees (Forsman et al. 1984, Hershey et al. 1998). Even in forests that have been previously logged, spotted owls select forests having a structure (i.e., larger trees, greater canopy closure) different than forests generally available to them (Folliard 1993, Buchanan et al. 1995, Hershey et al. 1998).

Foraging habitat is the most variable of all habitats used by territorial spotted owls (Thomas et al. 1990). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990) to forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutiérrez 1996).

Habitat Selection. Spotted owls generally rely on older forested habitats because such forests contain the structures and characteristics required for nesting, roosting, and foraging. Features that support nesting and roosting typically include a moderate to high canopy closure (60 to 90 percent); a multi-layered, multi-species canopy with large overstory trees (with dbh of greater than 30 inches); a high incidence of large trees with various deformities (large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for spotted owls to fly (Thomas et al. 1990). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001) and protection from predators.

While spotted owls nest almost exclusively in trees, foraging habitat generally has attributes similar to those of nesting and roosting habitat, but such habitat may not always support successfully nesting pairs (USDI FWS 1992b). Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities (USDI FWS 1992a). Although Forsman et al. (2002) found that spotted owls could disperse through highly fragmented forest landscapes, the stand-level and landscape-level attributes of forests needed to facilitate successful dispersal have not been thoroughly evaluated (Buchanan 2004).

Spotted owls may be found in younger forest stands that have the structural characteristics of older forests or retained structural elements from the previous forest. In redwood forests and mixed conifer-hardwood forests along the coast of northwestern California, considerable numbers of spotted owls also occur in younger forest stands, particularly in areas where hardwoods provide a multi-layered structure at an early age (Thomas et al. 1990, Diller and Thome 1999). In mixed-conifer forests in the eastern Cascades in Washington, 27 percent of nest sites were in old-growth forests, 57 percent were in the understory reinitiation phase of stand development, and 17 percent were in the stem exclusion phase (Buchanan et al. 1995). In the western Cascades of Oregon, 50 percent of spotted owl nests were in late-seral/old-growth stands (greater than 80 years old), and none were found in stands of less than 40 years old (Irwin et al. 2000).

In the Western Washington Cascades, spotted owls roosted in mature forests dominated by trees greater than 50 centimeters (19.7 inches) dbh with greater than 60 percent canopy closure more often than expected for roosting during the non-breeding season. Spotted owls also used young forest [trees of 20 to 50 centimeters (7.9 inches to 19.7 inches) dbh with greater than 60 percent canopy closure] less often than expected based on this habitat's availability (Herter et al. 2002).

In the Coast Ranges, Western Oregon Cascades and the Olympic Peninsula, radio-marked spotted owls selected for old-growth and mature forests for foraging and roosting and used young forests less than predicted based on availability (Forsman et al. 1984, Carey et al. 1990, Carey et al. 1992, Thomas et al. 1990). Glenn et al. (2004) studied spotted owls in young forests in western Oregon and found little preference among age classes of young forest.

Habitat use is influenced by prey availability. Ward (1990) found that spotted owls foraged in areas with lower variance in prey densities (that is, where the occurrence of prey was more predictable) within older forests and near ecotones of old forest and brush seral stages. Zabel et al. (1995) showed that spotted owl home ranges are larger where flying squirrels (*Glaucomys sabrinus*) are the predominant prey and smaller where wood rats (*Neotoma* spp.) are the predominant prey.

Recent landscape-level analyses in portions of Oregon Coast and California Klamath provinces suggest that a mosaic of late-successional habitat interspersed with other seral conditions may benefit spotted owls more than large, homogeneous expanses of older forests (Zabel et al. 2003, Franklin et al. 2000, Meyer et al. 1998). In Oregon Klamath Mountains and Western Oregon Cascade provinces, Dugger et al. (2005) found that apparent survival and reproduction was positively associated with the proportion of older forest near the territory center (within 730 meters) (2,395 feet). Survival decreased dramatically when the amount of non-habitat (non-forest areas, sapling stands, etc.) exceeded approximately 50 percent of the home range (Dugger

et al. 2005). The authors concluded that they found no support for either a positive or negative direct effect of intermediate-aged forest—that is, all forest stages between sapling and mature, with total canopy cover greater than 40 percent—on either the survival or reproduction of spotted owls. It is unknown how these results were affected by the low habitat fitness potential in their study area, which Dugger et al. (2005) stated was generally much lower than those in Franklin et al. (2000) and Olson et al. (2004), and the low reproductive rate and survival in their study area, which they reported were generally lower than those studied by Anthony et al. (2006a). Olson et al. (2004) found that reproductive rates fluctuated biennially and were positively related to the amount of edge between late-seral and mid-seral forests and other habitat classes in the central Oregon Coast Range. Olson et al. (2004) concluded that their results indicate that while mid-seral and late-seral forests are important to spotted owls, a mixture of these forest types with younger forest and non-forest may be best for spotted owl survival and reproduction in their study area.

Reproductive Biology

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls (Forsman et al. 1984, Gutiérrez et al. 1995). Spotted owls are sexually mature at 1 year of age, but rarely breed until they are 2 to 5 years of age (Miller et al. 1985, Franklin 1992, Forsman et al. 2002). Breeding females lay one to four eggs per clutch, with the average clutch size being two eggs; however, most spotted owl pairs do not nest every year, nor are nesting pairs successful every year (USDI FWS 1990b, Forsman et al. 1984, Anthony et al. 2006a**),** and renesting after a failed nesting attempt is rare (Gutiérrez 1996). The small clutch size, temporal variability in nesting success, and delayed onset of breeding all contribute to the relatively low fecundity of this species (Gutiérrez 1996).

Courtship behavior usually begins in February or March, and females typically lay eggs in late March or April. The timing of nesting and fledging varies with latitude and elevation (Forsman et al. 1984). After they leave the nest in late May or June, juvenile spotted owls depend on their parents until they are able to fly and hunt on their own. Parental care continues after fledging into September (USDI FWS 1990b, Forsman et al. 1984). During the first few weeks after the young leave the nest, the adults often roost with them during the day. By late summer, the adults are rarely found roosting with their young and usually only visit the juveniles to feed them at night (Forsman et al. 1984). Telemetry and genetic studies indicate that close inbreeding between siblings or parents and their offspring is rare (Haig et al. 2001, Forsman et al. 2002).

Dispersal Biology

Natal dispersal of spotted owls typically occurs in September and October with a few individuals dispersing in November and December (Miller et al. 1997, Forsman et al. 2002). Natal dispersal occurs in stages, with juveniles settling in temporary home ranges between bouts of dispersal (Miller et al. 1997, Forsman et al. 2002). The median natal dispersal distance is about 10 miles for males and 15.5 miles for females (Forsman et al. 2002). Dispersing juvenile spotted owls experience high mortality rates, exceeding 70 percent in some studies (USDI FWS 1990b, Miller 1989). Known or suspected causes of mortality during dispersal include starvation, predation, and accidents (Miller 1989, USDI FWS 1990a, Forsman et al. 2002). Parasitic infection may contribute to these causes of mortality, but the relationship between parasite loads and survival is poorly understood (Hoberg et al. 1989, Gutiérrez 1989, Forsman et al. 2002). Successful

dispersal of juvenile spotted owls may depend on their ability to locate unoccupied suitable habitat in close proximity to other occupied sites (LaHaye et al. 2001).

There is little evidence that small openings in forest habitat influence the dispersal of spotted owls, but large, non-forested valleys such as the Willamette Valley apparently are barriers to both natal and breeding dispersal (Forsman et al. 2002). The degree to which water bodies, such as the Columbia River and Puget Sound, function as barriers to dispersal is unclear, although radio telemetry data indicate that spotted owls move around large water bodies rather than cross them (Forsman et al. 2002). Analysis of the genetic structure of spotted owl populations suggests that gene flow may have been adequate between the Olympic Mountains and the Washington Cascades, and between the Olympic Mountains and the Oregon Coast Range (Haig et al. 2001).

Breeding dispersal occurs among a small proportion of adult spotted owls; these movements were more frequent among females and unmated individuals (Forsman et al. 2002). Breeding dispersal distances were shorter than natal dispersal distances and also are apparently random in direction (Forsman et al. 2002).

Food Habits

Spotted owls are mostly nocturnal, although they also forage opportunistically during the day (Forsman et al. 1984, Sovern et al. 1994). The composition of the spotted owl's diet varies geographically and by forest type. Generally, flying squirrels (*Glaucomys sabrinus*) are the most prominent prey for spotted owls in Douglas-fir and western hemlock (*Tsuga heterophylla*) forests (Forsman et al. 1984) in Washington and Oregon, while dusky-footed wood rats (*Neotoma fuscipes*) are a major part of the diet in the Oregon Klamath Mountains, California Klamath, and California Coastal provinces (Forsman et al. 1984, 2001, 2004, Ward et al. 1998, Hamer et al. 2001). Depending on location, other important prey include deer mice (*Peromyscus maniculatus*), tree voles (*Arborimus longicaudus, A. pomo*), red-backed voles (*Clethrionomys* spp.), gophers (*Thomomys* spp.), snowshoe hare (*Lepus americanus*), bushy-tailed wood rats (*Neotoma cinerea*), birds, and insects, although these species comprise a small portion of the spotted owl diet (Forsman et al. 1984, 2004, Ward et al. 1998, Hamer et al. 2001).

Other prey species such as the red tree vole (*Arborimus longicaudus),* red-backed voles (*Clethrionomys gapperi),* mice, rabbits and hares, birds, and insects may be seasonally or locally important (reviewed by Courtney et al. 2004). For example, Rosenberg et al. (2003) showed a strong correlation between annual reproductive success of spotted owls (number of young per territory) and abundance of deer mice (*Peromyscus maniculatus*) (r2 = 0.68), despite the fact they only made up 1.6±0.5 percent of the biomass consumed. However, it is unclear if the causative factor behind this correlation was prey abundance or a synergistic response to weather (Rosenberg et al. 2003). Ward (1990) also noted that mice were more abundant in areas selected for foraging by owls. Nonetheless, spotted owls deliver larger prey to the nest and eat smaller food items to reduce foraging energy costs; therefore, the importance of smaller prey items, like deer mice (*Peromyscus* ssp), in the spotted owl diet should not be underestimated (Forsman et al. 1984, 2001, 2004).

Population Dynamics

The spotted owl is relatively long-lived, has a long reproductive life span, invests significantly in parental care, and exhibits high adult survivorship relative to other North American owls

(Forsman et al. 1984, Gutiérrez et al. 1995). The spotted owl's long reproductive life span allows for some eventual recruitment of offspring, even if recruitment does not occur each year (Franklin et al. 2000).

Annual variation in population parameters for spotted owls has been linked to environmental influences at various life history stages (Franklin et al. 2000). In coniferous forests, mean fledgling production of the California spotted owl (*Strix occidentalis occidentalis*), a closely related subspecies, was higher when minimum spring temperatures were higher (North et al. 2000), a relationship that may be a function of increased prey availability. Across their range, spotted owls have previously shown an unexplained pattern of alternating years of high and low reproduction, with highest reproduction occurring during even-numbered years (e.g., Franklin et al. 1999). Annual variation in breeding may be related to weather (i.e., temperature and precipitation) (Wagner et al. 1996 and Zabel et al. 1996 *In*: Forsman et al. 1996) and fluctuation in prey abundance (Zabel et al. 1996).

A variety of factors may regulate spotted owl population levels. These factors may be density-dependent (e.g., habitat quality, habitat abundance) or density-independent (e.g., climate). Interactions may occur among factors. For example, as habitat quality decreases, density-independent factors may have more influence on survival and reproduction, which tends to increase variation in the rate of growth (Franklin et al. 2000). Specifically, weather could have increased negative effects on spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin et al. 2000). A consequence of this pattern is that at some point, lower habitat quality may cause the population to be unregulated (have negative growth) and decline to extinction (Franklin et al. 2000).

Olson et al. (2005) used open population modeling of site occupancy that incorporated imperfect and variable detectability of spotted owls and allowed modeling of temporal variation in site occupancy, extinction, and colonization probabilities (at the site scale). The authors found that visit detection probabilities average less than 0.70 and were highly variable among study years and among their three study areas in Oregon. Pair site occupancy probabilities declined greatly on one study area and slightly on the other two areas. However, for all owls, including singles and pairs, site occupancy was mostly stable through time. Barred owl presence had a negative effect on these parameters (see barred owl discussion in the New Threats section below). However, there was enough temporal and spatial variability in detection rates to indicate that more visits would be needed in some years and in some areas, especially if establishing pair occupancy was the primary goal.

Threats

Reasons for Listing

The spotted owl was listed as threatened throughout its range "due to loss and adverse modification of suitable habitat as a result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms" (USDI FWS 1990a: 26114). More specifically, threats to the spotted owl included low populations, declining populations, limited habitat, declining habitat, inadequate distribution of habitat or populations, isolation of provinces, predation and competition, lack of coordinated conservation measures, and vulnerability to natural disturbance (USDI FWS 1992b). These threats were characterized for each province as severe, moderate, low or unknown (USDI FWS 1992b) (The range of the

spotted owl is divided into 12 provinces from Canada to northern California and from the Pacific Coast to the eastern Cascades; see Figure 1). Declining habitat was recognized as a severe or moderate threat to the spotted owl throughout its range, isolation of populations was identified as a severe or moderate threat in 11 provinces, and a decline in population was a severe or moderate threat in 10 provinces. Together, these three factors represented the greatest concerns about range-wide conservation of the spotted owl. Limited habitat was considered a severe or moderate threat in nine provinces, and low populations were a severe or moderate concern in eight provinces, suggesting that these factors were also a concern throughout the majority of the spotted owl's range. Vulnerability to natural disturbances was rated as low in five provinces. The degree to which predation and competition might pose a threat to the spotted owl was unknown in more provinces than any of the other threats, indicating a need for additional information. Few empirical studies exist to confirm that habitat fragmentation contributes to increased levels of predation on spotted owls (Courtney et al. 2004). However, great horned owls (*Bubo virginianus*), an effective predator on spotted owls, are closely associated with fragmented forests, openings, and clearcuts (Johnson 1992, Laidig and Dobkin 1995). As mature forests are harvested, great horned owls may colonize fragmented forests, thereby increasing spotted owl vulnerability to predation.

New Threats

The Service conducted a 5-year review of the spotted owl in 2004 (USDI FWS 2004), for which the Service prepared a scientific evaluation of the status of the spotted owl (Courtney et al. 2004). An analysis was conducted assessing how the threats described in 1990 might have changed by 2004. Some of the key threats identified in 2004 are:

- "Although we are certain that current harvest effects are reduced, and that past harvest is also probably having a reduced effect now as compared to 1990, we are still unable to fully evaluate the current levels of threat posed by harvest because of the potential for lag effects…In their questionnaire responses…6 of 8 panel member identified past habitat loss due to timber harvest as a current threat, but only 4 viewed current harvest as a present threat" (Courtney and Gutiérrez 2004:11-7)
- "Currently the primary source of habitat loss is catastrophic wildfire, although the total amount of habitat affected by wildfires has been small (a total of 2.3% of the range-wide habitat base over a 10-year period)." (Courtney and Gutiérrez 2004:11-8)
- "Although the panel had strong differences of opinion on the conclusiveness of some of the evidence suggesting [barred owl] displacement of [spotted owls], and the mechanisms by which this might be occurring, there was no disagreement that [barred owls] represented an operational threat. In the questionnaire, all 8 panel members identified [barred owls] as a current threat, and also expressed concern about future trends in [barred owl] populations." (Courtney and Gutiérrez 2004:11-8)

Barred Owls. With its recent expansion to as far south as Marin County, California (Gutiérrez et al. 2004), the barred owl's range now completely overlaps that of the spotted owl. Barred owls may be competing with spotted owls for prey (Hamer et al. 2001) or habitat (Hamer et al. 1989, Dunbar et al. 1991, Herter and Hicks 2000, Pearson and Livezey 2003). In addition, barred owls physically attack spotted owls (Pearson and Livezey 2003), and circumstantial evidence strongly indicated that a barred owl killed a spotted owl (Leskiw and Gutiérrez 1998). Evidence that barred owls are causing negative effects on spotted owls is largely indirect, based primarily on

retrospective examination of long-term data collected on spotted owls (Kelly et al. 2003, Pearson and Livezey 2003, Olson et al. 2005). It is widely believed, but not conclusively confirmed, that the two species of owls are competing for resources. However, given that the presence of barred owls has been identified as a negative effect while using methods designed to detect a different species (spotted owls), it seems safe to presume that the effects are stronger than estimated. Because there has been no research to quantitatively evaluate the strength of different types of competitive interactions, such as resource partitioning and competitive interference, the particular mechanism by which the two owl species may be competing is unknown.

Barred owls were initially thought to be more closely associated with early successional forests than spotted owls, based on studies conducted on the west slope of the Cascades in Washington (Hamer 1988, Iverson 1993). However, recent studies conducted in the Pacific Northwest show that barred owls frequently use mature and old-growth forests (Pearson and Livezey 2003, Gremel 2005, Schmidt 2006). In the fire prone forests of eastern Washington, a telemetry study conducted on barred owls showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest, while spotted owl sites were located on mid-elevation areas with southern or western exposure, characterized by closed canopy, mature, ponderosa pine or Douglas-fir forest (Singleton et al. 2005).

The only study comparing spotted owl and barred owl food habits in the Pacific Northwest indicated that barred owl diets overlap strongly (76 percent) with spotted owl diets (Hamer et al. 2001). However, barred owl diets are more diverse than spotted owl diets and include species associated with riparian and other moist habitats, along with more terrestrial and diurnal species (Hamer et al. 2001).

The presence of barred owls has been reported to reduce spotted owl detectability, site occupancy, reproduction, and survival. Olson et al. (2005) found that the presence of barred owls had a significant negative effect on the detectability of spotted owls, and that the magnitude of this effect did not vary among years. The occupancy of historical territories by spotted owls in Washington and Oregon was significantly lower ($p < 0.001$) after barred owls were detected within 0.8 kilometer (0.5 miles) of the territory center but was "only marginally lower" ($p = 0.06$) if barred owls were located more than 0.8 kilometer (0.5 miles) from the spotted owl territory center (Kelly et al. 2003:51). Pearson and Livezey (2003) found that there were significantly more barred owl site-centers in unoccupied spotted owl circles than occupied spotted owl circles (centered on historical spotted owl site-centers) with radii of 0.8 kilometer (0.5 miles) ($p = 0.001$), 1.6 kilometer (1 mile) ($p = 0.049$), and 2.9 kilometer (1.8 miles) ($p = 0.005$) in Gifford Pinchot National Forest. In Olympic National Park, Gremel (2005) found a significant decline ($p = 0.01$) in spotted owl pair occupancy at sites where barred owls had been detected, while pair occupancy remained stable at spotted owl sites without barred owls. Olson et al. (2005) found that the annual probability that a spotted owl territory would be occupied by a pair of spotted owls after barred owls were detected at the site declined by 5 percent in the H.J. Andrews study area, 12 percent in the Coast Range study area, and 15 percent in the Tyee study area.

