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In Reply Refer To:
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Willows, California 95988

Subject: Formal Reinitiation of Consultation for the Smokey Fuels Treatment Project, Grindstone Ranger District, Mendocino National Forest, California

This is our biological opinion in reply to your letter dated April 9, 2014, received in our office on April 11, 2014, regarding reinitiation of consultation on potential effects of the Mendocino National Forest's Smokey Fuels Treatment Project on designated critical habitat for the federally listed as threatened northern spotted owl (*Strix occidentalis caurina*; U.S. Fish and Wildlife Service 2012b), in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Revised critical habitat was designated for the northern spotted owl on December 4, 2012, and will be affected by the Smokey Fuels Treatment Project, hence necessitating reinitiation of consultation (50 CFR § 402.16). We have also revised the Incidental Take Statement clarifying the amount of take expected due to project implementation.

This biological opinion on the effects of the Smokey Fuels Treatment Project on northern spotted owls and their designated critical habitat replaces and supersedes our March 15, 2012, biological opinion.

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1. BACKGROUND

The U.S. Forest Service, Mendocino National Forest (Forest), requested formal consultation with the U.S. Fish and Wildlife Service (Service) on the Smokey Fuels Treatment Project (Project) because they determined the Project may affect, and is likely to adversely affect, the threatened northern spotted owl (Service 1990) and its designated critical habitat. This document is the Service's biological opinion based on our review of the Project and its effects on northern spotted owl (*Strix occidentalis caurina*) and designated critical habitat for the northern spotted owl in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*; the Act).

This biological opinion (Opinion) includes an updated analysis of effects to northern spotted owls in light of current, protocol-level surveys that have been conducted in association with this Project. Therefore, some of our recommendations to the Forest may be different than those stated in previous Service documents (see Appendix F).

This Opinion is based on information provided in the following: Supplemental Biological Assessment for Smokey Fuels Treatment Project (Supplemental BA; April 11, 2014); Smokey Fuels Treatment Project Biological Assessment (BA; July 7, 2011); the Smokey Project BA Supplement (attachment to email from J. Ruhl to L. Lewis dated February 9, 2011), northern spotted owl survey results (North State Resources, Inc. 2010; NRM Corporation 2011; MGW Biological 2013), Smokey Prescription and Marking Guides (July 13, 2010; Appendix A), Smokey Silviculture Report (July 12, 2010), and other documents as referenced; telephone and email correspondence; and site visits to the project area.

1.1. Consultation History

Fall 2009	Interagency coordination on the Project began with site visits to proposed units by the Service and Forest on September 1, 23, and 24, and October 28, 2009.
Summer/Fall 2010	The Service reviewed and provided the Forest with comments on numerous draft biological assessments between June and October 2010. Michelle Havens of the Service met with Linda Angerer of the Forest to review and discuss comments on the draft BA on July 13, 2010.
February 3, 2011	Jim Smith and Lyle Lewis of the Service met with Forest staff to discuss the Forest's preliminary effects determination for the northern spotted owl.
April 11, 2011	The Service sent correspondence regarding the Forest's preliminary effects determination for the northern spotted owl to the Forest.
April 25, 2011	Michelle Havens and Lyle Lewis met with Linda Angerer, Jim Ruhl, and Chad Atwood of the Forest to discuss the proposed action.
May 10/19, 2011	Michelle Havens met with Forest staff to discuss the proposed action and possible conservation measures.

June 28, 2011	The Forest transmitted their biological assessment to the Service.
Sept. 12 & 14, 2011	Michelle Havens, Trisha Roninger, and Elizabeth Willy of the Service held conference calls with Forest staff to clarify information in the BA.
November 7, 2011	The Service met with Forest staff to discuss limited operating periods based on site-specific conditions and further clarify the BA.
March 15, 2012	The Service transmitted their biological opinion to the Mendocino National Forest.
November 30, 2012	Jim Ruhl discussed with Liisa Schmoele and James Bond of the Service via telephone implications of proposed northern spotted owl critical habitat on the Project.
April 9, 2014	The Mendocino National Forest transmitted their Supplemental BA to the Service via email, thus re-initiating section 7 consultation.

The Forest is using a species list obtained from the Arcata Fish and Wildlife Office (Service 2014) on May 5, 2014. The Service has provided technical assistance when requested. A complete administrative record of this consultation is available and on file at the Arcata Fish and Wildlife Office in Arcata, California.