Olson et al. (2004) found that the presence of barred owls had a significant negative effect on the reproduction of spotted owls in the central Coast Range of Oregon (in the Roseburg study area). The conclusion that barred owls had no significant effect on the reproduction of spotted owls in one study (Iverson 2004) was unfounded because of small sample sizes (Livezey 2005). It is

likely that all of the above analyses underestimated the effects of barred owls on the reproduction of spotted owls because spotted owls often cannot be relocated after they are displaced by barred owls (E. Forsman, pers. comm., cited in USDI FWS 2008b). Anthony et al. (2006a) found significant evidence for negative effects of barred owls on apparent survival of spotted owls in two of 14 study areas (Olympic and Wenatchee). They attributed the equivocal results for most of their study areas to the coarse nature of their barred owl covariate.

In a recent analysis of more than 9,000 banded spotted owls throughout their range, only 47 hybrids were detected (Kelly and Forsman 2004). Consequently, hybridization with the barred owl is considered to be "an interesting biological phenomenon that is probably inconsequential, compared with the real threat—direct competition between the two species for food and space" (Kelly and Forsman 2004:808).

The preponderance of evidence suggests that barred owls are exacerbating the spotted owl population decline, particularly in Washington, portions of Oregon, and the northern coast of California (Gutiérrez et al. 2004, Olson et al. 2005). There is no evidence that the increasing trend in barred owls has stabilized in any portion of the spotted owl's range in the western United States, and "there are no grounds for optimistic views suggesting that barred owl impacts on spotted owls have been already fully realized" (Gutiérrez et al. 2004:7-38).

Wildfire. Studies indicate that the effects of wildfire on spotted owls and their habitat are variable, depending on fire intensity, severity and size. Within the fire-adapted forests of the spotted owl's range, spotted owls likely have adapted to withstand fires of variable sizes and severities. Bond et al. (2002) examined the demography of the three spotted owl subspecies after wildfires, in which wildfire burned through spotted owl nest and roost sites in varying degrees of severity. Post-fire demography parameters for the three subspecies were similar or better than long-term demographic parameters for each of the three subspecies in those same areas (Bond et al. 2002). In a preliminary study conducted by Anthony and Andrews (2004) in the Oregon Klamath Mountains Province, their sample of spotted owls appeared to be using a variety of habitats within the area of the Timbered Rock fire, including areas where burning had been moderate.

In 1994, the Hatchery Complex fire burned 17,603 hectares in the Wenatchee National Forest in Washington's eastern Cascades, affecting six spotted owl activity centers (Gaines et al. 1997). Spotted owl habitat within a 2.9-kilometer (1.8-mile) radius of the activity centers was reduced by 8 to 45 percent (mean = 31 percent) as a result of the direct effects of the fire and by 10 to 85 percent (mean = 55 percent) as a result of delayed mortality of fire-damaged trees and insects. Direct mortality of spotted owls was assumed to have occurred at one site, and spotted owls were present at only one of the six sites 1 year after the fire. In 1994, two wildfires burned in the Yakama Indian Reservation in Washington's eastern Cascades, affecting the home ranges of two radio-tagged spotted owls (King et al. 1997). Although the amount of home ranges burned was not quantified, spotted owls were observed using areas that burned at low and medium intensities. No direct mortality of spotted owls was observed, even though thick smoke covered several spotted owl site-centers for a week. It appears that, at least in the short term, spotted owls may be resilient to the effects of wildfire—a process with which they have evolved. More research is needed to further understand the relationship between fire and spotted owl habitat use.

At the time of listing there was recognition that large-scale wildfire posed a threat to the spotted owl and its habitat (USDI FWS 1990a). New information suggests fire may be more of a threat than previously thought. In particular, the rate of habitat loss in the relatively dry East Cascades and Klamath provinces has been greater than expected (see "Habitat Trends" below). Moeur et al. (2005) suggested that 12 percent of late-successional forest rangewide would likely be negatively impacted by wildfire during the first 5 decades of the NWFP. Currently, the overall total amount of habitat affected by wildfires has been relatively small (Lint 2005). It may be possible to influence through silvicultural management how fire prone forests will burn and the extent of the fire when it occurs. Silvicultural management of forest fuels are currently being implemented throughout the spotted owl's range, in an attempt to reduce the levels of fuels that have accumulated during nearly 100 years of effective fire suppression. However, our ability to protect spotted owl habitat and viable populations of spotted owls from large fires through risk-reduction endeavors is uncertain (Courtney et al. 2004). The NWFP recognized wildfire as an inherent part of managing spotted owl habitat in certain portions of the range. The distribution and size of reserve blocks as part of the NWFP design may help mitigate the risks associated with large-scale fire (Lint 2005).

West Nile Virus. West Nile virus (WNV) has killed millions of wild birds in North America since it arrived in 1999 (McLean et al. 2001, Caffrey 2003, Marra et al. 2004). Mosquitoes are the primary carriers (vectors) of the virus that causes encephalitis in humans, horses, and birds. Mammalian prey may also play a role in spreading WNV among predators, like spotted owls. Owls and other predators of mice can contract the disease by eating infected prey (Garmendia et al. 2000, Komar et al. 2001). Recent tests of tree squirrels from Los Angeles County, California, found over 70 percent were positive for WNV (R. Carney, pers. comm., cited in USDI FWS 2004). One captive spotted owl in Ontario, Canada, is known to have contracted WNV and died.

Health officials expect that WNV will eventually spread throughout the range of the spotted owl (Courtney et al. 2004), but it is unknown how WNV will ultimately affect spotted owl populations. Susceptibility to infection and mortality rates of infected individuals vary among bird species, even within groups (Courtney et al. 2004). Owls appear to be quite susceptible. For example, breeding Eastern screech owls (*Megascops asio*) in Ohio experienced 100 percent mortality (T. Grubb, pers. comm., cited in Courtney et al. 2004). Barred owls, in contrast, showed lower susceptibility (B. Hunter, pers. comm., cited in Courtney et al. 2004). Some level of innate resistance may occur (Fitzgerald et al. 2003), which could explain observations in several species of markedly lower mortality in the second year of exposure to WNV (Caffrey and Peterson 2003). Wild birds also develop resistance to WNV through immune responses (Deubel et al. 2001). The effects of WNV on bird populations at a regional scale have not been large, even for susceptible species (Caffrey and Peterson 2003), perhaps due to the short-term and patchy distribution of mortality (K. McGowan, pers. comm., cited in Courtney et al. 2004) or annual changes in vector abundance and distribution.

Courtney et al. (2004) offer competing propositions for the likely outcome of spotted owl populations being infected by WNV. One proposition is that spotted owls can tolerate severe, short-term population reductions due to WNV, because spotted owl populations are widely distributed and number in the several hundreds to thousands. An alternative proposition is that WNV will cause unsustainable mortality, due to the frequency and/or magnitude of infection, thereby resulting in long-term population declines and extirpation from parts of the spotted owl's

current range. Thus far, no mortality in wild, spotted owls has been recorded; however, WNV is a potential threat of uncertain magnitude and effect (Courtney et al. 2004).

Sudden Oak Death. Sudden Oak Death was recently identified as a potential threat to the spotted owl (Courtney et al. 2004). This disease is caused by the fungus-like pathogen, *Phytopthora ramorum* that was recently introduced from Europe and is rapidly spreading. At the present time, Sudden Oak Death is found in natural stands from Monterey to Humboldt Counties, California, and has reached epidemic proportions in oak (*Quercus* spp.) and tanoak (*Lithocarpus densiflorus*) forests along approximately 300 km of the central and northern California coast (Rizzo et al. 2002). It has also been found near Brookings, Oregon, killing tanoak and causing dieback of closely associated wild rhododendron (*Rhododendron* spp.) and evergreen huckleberry (*Vaccinium ovatum*) (Goheen et al. 2002). It has been found in several different forest types and at elevations from sea level to over 800 meters. Sudden Oak Death poses a threat of uncertain proportion because of its potential impact on forest dynamics and alteration of key prey and spotted owl habitat components (e.g., hardwood trees - canopy closure and nest tree mortality); especially in the southern portion of the spotted owl's range (Courtney et al. 2004).

Inbreeding Depression, Genetic Isolation, and Reduced Genetic Diversity. Inbreeding and other genetic problems due to small population sizes were not considered an imminent threat to the spotted owl at the time of listing. Recent studies show no indication of reduced genetic variation and past bottlenecks in Washington, Oregon, or California (Barrowclough et al. 1999, Haig et al. 2004, Henke et al. unpublished). However, in Canada, the breeding population is estimated to be less than 33 pairs and annual population decline may be as high as 35 percent (Harestad et al. 2004). It is possible (but not necessarily the case) that the Canadian populations may be more adversely affected by issues related to small population size including inbreeding depression, genetic isolation, and reduced genetic diversity (Courtney et al. 2004). Low and persistently declining populations throughout the northern portion of the species range (see "Population Trends" below) may be at increased risk of losing genetic diversity.

Climate Change. Climate change, a potential additional threat to spotted owl populations, is not explicitly addressed in the NWFP. Climate change could have direct and indirect impacts on spotted owls and their prey. However, the emphasis on maintenance of seral stage complexity and related organismal diversity in the Matrix under the NWFP should contribute to the resiliency of the federal forest landscape to the impacts of climate change (Courtney et al. 2004). There is no indication in the literature regarding the direction (positive or negative) of the threat.

Based upon a global meta-analysis, Parmesan and Yohe (2003) discussed several potential implications of global climate change to biological systems, including terrestrial flora and fauna. Results indicated that 62 percent of species exhibited trends indicative of advancement of spring conditions. In bird species, trends were manifested in earlier nesting activities. Because the spotted owl exhibits a limited tolerance to heat relative to other bird species (Weathers et al. 2001), subtle changes in climate have the potential to affect this. However, the specific impacts to the species are unknown.

Disturbance-Related Effects. The effects of noise on spotted owls are largely unknown, and whether noise is a concern has been a controversial issue. The effect of noise on birds is extremely difficult to determine due to the inability of most studies to quantify one or more of the following variables: 1) timing of the disturbance in relation to nesting chronology; 2) type,

frequency, and proximity of human disturbance; 3) clutch size; 4) health of individual birds; 5) food supply; and 6) outcome of previous interactions between birds and humans (Knight and Skagen 1988). Additional factors that confound the issue of disturbance include the individual bird's tolerance level, ambient sound levels, physical parameters of sound and how it reacts with topographic characteristics and vegetation, and differences in how species perceive noise.

Although information specific to behavioral responses of spotted owls to disturbance is limited, research indicates that recreational activity can cause Mexican spotted owls (*S. o. lucida*) to vacate otherwise suitable habitat (Swarthout and Steidl 2001) and helicopter overflights can reduce prey delivery rates to nests (Delaney et al. 1999). Additional effects from disturbance, including altered foraging behavior and decreases in nest attendance and reproductive success, have been reported for other raptors (White and Thurow 1985, Andersen et al. 1989, McGarigal et al. 1991).

Spotted owls may also respond physiologically to a disturbance without exhibiting a significant behavioral response. In response to environmental stressors, vertebrates secrete stress hormones called corticosteroids (Campbell 1990). Although these hormones are essential for survival, extended periods with elevated stress hormone levels may have negative effects on reproductive function, disease resistance, or physical condition (Carsia and Harvey 2000, Saplosky et al. 2000). In avian species, the secretion of corticosterone is the primary non-specific stress response (Carsia and Harvey 2000). The quantity of this hormone in feces can be used as a measure of physiological stress (Wasser et al.1997). Recent studies of fecal corticosterone levels of spotted owls indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel and Gutiérrez 2003, Tempel and Gutiérrez 2004). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to spotted owl core areas (see Wasser et al. 1997, Tempel and Gutiérrez 2004).

Post-harvest fuels treatments may also create above-ambient smoke or heat. Although it has not been conclusively demonstrated, it is anticipated that nesting spotted owls may be disturbed by heat and smoke intrusion into the nest grove.

Conservation Needs of the Spotted Owl

Based on the above assessment of threats, the spotted owl has the following habitat-specific and habitat-independent conservation (i.e., survival and recovery) needs:

Habitat-specific Needs

1. Large blocks of habitat capable of supporting clusters or local population centers of spotted owls (e.g., 15 to 20 breeding pairs) throughout the owl's range distributed across a variety of ecological conditions within the spotted owl's range to reduce risk of local or widespread extirpation;

2. Habitat conditions and spacing between local spotted owl populations throughout its range that facilitate survival and movement;

3. A coordinated, adaptive management effort to reduce the loss of habitat due to catastrophic wildfire throughout the spotted owl's range, and a monitoring program to

clarify whether these risk reduction methods are effective and to determine how owls use habitat treated to reduce fuels; and

4. In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty.

Habitat-independent Needs

1. A coordinated research and adaptive management effort to better understand and manage competitive interactions between spotted and barred owls; and

2. Monitoring to better understand the risk that WNV and sudden oak death pose to spotted owls and, for WNV, research into methods that may reduce the likelihood or severity of outbreaks in spotted owl populations.

Conservation Strategy

Since 1990, various efforts have addressed the conservation needs of the spotted owl and attempted to formulate conservation strategies based upon these needs. These efforts began with the Interagency Scientific Committee (ISC)'s Conservation Strategy (Thomas et al. 1990); they continued with the designation of critical habitat (USDI FWS 1992b), the Draft Recovery Plan (USDI FWS 1992a), and the Scientific Analysis Team report (Thomas et al. 1993), report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993); and they culminated with the NWFP (USDA FS and USDI BLM 1994a). Each conservation strategy was based upon the reserve design principles first articulated in the ISC's report, which are summarized as follows.

- Species that are well distributed across their range are less prone to extinction than species confined to small portions of their range.
- Large blocks of habitat, containing multiple pairs of the species, are superior to small blocks of habitat with only one to a few pairs.
- Blocks of habitat that are close together are better than blocks far apart.
- Habitat that occurs in contiguous blocks is better than habitat that is more fragmented.
- Habitat between blocks is more effective as dispersal habitat if it resembles suitable habitat.

Northwest Forest Plan

Since it was signed on April 13, 1994, the NWFP has guided the management of federal forest lands within the range of the spotted owl (USDA FS and USDI BLM 1994a, 1994b). The NWFP was designed to protect large blocks of old growth forest and provide habitat for species that depend on those forests including the spotted owl, as well as to produce a predictable and sustainable level of timber sales. The NWFP was designed around reserve/connectivity functions that are expected to be achieved through a variety of land-use allocations (LUAs). Each LUA has a distinct set of Standards and Guidelines that established goals and directs management actions that are consistent with NWFP expectations for ensuring appropriate management of reserves (large blocks) of late-successional and old-growth forest habitat to support multiple pairs of nesting owls and for connectivity between reserves in the intervening matrix. LUAs in the plan that are designed to support or contribute to supporting population clusters are: LSRs, Managed Late-successional Areas, and Congressionally Reserved areas. Riparian Reserves, Adaptive Management Areas and Administratively Withdrawn areas can

provide both demographic support and connectivity/dispersal between the larger blocks, but were not necessarily designed for that purpose. Matrix areas may, in the short-term, contribute demographic support but is designed to support timber production while also retaining biological legacy components important to old-growth obligate species (in 100-acre owl cores, 15 percent late-successional provision, etc. (USDA FS and USDI BLM 1994a, USDI FWS 1994) which would persist into future managed timber stands.

The NWFP with its range-wide system of LSRs was based on work completed by three previous studies (Thomas et. al. 2006): the 1990 ISC Report (Thomas et. al. 1990), the 1991 report for the Conservation of Late-successional Forests and Aquatic Ecosystems (Johnson et. al. 1991), and the 1993 report of the Scientific Assessment Team (Thomas et. al. 1993). In addition, the 1992 Draft Recovery Plan for the Northern Spotted Owl (USDI FWS 1992a) was based on the ISC report.

The Forest Ecosystem Management Assessment Team predicted, based on expert opinion, the spotted owl population would decline in the Matrix land-use allocation over time, while the population would stabilize and eventually increase within LSRs as habitat conditions improved over the next 50 to 100 years (Thomas and Raphael 1993, USDA FS and USDI BLM 1994a, 1994b). Based on the results of the first decade of monitoring, Lint (2005) could not determine whether implementation of the NWFP would reverse the spotted owl's declining population trend because not enough time had passed to provide the necessary measure of certainty. However, the results from the first decade of monitoring do not provide any reason to depart from the objective of habitat maintenance and restoration as described in the NWFP (Lint 2005, Noon and Blakesley 2006). Bigley and Franklin (2004) suggested that more fuels treatments are needed in east-side forests to preclude large-scale losses of habitat to stand-replacing wildfires. Other stressors that occur in suitable habitat, such as the range expansion of the barred owl (already in action) and infection (WNV) (which may or may not occur) may complicate the conservation of the spotted owl. Recent reports about the status of the spotted owl offer few management recommendations to deal with these emerging threats. The arrangement, distribution, and resilience of the NWFP land-use allocation system may prove to be the most appropriate strategy in responding to these unexpected challenges (Bigley and Franklin 2004).

Under the NWFP, the agencies anticipated a decline of spotted owl populations during the first decade of implementation. Recent reports (Courtney et al. 2004, Anthony et al. 2006a) identified greater than expected spotted owl declines in Washington and northern portions of Oregon, and more stationary populations in southern Oregon and northern California. The reports did not find a direct correlation between habitat conditions and changes in vital rates of spotted owls at the meta-population scale. However, at the territory scale, there is evidence of negative effects to spotted owl fitness due to reduced habitat quantity and quality. Also, there is no evidence to suggest that dispersal habitat is currently limiting (Courtney et al. 2004, Lint 2005). Even with the population decline, Courtney et al. (2004) noted that there is little reason to doubt the effectiveness of the core principles underpinning the NWFP conservation strategy.

The current scientific information, including information showing spotted owl population declines, indicates that the spotted owl continues to meet the definition of a threatened species (USDI FWS 2004). That is, populations are still relatively numerous over most of its historic range, which suggests that the threat of extinction is not imminent, and that the subspecies is not

endangered; even though, in the northern part of its range population trend estimates are showing a decline.

Northern Spotted Owl Recovery Plan
In May, 2008, the Service published the 2008 Final Recovery Plan for the Northern Spotted Owl (USDI FWS 2008b). This recovery plan identifies that competition with barred owls, ongoing loss of suitable habitat as a result of timber harvest and catastrophic fire, and loss of amount and distribution of suitable habitat as a result of past activities and disturbances are the most important range-wide threats to the spotted owl (USDI FWS 2008b). To address these threats, the present recovery strategy has the following three essential elements: barred owl control, dry-forest landscape management strategy, and MOCAs (USDI FWS 2008b). The 2008 Final Recovery Plan lists recovery actions that address research of the competition between spotted and barred owls, experimental control of barred owls to better understand the impact the species is having on spotted owls, and, if recommended by research, management of barred owls (USDI FWS 2008b). The foundation of the 2008 Final Recovery Plan for managing forest habitat in the non-fire-prone western Provinces of Washington and Oregon is the MOCA network on federal lands, which are intended to support stable and well-distributed populations of spotted owls over time and allow for movement of spotted owls across the network (USDI FWS 2008b). These areas generally overlap LSRs on the forest service lands.