2. DESCRIPTION OF THE PROPOSED ACTION

2.1. Location of Proposed Action

The Smokey Fuels Treatment Project (Project) area is located on the Grindstone Ranger District of the Mendocino National Forest in the Mt. Diablo Base Meridian, T22N, R8W, Sections 7, 8, 17, and 18; T22N, R9W, Sections 1- 5, 8-17, 21-27; T22N, R10W, Sections 1, 2, and 12; T23N, R9W, Sections 31, and 32; and T23N, R10W, Sections 35 and 36 (Fig. 1). The Project is located in Grindstone Creek Watershed, within Board Creek, Panther Creek, Kill Dry Creek, and Harvey Spring Creek drainages. The elevation is between 2,400 and 6,700 feet.

2.2. Proposed Action

The Project proposes to protect and enhance older forests by treating hazardous fuels and high stand densities within and surrounding 11 strategically placed landscape area treatment (SPLAT) units. The Project is designed to slow, alter direction, or help stop fires across the landscape thereby reducing the risk of large stand-replacing fires, and protecting and enhancing important habitats within the Buttermilk Late-Successional Reserve (LSR) RC 309 (including late-successional stands).

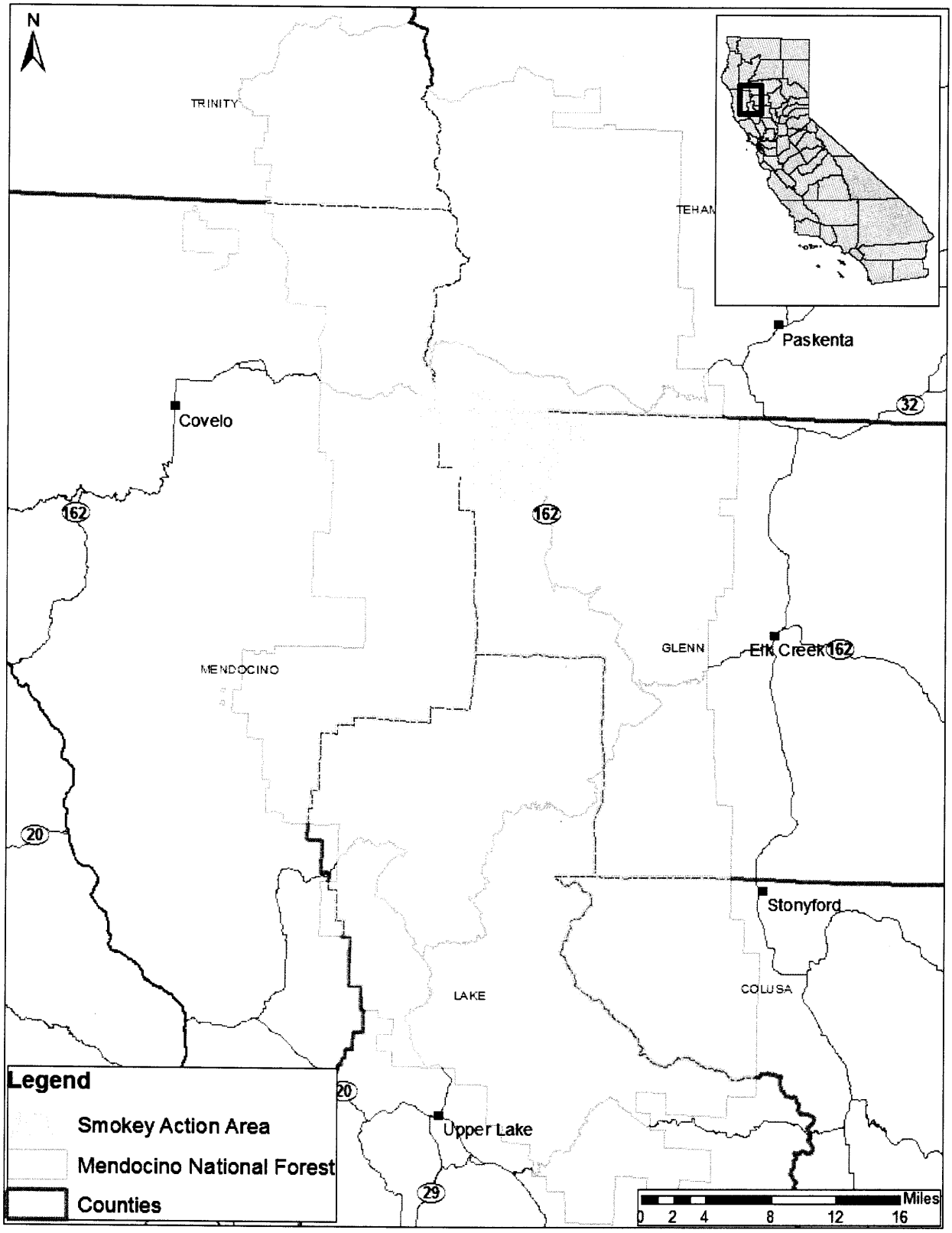


Figure 1. Location of the Smokey Fuels Treatment Project.