On the fire-dominated east side of the Cascade Mountains in Washington and Oregon, and the California Cascades, the dry-forest habitat management strategy is intended to maintain spotted owl habitat in an environment of frequent natural disturbances (USDI FWS 2008b). Additionally, the 2008 Final Recovery Plan identifies Conservation Support Areas (CSAs) in Washington, the west side of the Cascades in Oregon, and in California. These CSAs are located on private, state, and federal lands and are expected to support the MOCA network and the dry-forest landscape management approach (USDI FWS 2008b). In addition, the 2008 Final Recovery Plan recommends a research and monitoring program be implemented to track progress toward recovery, inform changes in recovery strategy by a process of adaptive management, and ultimately determine when delisting is appropriate (USDI FWS 2008b). The three primary elements of this program include: 1) the monitoring of spotted owl population trends, 2) an inventory of spotted owl distribution, and 3) a comprehensive program of barred owl research and monitoring (USDI FWS 2008b). The 2008 Final Recovery Plan estimates that recovery of the spotted owl could be achieved in approximately 30 years (USDI FWS 2008b).

The Effect of Barred Owls on NWFP Implementation
The Service believes that the NWFP in concert with the guidance from the 2008 Northern Spotted Owl Recovery Plan helps to provide the federal contribution to spotted owl recovery even with the uncertainty surrounding the effect of barred owls on spotted owls.

Reserve Network. The most important aspect of the NWFP for spotted owls are the substantial forest reserves and related management standards. These reserves are separated by matrix habitat (suitable for dispersal and some breeding) and non-federal lands (which also have some roles as breeding and dispersal habitats). Invasion of protected reserves (such as the Olympic National Park area) by barred owls may lead to the loss of some conservation function of the reserve network. For example, Schmidt (2003) reported a decline of spotted owls in one such reserve in northern California. Pearson and Livezey (2003) established that the density of barred owls was highest in Gifford Pinchot National Forest LSRs and other reserve areas and lower in

areas subject to harvest. Annual reports by Anthony et al. (2006b, 2006c) in both the central and southern Oregon Cascades show continued annual declines in spotted owl pair occupancy in the major land-use allocations of LSR, Adaptive Management Areas (AMA) and Matrix, while barred owl frequency is increasing, although the latter information is not presented by land-use allocation. No information is provided in terms of spotted owl survival by land-use allocation.

The inability of a reserve strategy of the federal land base (USDA FS and USDI BLM 1994a) to deal with invasive species, such as the barred owl is a concern. If late-successional reserves fail to protect breeding populations of spotted owls, then the overall conservation strategy for the species could be based on an untenable premise and may be questionable. The above data suggests that reserves are insufficient protection against invasive owls, and other habitat management options, such as increased habitat protection (although see habitat discussion below) outside reserves may not have an additive effect of helping spotted owl populations against barred owls. It is recognized however, that the NWFP has made important conservation contributions, and without the NWFP the situation of spotted owls would be far bleaker.

*Dispersal-Matrix Habitat***.** The NWFP provision for dispersal habitat in the matrix is an important component of long-term spotted owl conservation. Management of matrix habitat (15 percent of the NWFP federal land base) has been of lower impact on spotted owls than anticipated (Courtney et al. 2004, Lint 2005), yet decline in spotted owl populations are occurring in some areas. The NWFP provided for some protection of spotted owl nesting and foraging habitat within the matrix (e.g., reserves around know nest sites) as well as maintenance of general conditions within the matrix that would facilitate dispersal of spotted owls and recovery of spotted owl habitat following logging (e.g., variable retention harvesting). For these reasons, spotted owls are likely using matrix habitat more than anticipated as a consequence of lack of harvest activity in the matrix. However, the long-term suitability of matrix areas under a fully-implemented NWFP is impossible to assess at this point (Courtney et al. 2004) and dispersal remains a difficult topic to study (Buchanan 2004).

Because dispersal habitat in the matrix is important for spotted owl conservation and if barred owls now occupy matrix habitat, one suggestion is that such areas may be less suitable for dispersal of young spotted owls, due to both direct antagonism (and possibly predation) and indirect inhibition (Courtney et al. 2004). An alternative view, and tenable under the current understanding of dispersal dynamics of spotted owls (Forsman et al. 2002), is that barred owl presence in matrix habitat may promote a more rapid dispersal of juvenile spotted owls through lower quality habitat. If barred owls exclude spotted owls, then spotted owls will likely spend less time in matrix habitat occupied by barred owls. If this were accomplished without reduced survivorship of spotted owls, there might be few or no negative consequences of barred owls occupying matrix habitat (Courtney et al. 2004).

Barred owls are known to use a wide variety of forest types, including early successional habitats, and some authors have suggested that timber harvest activities may favor the species (Hamer 1988, Iverson 1993, Pearson and Livezey 2003). For instance, fragmentation of forest habitat may have created favorable conditions for survival and reproduction. By contrast, spotted owls appear to be more generally associated with old growth forest or forests that are structurally complex over a greater part of the species' range (Courtney et al. 2004). Under such conditions, timber harvest may have increased interpolation and contact of the two species' preferred and potential habitats, leading to increased competition between the species. Hicks et

al. (2001) have attempted to examine this hypothesis in the northern part of the range by determining the amounts of different habitat types surrounding spotted owl territories that both have and have not been invaded by barred owls. Their results (Hicks et al. 2001) detected no effect of surrounding habitat on the probability of replacement. Also, under the Plum Creek Habitat Conservation Plan (HCP), harvest was deferred for areas of nesting, roosting and foraging habitat around 30 productive spotted owl sites. After six years, only 10 sites had any spotted owl presence – this rate of decline is very similar to that seen at other areas where timber harvest occurred. These results suggest something other than timber harvest is influencing occupancy in this location, although, overall, it is unclear if forest management affects the outcome of the interaction between the two species (Courtney et al. 2004, Chapter 8).

It is also clear that, in some portions of the spotted owl's range, barred owls are increasing and spotted owls are declining to some degree independently of forest management history in the area. For example, the population of spotted owls has decreased on both the Plum Creek Cascades HCP area (with extensive harvest) and nearby reserve areas without harvest (Courtney et al. 2004). Similarly, barred owls are increasing while spotted owls are declining throughout the Olympic peninsula in both industrial and national forest land, but also in the unharvested areas of the Olympic National Park (Anthony et al. 2006a for trend information). On the Gifford Pinchot National Forest in Washington, the density and impact of barred owls appears higher in areas without timber harvest (Pearson and Livezey 2003). Although there is a strong overall correlation between barred owl increases and spotted owl declines, many historical spotted owl sites are not currently known to be occupied by either species (Wiedemeier and Horton 2000, Herter and Hicks 2000). Large numbers of truly vacant sites are not to be expected if the main cause of spotted owl decline is barred owl invasion and pre-emption of suitable sites (Courtney et al. 2004). Habitat loss to timber harvest is often postulated to be a major factor in spotted owl decline, but habitat is still present in the study areas (indeed some areas where spotted owls are in the worst decline, such as Olympic National Park, have never been harvested). Further, these results are not inconsistent with other factors that are known to negatively affect spotted owls. For example, Franklin et al. (2000) predicted, based on past weather data that there could be long periods of decline in a spotted owl population due solely to weather effects.

The Reserve and Matrix strategy of the NWFP has been successful in that spotted owl populations are persisting, and (largely) performing as predicted (Courtney et al. 2004). Continued cutting of spotted owl suitable habitat, in absence of a NWFP, might have accelerated the decline of the species and, possibly, facilitated more rapid displacement or occupation of vacated habitat by barred owls. However, the provision of suitable habitat for spotted owls was an essential contribution of the NWFP but has not protected it from competition from the invasive and highly competitive barred owl. At present, based on the habitat use patterns of both species and what little is known of interspecific competition, it is unclear whether additional habitat protection would improve conditions from the spotted owl.

Spotted Owl Population Declines and NWFP. Anthony et al. (2006a) noted precipitous declines in adult spotted owl populations on all four study areas in Washington. In northern Oregon, spotted owl population declines were noted in all three of the study areas, although the declines were generally less than those in Washington (Anthony et al. 2006a). The spotted owl has continued to decline in the northern portion of its range, despite the presence of a high proportion of protected habitat on federal lands in that area. Although Courtney et al. (2004) indicate that the population decline of the spotted owl over the last 14 years was expected, they conclude that

the greater than expected downward trends in certain study areas in Washington where little timber harvest was taking place suggest that something other than timber harvest is responsible for the recent decline. Anthony et al. (2006a) stated that determining the cause of this decline was beyond the scope of their study, and that they could only speculate among the numerous possibilities including: competition from barred owls, loss of habitat from wildfire, timber harvest including lag effects from prior harvest, poor weather conditions, and defoliation from insect infestations. Not unexpectedly, considering the fact that the spotted owl is a predator species, Anthony et al. (2006a) also noted the complexities of the relationships of prey abundance on predator populations, and identified declines in prey abundance as another possible reason for declines in apparent survival of spotted owls.

In southern Oregon and northern California, spotted owl populations are more stationary than in Washington (Anthony et al. 2006a) despite the fact that more timber harvest is taking place in these areas than in areas experiencing greater than expected declines. The fact that spotted owl populations in some portions of the range were stationary was not expected within the first ten years, given the general prediction of continued declines in the population over the first several decades of NWFP implementation (Lint 2005). The cause of the better demographic performance on the southern Oregon and northern California study areas, and the cause of declines in the Washington study areas are both unknown (Anthony et al. 2006a). Although population declines in the Washington demographic areas exceeded anticipated levels, Courtney et al. (2004) noted that a rangewide decline in the spotted owl population was not unexpected during the first decade, and that the observed rangewide population change during this period was not a reason to doubt the effectiveness of the core NWFP conservation strategy. It is clear that there is no simple correlation with timber harvest patterns (AFRC 2004), and barred owl invasion is certainly a viable hypothesis for this regional pattern (Courtney et al. 2004).
The synergistic effects of past threats and new threats are unknown. Although, the science behind the NWFP appears valid, new threats from barred owls, and potential threats from West Nile Virus and Sudden Oak Death may result in spotted owl populations in reserves falling to lower levels (and potentially at a faster rate) than originally anticipated, which would further retard spotted owl recovery (Courtney et al. 2004). According to the USDI FWS (2004), the current scientific information, including that showing the declines in Washington and northern Oregon, and Canada, indicate that the spotted owl continues to meet the definition of a threatened species. Populations are still relatively numerous over most of the species' historic range, which suggests that the threat of extinction is not imminent, and that the subspecies is not endangered even in the northern part of its range where greater than expected population declines were documented (USDI FWS 2004). The USDI FWS (2004) did not consider the increased risk to spotted owl populations due to the uncertainties surrounding barred owls and other factors sufficient to reclassify the species as endangered at this time. However, a problem in assessing this decline is that we lack a strong benchmark to know whether this decline is greater or less than that predicted under the NWFP (Courtney et al. 2004).

A complication noted by some biologists in studying spotted owls is their belief that spotted owls are silent in the presence of barred owls (Olson et al. 2005, Crozier et al. 2006). Hence, an area may be recorded as vacated by spotted owls, when in fact the birds are merely unresponsive to surveyors' calls. Evidence contradictory to this hypothesis comes from the meta-analysis, where, if this scenario were true, we would expect to observe a decline in recapture rates for banded spotted owls in areas where barred owls are increasing, but this does not seem to be the case for any study area (Anthony et al. 2006a).

Given the observed inverse correlations of some barred owl and spotted owl population trends, it is important to evaluate the relative effects of interspecific competition as a cause of spotted owl decline, as compared to other factors such as habitat loss. Historically, much of the observed loss of old-growth habitat occurred well before barred owls arrived in the region. Hence, there must have been substantial effects of habitat loss on spotted owl populations prior to the period 1965 to 1980 (when the barred owl arrived in western states) (Gutiérrez et al. 2004). However, the arrival of the barred owl has introduced a new threat.

Previous estimates of spotted owl demographic parameters in 1994 (Burnham et al. 1994) and 1998 (Franklin et al. 1999) have produced substantial evidence that some populations at least are in decline. Of particular concern was the 1994 meta-analysis result that there was an accelerating rate of adult female mortality over the period of study for the various demographic study areas. This trend was not apparent in the 1998 meta-analysis although some populations apparently were declining. Although habitat loss is one plausible explanation for such population trends, an alternative explanation is that barred owl invasion has been depressing spotted owl survival and reproduction. Recent studies have shown strong effects (Franklin et al. 2000) and relatively weak effects (Olson et al. 2005) of some habitat conditions on spotted owl survival and reproduction. In demographic study areas where barred owls have been present the longest, and have been increasing through time, Anthony et al. (2006a) noted strong evidence for negative effects of barred owls on spotted owl survival in the Olympic and Wenatchee study areas, weak evidence for a barred owl effect on survival on the Cle Elum study area, but no effect of barred owls on fecundity on any demographic study population (Table 4). Even a low level of competition may contribute to depressed demographic parameters.

Demographic data collected over 15 years document declining populations across the species range with the most pronounced declines in British Columbia, Washington, and northern Oregon. This area of pronounced decline constitutes approximately 50 percent of the geographic range of the spotted owl, but supports about 25 percent of all known spotted owl activity centers, and contains approximately 25 percent of all spotted owl habitat, greater than 90 percent of which is federally managed. These declines in Washington and northern Oregon demographic study areas, as well as Canada, indicate the spotted owl meets the definition of a threatened species. However, populations are still relatively numerous over most of the species historic range, suggesting the threat of extinction is not imminent, and the subspecies in not "endangered" even in the northern part of the range where the demographic results are least promising (USDI FWS 2004, p. 54)

In summary, a decline of spotted owl populations under the NWFP during the past decade was anticipated, however, Anthony et al. (2006a) and Courtney et al. (2004) identified greater than expected spotted owl population declines in Washington and northern portions of Oregon, and more stationary populations in southern Oregon and northern California. These reports did not find a direct correlation between habitat conditions and changes in spotted owl populations, and they were inconclusive as to the cause of the declines. Lag effects from prior harvest of suitable habitat, competition with barred owls, and habitat loss due to wildfire were identified as current threats. Complex interactions are likely among the various factors. The status of the spotted owl population, and increased risk to spotted owl populations due to uncertainties surrounding barred owls were reported as not sufficient to reclassify the species to endangered at this time.

Similarly, the reports did not identify cause for changing the basic conservation strategy in the NWFP.

Conservation Efforts on Non-Federal Lands
In the report from the Interagency Scientific Committee (Thomas et al. 1990), the Draft Recovery Plan (USDI FWS 1992a), and the report from the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993), it was noted that limited federal ownership in some areas constrained the ability to form a network of old-forest reserves to meet the conservation needs of the spotted owl. In these areas in particular, non-federal lands would be important to the range-wide goal of achieving conservation and recovery of the spotted owl. The Service's primary expectations for private lands are for their contributions to demographic support (pair or cluster protection) to federal lands, or their connectivity with federal lands (USDI FWS 2008b, page 55). In addition, timber harvest within each state is governed by rules that provide protection of spotted owls or their habitat to varying degrees.

There are some current habitat conservation plans (HCP) in Washington, Oregon and California that have incidental take permits issued for spotted owls. The HCPs range in size from 40 acres to more than 1.6 million acres, although not all acres are included in the mitigation for spotted owls. In total, the HCPs cover approximately 2.9 million acres (9.1 percent) of the 32 million acres of non-federal forest lands in the range of the spotted owl. The period of time that the HCPs will be in place ranges from 5 to 100 years; however, most of the HCPs are of fairly long duration. While each HCP is unique, there are several general approaches to mitigation of incidental take:

- Reserves of various sizes, some associated with adjacent federal reserves
- Forest harvest that maintains or develops suitable habitat
- Forest management that maintains or develops dispersal habitat
- Deferral of harvest near specific sites

Washington. In 1996, the State Forest Practices Board adopted rules (Washington Forest Practices Board 1996) that would contribute to conserving the spotted owl and its habitat on non-federal lands. Adoption of the rules was based in part on recommendations from a Science Advisory Group that identified important non-federal lands and recommended roles for those lands in spotted owl conservation (Hanson et al. 1993, Buchanan et al. 1994). The 1996 rule package was developed by a stakeholder policy group and then reviewed and approved by the Forest Practices Board (Buchanan and Swedeen 2005). Spotted owl-related HCPs in Washington generally were intended to provide demographic or connectivity support (USDI FWS 1992b).

Oregon. The Oregon Forest Practices Act provides for protection of 70-acre core areas around sites occupied by an adult pair of spotted owls capable of breeding (as determined by recent protocol surveys), but it does not provide for protection of spotted owl habitat beyond these areas (Oregon Department of Forestry 2007). In general, no large-scale spotted owl habitat protection strategy or mechanism currently exists for non-federal lands in Oregon. The three spotted owl-related HCPs currently in effect cover more than 300,000 acres of non-federal lands. These HCPs are intended to provide some nesting habitat and connectivity over the next few decades.

California. The California State Forest Practice Rules, which govern timber harvest on private lands, require surveys for spotted owls in suitable habitat and to provide protection around activity centers (California Department of Forestry and Fire Protection 2007). Under the Forest Practice Rules, no timber harvest plan can be approved if it is likely to result in incidental take of federally listed species, unless the take is authorized by a federal incidental take permit (California Department of Forestry and Fire Protection 2007). The California Department of Fish and Game initially reviewed all timber harvest plans to ensure that take was not likely to occur; the Service took over that review function in 2000. Several large industrial owners operate under spotted owl management plans that have been reviewed by the Service and that specify basic measures for spotted owl protection. Four HCPs authorizing take of spotted owls have been approved; these HCPs cover more than 669,000 acres of non-federal lands. Implementation of these plans is intended to provide for spotted owl demographic and connectivity support to NWFP lands.

Current Condition of the Spotted Owl

The current condition of the species incorporates the effects of all past human activities and natural events that led to the present-day status of the species and its habitat (USDI FWS and USDC NMFS 1998).

Range-wide Habitat and Population Trends

Habitat Baseline. The 1992 Draft Spotted Owl Recovery Plan estimated approximately 8.3 million acres of spotted owl habitat remained range-wide (USDI FWS 1992a). However, reliable habitat baseline information for non-federal lands is not available (Courtney et al. 2004). The Service has used information provided by the Forest Service, BLM, and National Park Service to update the habitat baseline conditions on federal lands for spotted owls on several occasions since the spotted owl was listed in 1990. The estimate of 7.4 million acres used for the NWFP in 1994 (USDA FS and USDI BLM 1994a) was believed to be representative of the general amount of spotted owl habitat on these lands. This baseline has been used to track relative changes over time in subsequent analyses, including those presented here.