Past forest management, wildfire, and fire suppression on the Forest have altered the fire ecology of the area. Unnaturally high levels of ground and ladder fuels are present throughout the Forest which could increase the frequency of moderate- to high-severity fire behavior over large areas of the Forest. An increase in the occurrence of higher severity fire events could put late-successional habitat within the LSR at risk, ultimately compromising its functionality. The proposed action will allow fire to return as a natural process to the ecosystem and increase site productivity, accelerating growth of dominant and co-dominant trees by reducing competition for nutrients, sunlight, and water.

All treatments proposed within the LSR intend to (BA, p. 5):

- reduce ground and ladder fuels and break up continuity of fire-prone vegetation;
- protect, enhance, and accelerate the development of late-successional habitat by thinning overstocked stands to reduce stand density, increase longevity, and promote tree growth and vigor;
- maintain the health of forest stands by re-establishing natural fire regimes in order to produce fire-resistant stands; and
- protect and enhance important general wildlife habitats (oaks and meadows) that are threatened by fire suppression.

All treatments within lands designated as Matrix under the Northwest Forest Plan are designed to reduce (BA, p. 5-6):

- the risk of severe mortality due to wildfire by treating ground and ladder fuels and breaking up the continuity of fire-prone vegetation, and
- the overstocked condition in timber stands that are not growing to their full potential and are showing signs of stress.

The Project units cover 6,337 acres, which include commercial thinning, SPLAT treatments, habitat enhancement, plantation thinning, and road maintenance and construction. For the purpose of analyzing effects to the northern spotted owl and its designated critical habitat, the prescribed vegetation treatments have been categorized as fuel reduction/wildlife habitat enhancement, plantation thinning, and commercial thinning (Supplemental BA, p. 15).

2.2.1. Fuel Reduction/Wildlife Habitat Enhancement

Vegetation treatments within the Fuel Reduction/Wildlife Habitat Enhancement category include understory thinning, prescribed burning, and/or mastication, some of which are strategically designed at a fireshed scale (SPLAT units) or for restoring wildlife habitat in general (BA, pp. 11-13; Supplemental BA, pp. 15-18). Treatments are proposed for 1,177 acres in 21 habitat enhancement units (Table 1; BA, pp. 13-15) and 4,275 acres in 11 SPLAT units (Table 2; BA, pp. 11-13), with implementation beginning in 2014.

Forested stands with heavy fuels accumulations and high densities of trees less than 10 inches diameter at breast height (dbh) will be treated through understory thinning and pruning, mastication, and prescribed/helitorch burning. In meadows, chaparral, and oak stands, conifers trees (less than 10 inches dbh) will be removed from within, and up to 20 feet from, the edges of these habitat types. These treatments will help to decrease horizontal fuel continuity, increase the

height to live crown, and decrease surface fuels, all of which reduce the risk of crown fires and associated mortality of large trees (Supplemental BA, p. 17).

In coniferous forests, trees will be spaced 25 to 35 feet apart and remaining trees will be pruned to a height of 6 feet. In forested and non-forested habitats (e.g., meadows, oak stands), healthy and releasable fire-tolerant hardwoods will be favored over conifers in the understory. All living oaks will be maintained, unless regeneration through stump sprouting is preferred for oaks in very poor condition.

Table 1. Habitat enhancement units and overlap with LSR and Matrix areas.

		Acres		
Unit	Treatment	LSR	Matrix	Total
40	Remove conifer encroachment, Understory thin	66	0	66
41	Remove conifer encroachment	14	0	14
43	Understory thin	1	6	7
44	Remove conifer encroachment, Understory thin	52	0	52
45	Understory thin	11	0	11
46	Understory thin	228	0	228
47	Remove conifer encroachment, Understory thin	216	0	216
48	Remove conifer encroachment	6	0	6
49	Remove conifer encroachment	29	9	38
50	Remove conifer encroachment	0	5	5
51	Remove conifer encroachment	0	27	27
52	Remove conifer encroachment, Understory thin	0	158	158
53	Remove conifer encroachment	0	42	42
54	Understory thin	2	45	47
55	Remove conifer encroachment	15	5	20
56	Understory thin	22	0	22
57	Remove conifer encroachment, Understory thin	2	92	94
58	Remove conifer encroachment	5	1	6
59	Understory thin	40	0	40
60	Understory thin	43	0	43
61	Remove conifer encroachment	33	2	35
	Total	785	392	1,177

Surface fuels resulting from mechanical removal (e.g., understory thinning, mastication) will be removed or treated through under-burning, chainsaw and hand-piling, tractors with brush rakes, or masticators. Pile burning will occur in late fall and prescribed burning to reduce fuel loading will occur in winter or early spring, when fuel moistures are higher. Conducting prescribed burns and pile burning when fuel moisture levels are high decreases the chance of the fire consuming snags and coarse woody debris; since these larger fuels hold more moisture, making it difficult for them to light on fire (Supplemental BA, p. 61). Higher fuel moisture levels also allow firefighters to better control flame heights and fire effects to vegetation. Drip torches will be used to initiate burning, and handlines will be constructed where roads, trails, and natural barriers cannot be used. Handlines will be rehabilitated when burning is complete. One fuels unit (I), composed mostly of chaparral, will be burned using aerial ignition from a helicopter (helitorch).

The intent is to develop a mosaic of different age classes to establish a buffer between the down-canyon chaparral fields and upslope conifer habitat to slow the spread and intensity of wildfires initiated in the lower part of the canyon. Burning in each area would be completed in one day.

Table 2. SPLAT units and overlap with other treatments, LSR, and Matrix.

		Acres				
Unit	Treatment[1]	Treatment	LSR	Matrix	SPLAT Only	Total
A	Understory Thin/Prescribed Burn	248	248	0	519	519
	Remove conifer encroachment	108	108	0		
	Masticate/Prescribed Burn	163	163	0		
B	Understory Thin/Prescribed Burn	198	198	0	659	680
	Remove conifer encroachment	146	146	0		
	Masticate/Prescribed Burn	315	315	0		
	Commercial Thin (Unit 30)	21	21	0		
C	Understory Thin/Prescribe Burn	198	198	0	212	243
	Masticate/Prescribed Burn	14	14	0		
	Commercial Thin (Unit 27)	8	8	0		
	Plantation Thin (Units 111, 112, 113)/pile burn	23	23	0		
D	Understory Thin/Prescribed Burn	25	25	0	91	91
	Masticate/Prescribed Burn	22	22	0		
	Remove conifer encroachment	44	44	0		
E	Understory Thin/Prescribed Burn	32	0	32	192	201
	Masticate/Prescribed Burn	21	0	21		
	Remove conifer encroachment	139	0	139		
	Commercial Thin (Units 18, 25)	9	0	9		
F	Understory Thin/Prescribed Burn	91	91	0	96	291
	Remove conifer encroachment	5	5	0		
	Commercial Thin (Units 10, 14, 15, 16,17, 22)	151	151	0		
	Plantation Thin (Units 106, 107)/Pile burn	44	44	0		
G	Understory Thin/Prescribed Burn	787	787	0	787	787
H	Understory Thin/Prescribed Burn	216	216	0	216	216
I	Helitorch Burn	528	0	528	630	630
	Masticate/Prescribed Burn	102	0	102		
J	Understory Thin/Prescribed Burn	182	182	0	186	256
	Remove conifer encroachment	4	4	0		
	Commercial Thin (Units 7, 8, 9)	66	66	0		
	Plantation Thin (Unit 103)/Pile Burn	4	4	0		
K	Understory Thin/Prescribed Burn	184	156	28	239	361
	Remove conifer encroachment	55	50	5		
	Commercial Thin (Units 4, 5)	119	100	19		
	Plantation Thin (Unit 102)/Pile burn	3	0	3		
	Total	4,275	3,389	886	3,827	4,275

[1]Prescribed treatment listed in this table includes treatment prescription of overlapping units. See Tables 1, 3, and 4 in this document for additional information on other treatments overlapping SPLATs.

2.2.2. Commercial Thinning

Commercial thinning is proposed on 933 acres of the project area in 29 harvest units (Table 3; BA, pp. 8-11). Trees 10 inches dbh or greater will be thinned to a prescribed basal area of 100 to 330 ft^2 per acre (Table 3). Trees selected for harvest will be those in poorest condition growing in clumps and groups and all merchantable, suppressed conifers, including large, co-dominant and intermediate trees. Emphasis will be given to retaining a multi-layered structure, including hardwoods, in order to provide stand diversity. Trees will be spaced 25 to 35 feet apart with canopy closure ranging from 20 to 90 percent (Table 3). The largest, healthiest trees will be left on site (with an average minimum diameter of 22 inches dbh) and in the LSR, the most vigorous predominant, dominant, or codominant trees will be retained based on phenotypic characteristics and species preference (Appendix A). Shrubby vegetation will be intermixed with retained trees and clumps of small trees will be left as long as they do not create additional ladder fuels.

Commercial thinning activities will include tractor or cable timber harvest, road maintenance, and post-thinning fuels treatments. Trees will be felled with saws, and then limbed, cut into appropriate lengths for milling, and skidded to landings using tractors, rubber-tired skidders, or cable yarders. Logs will be hauled on logging trucks using tributary roads leading to Forest Highway 7 and on non-Forest roads to the sawmill. Harvesting will include the use of existing landings or construction of new landings, the development of skid trails, and use of existing ponds (or development of new water sources) for dust abatement and road maintenance. After treatment, skid trails will be blocked to prevent unauthorized use. Following thinning, these units will undergo slash removal and ladder fuel reduction. See the Smokey Project Silvicultural Prescription and Marking Guides dated July 13, 2010, for more detailed information and guidelines for individual units (Appendix A).