In 2005, a new map depicting suitable spotted owl habitat throughout the range of the spotted owl was produced as a result of the NWFP's effectiveness monitoring program (Lint 2005). However, the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects. The Service is evaluating the map for future use in tracking habitat trends. Additionally, there continues to be no reliable estimates of spotted owl habitat on non-federal lands; consequently, consulted-on acres can be tracked, but not evaluated in the context of change with respect to a reference condition on non-federal lands. The production of the monitoring program habitat map does, however, provide an opportunity for future evaluations of trends in non-federal habitat.

NWFP Lands Analysis 1994 – 2001. In 2001, the Service conducted an assessment of habitat baseline conditions, the first since implementation of the NWFP (USDI FWS 2001). This range-wide evaluation of habitat, compared to the Final Supplemental Environmental Impact Statement (FSEIS), was necessary to determine if the rate of potential change to spotted owl habitat was consistent with the change anticipated in the NWFP. In particular, the Service considered habitat effects that were documented through the section 7 consultation process since 1994. In general, the analytical framework of these consultations focused on the reserve and connectivity goals

established by the NWFP land-use allocations (USDA FS and USDI BLM 1994a), with effects expressed in terms of changes in suitable spotted owl habitat within those land-use allocations. The Service determined that actions and effects were consistent with the expectations for implementation of the NWFP from 1994 to June, 2001 (USDI FWS 2001).

Range-wide Analysis from 1994 to June 15, 2010. This section updates the information considered in USDI FWS (2001), relying particularly on information in documents the Service produced pursuant to section 7 of the Act and information provided by NWFP agencies on habitat loss resulting from natural events (e.g., fires, windthrow, insect and disease). To track impacts to spotted owl habitat, the Service designed the Consultation Effects Tracking System database which records impacts to spotted owls and their habitat at a variety of spatial and temporal scales. Data are entered into the database under various categories including, land management agency, land-use allocation, physiographic province, and type of habitat affected.

In 1994, about 7.4 million acres of suitable spotted owl habitat were estimated to exist on federal lands managed under the NWFP. As of June 15, 2010, the Service had consulted on the proposed removal and had natural events resulting in the loss of approximately 394,620 acres (Table 4) or 5.33 percent of 7.4 million acres (Table 4) of spotted owl suitable habitat on federal lands. Of the total federal acres consulted on for removal, approximately 226,726 acres (Table 4) or 3.07 percent of 7.4 million acres of spotted owl habitat were removed as a result of timber harvest. These changes in suitable spotted owl habitat are consistent with the expectations for implementation of the NWFP (USDA FS and USDI BLM 1994a).

April 13, 2004, marked the start of the second decade of the NWFP. Decade specific baselines and summaries of effects by State, physiographic province and land use function from proposed management activities and natural events are not provided here, but can be calculated using the Service's Consultation Effects Tracking System.

Habitat loss from federal lands due to management activities has varied among the individual provinces with most of the impacts concentrated within the Non-Reserve relative to the Reserve land-use allocations (Table 4). When habitat loss is evaluated as a proportion of the affected acres range-wide, the most pronounced losses have occurred within Oregon (84.23 %), especially within its Klamath (50%) and Western Cascades (24.07%) Provinces (Table 4), followed by much smaller habitat losses in Washington (7.52%) and California (8.25%) (Table 4). When habitat loss is evaluated as a proportion of provincial baselines, the Oregon Klamath Mountains (25.12%), Oregon Eastern Cascades (7.97%), and the California Cascades (5.45%) all have proportional losses greater than the range-wide mean (5.33%) (Table 4).

From 1994 through June 15, 2010, habitat lost due to natural events was estimated at approximately 167,894 acres (range-wide) (Table 4). About two-thirds of this loss was attributed to the Biscuit Fire that burned over 500,000 acres in southwest Oregon (Rogue River basin) and northern California in 2002. This fire resulted in a loss of approximately 113,451 acres of spotted owl habitat, including habitat within five LSRs. Approximately 18,630 acres of spotted owl habitat were lost due to the B&B Complex and Davis Fires in the Oregon Eastern Cascades Province.

Because there is no comprehensive spotted owl habitat baseline for non-federal lands, there is little available information regarding spotted owl habitat trends on non-federal lands. Yet, we do

know that internal Service consultations conducted since 1992, have documented the eventual loss of 406,012 acres (Table 3) of habitat on non-federal lands. Most of these losses have yet to be realized because they are part of large-scale, long-term HCPs. Combining effects on federal and non-federal lands, the Service had consulted on the proposed removal of approximately 658,991 acres of spotted owl habitat range-wide, resulting from all management activities, from 1994 to June 15, 2010 (Table 3).

Other Habitat Trend Assessments. In 2005, the Washington Department of Wildlife released the report, "An Assessment of Spotted Owl Habitat on Non-Federal Lands in Washington between 1996 and 2004" (Pierce et al. 2005). This study estimates the amount of spotted owl habitat in 2004 on lands affected by state and private forest practices. The study area is a subset of the total Washington forest practice lands, and statistically-based estimates of existing habitat and habitat loss due to fire and timber harvest are provided. In the 3.2-million acre study area, Pierce et al. (2005) estimated there was 816,000 acres of suitable spotted owl habitat in 2004, or about 25 percent of their study area. Based on their results, Pierce et al. (2005) estimated there were less than 2.8 million acres of spotted owl habitat in Washington on all ownerships in 2004. Most of the suitable owl habitat in 2004 (56%) occurred on federal lands, and lesser amounts were present on state-local lands (21%), private lands (22%) and tribal lands (1%). Most of the harvested spotted owl habitat was on private (77%) and state-local (15%) lands. A total of 172,000 acres of timber harvest occurred in the 3.2 million-acre study area, including harvest of 56,400 acres of suitable spotted owl habitat. This represented a loss of about 6 percent of the owl habitat in the study area distributed across all ownerships (Pierce et al. 2005). Approximately 77 percent of the harvested habitat occurred on private lands and about 15 percent occurred on State lands. Pierce et al. (2005) also evaluated suitable habitat levels in 450 spotted owl management circles (based on the provincial annual median spotted owl home range). Across their study area, they found that owl circles averaged about 26 percent suitable habitat in the circle across all landscapes. Values in the study ranged from an average of 7 percent in southwest Washington to an average of 31 percent in the east Cascades, suggesting that many owl territories in Washington are significantly below the 40 percent suitable habitat threshold used by the State as a viability indicator for spotted owl territories (Pierce et al. 2005).

Moeur et al. (2005) estimated an increase of approximately 1.25 to 1.5 million acres of medium and large older forest (greater than 20 inches dbh, single and multi-storied canopies) on federal lands in the NWFP area between 1994 and 2003. The increase occurred primarily in the lower end of the diameter range for older forest. The net area in the greater than 30 inch dbh size class increased by only an estimated 102,000 to 127,000 acres. The estimates were based on change-detection layers for losses due to harvest and fire and re-measured inventory plot data for increases due to ingrowth. Transition into and out of medium and large older forest over the 10-year period was extrapolated from inventory plot data on a subpopulation of Forest Service land types and applied to all federal lands. Because size class and general canopy layer descriptions do not necessarily account for the complex forest structure often associated with spotted owl habitat, the significance of these acres to spotted owl conservation remains unknown.

Spotted Owl Numbers, Distribution, and Reproduction Trends. There are no estimates of the size of the spotted owl population prior to settlement by Europeans. Spotted owls are believed to have inhabited most old-growth forests or stands throughout the Pacific Northwest, including northwestern California, prior to beginning of modern settlement in the mid-1800s (USDI FWS 1989). According to the final rule listing the spotted owl as threatened (USDI FWS 1990a),

approximately 90 percent of the roughly 2,000 known spotted owl breeding pairs were located on federally-managed lands, 1.4 percent on state lands, and 6.2 percent on private lands; the percent of spotted owls on private lands in northern California was slightly higher (Forsman et al. 1984, USDI FWS 1989, Thomas et al. 1990).

The current range of the spotted owl extends from southwest British Columbia through the Cascade Mountains, coastal ranges, and intervening forested lands in Washington, Oregon, and California, as far south as Marin County (USDI FWS 1990b). The range of the spotted owl is partitioned into 12 physiographic provinces (Figure 1) based on recognized landscape subdivisions exhibiting different physical and environmental features (Thomas et al. 1993). The spotted owl has become rare in certain areas, such as British Columbia, southwestern Washington, and the northern coastal ranges of Oregon.

As of July 1, 1994, there were 5,431 known site-centers of spotted owl pairs or resident singles: 851 sites (16 percent) in Washington, 2,893 sites (53 percent) in Oregon, and 1,687 sites (31 percent) in California (USDI FWS 1995). By June 2004, the number of territorial spotted owl sites recognized by Washington Department of Fish and Wildlife was 1,044 (Buchanan and Swedeen 2005). The actual number of currently occupied spotted owl locations across the range is unknown because many areas remain unsurveyed (USDI FWS 1992b, Thomas et al. 1993). In addition, historical sites may no longer be occupied because spotted owls have been displaced by barred owls, timber harvest, or severe fires, and it is possible that some new sites have been established due to reduced timber harvest on federal lands since 1994. The totals in USDI FWS (1995) represent the cumulative number of locations recorded in the three states, not population estimates.

Because the existing survey coverage and effort are insufficient to produce reliable range-wide estimates of population size, demographic data are used to evaluate trends in spotted owl populations. Analysis of demographic data can provide an estimate of the finite rate of population change (λ), which provides information on the direction and magnitude of population change. A λ of 1.0 indicates a stationary population, meaning the population is neither increasing nor decreasing. A λ of less than 1.0 indicates a decreasing population, and a λ of greater than 1.0 indicates a growing population. Demographic data, derived from studies initiated as early as 1985, have been analyzed periodically (Anderson and Burnham 1992, Burnham et al. 1994: Forsman et al. 1996, Anthony et al. 2006a) to estimate trends in the populations of the spotted owl.

In January 2004, two meta-analyses modeled rates of population change for up to 18 years using the re-parameterized Jolly-Seber method (λ_{RJS}). One meta-analysis modeled all 13 long-term study areas excluding the Marin study area, while the other modeled the eight study areas that are part of the effectiveness monitoring program of the NWFP (Anthony et al. 2006a). Data were analyzed separately for individual study areas, as well as across all study areas in a meta-analysis. Portion of these results are provided in Figure 1.

More recently, in January 2009, two meta-analyses modeled rates of population change for up to 24 years using the re-parameterized Jolly-Seber method (λRJS) (Table 5). One meta-analysis modeled the 11 long-term study areas, while the other modeled the eight study areas that are part of the effectiveness monitoring program of the NWFP (Forsman et al. 2010).

Point estimates of λRJS were all below 1.0 and ranged from 0.929 to 0.996 for the 11 long-term study areas. There was strong evidence that populations declined on 7 of the 11 areas (Forsman et al. 2010), these areas included Rainier, Olympic, Cle Elum, Coast Range, HJ Andrews, Northwest California and Green Diamond. On other four areas (Tyee, Klamath, Southern Cascades, and Hoopa), populations were either stable, or the precision of the estimates was not sufficient to detect declines. Demographic data suggest that populations over the 11 long-term demographic study areas decreased by about 2.9 percent from 1985 to 2008. The weighted mean λRJS for all of the 11 study areas was 0.971 (standard error [SE] = 0.007, 95 percent confidence interval [CI] = 0.960 to 0.983), which indicated an average population decline of 2.9 percent per year from 1985 to 2006. This is a lower rate of decline than the 3.7 percent reported by Anthony et al. (2006), but the rates are directly comparable because Anthony et al. (2006) examined a different series of years and because two of the study areas in their analysis were discontinued and not included in Forsman et al. (2010). Forsman et al. (2010) explains that the indication populations were declining was based on the fact that the 95 percent confidence intervals around the estimate of mean lambda did not overlap 1.0 (stable) or barely included 1.0.

The mean λRJS for the eight demographic monitoring areas (Cle Elum, Olympic, Coast Range, HJ Andrews, and Northwest California) that are part of the effectiveness monitoring program of the NWFP was 0.972 (SE = 0.006, 95 percent CI = 0.958 to 0.985), which indicated an estimated decline of 2.8 percent per year on Federal lands with the range of the spotted owl. The weighted mean estimate λRJS for the other three study areas (Rainier, Hoopa and Green Diamond) was 0.969 (SE = 0.016, 95 percent CI = 0.938 to 1.000), yielding an estimated average decline of 3.1 percent per year. These data suggest that demographic rates for spotted owl populations on Federal lands were somewhat better than elsewhere; however, this comparison is confounded by the interspersion of non-Federal land in study areas and the likelihood that spotted owls use habitat on multiple ownerships in some demography study areas. Decreases in apparent adult survival rates were an important factor contributing to decreasing population trends.

The number of populations that declined and the rate at which they have declined are noteworthy, particularly the precipitous declines in the Olympic, Cle Elum, and Rainier study areas in Washington and the Coast Range study area in Oregon. Estimates of population declines in these areas ranged from 40 to 60 percent during the study period through 2006 (Forsman et al. 2010). Spotted owl populations on the HJ Andrews, Northwest California, and Green Diamond study areas declined by 20-30 percent whereas the Tyee, Klamath, Southern Cascades, and Hoopa study areas showed declines of 5 to 15 percent.

Decreases in adult apparent survival rates were an important factor contributing to decreasing population trends. Forsman et al. (2010) found apparent survival rates were declining on 10 of the study area with the Klamath study area in Oregon being the exception. Estimated declines in adult survival were most precipitous in Washington where apparent survival rates were less than 80 percent in recent years, a rate that may not allow for sustainable populations (Forsman et al. 2010). In addition, declines in adult survival for study areas in Oregon have occurred predominately within the last five years and were not observed in the previous analysis by Anthony et al. 2006. Forsman et al. (2010) express concerns by the collective declines in adult survival across the subspecies range because spotted owl populations are most sensitive to changes in adult survival.

There are few spotted owls remaining in British Columbia. Chutter et al. (2004) suggested immediate action was required to improve the likelihood of recovering the spotted owl population in British Columbia. So, in 2007, personnel in British Columbia captured and brought into captivity the remaining 16 known wild spotted owls. Prior to initiating the captive-breeding program, the population of spotted owls in Canada was declining by as much as 35 percent per year (Chutter et al. 2004). The amount of previous interaction between spotted owls in Canada and the United States is unknown (Chutter et al. 2004).

Table 3. Changes to Northern Spotted Owl Suitable[1] Habitat Acres from Activities Addressed in Section 7 Consultations (both formal and informal) and other Causes, Range-wide from 1994 to June 15, 2010.

Land Ownership		Consulted On Habitat Changes[2]		Other Habitat Changes[3]	
		Removed/ Downgraded	Maintained	Removed/ Downgraded	Maintained
Federal - Forest Plan	Bureau of Land Management	101,186	56,166	760	0
	Forest Service	117,740	472,821	36,911	5,481
	National Park Service	3,916	5,286	3	0
	Multi-agency[4]	15,381	23,314	0	0
	Subtotal	238,223	557,587	37,674	5,481
Other Management and Conservation Plans (OMCP)	Bureau of Indian Affairs and Tribes	110,123	28,398	2,398	0
	Habitat Conservation Plans	295,889	14,430	0	0
	OMCP Subtotal	406,012	42,828	2,398	0
Other Federal Agencies & Lands[5]		283	466	28	70
Other Public & Private Lands[6]		14,473	880	30,240	20,949
TOTAL Changes		658,991	601,761	70,340	26,500

[1] Nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.
[2] Includes both effects reported by USDI FWS (2001) and subsequent effects compiled in the Spotted Owl Consultation Effects Tracker (web application and database).
[3] Includes effects to NRF habitat (as documented through technical assistance) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation.
[4] The 'Multi-agency' grouping is used to lump a variety of NWFP mixed agency or admin unit consultations that were reported together prior to 6/26/2001, and cannot be split out.
[5] Includes lands that are owned or managed by other federal agencies not included in the NWFP.
[6] Includes lands not covered by Habitat Conservation Plans that are owned or managed by states, counties, municipalities, and private entities. Effects that occurred on private lands from right-of-way permits across Forest Service and BLM lands are included here.

Table 4. Acres of Northern Spotted Owl Suitable (NRF[1]) Habitat Loss on Federal Lands from 1994 to June 15, 2010 from Proposed Management Activities and Natural Events: Baseline and Summary of Effects by State, Physiographic Province and Land Use Function.

Physiographic Province[4]		Evaluation Baseline[2]			Habitat Removed/Downgraded[3]				% Provincial Baseline Affected	% of Range-wide Effects
		Reserves[5]	Non-reserves[6]	Total	Reserves[5]	Non-reserves[6]	Habitat loss to natural events[7]	Total		
WA	Olympic Peninsula	548,483	11,734	560,217	867	24	299	1,190	0.21	0.30
	Eastern Cascades	506,340	200,509	706,849	4,028	6,082	5,754	15,864	2.24	4.02
	Western Cascades	864,683	247,797	1,112,480	1,681	10,924	0	12,605	1.13	3.19
	Western Lowlands	0	0	0	0	0	0	0	0.00	0.00
OR	Coast Range	422,387	94,190	516,577	734	3,938	66	4,738	0.92	1.20
	Klamath Mountains	448,509	337,789	785,589	23,402	72,245	101,676[8]	197,323[9]	25.12	50.00
	Eastern Cascades	247,624	196,035	443,659	2,343	13,448	19,547	35,338	7.97	8.96
	Western Cascades	1,012,426	1,033,337	2,046,472	4,020	66,397	24,583	95,000	4.64	24.07
	Willamette Valley	593	5,065	5,658	0	0	0	0	0.00	0.00
CA	Coast Range	47,566	3,928	51,494	455	65	100	620	1.20	0.16
	Cascades	61,852	26,385	88,237	0	4,809	0	4,809	5.45	1.22
	Klamath	734,103	345,763	1,079,866	1,545	9,719	15,869	27,133	2.51	6.88
Total		4,894,566	2,502,532	7,397,098	39,075	187,651	167,894	394,620	5.33	100.00

[1] Nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components; nesting – roosting (NR) habitat, and foraging (F) habitat. The NR component most closely resembles NRF habitat in Oregon and Washington. Due to differences in reporting methods, effects to suitable habitat compiled in this, and all subsequent tables include effects for nesting, roosting, and foraging (NRF) for 1994-6/26/2001. After 6/26/2001, suitable habitat includes NRF for Washington and Oregon but only nesting and roosting (NR) for California.

[2] 1994 FSEIS baseline (USDA FS and USDI BLM 1994b).

[3] Includes consulted-on effects reported by USDI FWS (2001) and subsequent effects compiled in the Northern Spotted Owl Consultation Effects Tracking System database.

[4] Defined by the NWFP as the twelve physiographic provinces, as presented in Figure 3&4-1 on page 3&4-16 of the FSEIS.

[5] Land-use allocations intended to provide large blocks of habitat to support clusters of breeding pairs

[6] Land-use allocations intended to provide habitat to support movement of spotted owls among reserves.