2.2.3. Plantation Thinning

Existing conifer plantations with high densities of trees less than 10 inches dbh and brush will be thinned and burned in 14 units on a total of 400 acres (Table 4; BA, pp. 15-16). Following thinning, fuels reduction treatments will occur as discussed in Section 2.2.1.

Table 3. Commercial Thinning units and overlap with SPLAT units (see Table 2), LSR, and Matrix (adapted from the BA, Tables 4 and 19).

						Post-Treatment	
Unit	Total Acres	Treatment Method	Acres overlapping SPLATs (Unit)	LSR Acres	Matrix Acres	Canopy Closure (%)	Basal Area (ft^2/ac)
1	33	tractor	0	28	5	30-50	120-180
2	18	tractor	0	18	0	60	125
3	32	tractor	0	32	0	40	125
4	104	tractor	60 (K)	69	35	40-70	150-330
5	59	tractor	59 (K)	59	0	30-40	150
6	27	cable	0	27	0	40	150
7	18	tractor	18 (J)	18	0	40	150
8	26	cable	26 (J)	26	0	40	100-150
9	22	tractor	22 (J)	22	0	40	150
10	36	tractor	36 (F)	36	0	30-40	125
11	50	tractor	0	50	0	20-40	100-150
12	64	tractor	0	64	0	40	125-150
13	22	tractor	0	0	22	40-70	175-295
14	15	tractor	14 (F)	15	0	40	150
15	10	tractor	10 (F)	10	0	40	125
16	22	tractor	22 (F)	22	0	30-40	125
17	67	cable	67 (F)	67	0	40	125-150
18	5	tractor	4 (E)	0	5	40-60	140-195
19	19	tractor	0	0	19	30-60	125-195
20	63	tractor	0	1	62	50-90	150-260
21	34	cable	0	23	11	50-80	150-215
22	2	tractor	2 (F)	2	0	40	150
24	31	tractor	0	31	0	60	150
25	5	tractor	5 (E)	0	5	30-35	150-200
26	26	tractor	0	26	0	40	125
27	32	tractor	8 (C)	32	0	35-40	60-150
28	28	tractor	0	0	28	30-50	100-200
29	39	cable	0	35	4	40-70	150-265
30	24	tractor	21 (B)	24	0	40	150
Total	**933**		**374**	**737**	**196**		

Table 4. Plantation Thin units and overlap with SPLAT units, LSR, and Matrix.

	Acres			
Unit	SPLAT (Unit)	LSR	Matrix	Total
100	0	3	8	11
101	0	0	20	20
102	3 (K)	0	12	12
103	4 (J)	53	0	53
104	0	68	70	138
105	0	0	22	22
106	29 (F)	29	0	29
107	15 (F)	15	0	15
108	0	12	0	12
109	0	60	0	60
110	0	5	0	5
111	15 (C)	15	0	15
112	4 (C)	4	0	4
113	4 (C)	4	0	4
Total	74	268	132	400

2.2.4. Other Related Actions

2.2.4.1. *Road Maintenance*

The project will use Forest Highway 7, Recer Ridge Road, and smaller roadways. The proposed action could include up to 42 miles of maintenance on existing roads to facilitating hauling. Road maintenance could include any or all of the following activities (see BA, pp.16-18):

- Installing, replacing, cleaning, and maintaining culverts
- Road clearance
- Installing or creating closure devices
- Dust abatement
- Grading and blading
- Cleaning, creating, or repairing waterbars/crossdrains
- Outsloping or removing berms
- Plowing snow
- Stabilizing cut and fill slopes

Felling of road/trailside hazard and maintenance trees (BA, p. 18) is also proposed for trees that have the potential to reach a roadway or trail. A hazard tree is: (1) dead, unstable, or has visible defects that could cause personal injury, death, or significant property damage and (2) within one tree height of the road and is straight or leaning toward the road. Upslope distances may be greater in steeper areas where falling trees may slide downhill. A maintenance tree would: (1) prevent effective and efficient maintenance of Forest repair activities, (2) become a hazard tree due to root damage caused by necessary road maintenance and repair activities, (3) prevent road drainage features from functioning, or (4) prevent effective alteration of an inslope road to an

outslope road. Any trees felled onto roadways and cut slopes may be removed. Parts of felled trees remaining outside of the road prism will be left in place as coarse woody debris, unless it creates a fuels hazard or falls within 100 feet upstream of a culvert or bridge.