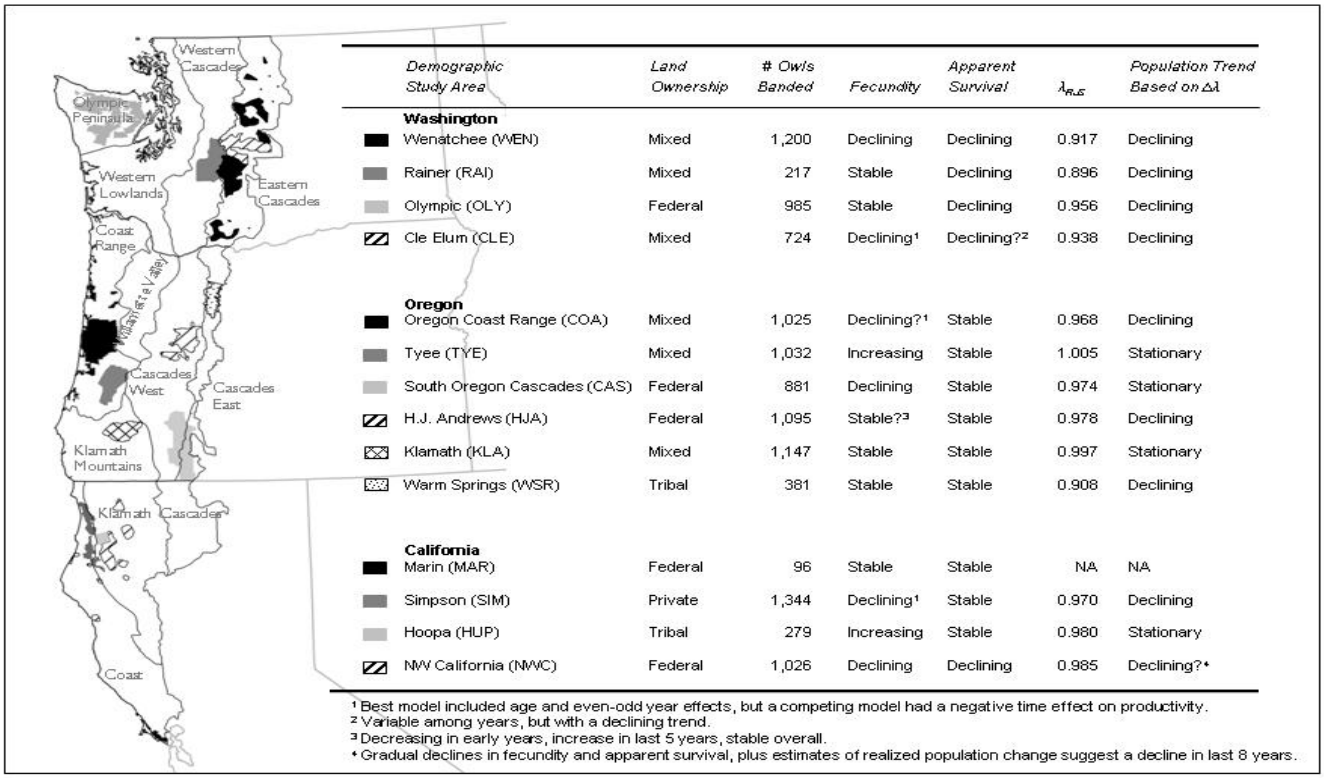
[7] Acres for all physiographic provinces, except the Oregon Klamath Mountains and Oregon Eastern Cascades, are from the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004).

[8] Acres data in the Northern Spotted Owl Consultation Effects Tracking Database.

[9] Acres data in the Northern Spotted Owl Consultation Effects Tracking Database.

Figure 1 depicts the physiographic provinces within the range of the spotted owl, and identifies demographic study areas and demographic trends as of 2006. Recent demographic trends (Forsman et al 2010, in press) are displayed in Table 5.

Figure 1. Physiographic provinces, northern spotted owl demographic study areas, and demographic trends (Anthony et al. 2006a).



Demographic Study Area	Land Ownership	# Owls Banded	Fecundity	Apparent Survival	λ_{RJS}	Population Trend Based on $\Delta\lambda$
Washington						
Wenatchee (WEN)	Mixed	1,200	Declining	Declining	0.917	Declining
Rainer (RAI)	Mixed	217	Stable	Declining	0.896	Declining
Olympic (OLY)	Federal	985	Stable	Declining	0.956	Declining
Cle Elum (CLE)	Mixed	724	Declining[1]	Declining?[2]	0.938	Declining
Oregon						
Oregon Coast Range (COA)	Mixed	1,025	Declining?[1]	Stable	0.968	Declining
Tyee (TYE)	Mixed	1,032	Increasing	Stable	1.005	Stationary
South Oregon Cascades (CAS)	Federal	881	Declining	Stable	0.974	Stationary
H.J. Andrews (HJA)	Federal	1,095	Stable?[3]	Stable	0.978	Declining
Klamath (KLA)	Mixed	1,147	Stable	Stable	0.997	Stationary
Warm Springs (WSR)	Tribal	381	Stable	Stable	0.908	Declining
California						
Marin (MAR)	Federal	96	Stable	Stable	NA	NA
Simpson (SIM)	Private	1,344	Declining[1]	Stable	0.970	Declining
Hoopa (HUP)	Tribal	279	Increasing	Stable	0.980	Stationary
NW California (NWC)	Federal	1,026	Declining	Declining	0.985	Declining?[4]

[1] Best model included age and even-odd year effects, but a competing model had a negative time effect on productivity.
[2] Variable among years, but with a declining trend.
[3] Decreasing in early years, increase in last 5 years, stable overall.
[4] Gradual declines in fecundity and apparent survival, plus estimates of realized population change suggest a decline in last 8 years.

Table 5. Spotted Owl Demographic Parameters (1985-2008) from Demographic Study Areas (adapted from Forsman et al. 2010, *in press*).

Study Area	Fecundity	Apparent Survival Model Average	$^{\lambda}$RJS	Population Change
Cle Elum	Declining	Declining	0.937	Declining
Rainier	Increasing	Declining	0.929	Declining
Olympic	Stable	Declining	0.957	Declining
Coast Ranges	Increasing	Declining since 1998	0.966	Declining
HJ Andrews	Increasing	Declining since 1997	0.977	Declining
Tyee	Stable	Declining since 2000	1.996	Stationary
Klamath	Declining	Stable	0.990	Stationary
S. Cascades	Declining	Declining since 2000	0.982	Stationary
NW California	Declining	Declining	0.983	Declining
Hoopa	Stable	Declining since 2004	0.989	Stationary
GDR	Declining	Declining	0.972	Declining

Status of Spotted Owl Critical Habitat

Legal Status

On January 15, 1992, the Service designated critical habitat for the spotted owl within 190 critical habitat units (CHUs) which encompassed nearly 6.9 million acres across Washington (2.2 million acres), Oregon (3.3 million acres), and California (1.4 million acres) (USDI FWS 1992b). Only Federal lands were designated as critical habitat in that final rule (USDI FWS 1992b). In 2008 the Service re-designated critical habitat for the spotted owl in 29 units on approximately 5,312,300 acres of Federal lands in California, Oregon, and Washington (USDI FWS 2008a). Section 7 analyses of activities affecting spotted owl critical habitat should consider effects on the ability of critical habitat to support a viable spotted owl population at the individual CHU level, at the network of functional units within a physiographic province scale, as well as at the range-wide scale. The adverse modification finding is based upon whether the local effects appreciably reduce the conservation role of affected critical habitat at the provincial or range-wide scale for the survival or recovery of the spotted owl (USDI FWS 2008a, page 47358).

Primary Constituent Elements

Primary constituent elements (PCEs) are the physical and biological features of critical habitat essential to a species' conservation. PCEs identified in the spotted owl critical habitat final rule include forest types that support nesting, roosting, foraging, and/or dispersal habitat and lands capable of these features in the future (USDI FWS 2008a, pages 47347-47348).

Conservation Role of Critical Habitat

The conservation role of spotted owl critical habitat is to support a viable spotted owl population at the range-wide scale by providing a network of functional units within each physiographic province, excluding the Willamette and Western Washington Lowland Provinces. The size and distribution of these critical habitat units in the western part of the species' range are based on the "Managed Owl Conservation Areas," or MOCAs identified in the Recovery Plan for the Northern Spotted Owl, while those units east of the Cascades in the dry-forest areas are based on the draft MOCAs from the 2007 Draft Recovery Plan for the Northern Spotted Owl (USDI FWS 2007). MOCAs and draft MOCAs are intended to support stable and well-distributed populations of spotted owls over time and allow for movement of spotted owls across the network of MOCAs.

MOCAs are a network of large habitat blocks, capable of supporting 20 or more breeding pairs of owls (MOCA 1s), and smaller habitat blocks capable of supporting up to 19 breeding pairs of owls (MOCA 2s). The 2008 final recovery plan recommends a network of MOCA 1s and MOCA 2s in the westside provinces and adopts a broader scale landscape management strategy without defined boundaries in the fire-prone provinces in the eastside of the species' range.

The federal lands comprising the MOCA network of the final recovery plan include areas of congressionally-reserved lands, such as designated wilderness areas. These areas were therefore

included in the recovery plan's assessment that the MOCA network is sufficient to achieve the recovery of the spotted owl. However, congressionally-reserved lands such as wilderness areas and national parks are not included within the boundaries of the critical habitat designation since no special management considerations are needed in these areas to conserve the area for spotted owl use. The contribution of these congressionally-reserved areas must be considered in any evaluation of the sufficiency of the overall conservation habitat network recommended for the recovery of the spotted owl.

Critical Habitat Units and Managed Owl Conservation Areas – 2008

According to the Assessment, no activities included in the proposed action are planned to occur within critical habitat for the spotted owl, designated in 2008 (USDI FWS 2008a). However, at this time, the Service anticipates the possibility that the 2008 spotted owl critical habitat designation may be vacated based on on-going litigation. If this occurs, the 1992 spotted owl critical habitat designation may likely replace the 2008 designation for the near future.

Critical Habitat Unit OR 38 – 1992 Designated Critical Habitat

Some activities included in the proposed action are planned to occur within critical habitat for the spotted owl, designated in 1992. The potential effects are described in the Effects to Critical Habitat section, below. Federally-managed public lands in CHU OR 38 were designated to maintain and improve existing essential spotted owl NRF and dispersal habitats located within the area that links the Cascades West and Klamath Mountains physiographic provinces. Fifty-two percent of CHU OR 38 occurs within the boundary of the Cascade-Siskiyou National Monument (CSNM), on federal public lands managed by the District. As described in the Assessment, management activities within the monument will be designed to enhance and restore ecological values, including spotted owl habitat. CHU OR 38 consists of 66,642 acres, of which 41,578 acres represent federally managed lands. The remaining 25,064 acres include private and state managed lands. According to the Assessment, all federal lands in this CHU are managed by the District. Currently, approximately 14,120 acres (31 percent) of spotted owl NRF habitat and an additional 23,699 acres (35 percent) of spotted owl dispersal habitat occur in CHU OR 38.

ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed federal projects in the action area which have undergone section 7 consultations, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

The Assessment included the following (Table 6), describing the Environmental Baseline of spotted owl habitats in the action area by section seven watershed.

Table 6. Environmental Baseline of Spotted Owl Habitats.

Environmental Baseline of Spotted Owl Habitats	
Illinois Watershed	**Acres**
Total acres all ownership	632,699
Total acres non-Medford BLM ownership	566,521
Total acres Medford BLM	66,637
Non-habitat	7,513
Capable	22,306
Dispersal	9,807
NRF	27,016
Other Federal NRF	142,690
Non-Federal NRF	26,021
Little Butte Watershed	**Acres**
Total acres all ownership	238,594
Total acres non-Medford BLM ownership	184,303
Total acres Medford BLM	54,291
Non-habitat	14,116
Capable	17,968
Dispersal	5,985
NRF	16,222
Other Federal NRF	23,115
Non-Federal NRF	3,058
Bear Watershed	
Total acres all ownership	231,095
Total acres non-Medford BLM ownership	204,852
Total acres Medford BLM	26,243
Non-habitat	9,086
Capable	4,222
Dispersal	1,994
NRF	10,942
Other Federal NRF	10,788
Non-Federal NRF	12,130
Klamath Watershed	
Total acres all ownership	396,386
Total acres non-Medford BLM ownership	329,880
Total acres Medford BLM	66,506
Non-habitat	32,337
Capable	12,289
Dispersal	3,514
NRF	18,366

Environmental Baseline of Spotted Owl Habitats	
Other Federal NRF	28,192
Non-Federal NRF	39,734
Information not available for the California part of the Klamath Watershed	[redacted]
Rogue Upper Watershed	
Total acres all ownership	793,935
Total acres non-Medford BLM ownership	685,565
Total acres Medford BLM	108,370
Non-habitat	10,339
Capable	33,656
Dispersal	22,878
NRF	41,497
Other Federal NRF	172,524
Non-Federal NRF	24,222

The proposed action is planned to occur within the Klamath Mountains and Cascades West Physiographic Provinces. As of June 15, 2010 approximately 588,266 of spotted owl NRF habitat occurs within the Klamath Mountains province (calculated using the data found in Table 4). Management activities have resulted in the loss of approximately 23,402 acres in reserve areas, and additional 72,245 acres of spotted owl NRF habitat in non-reserves in this province. An additional 101,676 acres of spotted owl NRF habitat were lost due to natural events (Table 4) in the Klamath province. The Cascades West physiographic province currently is comprised of approximately 2,046,472 acres of spotted owl NRF habitat (calculated using the data found in Table 4), of which management activities have removed or downgraded approximately 4,020 acres in reserve areas, and approximately 66,397 acres in non-reserves. In addition, approximately 24,583 acres have been lost due to natural events.

Spotted Owl Sites within the Action Area

Table 7 displays the number of historic and computer generated spotted owl sites at the watershed and individual project scales.

Table 7. Spotted Owl Sites by Section Seven Watershed and Project Area

	Number of spotted owl sites (centers) within the affected Watersheds *	Number of spotted owl home ranges that overlap proposed treatment units.
Illinois Watershed	**50**	
Deer North		**7**
East West Junction		**3**
Little Butte Watershed	**33**	
DF Restore		**1**
Klamath Watershed	**26**	
Swinning		**4**
Bear Watershed	**28**	
Sampson Cove		**7**
Rogue Upper	**90**	
Twin Ranch		**5**

*According to the Assessment, this number represents spotted owl sites that primarily occur on federal lands managed by the District, and some sites that occur on federal lands managed by the Forest Service. There are likely more spotted owl sites on Forest Service lands not included in this number.

Occupancy

Spotted owl sites affected by the proposed action are located in the Klamath Mountains and Cascades West Physiographic Provinces. According to the Forsman et al. (2010, *in press*), populations in both the Klamath and South Cascades demography study areas each had population trend estimates of less than 1.0 (Table 5); however, the confidence intervals overlapped 1.0, suggesting the population could be stationary. Range-wide, the spotted owl population was declining at an average annual rate of almost 3 percent (Forsman et al. 2010, *in press*). From individual study initiation, the proportion of spotted owls has declined from 5 to as much as 60 percent, for each of the 11 individual areas (Forsman et al. 2010, *in press*).

Three of the timber sales (Deer North, East West Junction, and DF Restore) included in the proposed action are planned to occur within the Klamath Mountains physiographic province (Table 2). As stated above, approximately 588,266 acres of spotted owl NRF habitat occurs within this province. As documented in Horn et al. (2009) for the Klamath Demographic Study Area, 156 spotted owl sites were surveyed to demographic survey protocol in 2008 and 2009. Spotted owls occupied 72 (2008) and 63 (2009) percent of the sites visited, indicating a slight decrease in occupancy between years. Overall, spotted owl site occupancy rate has been in a steady decline since 2002 (Horn et al. 2009).

The remaining three timber sales (Swinning, Sampson Cove and Twin Ranch) are planned to occur within the Cascades West physiographic province (Table 2). As indicated above, approximately 2,046,472 acres of spotted owl NRF habitat currently occurs in this province. As

documented in the 2009 annual report for the South Cascades Study Area, (Anthony et al. 2010), well over 120 spotted owl sites have been surveyed across the study area for many years. The lowest percentage (45 percent) of occupied sites was recorded in 2009. Similar to the Klamath Study Area, there has been a continuing decline in site occupancy during the past decade.

Reproduction

Forsman et al. (2010) found evidence of nine of the 11 study areas had an even-odd year effect on fecundity, with higher fecundity in the even years. For the 11 study areas, fecundity was declining on four areas, stable on four areas, and increasing on three areas. Specifically for the Klamath and Southern Cascades study areas, fecundity was shown to be declining through time for both areas.

Barred Owls

As discussed in the *Status of the Species* section, the 2008 Final Recovery Plan for the Northern Spotted Owl (USDI FWS 2008b) identifies competition from the barred owl (*Strix varia*) as an important threat to the spotted owl. Barred owls are native to eastern North America, but during the past century, have moved westward, arriving in the Pacific Northwest a couple of decades ago and settling into spotted owl habitat. Since barred owls are less selective about the habitat they use and the prey they feed on, they are out competing northern spotted owls for habitat and food (USDI FWS 2008b). For each of the individual demographic study areas, there has been an almost steady increase in the number of barred owls as measured by the proportion of spotted owl sites with barred owls detected (Forsman et al. 2010, *in press*). In some areas, as many of 60 percent of the spotted owl sites have barred owls detected; specifically for the Klamath and South Cascades study areas, approximately 30 percent of the spotted owl sites have barred owls in recent years. Forsman et al. (2010, *in press*) found evidence barred owl detections were important sources of variation and had negative effects on spotted owl apparent survival and recruitment. Barred owls are attributed to a decline in spotted owls (Forsman et al. 2010, *in press*).

Barred owl detections on the District have generally occurred opportunistically; however, these opportunistic detections indicate there is a trend of increasing numbers of barred owls within the District boundary, following a similar pattern to the surrounding demographic study areas.

Role of the Action Area in Spotted Owl Survival and Recovery

Under the conservation strategy set forth in the NWFP and the Spotted Owl Recovery Plan, the action area, which occurs within the matrix land use allocation, is intended to provide for spotted owl dispersal between habitat blocks reserved for breeding spotted owls.

The NWFP conservation strategy for the spotted owl does not rely on nesting pairs and nesting habitat outside of reserved habitat blocks to maintain and recover the spotted owl population. As discussed above under the *Status of the Species* section, it was assumed under the NWFP that about 2.5 percent of Matrix lands would be subject to timber harvest per decade. At that rate, a large area of Matrix is expected to continue to support nesting spotted owls and the overall species' population while additional spotted owl suitable habitat is developing within the late

Successional reserve system. In the first decade of the NWFP, timber harvest in the Matrix land use allocation was consistent with that assumption. As discussed in the *Status of the Species* section, the NWFP along with the strategy outlined in the Spotted Owl Recovery Plan is the basis for the federal contribution to spotted owl recovery, even in light of spotted owl population declines and threats from such things as barred owls and West Nile virus.