2.2.4.2. *Temporary Road Construction*

Approximately 2.8 miles of temporary roads will be constructed to facilitate treatment in six commercial thin units (Table 5; BA, p. 19). Temporary roads used to access units 17 and 29 will require the development of a new road bed; the remainder will be created on existing non-system road beds. These roads will be closed immediately after harvest. No permanent road construction is proposed.

Table 5. Temporary road distances (in feet) in commercial thin units.

Unit	Distance
2	1,954
2, 4	6,970
12	2,145
17	694
21	793
29	2,236
Total	14,792

2.2.4.3. *Landings*

Existing landings will be used and two new landings will be created; one in unit 22 and one in unit 29 (Table 3), each less than 0.5 acre in size. Landings will be tilled and planted or allowed to re-seed naturally following use (BA, p. 9).

2.2.4.4. *Water Drafting*

Eight water drafting sites may be used for dust abatement and fire control during road maintenance, timber harvest, and burning operations (BA, p. 19). Proposed temporary sites would be developed at existing culverts by partially blocking the culvert with a board only during the time needed. The board will be removed once water is no longer needed.

2.2.5. Conservation Measures

When used in the context of the Endangered Species Act, conservation measures are actions that are included by the Federal agency as part of the proposed action to further the recovery of and/or to minimize or compensate for project effects on the species under review. Because conservation measures are pledged in the project description by the action agency, their implementation is required under the terms of the consultation (Service and NMFS 1998). The following design criteria constitute conservation measures proposed as part of the Smokey Fuels Treatment Project.

2.2.5.1. *Limited operating period: Noise restrictions for northern spotted owls*

Limited operating periods (LOPs) shall be in place from February 1 through July 10 within 0.25 mile of an occupied activity center or nest tree (as determined by current, protocol-level surveys) for protection against noise disturbance (Table 6). Helitorch operations shall require an increased LOP buffer of 0.5 mile from an occupied activity center or nest tree due to the potential elevated noise level. These LOPs apply to any and all treatment activities that have the potential to increase noise above ambient levels, including road maintenance activities. Seasonal restrictions may be waived, in coordination with the Service, if protocol-level surveys indicate northern spotted owls in known home ranges are non-reproductive. Conversely, if northern spotted owls are detected at a previously unoccupied activity center, the seasonal LOP will be immediately enacted.

Table 6. Treatment units[1] potentially subject to noise LOPs during the breeding season, dependent on results from protocol-level surveys.

SPLAT Units	Commercial Thin Units
A	17
F	

[1]Entire unit is listed; however, only the portion of the unit within 0.25 mile of an occupied activity center or nest tree is subject to the LOP.

2.2.5.2. *Limited operating period: Smoke restrictions for northern spotted owls*

A seasonal restriction from February 1 to July 10 shall apply to activities that create smoke within 0.25 mile of an occupied activity center or nest tree, as determined by current, protocol-level surveys. Helitorch shall require an increased buffer of 0.5 mile due to the potential elevated noise level. Burning *may* take place within this LOP if smoke dissipates or lifts within 24 hours while burning in the spring. If heavy or concentrated smoke begins to inundate an occupied activity center core area late in the afternoon (as determined by current, protocol-level surveys), ignition shall be discontinued (see Supplemental BA, pp. 61-77).

2.2.5.3. *Burning prescriptions*

Burning prescriptions shall be designed to reduce the potential for overstory torching or loss of snags within suitable northern spotted owl habitat in LSR land allocations. The prescribed fire tactics to preserve habitat components described in the Supplemental BA (pp. 61-77) are incorporated here as conservation measures.

2.2.5.4. *Retention of tree clumps*

Occasional clumps of small trees (approximately 5-10 trees per clump) shall be retained to promote size class diversity and provide wildlife cover.

2.2.5.5. *Snag and coarse woody debris retention*

All existing snags shall be retained unless they pose a threat to human safety or occur in densities that could result in high fuels levels (as determined by the Wildlife Biologist and District Fuels Officer). If snags need to be removed, a minimum average of 6 snags per acre in the LSR and 3.2 snags per acre in the Matrix will be retained (see Appendix B for guidelines).

All large logs shall be maintained unless they contribute to dangerous fuels levels (as determined by the Wildlife Biologist and District Fuels Officer). A minimum of three logs greater than 20 inches dbh per acre shall be retained (see Appendix B for guidelines). Large coarse woody debris shall be protected during fuels treatments and burning.

2.2.5.6. *Hand pile retention*

At least one hand pile per acre shall be retained during fuels treatments as northern spotted owl prey habitat. Additional piles shall be reserved if they will not result in mortality of adjacent trees during a wildfire. Piles shall be lit for burning only on one side (preferably the uphill side) to allow small vertebrates, such as woodrats, and invertebrates to escape.

2.2.5.7. *Northern spotted owl habitat protection*

A maximum of 35 percent of suitable northern spotted owl habitat within a core area and 25 percent of suitable habitat within a home range shall be treated annually (including actions from other projects not yet implemented).

Units proposed for timber harvest containing foraging habitat shall maintain:

- 120 to 200 square feet basal area per acre
- 40 to 60 percent overstory canopy closure (minimum)
- 13 inches quadratic mean diameter (minimum)
- 5 trees at least 26 inches dbh per acre (minimum)

Skid trails and falling cut trees shall be routed away from remnant overstory trees. If necessary, duff and ladder fuels will be removed from around remnant overstory trees to limit damage from prescribed burning. Some understory trees shall be retained as perch trees where they do not constitute a fuel hazard, especially in stands lacking a well-established understory. Trees with unique phenotypical differences (e.g., large limbs, broken tops) shall be retained at a minimum of 2 trees per acre and up to 10 percent of the stand in LSR units.

2.2.5.8. *Other conservation measures*

Woodrat nests shall be avoided during burning and thinning treatments.
Live trees with animal nests of any kind (e.g., stick platforms) shall be retained.

2.3. Definition of the Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action, including interrelated and interdependent actions, and not merely the immediate area involved in the action (50 CFR § 402.02). For purposes of this Opinion, the action area is defined as a 1.3-mile buffer around all areas proposed for treatment in Section 2.2 (Service 2009, pp. 18-23). The 1.3-mile distance is based on the average home range size of northern spotted owls in the California Klamath physiographic province and recovery unit and is a suitable scale to assess potential effects to known spotted owl territories from the proposed action. The action area includes all critical habitat that may be directly or indirectly from the proposed action. The action area contains approximately 35,023 acres, which includes the project footprint (6,337 acres, 18 percent of the action area) and 19,068 acres of critical habitat (54 percent of the action area).

3. ANALYTICAL APPROACH

Pursuant to section 7(a)(2) of the Act, Federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. The implementing regulations for section 7 of the Act (50 CFR § 402.02) define "jeopardize the continued existence of" to mean "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, and distribution of that species."

Below, we outline the conceptual framework and key steps and assumptions used in the jeopardy and critical habitat destruction or adverse modification analyses.

3.1. Analytical Framework for the Jeopardy Determination

In accordance with policy and regulation, the jeopardy analysis in this Opinion relies on four components: (1) the *Status of the Species*, which evaluates the species' current range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the current condition of the species in the action area, the factors responsible for that condition, and the role of the action area in the species' survival and recovery; (3) the *Effects of the Action*, which describes the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) *Cumulative Effects*, which evaluates the effects on the species of future, non-Federal activities reasonably certain to occur in the action area.
The jeopardy determination is made in the following manner: the effects of the proposed Federal action are evaluated in the context of the aggregate effects of all factors that have contributed to the northern spotted owl's current status and, for non-Federal activities in the action area, those actions likely to affect the northern spotted owl in the future, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the northern spotted owl in the wild (Service and NMFS 1998).

The project area is located in the California Klamath physiographic province and recovery unit (Service 2011, pp. III-2 and A-3). Pursuant to Service policy, when an action impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, the biological opinion describes how the action affects not only the recovery unit's capability, but also the relationship of the recovery unit to both the survival and recovery of the listed species as a whole. For the northern spotted owl, when an action impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may inform the jeopardy analysis of the northern spotted owl at the range-wide scale.

3.2. Analytical Framework for the Adverse Modification Determination

We are aware that several courts have ruled that the definition of destruction or adverse modification that appears in the Act section 7 implementing regulations at 50 CFR § 402.02 is invalid (*Gifford Pinchot Task Force v. Service*, 378 F.3d 1059 [9th Cir. 2004], amended by 387 F.3d 968 [9th Cir. 2004]), and we do not rely on that definition for the determinations we make in this Opinion. Instead, we rely on the statutory provisions of the Act to complete the analysis

with respect to critical habitat. As we explain in the text below, we use the "conservation value" of critical habitat for our determinations which focuses on its ability to contribute to the conservation of the species for which the area was designated.

The adverse modification analysis in this Opinion relies on four components: (1) the *Status of Critical Habitat*, which evaluates the range-wide condition of designated critical habitat for the northern spotted owl in terms of primary constituent elements, the factors responsible for that condition, and the intended recovery function of the critical habitat overall; (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 primary constituent elements 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 primary constituent elements 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 spotted owl critical habitat are evaluated in the context of the aggregate effects of all factors that have contributed to the current status of the critical habitat at the provincial and range-wide scales and, for non-Federal activities in the action area, those actions likely to affect critical habitat in the future, to determine if critical habitat at the range-wide scale would remain functional (or retain the current ability for the primary constituent elements to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended conservation role for the spotted owl with implementation of the proposed Federal action.