Critical Habitat within the Action Area – 1992 designated

As stated earlier, according to the Assessment, the activities included in the proposed action will not occur within spotted owl critical habitat designated in 2008. However, due to on-going litigation which may result in vacating the 2008 critical habitat rule and reverting to the 1992 may occur. Therefore, a cursory analysis of impacts to the 1992 critical habitat is provided.

Generally, critical habitat within the action area occurs as fragmented stands of varying quality habitat, ranging from intact stands of late seral Douglas fir dominated forest to small patches of mid to late seral forest. Within critical habitat unit (OR 38) affected by this proposed action forest structure has been modified as a result of timber harvest activities, conversion of forest lands to urban development, as well as natural disturbance events such as wildland fires, resulting in a patchwork of age classes of forest throughout the CHU.

Federally-managed public lands in CHU OR 38 were designated to maintain and improve existing essential spotted owl NRF and dispersal habitats located within the area that links the Cascades West and Klamath Mountains physiographic provinces. Fifty-two percent of CHU OR 38 occurs within the boundary of the Cascade-Siskiyou National Monument (CSNM), on federal public lands managed by the District. As described in the Assessment, management activities within the monument will be designed to enhance and restore ecological values, including spotted owl habitat. CHU OR 38 consists of 66,642 acres, of which 41,578 acres represent federally managed lands. The remaining 25,064 acres include private and state managed lands. According to the Assessment, all federal lands in this CHU are managed by the District. Currently, approximately 14,120 acres of spotted owl NRF habitat and an additional 23, 699 acres of spotted owl dispersal habitat occur in CHU OR 38.

EFFECTS OF THE ACTION

Background Information

Effects of the action refer to the permanent or temporary direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action that will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action, occur later in time, but are still reasonably certain to occur.

The decline of the spotted owl throughout its range is in part linked to the removal and degradation of suitable habitat (USDI FWS 2001, Courtney et al. 2004). Specific vegetational and structural components are associated with spotted owl suitable habitat (USDI FWS 2001, Courtney et al. 2004). The removal of any of those components can cause adverse effects to spotted owls by:

- Displacing spotted owls from nesting, roosting, or foraging areas;
- Concentrating displaced spotted owls into smaller, fragmented patches of suitable habitat that may already be occupied;
- Increasing intra-specific competition for suitable nest sites;
- Decreasing survival of displaced spotted owls and their offspring by increasing their exposure to predators and/or limiting the availability of food resources;
- Diminishing the future reproductive productivity of displaced nesting pairs that may forgo nesting temporarily following their displacement; and
- Diminishing spotted owl population size due to declines in productivity and recruitment.

The effects of habitat modification activities and the duration of those effects on spotted owls depend upon the type of silvicultural prescriptions used and the location of the harvest relative to suitable habitat. The impacts of timber harvest may include the removal or downgrading of suitable habitat and/or altering of suitable habitat by the creation of exposed habitat edges. Harvest prescriptions that remove spotted owl suitable habitat and other harvest prescriptions that result in even-aged, monotypic forest stands that would not be suitable for nesting, roosting, or foraging, are likely to adversely affect spotted owls by reducing the available amount and quality of habitat. Silvicultural prescriptions that promote multi-aged and multi-storied stands may retain the suitability of habitat within affected stands for spotted owls and may increase the quality of that habitat over time (USDI FWS 2007).

Effects to Spotted Owls

The Service uses the guidance of 40 percent at the scale of a spotted owl home range to determine if incidental take of the spotted owl is likely to occur when suitable habitat is removed by a timber harvest action. If a proposed action will reduce the amount spotted owl suitable habitat within a provincial home range to less than 40 percent, incidental take of the spotted owl(s) occupying that home range is considered to be likely. The best available information and professional judgment of spotted owl experts support a finding that under those conditions the nesting, foraging, or roosting behavior of affected spotted owls is likely to be disrupted to the degree that harm is likely (USDI/USDA 2008). For similar reasons, the Service has used 50 percent at the scale of a spotted owl core area (500 acres - 0.5 mile radius circle around the activity center) to determine if timber harvest actions are likely to cause take of the spotted owl (USDI/USDA 2008). If the amount of suitable habitat within a specific core area equals less than 250 acres, take of spotted owls is likely to occur. Any habitat removal at or in the immediate vicinity of a spotted owl nest patch (which equals approximately 70 acres) is generally considered by the Service to cause take of the spotted owl (USDI/USDA 2008). Please see the Incidental Take Statement of this document for a definition of take as relates to the activities included in the proposed action.

The District has determined implementation of the activities included in the proposed action may affect up to 27 individual spotted owl sites. Within 18 of the 27 spotted owl sites, planned timber harvest activities will not occur within the nest patch of these sites. However, the District plans to implement timber harvest activities that will maintain spotted owl NRF habitat within the core and home range scales of these 18 sites. The prescriptions, if implemented correctly, should

provide for the necessary canopy cover and other attributes of spotted owl habitat such as down wood, snags, hardwoods, etc. (see page 7 for a description of NRF Maintained), thus accommodating spotted owl prey-habitat needs (see Effects to Prey section below) and continued use of these areas by spotted owls. While there are no experimental studies currently available relating spotted owl response to thinning in NRF habitat, there are observational accounts that provide support to the relationship of spotted owl use of thinned NRF habitat (Solis 1983, Forsman et al. 1984, King 1993, Anthony and Wagner 1998, and Hicks 1999). A case study conducted by Meiman et al (2003) did show potential negative effects due to NRF thinning to one owl that was radio-tracked in the Oregon Coast Range. The areas mentioned above, except Anthony and Wagner, all have northern fly squirrels as the primary prey item, whereas in the Action Area, both flying squirrels and woodrats are the co-dominate prey items (Forsman et al. 2004). Therefore, spotted owls in southwest Oregon are afforded a more diverse large-prey food source which likely results in relative increases in energetic benefitted foraging opportunities and fitness of spotted owls. For the reasons of large-prey variety/availability, thinning prescriptions maintaining important elements of spotted owl habitat, and observational findings of spotted owl use of thinned NFR habitat, the Service anticipates continued function of NRF habitat post-treatment within the Action Area.

The District provided the following tabular (Table 8) and narrative information for the remaining nine spotted sites, within which spotted owl NRF habitat may be removed or downgraded, or in which proposed treatments are planned to occur within the nest patch of the affected spotted owl site.

Table 8. Effects to Spotted Owl Sites at the Nest Patch, Core Area, and Home Range.

	NEST PATCH (300M)		CORE AREA (0.5 MILES)		HOME RANGE (1.3/1.2 MILES)		SALES AFFECTING SITES
	CURRENT NRF ACRES (% NP)	POST NRF ACRES (% NP)	CURRENT NRF ACRES (% CORE)	POST NRF ACRES (% CORE)	CURRENT NRF ACRES (% HR)	POST NRF ACRES (% HR)	
SITE # 0967O (BLM)							
ALL NRF	45 (64.3)	45 (64.3)	209 (41.8)	209 (41.8)	512 (17.4)	510 (17.3)	SAMPSON COVE (CASCADES WEST)
FEDERAL NRF ONLY	45 (64.3)	45 (64.3)	207 (41.4)	207 (41.4)	485 (16.4)	483 (16.4)	
SITE # 10HCRDO (USFS)							
ALL NRF	53 (75.7)	53 (75.7)	303 (60.6)	303 (60.6)	1305 (44.2)	1252 (42.4)	TWIN RANCH (CASCADES WEST)
FEDERAL NRF ONLY	53 (75.7)	53 (75.7)	303 (60.6)	303 (60.6)	1297 (44)	1244 (42.1)	
SITE # 119G (BLM)							
ALL NRF	59 (84.3)	59 (84.3)	180 (36)	180 (36)	1017 (30.4)	1014 (30.4)	DEER NORTH (KLAMATH)
FEDERAL NRF ONLY	59 (84.3)	59 (84.3)	118 (23.6)	118 (23.6)	298 (8.9)	295 (8.8)	
SITE # 133G (BLM)							
ALL NRF	67 (95.7)	18 (25.7)	251 (50.2)	171 (34.2)	866 (25.9)	783 (23.4)	EAST WEST JUNCTION (KLAMATH)
FEDERAL NRF ONLY	58 (82.9)	9 (12.9)	139 (27.8)	58 (11.6)	376 (11.3)	293 (8.8)	
SITE # 158G (BLM)							
ALL NRF	47 (67.1)	47 (67.1)	163 (32.6)	163 (32.6)	665 (22.5)	663 (22.5)	SWINNING (CASCADES WEST)
FEDERAL NRF ONLY	47 (67.1)	47 (67.1)	156 (31.2)	156 (31.2)	629 (21.3)	627 (21.3)	
SITE # 180G (BLM)*							
ALL NRF	49 (70)	49 (70)	116 (23.2)	116 (23.2)	369 (12.5)	368 (12.5)	SWINNING (CASCADES WEST)
FEDERAL NRF ONLY	49 (70)	49 (70)	116 (23.2)	116 (23.2)	366 (12.4)	365 (12.4)	

	NEST PATCH (300M)		CORE AREA (0.5 MILES)		HOME RANGE (1.3/1.2 MILES)		SALES AFFECTING SITES
	CURRENT NRF ACRES (% NP)	POST NRF ACRES (% NP)	CURRENT NRF ACRES (% CORE)	POST NRF ACRES (% CORE)	CURRENT NRF ACRES (% HR)	POST NRF ACRES (% HR)	
SITE # 2059O (BLM)							
ALL NRF	38 (54.3)	38 (54.3)	113 (22.6)	109 (21.8)	681 (23.1)	533 (18.1)	TWIN RANCH (CASCADES WEST)
FEDERAL NRF ONLY	38 (54.3)	38 (54.3)	113 (22.6)	109 (21.8)	681 (23.1)	533 (18.1)	
SITE # 3260O (BLM)							
ALL NRF	23 (32.9)	23 (32.9)	91 (18.2)	91 (18.2)	1187 (40.2)	1132 (38.4)	TWIN RANCH (CASCADES WEST)
FEDERAL NRF ONLY	23 (32.9)	23 (32.9)	91 (18.2)	91 (18.2)	1187 (40.2)	1132 (38.4)	
SITE # 4608O (BLM)							
ALL NRF	52 (74.3)	52 (74.3)	261 (52.2)	261 (52.2)	1133 (33.9)	1129 (33.8)	DEER NORTH (KLAMATH)
FEDERAL NRF ONLY	50 (71.4)	50 (71.4)	219 (43.8)	219 (43.8)	406 (2.2)	402 (12.0)	

Site # 0967O (Sampson Cove) (denotes timber sale name)
This site was last monitored in 2006 with a resident single owl located. Previously, the site was occupied by a pair in 2005, a resident single in 2003, and a successful nesting pair in 2000.

Under the Sampson Cove timber sale, no timber harvest would occur within the 100-acre KSOAC or the nest patch. District staff did identified two (2) acres of a harvest unit (NRF downgrade) overlapping with the home range of spotted owl site number 0967O (see Table 8). Subsequently, the District made the decision to drop these two acres of spotted owl NRF habitat that occur within the home range of site number 09670. However, harvest within the provincial home range radius will be limited to those prescriptions that "treat and maintain" spotted owl habitat.

Site # 10HCRCO (Twin Ranch)
One historic site is known to occur on lands managed by the Rogue-Siskiyou National Forest (northeast corner of township 35 south, range 4 east, section 7); in 2002 surveys determined a

new site (to the east) within the same section based on a single owl. The nest patch for this new location is outside the Twin Ranch timber sale units.

Protocol surveys (USDI FWS 2010) to determine occupancy will be completed during the next few years. If spotted owls are found, the District plans to drop or modify prescriptions within the provincial radius of the new site to "treat and maintain." If surveys fail to detect spotted owls, the District plans to move forward with harvest activities that remove up to 53 acres of spotted owl NRF habitat in the home range of the site, as displayed in Table 8.

Site # 119G (Deer North)
This computer generated site (USDI/USDA 2008) occurs in un-surveyed spotted owl NRF habitat. District staff originally identified three (3) acres of spotted owl NRF (from the Districts GIS owl-habitat layer) that would be downgraded within this predicted home range. However, subsequent field inspections by District biologists identified those three acres as spotted owl dispersal habitat. Therefore, the District has determined the proposed timber harvest and activity fuels treatments planned to occur on these three acres would not likely to adversely affect spotted owls because the treatments would maintain spotted owl dispersal habitat within the home range of this site, rather than downgrade NRF as originally identified.

Site # 133G (East West Junction)
This computer generated site occurs within un-surveyed spotted owl NRF habitat and habitat amount at the core and home range scales currently occur below suggested levels (USDI/USDA 2008). The proposed action includes the removal of up to 39 acres and the downgrading of up to 10 acres of spotted owl NRF habitat in the nest patch. Because generated points are based on a computer simulation and may not reflect actual spotted owl locations on the landscape, the District plans to conduct surveys (USDI FWS 2010) at this predicted site to determine occupancy by spotted owls. If spotted owls are found within the provincial radius of this site, the District will modify the project to avoid potential harm to spotted owls by alter the timber harvest prescription. If surveys fail to detect spotted owls, the District plans to proceed with the removal and downgrade of spotted owl NRF habitat (Table 8).

Site # 158G (Swinning)
This computer-generated site occurs within un-surveyed NRF habitat with NRF amounts currently occurring below the suggested level for the home range (Table 8). Approximately two (2) acres of NRF habitat downgrade is planned under the Swinning timber sale and within the home range of this site (Table 8). Because the proposed treatment is within the home range of the generated site, and the available amount of spotted owl NRF habitat is already below threshold amounts, the District plans to alter the prescriptions to treat and maintain spotted owl NRF habitat, rather than downgrading spotted owl NRF habitat as planned in the original proposal.

Site # 180G (Swinning)
This computer-generated site 180G occurs in un-surveyed spotted owl NRF habitat. According to the Assessment, the District's GIS spotted owl habitat coverage identified that one acre of NRF in the home range of this site will be downgraded as a result of the timber harvest. In the District's opinion, the identification of this one acre of a proposed harvest unit represents a mapping inaccuracy, and, in their opinion, no spotted owl NRF habitat will be removed or

downgraded within the home range of this site because the proposed harvest units will occur beyond the boundary of the home range of spotted owl site number 180G.

Site # 2059O (Twin Ranch)
The District has continually monitored this site since 1989 with a spotted owl pair occupying the site from 1994 through 2004, in 2005 a resident single was found, and from 2006 to 2009, surveys inferred that the site was unoccupied. In 2007, the female, which had been previously color-banded at this site, was discovered nesting at another site approximately three (3) miles northeast of the historic site.

The private lands surrounding the 100-acre KSOAC were harvested in the early 2000s. The home range has 23.5 percent suitable habitat (Table 8). The District considers this site unoccupied for the following reasons: 1) spotted owls have not been recently located given four (4) consecutive years of protocol surveys, 2) the female owl being located at a new site, and 3) insufficient amounts of suitable habitat.

Under the proposed Twin Ranch timber sale, no timber harvest would occur within the 100-acre KSOAC or within the nest patch of site 2059O. The District plans to complete additional surveys with the updated protocol (USDI FWS 2010) to determine occupancy prior to the implementation of the Twin Ranch project. If spotted owls are found, the District will drop units within the provincial home range or modify proposed harvest units to a treat and maintain prescription. If protocol surveys fail to detect spotted owls, the District plans to move forward with the proposed timber harvest of 152 acres of NRF (Table 8)

Site # 3260O (Twin Ranch)
This site has been monitored intermittently by BLM since 1992. Records show a non-nesting spotted owl pair in 1992, a single male in 1993. From 1994-1999, surveys of the site and surrounding NRF (2 to 3 visits per year) were conducted with no spotted owls being detected. BLM considered the site as vacant and did not check from 2000 to 2004. In 2005, surveys resumed with 1 nighttime visit that season, but from 2006 through 2009, at least 3 surveys per season (a mix of day and nighttime surveys) were conducted with no spotted owls detected. The private lands on three sides of the activity center were clearcut in the early 1990's. BLM currently considers this site to be unoccupied given the consecutive years of surveys and the negative impacts of the adjacent private land harvest.

Under the current Twin Ranch timber sale, no timber harvest would occur within the 100-acre KSOAC or within the nest patch. Prior to implementation of the timber harvest, surveys using the updated survey protocol (USDI FWS 2010) will be completed to determine if spotted owls occupying the site. If spotted owls are found, units within the provincial radius of the site would either be dropped from the sale or modified to treat and maintain spotted owl NRF habitat. If surveys fail to detect spotted owls, the District plans to move forward with the harvest of 55 acres of NRF in the home range (Table 8).

Site # 4608O (Deer North)
Four (4) acres of NRF downgrade are proposed to occur at the outer periphery this spotted owl home range; a mix of private timber and agricultural land are located between the historic nest site and the proposed unit (see aerial photograph Appendix C). This non-federal land includes

approximately 180 acres agricultural fields and Deer Creek that do not provide habitat for spotted owls. It is unlikely spotted owls would use the four acres of NRF habitat in the proposed harvest unit because actual home range configuration likely includes the more contiguous habitat to the northwest and southwest of the site center. In addition, it is likely that the owls would not risk predation and expend limited energy by crossing an expansive open field to access limited NRF habitat at this distance.

Summary of Effects to Spotted Owls

For each of the nine affected spotted owl sites described above, it is the Service's opinion that implementation of the proposed action *may affect, is likely to adversely affect* spotted owls. The effects are due to the proposed removal or downgrading 1,180 acres of spotted owl NRF habitat within the affected home ranges or core areas (Table 8).

Spotted owls need a certain amount of suitable habitat within their home range to provide the resources necessary to meet essential life functions [Thomas et al. 1990, Courtney et al. 2004, Seattle Audubon Society et al. v. Sutherland et al. Civ. No. C06-1608MJP (D.W. Wa August 1, 2007)]. As the amount of suitable habitat in an owl's home range decreases, so does site occupancy, reproduction and survival (Courtney et al. 2004).

Specifically for spotted owl core use areas, Rosenberg and McKelvey (1999) reported that spotted owls are "central place" animals with the core area (the area closest to the nest) being the focal area. Recently developed habitat-fitness and landscape models have demonstrated the importance of habitat amount within core areas. For example, Meyer et al. (1998) examined landscape indices associated within spotted owl sites versus random plots on BLM lands throughout Oregon. Across provinces, landscape indices highly correlated with the probability of spotted owl occupancy included the percent older forest (30 percent) within the 500 acres surrounding the site. Zabel et al. (2003) found for their northwest California study that the highest probability of owl occupancy occurred when the core area was composed of 69 percent nest/roosting habitat. Bart (1995) found that core areas should contain 30-50 percent mature and old growth forest. Franklin (pers. comm.) found that the proportion of good to medium to lesser quality habitat for owl cores in northwest California was approximately 60:30:10 percent. Lastly, Dugger et al. (2005) showed that when owl core areas in their southern Oregon study area had at least 50-60 percent older forest habitat, spotted owl fitness (i.e., survival and reproduction) was relatively higher than in core areas with lesser amounts. In summary, habitat composition in owl core areas varies by region and study, ranging from a low of 27 percent to a high of 78 percent (mean 43%, 14 SD). Based on the above studies, it is the Service's view that 50 percent or higher cover of suitable habitat within a 0.5 mile radius should be considered as necessary to maintain spotted owl life history functions.

At the home range scale, the available science (Bart and Forsman 1992, Bart 1995, Forsman et al. 2005) suggests that as the amount of suitable habitat in an owl's home range decreases, so does site occupancy, reproduction, and survival. Bart and Forsman (1992) found that areas with less than 20 percent suitable habitat had few owls and less reproductive success than areas with more suitable habitat. In 1995, Bart re-analyzed his prior data, and concluded that spotted owl reproduction and survival decreased as suitable habitat decreased from 40 to 20 percent. While the threshold amounts of habitat needed to support spotted owls is uncertain, the studies cited

above suggest that the removal of suitable habitat to below 40 percent of the median annual home range area is likely to adversely affect spotted owls. Based on these studies, suitable habitat coverage of at least 40 percent or higher at the home range scale is likely necessary for maintaining spotted owl life history functions, although site-specific conditions may warrant deviations from this guideline.

Based on the available science, it is the Service's view that removal or downgrade of spotted owl habitat, per the conditions provided above, and at spotted owl sites already deficient in NRF habitat (Table 8), such as the proposed actions by the BLM, are likely to adversely affect spotted owls.

Effects to Spotted Owl NRF Habitat

Treat and Maintain

See the discussion under the Effects to Individual Spotted Owl Sites section above.

Remove or Downgrade

Collectively, implementation of the six individual timber harvest projects will remove up to 316 acres and downgrade up to 864 acres of spotted owl NRF habitat. The removal and downgrading of 1,180 acres represents approximately 1.03 percent of the extant spotted owl NRF habitat, which occurs on federal lands managed by the District in the five affected watersheds (Table 9).

Table 9. Effects to Spotted Owl NRF Habitat.

Project Name	Amount of Spotted Owl NRF Habitat Pre-Project[1]	Acres Spotted Owl NRF Habitat Removed	Acres of Spotted Owl NRF Habitat Downgraded	Amount of Spotted Owl NRF Habitat Post-Project	Percent Change
Illinois Watershed					
Deer North		0	60		
East West Junction		114	123		
Watershed Total	**26,995**	**114**	**183**	**26,698**	**1.10**
Little Butte Watershed					
DF Restore		77	210		
Watershed Total	**16,222**	**77**	**210**	**15,935**	**1.77**
Klamath Watershed					
Swinning		**91**	**227**		
Watershed Total	**18,366**	**91**	**227**	**18,048**	**1.73**
Bear Watershed					
Sampson Cove		**34**	**42**		
Watershed Total	**10,942**	**34**	**42**	**10,866**	**0.70**
Rogue Upper Watershed					
Twin Ranch		**0**	**202**		
Watershed Total	**41,497**	**0**	**202**	**41,295**	**0.49**
Proposed Action Total	**114,022**	**316**	**864**	**112,842**	**1.03**

[1] From Table 6. Represents amount of spotted owl NRF habitat on federal lands managed by the District.

As detailed in the Assessment, the six timber harvest projects included in the proposed action are dispersed among five individual watersheds, with the loss of spotted owl NRF habitat ranging from only 0.5 to 1.8 percent (Table 9) within the affected watersheds. In other words, at least 98 percent of extant suitable habitat will remain post-harvest. While the proposed action will result in a relatively small loss of spotted owl NRF habitat, the Service does not anticipate that this loss will necessarily prevent spotted owls from occupying these watersheds. For example, the amount of remaining extant spotted owl habitat seems sufficient within the watersheds to provide for occupancy, albeit depending on the configuration of such habitat. Within the watersheds, the continuity of extant spotted owl habitat enables adult spotted owl movements for home range exploration for foraging as well as providing for higher quality dispersal habitat. Helping to facilitate occupancy is the fact that no spotted owl nest patch area habitat and to some extent, core area habitat coincident with the proposed action in these watersheds will be harvested.

The Service's has determined that the proposed removal and downgrading of up to 1,180 acres of spotted owl NRF habitat, planned to occur within two physiographic provinces and dispersed among five watersheds, *may affect, and is likely to adversely affect* spotted owls for the following reasons:

- Regeneration harvest prescriptions that result in the removal of spotted owl NRF habitat may eliminate key habitat elements, including large diameter tree with nesting cavities or platforms, multiple canopy layers, adequate forest cover, as well as hunting perches used by spotted owls.
- Regeneration harvest prescriptions will result in forest stands reduced to below 40 percent canopy cover, and the simplification of existing multi-canopy, uneven age tree structure. Once harvested, treated stands are not expected to provide suitable NRF habitat for many years post-treatment.
- Implementation of treatments that remove and downgrade spotted owl NRF habitat will reduce nesting, roosting, foraging and dispersal opportunities in the action area.
- Loss of habitat has the potential to reduce future reproduction and survival of young spotted owls in the action area.

Recovery Action 32 – Structurally complex stands

During the planning process for the proposed action, the District conducted office and field evaluations to determine if forest stands that meet the definition of "older, structurally complex, multi-storied conifer stands," as defined in the spotted owl recovery plan (USDI FWS 2008b) occurred in the planning areas. According to the Assessment, approximately 715 acres of forest stands that meet that definition were identified and not included in the proposed action.

Effects to Spotted Owl Dispersal Habitat

Collectively, implementation of the proposed action will result in the removal of up to 291 acres and the maintenance of up to 899 acres of spotted owl dispersal habitat, distributed among two physiographic provinces and among five individual watersheds (Table 10). The removal of dispersal habitat will not occur in any critical habitat units or spotted owl nest patches.

Table 10. Effects to Spotted Owl Dispersal Habitat.

Watershed	Total Acres	Acres Spotted Owl Dispersal Habitat Removed	Acres Spotted Owl Dispersal Habitat Maintained	-	Percent of Spotted Owl Dispersal Habitat Removed
Illinois Watershed					
Deer North		38	132		
East West Junction		40	43		
Illinois Total	9,807	78	175	9,729	Less than 1 %
Little Butte Creek Watershed					
DF Restore		14	70		
Little Butte Total	5,985	14	70	5,971	Less than 1 %
Klamath Watershed					
Swinning		0	233		
Klamath Total	3,514	0	233	3,514	0
Bear Watershed					
Sampson Cove		25	168		
Bear Total	1,994	25	168	1,969	1.25
Rogue Upper Watershed					
Twin Ranch		174	253		
Rogue Upper Total	22,878	174	253	22,704	Less than 1 %
Action Area Total	44,178	291	899	44,568	Less than 1 %

It is the Service's opinion that the removal of up to 291 acres of spotted owl dispersal habitat, *may affect, but is not likely to adversely affect* spotted owls, for the reasons provided below.

- Collectively, the amount of spotted owl dispersal habitat removal equals less than one percent of the 44,178 acres of spotted owl dispersal habitat that currently occurs within the five affected watersheds.
- The proposed treatments will be dispersed among five individual watersheds, minimizing the potential for adversely affects to spotted owl dispersal.
- Implementation of the proposed action would make the residual spotted owl dispersal habitat more ecologically-sustainable over time. Stands identified for thinning will have smaller, less vigorous trees harvested. Thinning will reduce the number of trees to levels that the site has water and nutrients to sustain. Thinning is expected to increases average stem diameter, crown width, tree growth rate and enhances overall tree vigor (Hann 2003).

Overall, the Service believes that post-harvest, dispersal habitat condition remains in sufficient amounts, greater than 50 percent per watershed, so as to allow for continued successful dispersal of spotted owls across the landscape (Lint et al. 2005 and Forsman et al 2002).

It is the Service's opinion that the maintenance of up to 899 acres of spotted owl dispersal habitat associated with the proposed action *may affect, but is not likely to adversely affect* spotted owls because:

- Canopy cover in treated stands will be maintained at 40 percent, a value found to be important for spotted owl dispersal across the landscape (Thomas et al 1990), helping to ameliorate microclimate conditions and providing concealment cover against predators.
- Decadent woody material, such as large snags and down wood that provide habitat for the prey species of dispersing spotted owls will retained post-harvest; therefore helping to keep prey abundant and available to dispersing spotted owls.
- The proposed treatments will be among five individual watersheds, minimizing the potential for adverse effects to spotted owl dispersal by having remaining dispersal habitat well distributed, thus facilitating successful among stands across multiple watersheds (Lint et al. 2005).

Effects to Spotted Owl Critical Habitat designated in 2008

According to the Assessment, the proposed action will not occur within critical habitat for the spotted owl, designated in 2008; therefore, no effects to this critical habitat are expected.

Effects to Spotted Owl Critical Habitat designated in 1992

<u>Spotted Owl NRF Habitat</u>

According to the Assessment, implementation of the proposed action includes the treating and maintaining of up to 206 acres (1.46 percent) of the 14,120 acres of spotted owl NRF habitat within CHU OR 38. The Service anticipates the project is designed in such a manner that should have the following effects to CHU OR 38:

- The structural components of spotted owl NRF habitat important to spotted owls, such as nest trees, multilayered canopy and dead and down wood that support prey species habitat will remain post-harvest, retaining the ability of spotted owl NRF habitat to provide for nesting, roosting, foraging and dispersal of spotted owls.
- Activities that treat and maintain spotted owl NRF habitat will not decrease the amount of spotted owl NRF habitat in the affected CHU; therefore the remaining extant habitat should be sufficient for the intended function of this CHU.
- Treated stands should be more ecologically sustainable and fire resilient (Agee and Skinner 2005).
- Canopy cover within treated stands will be retained at or above 60 percent, allowing for the continued nesting, roosting and foraging of spotted owls within treated stands.

- Decadent woody material in the treatment area, such as large snags and down wood will remain post-treatment, providing habitat for spotted owl prey species.
- Any multi-canopy, uneven aged tree structure that was present prior to treatment will remain post-treatment, providing important habitat features of spotted owl NRF habitat.
- No nest trees will be removed.
- The application of mandatory PDC to activities that treat and maintain spotted owl NRF habitat will avoid adverse disturbance to spotted owls.

For the above reasons, it is the Service's opinion that implementation of activities that treat and maintain up to 206 acres of spotted owl NRF habitat in CHU OR 38 *may affect, and is not likely to adversely affect* spotted owl NRF habitat because the primary constituent elements are retained and the intended function of the CHU should remain intact. For additional rationale supporting this determination, see the Effects to Spotted Owls section above.

Spotted Owl Dispersal Habitat

As detailed in the Assessment, the proposed includes activities that will treat and maintain up to 35 acres (0.15 percent) of the 23,699 acres of spotted owl dispersal habitat within designated CHU OR 38. These 35 acres represent a subset of the 899 acres of spotted owl dispersal habitat that will be treated and maintained as part of this proposed action (Table 6). While planned thinning treatments may affect spotted owl dispersal habitat by removing some horizontal and vertical structure, the Service anticipates the District has designed the prescriptions in a manner that ensures treatments will not adversely affect the primary constituent elements of spotted owl dispersal habitat. The District has determined treating and maintaining up to 35 acres of spotted owl dispersal habitat in CHU OR 38 will be insignificant, and *may affect, but is not likely to adversely affect* the PCEs of spotted owl dispersal habitat in the CHU for the following reasons:

- Post-project, affected spotted owl dispersal habitat will retain the values that qualified it as dispersal habitat prior to the implementation of the proposed action.
- Canopy cover within treated stands will be retained at or above 40 percent, a value important to the use of the treated stands for dispersal by spotted owls (Thomas et al 1990).
- Decadent woody material in the treatment area, such as large snags and down wood will be maintained during treatment, providing important habitat elements for the prey species of spotted owls.
- Any multi-canopy, uneven aged tree structure that was present prior to treatment will remain post-treatment, maintaining important habitat elements for spotted owls.
- Thinning and prescribed fire can reduce surface fuels, reduce crown density and managing surface fuels to increase the likelihood that the stand can better withstand a wildfire (Agee and Skinner 2005).
- Stands identified for thinning will have smaller, less vigorous trees harvested. Thinning will reduce the number of trees to levels that the site has water and nutrients to sustain. Thinning increases average stem diameter, crown width, tree growth rate and enhances overall tree vigor (Hann 2003).
- Dense stands will be opened by thinning, improving conditions for dispersing spotted owls by providing additional flying space.

For the above reasons, the Service concurs with the District's finding that implementation of activities that treat and maintain up to 35 acres of spotted owl dispersal habitat in CHU OR 38 *may affect, but is not likely to adversely affect* spotted owl dispersal habitat within designated critical habitat.

Effects to Spotted Owl Prey

Effects to spotted owl prey species are likely to occur due to the implementation of the proposed action. However, quantifying those impacts is somewhat problematic based on the following best available information. We recognize that the Northern Spotted Owl Occupancy Map (NSOOM) (USDI/USDA 2008) used by the District to assess potential impacts to spotted owls likely overestimates the number of spotted owls in a given area (USDI/USDA 2008). In addition, we have no data indicating prey species abundance for the action area. Studies have shown variations of prey availability across different stands within the range of the spotted owl, which is likely reflected in the action area, as well. While some reports suggest negative impacts of thinning on flying squirrels (Wilson 2010), there is also some counter information as to these effects (e.g., Gomez et al. 2005, Ransome et al. 2004, Waters and Zabel 1995). Woodrats, both bushy-tailed and dusky-footed (Neotoma cinerea and N. fuscipes) are important components of the spotted owls' diet in in the action area. Some beneficial effects to dusky-footed woodrats due to shrub development in thinned stands may be possible (Sakai and Noon 1993, Suzuki and Hayes 2003). There are observational studies of spotted owls remaining on territories and using treated stands post-treatment (Irwin et al. 2008, Solis 1983, Forsman et al. 1984, King 1993, Anthony and Wagner 1998, and Hicks 1999). Whereas, a case study (Meiman et al. 2003) and anecdotal accounts have shown spotted owls shift their use patterns post-harvest activity. For these reasons, the potential impacts to spotted owls due to the affects to their prey species are difficult to fully ascertain; but are likely to occur from the proposed action. Therefore, the combination of this prey abundance information and the effects of habitat removal suggest negative effects to spotted owls. However, this is somewhat mitigated in the action area, relative to other areas in the owl's range due to the occurrence woodrats and neutral to positive effects of thinning on their occurrence.

Effects to Spotted Owls due to Disturbance

As described in the Status of the Species section of this Opinion, the effects of noise on spotted owls is largely unknown. Although information specific to behavioral responses of spotted owls to disturbance is limited, research indicates helicopter overflights can reduce prey delivery rates to nests (Delaney et al. 1999). Additional effects from disturbance, including altered foraging behavior and decreases in nest attendance and reproductive success have been reported for other raptors (White and Thurow 1985, Andersen et al. 1989, McGarigal et al. 1991).

Spotted owls may also respond physiologically to a disturbance without exhibiting a significant behavioral response. In response to environmental stressors, vertebrates secrete stress hormones called corticosteroids (Campbell 1990). Although these hormones are essential for survival, extended periods with elevated stress hormone levels may have negative effects on reproductive function, disease resistance, or physical condition (Carsia & Harvey 2000, Saplosky et al. 2000). In avian species, the secretion of corticosterone is the primary non-specific stress response

(Carsia & Harvey 2000). The quantity of this hormone in feces can be used as a measure of physiological stress (Wasser et al. 1997). Recent studies of fecal corticosterone levels of spotted owls indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel & Gutiérrez 2003, Tempel & Gutiérrez 2004). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to spotted owl core areas (see Wasser et al. 1997, Tempel & Gutiérrez 2004).

According to the Assessment, the District plans to incorporate Mandatory PDC (Appendix A) in all activities included in the proposed action. Mandatory PDC include implementing activities outside of the spotted owl breeding season, as well as beyond recommended disturbance distance thresholds. Therefore, the District has determined there will be no effect to spotted owls as a result of the implementation of the activities included in the proposed action.

Spotted Owl Recovery Plan

District biologists conducted on-the-ground investigations for the purpose of identifying forest stands that meet the definition of older and more structurally complex, multi-layered conifer forests, as defined in recovery action 32 (RA 32) of the Recovery Plan (2008) using the January 2010 draft Medford Bureau of Land Management and Rogue River-Siskiyou National Forest methodology. According to the Assessment, the District identified approximately 715 acres of forest stands that meet the definition of RA 32 stands were identified in the planning process, and were subsequently not included in the proposed action. Retaining these stands has reduce the overall number of acres of spotted owl NRF habitat originally considered for removal and downgrading as part of the proposed action.

A Review of Combined Effects of the Action to the Spotted Owl

Spotted owl NRF habitat at site numbers 0967, 199G, 133G, 158G, 180G, 2059, 3260 and 4608, currently occurs at levels less than the recommended threshold amounts of 40 percent at the home range scales. At sites 0967, 199G, 158G, 180G, 2059 and 3260, spotted owl NRF habitat occurs at levels less than the recommended threshold amounts of 50 percent at the core area level (USDI/USDA 2008). Post project implementation, amounts of spotted owl NRF habitat may be further reduced at the home range only scale at site numbers 10HCRD0, 119G, 3260O and 4608O; while at spotted owl site numbers 133G and 2059O, amounts of spotted owl NRF habitat may be further reduced at both the core and home range scales (Table 8), if protocol surveys fail to detect spotted owls at these sites.

As discussed above (Effects to Spotted Owls), a reduction in NRF habitat is anticipated to have negative effects on spotted owl occupancy (numbers), survival, and reproduction. However, the Service anticipates that adult spotted owls in the action area are expected to persist for some time, but with reduced fitness and survival (Dugger et al 2005). Reduced fitness may exacerbate conditions of moving and searching for a new territory potentially causing the adults to be exposed to a greater predation risk than that which the adult spotted owls experienced within their established territories. Predation on spotted owls has been directly observed on a limited basis, but is suspected by northern goshawks (*Accipiter gentiles*), cooper's hawks (*Accipiter cooperi*), red-tailed hawks, great horned owls (*Bubo virginianus*), and barred owls (*Strix varia*)

(Courtney et al. 2004, page 2-8). Further impact to sites associated with the implementation of the proposed projects may delay the ability of spotted owls to achieve reproduction levels that will replace themselves, that will significantly contribute to the recovery of the species.

CUMMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur within the action area considered in this Opinion. Future federal actions which are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

According to the Assessment, state and private lands within the action area support marginal habitats for the spotted owl, and do not notably contribute to the viability of this species, given the management practices on those lands. Portions of these lands do not currently provide any habitat. Habitat conditions on these lands are not expected to improve significantly within the foreseeable future.

Cumulative effects to spotted owls are likely to continue in the future within the action area. To date, the Oregon Forest Practice Rules have not adopted any regulations that specifically provide protection to spotted owls. Implementation of timber harvest activities that may occur on non-federal lands in the action area have the potential to adversely affect individual spotted owl home ranges by further reducing the amounts of spotted owl NRF habitat at the nest patch, core or home range scales. While the Assessment provided information regarding the amounts of spotted owl NRF habitat that exists on non-federal lands within the affected spotted owl home ranges (Table 7), no mechanism exists to track the timing and extent of spotted owl NRF habitat removal on non-federal lands. Based on the above, private lands do not currently, and are not expected in the future to contribute significantly to the recovery of spotted owls.

CONCLUSION

After reviewing the current status of the spotted owl, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the District's proposed action, *is not likely to jeopardize* the continued existence of the spotted owl. The Service reached this conclusion because the action area is expected to continue to fulfill its role in the survival and recovery of the spotted owl because implementation of the proposed action will retain 99 percent of currently occupied or un-surveyed suitable spotted owl NRF and dispersal habitats in the action area. In addition, while the spotted owl population has declined from 5-20 percent on the adjacent study areas since study area initiation these areas appear to have relatively stationary population change estimates. However, it is recognized that some of the underlying demographic parameters such as fecundity and survival are decreasing. The Service has determined this outcome (maintenance of currently occupied habitat and minimization of unoccupied habitat loss) will provide sufficient habitat for spotted owl survival and recovery (USDI FWS 2008b).

The Service has determined implementation of the proposed action will not adversely affect designated critical habitat for the spotted owl because the proposed action will not occur within critical habitat designated in 2008.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Amount or Extent of Take

The Service neither anticipates nor authorizes the incidental take of spotted owls due to the implementation of this proposed action. Although the Effects of the Proposed Action above includes a finding that implementation of the proposed action has the potential to cause biological effects to the spotted owl that conform to the regulatory definition of take, the mere potential for take is not a legitimate basis for a take exemption. The Service bases this determination on: 1) for many of the spotted owl sites affected, many consecutive years of surveys have been conducted leading to inferring the sites are unoccupied (no species present), 2) the District plans to continue surveys at these same sites using an updated protocol, 3) if spotted owls are found occupying the sites with the new surveys, the District will drop the sale units and/or 4) the District will modify the prescriptions to reduce the effects to spotted owls.

Since no take is anticipated or exempted, no reasonable and prudent measures or terms and conditions are provided below. If take is detected during implementation of the proposed action, reinitiation of formal consultation should be requested, and any operations causing such take must cease pending the outcome of the reinitiated consultation.

Effect of Take

Not applicable

Reasonable and Prudent Measures

No reasonable and prudent measures are included in this Opinion, because the PDC were developed as part of the proposed action and include adequate measures to minimize the impacts of anticipated take on the spotted owl.

Terms and Conditions

Not applicable

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The Service believes the following conservation action would reduce the impact of the proposed action on the spotted owl within the action area:

1. Delay implementation of activities as late in the breeding season as possible.
2. As needed, the District is encouraged to discuss updated survey information with the Service for interpretation of site status.

In order for the Service to be kept informed of actions that minimize or avoid adverse effects or benefit listed species or their habitats, the Service requests notification regarding the implementation of any conservation recommendation.

REINITIATION NOTICE

This concludes formal consultation on the four actions outlined in your Assessment. As provided in (50 CFR § 402.16), reinitiation of consultation is required where discretionary federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, and in this case, the take limit and project limit of effects are coextensive and expressed in terms of habitat; (2) new information reveals effects of the agencies' action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation of formal consultation. This Opinion and the associated Incidental Take Statement are valid for activities included in the proposed actions that are completed prior to October 1, 2020.

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APPENDIX A. PROJECT DESIGN CRITERIA

Project design criteria (PDC) are measures applied to project activities designed to minimize potential detrimental effects to proposed or listed species. PDC usually include seasonal restrictions and may also include clumping of retention trees around nest trees, establishment of buffers, dropping the unit(s)/portions, or dropping the entire project. Use of project design criteria may result in a determination of no effect for a project which would have otherwise been not likely to adversely affect. In other cases, project design criteria have resulted in a determination of not likely to adversely affect for a project which might have otherwise been determined to be likely to adversely affect. The goal of project design criteria is to reduce adverse effects to listed or proposed threatened or endangered species.

Physical impacts to habitat and disturbances to spotted owls will be reduced or avoided with PDC. Listed are project design criteria designed for the programmatic impacts discussed in the Effects of the Action section.

Medford BLM retains discretion to halt and modify all projects, anywhere in the process, should new information regarding proposed and listed threatened or endangered species arise. Minimization of impacts will then, at the least, include an appropriate seasonal restriction; and could include clumping of retention trees around the nest trees, establishment of buffers, dropping the unit(s)/portions, or dropping the entire project.

The seasonal or daily restrictions listed below may be waived at the discretion of the decision maker if necessary to protect public safety (as in the case of emergency road repairs or hazard tree removal). Emergency consultation with the Service will then be initiated in such cases, where appropriate.

PDC for disturbance are intended to reduce disturbance to nesting spotted owls or marbled murrelets. For this consultation, potential disturbance could occur near either documented owl sites or projected owl sites. To estimate likely occupied habitat outside of known home ranges, nearest-neighbor distances and known spotted owl density estimates were utilized to “place” potential spotted owl occupied sites in suitable habitat. Marbled murrelets are difficult to locate. No murrelets have been documented on the District, but Medford remains within zone B. To ensure that activities that have the potential of disturbing marbled murrelets are reduced to not likely to adversely affect (NLAA) (or no effect (NE)), we (Medford BLM) will impose the PDC in or adjacent to marbled murrelet habitat.

Any of the following Mandatory PDC may be waived in a particular year if nesting or reproductive success surveys conducted according to the Service endorsed survey guidelines reveal that spotted owls are non-nesting or that no young are present that year. Waivers are only valid until March 1 of the following year. Previously known sites/ activity centers are assumed occupied until protocol surveys indicate otherwise.

Mandatory Project Design Criteria (spotted owls)

A. Activities (such as tree felling, yarding, road construction, hauling on roads not generally used by the public, prescribed fire, muffled blasting) that produce loud noises above ambient levels will not occur within specified distances (Table A-1) of any documented or projected owl site between March 1 and June 30 (or until two weeks after the fledging period) – unless protocol surveys have determined the activity center to be not occupied, non-nesting, or failed in their nesting attempt. The distances may be shortened if significant topographical breaks or blast blankets (or other devices) muffle sound traveling between the work location and nest sites.

B. The action agency has the option to extend the restricted season until September 30 during the year of harvest, based on site-specific knowledge (such as a late or recycle nesting attempt) if project would cause a nesting spotted owl to flush. (See disturbance distance).

C. Burning will not take place within 0.25 miles of spotted owl sites (documented or projected) between 1 March and 30 June (or until two weeks after the fledging period) unless substantial smoke will not drift into the nest stand.

D. To minimize the number of potential spotted owl nest trees used for used for instream structures, only the following sources will be used:

(I) Trees already on the ground in areas where large woody material is adequate;

(II) Trees lacking suitable nesting structure for spotted owls.

Table A-1. Mandatory Restriction Distance to Avoid Disturbance to Spotted Owl Sites.

Activity	Documented Owl Site	Projected Owl Site**
Heavy Equipment (including non-blasting quarry operations)	105 feet	761 feet
Chain saws	195 feet	851 feet
Impact pile driver, jackhammer, rock drill	195 feet	851 feet
Small helicopter or plane	360 feet*	1016 feet
Type 1 or Type 2 helicopter	0.25 mile*	0.512 mile
Blasting; 2 lbs of explosive or less	360 feet	1016 feet
Blasting; more than 2 lbs of explosives	1 mile	1.12 miles

* If below 1,500 feet above ground level

** Radius distances were increased by 656 feet (200 meters) around estimated nest sites to provide additional protection, since the exact location of owls is unknown in these areas.

Above-ambient noises further than these Table B-1 distances from spotted owls are expected to have ether negligible effects or no effect to spotted owls. The types of reactions that spotted owls could have to noise that the Service considers to have a negligible impact, include flapping of wings, the turning of a head towards the noise, hiding, assuming a defensive stance, etc. (USDI FWS 2003).

Recommended Project Design Criteria--Murrelets

Restrict operations from March 1 through September 30 (through the extended breeding period) within disturbance distances (unless protocol surveys demonstrate non-nesting).

Table B-2. Mandatory Marbled Murrelet Project Design Criteria

Impacts	Species: Marbled Murrelet
Disturbance	(II) Mandatory -For Survey Areas A and B work activities (such as tree felling, yarding, road and other construction activities, hauling on roads not generally used by the public, muffled blasting) which produce noises above ambient levels will not occur within specified distances (see table below) of any occupied stand or unsurveyed suitable habitat between April 1 – August 5. For the period between August 6 – September 15, work activities will be confined to between 2 hours after sunrise to 2 hours before sunset. See Fuels management PDCs for direction regarding site preparation and prescribed fire.
Disturbance	(III) Mandatory -Clean up trash and garbage daily at all construction and logging sites. Keep food out of sight so as to not attract crows and ravens (predators on eggs or young murrelets).
Disturbance	(IV)Mandatory- Blasting (open air/unmuffled) – No blasting activities during the critical breeding period (1 April through 15 August) within 1.0 mile of occupied stands or unsurveyed suitable habitat. This distance may be shortened if significant topographical breaks or blast blankets (or other devices) muffle sound traveling between the blast and nest sites or less than 2 lbs of explosives are used If so, then use described distance.
Disturbance	1) Recommended Delay project implementation until after September 15 where possible
Disturbance	2) Recommended Between 1 April and 15 September, concentrate disturbance activities spatially and temporally as much as possible (e.g., get in and get out, in as small an area as possible; avoid spreading the impacts over time and space).
Disturbance	(IV)Mandatory- Blasting (open air/unmuffled) – No blasting activities 1 April through 15 September within 1.0 mile of occupied stands or unsurveyed suitable habitat. This distance may be shortened if significant topographical breaks or blast blankets (or other devices) muffle sound traveling between the blast and nest sites or less than 2 lbs of explosives are used If so, then use described distance.
Disturbance	1) Recommended Delay project implementation until after September 15 where possible
Disturbance	2) Recommended Between 1 April and 15 September, concentrate disturbance activities spatially and temporally as much as possible (e.g., get in and get out, in as small an area as possible; avoid spreading the impacts over time and space).
Restoration projects	Mandatory To minimize the number of potential spotted owl or murrelet nest trees used for instream structures, only the following sources shall be used: (I) Trees already on the ground in areas where large woody material is adequate;

Impacts	Species: Marbled Murrelet
	(II) Trees lacking suitable nesting structure for spotted owls or murrelets or contributing to trees with suitable nesting structure, as determined by an action agency wildlife biologist.
Fuels	Mandatory (I) Burning would not take place within 0.25 mile of known occupied marbled murrelet sites, or unsurveyed marbled murrelet habitat between April 1 and August 6 unless substantial smoke will not drift into the occupied site or suitable habitat. (II) All broadcast and under-burning operations (except for residual "smokes") will be completed in the period from two hours after sunrise to two hours before sunset. (IV) During helicopter operations, flights over suitable habitat will be restricted (helicopter should be a least 1,500 feet above ground level); if not possible, fly a minimum of 500 feet above suitable habitat (above canopy).
Wildfire	Mandatory Whenever possible, protect known nest sites of any listed species from high intensity fire. Update Resource Information Book annually; incorporate new nests or sites as soon as possible.
Wildfire	Mandatory (I) From 1 April - 5 August noise disturbance should be minimized inside occupied stands and within 0.25 mile of the edge of these stands. In order to accomplish this objective, minimize repeated aircraft flights that are less than 1,500 feet Above Ground Level (AGL). Also, minimize the use of fire line explosives within 1 air mile of occupied stands during the protection period.
	Light Hand Tactics or Minimize Impact Suppression Tactics (MIST) should receive consideration for use within the protection zones for northern spotted owls and murrelets.
Quarries	Mandatory For any occupied stands or unsurveyed suitable habitat within 0.25 miles of the quarry operation, restrict operation of the quarry from April 1 to August 5. Agency biologists also have the discretion to modify the 0.25-mile zone depending on topography and the level of noise - what equipment will be present (crusher or dozer/ripper or only loading of existing stockpiled rock). Recommended 2) For active nest stands or unsurveyed suitable habitat within 0.25 mile of the quarry operation, restrict operation of the quarry from April 1 through September 15 (unless protocol surveys demonstrate non-nesting).

APPENDIX B. MONITORING FORM

Consultation Effects Data Input Form for
Northern Spotted Owls & Marbled Murrelets
(for use in preparing BA, BO, and annual tracking reports)

Section I: Consultation Identifier Information (fill out for each form) Page ____ of ____ forms

Consultation Type:	Consultation #	Consultation Name			Sale Volume (MBF)
☐ Formal					
☐ Informal	Reinitiation Cross-Ref.#	Consultation Author (full name)			Fiscal Year Signed
☐ Tech Assistance					
☐ Tech Asst Nat Event	Suppl. ☐ or Replace ☐	Termination Date	/ /	Signature Date	/ /
Comments					

Section II: Ownership and Location Identifier Information[1]

Species	NWFP Province	Group	Land Use Allocation	CHU Identifier
		☐ NWFP Lands	☐ AMA ☐ AW	
Consulting Agency	California Ecozone	☐ Tribal	☐ CRA ☐ LSR	FY of Record
		☐ Other Fed Agency/Land	☐ MLSA ☐ MX	
Administrative Unit	MAMU Conservation Zone	☐ HCP	☐ NAT ☐ PVT	Decade
		☐ Other Private/State	☐ SEA[2]	
Administrative Subunit	NWFP Timber Sale Activity		[2]Murrelets only	Consult Status
	☐ YES ☐ NO			☐ Authorize
Project Report Name	**Report Contact Name**	**Report Contact Phone**	LUA Identifier	☐ Proj. Report

[1]Requires a new data entry form for each change in any field (fill out all fields for each form).

Section III: NSO Consultation Habitat Effects (requires separate form for each change in any data entry field in Section II)

Affected Suitable Habitat				Habitat Associated Take			Dispersal Habitat (non NRF)	
Effect	NRF	NR[3]	F[3]	Acres	AC (w/acres)	AC (wo/acres)	Acres	Assoc. Harm
Removed								
Downgraded								
Degraded								
Added								

[3] California only.

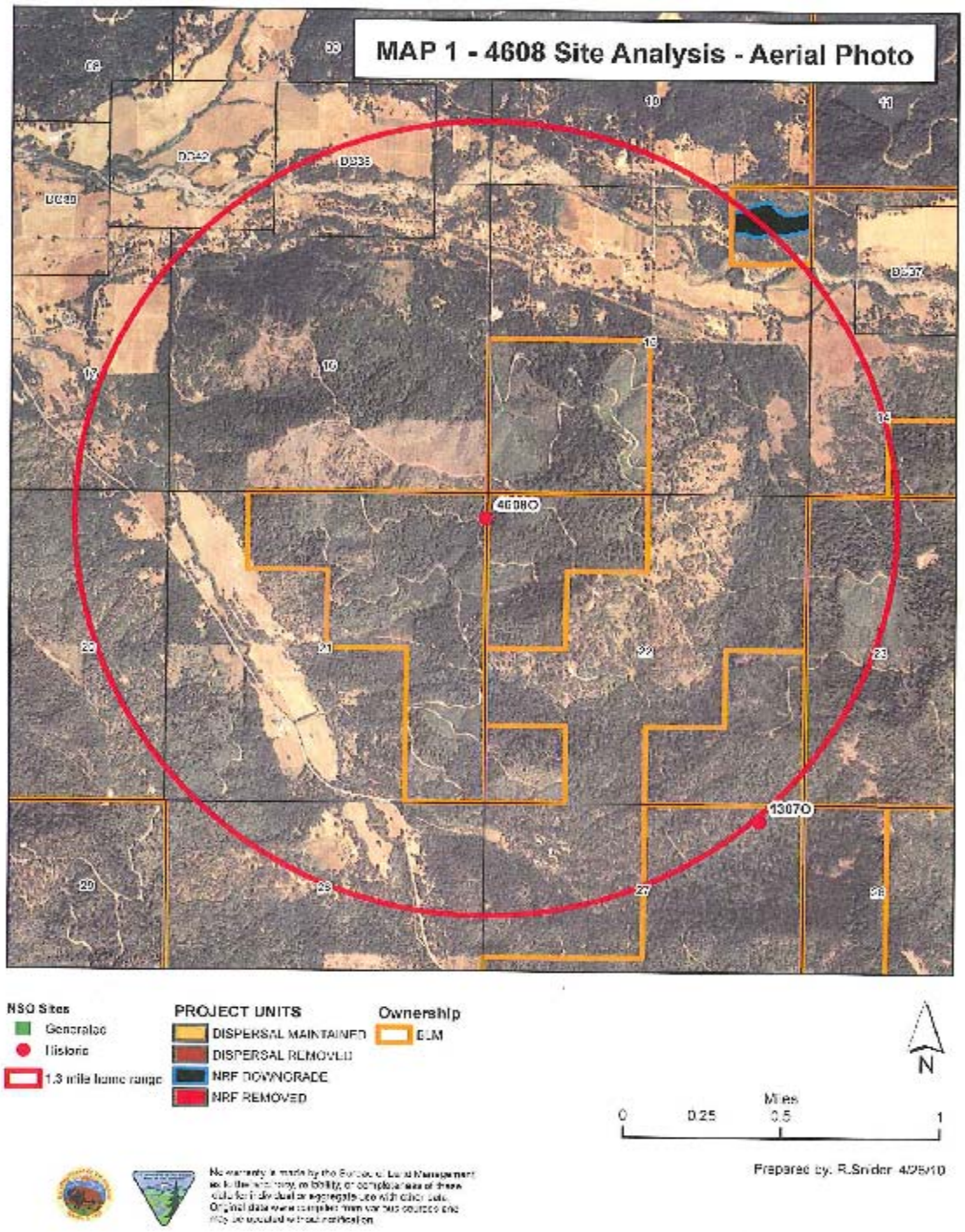
	Disturbance Effects	Annual Effects (Number by Fiscal Year)					
		FY'	FY'	FY'	FY'	FY'	FY'
☐ Harm	Acres (wo/ LOPs)						
☐ Harass	Activity Centers (w/acres)						
	Activity Centers (wo/acres)						

Section III: MAMU Consultation Habitat Effects (requires separate form for each change in any data entry field in Section II)

Affected Habitat				Habitat Associated Harm		
	Suitable Habitat		Critical Habitat			
Effect	Stands	Remnants	½ Site Potential w/in .5 mile	Unsurveyed Acres	Occupied Acres	Surveyed Not Occupied Acres
Removed						
Degraded						
Added						
# trees						

	Non-Habitat Effects	Annual Effects (Number by Fiscal Year)					
		FY'	FY'	FY'	FY'	FY'	FY'
☐ Harm	Unsurveyed Suitable Habitat (Acres)						
☐ Harass	Occupied Suitable Habitat (Acres)						
	# Individuals						

Section II & III: General Note and Comments

R1 ES/OTS-3 Rev. 03/22/2004

APPENDIX C. AERIAL PHOTOGRAPH OF SPOTTED OWL SITE NUMBER 4608.