4. THE NORTHERN SPOTTED OWL

4.1. Status of the Species

The following summary text describes those aspects of the northern spotted owl's ecology and threats that have direct bearing on the analysis of the proposed action being considered in this consultation. Appendix C of this Opinion includes a complete description of the species and the threats to its continued existence in substantial detail. In completing this consultation, the Service has considered all information provided in Appendix C in our assessment of project effects.

4.1.1. Northern Spotted Owl Population Status

Because current range-wide survey data are insufficient to produce reliable range-wide estimates of the northern spotted owl's population size, demographic data are used to evaluate trends in 11 spotted owl study area populations. These trends are used as a surrogate to inform a characterization of the range-wide status of the spotted owl. Two recent (January 2009) meta-analyses modeled rates of population change (Forsman et al. 2011). Strong evidence showed that populations declined on 7 of the 11 long-term study areas; the others were either stable or the precision of the estimates was not sufficient to detect declines. In the second meta-analysis, populations declined an estimated 2.8 percent per year in the eight demographic monitoring areas included in the effectiveness monitoring program of the Northwest Forest Plan. Forsman et al.

(2011) indicated that the number of declining populations on study areas in Washington and northern Oregon together with their rates of decline are concerning for the long-term sustainability of northern spotted owl populations.

Annual reports from two of the demographic study areas represent the best source of information on population trends that may be occurring in the recovery unit and action area. The Southern Oregon Cascades Demographic Study Area (DSA) is located approximately 170 miles to the north of the action area boundary and includes portions of the Rogue River-Siskiyou, Fremont-Winema, and Umpqua National Forests. The Willow Creek and Regional Study Areas are located approximately 85 miles to the northwest of the action area boundary and include portions of the Six Rivers, Klamath, and Shasta-Trinity National Forests, and lands managed by the Bureau of Land Management.

Southern Oregon Cascades Demographic Study Area
The fiscal year 2012 report from the Southern Oregon Cascades DSA was completed in December of 2012 (Dugger et al. 2012). In 2012, 42 percent of the 170 territories monitored were occupied, which is a 3.5 percent increase from 2011; however, the number of pairs located was the lowest recorded during the study period (Dugger et al. 2012, p. 4). Of the 44 owl pairs detected in 2012, 15 pairs nested and produced an average of 1.46 young per successful pair, which is similar to the average for all years (1.60) of the study (Dugger et al. 2012, p. 6). In 2012, the average number of young fledged per pair (0.5) was less than the average for all years of the study (0.67; Dugger et al. 2012, p. 6).

Willow Creek and Regional Study Areas
The calendar year 2012 report from the Willow Creek and Regional Study Areas was completed in March of 2013 (Franklin et al. 2013). In 2012, 37.2 percent of the 94 territories monitored were occupied, which is a 6.6 percent decrease from 2011; the number of pairs detected also dropped from 32 in 2011 to 27 in 2012 (Franklin et al. 2013, pp. 6, 16; Franklin et al. 2012, pp. 6, 16). Of the 27 owl pairs detected in 2012, 19 pairs nested and 4 of those pairs were monitored for reproductive success with an average of 2.0 young produced, which is above the average for all years (1.58) of the study (Franklin et al. 2013, pp. 19-21). In 2012, the average number of young fledged per pair (0.35) was less than the average for all years of the study (0.58; Franklin et al. 2013, pp. 20-21).

4.1.2. Habitat Use

Northern 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), multi-layered, multi-species canopy with large overstory trees (dbh greater than 30 inches), high incidence of large trees with various deformities, 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, p. 19).

Foraging habitat for northern spotted owls is correlated with the habitat needs of prey species. In the southern portion of the range, where dusky-footed woodrats (*Neotoma fuscipes*) are the primary prey source, northern spotted owls forage in younger stands (Carey et al. 1992, p. 247;

Rosenberg and Anthony 1992, p. 165; Thome et al. 1999, pp. 56-57) and along the edge between young forests and mid- to late-successional forests (Zabel et al. 1995, Sakai and Noon 1997, Ward et al. 1998).

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 (Service 2011, p. G-1). Dispersal habitat may include younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, but such stands should contain some roosting structures and foraging habitat to allow for temporary resting and feeding for dispersing juveniles (Service 2011, p. G-1). Forsman et al. (2002, p. 22) found that spotted owls could disperse through highly fragmented forest landscapes.

The Service has used information provided by the USFS, BLM, and National Park Service to update the habitat baseline conditions by tracking relative habitat changes over time on Federal lands for northern spotted owls on several occasions, since the northern spotted owl was listed in 1990 (USFS and BLM 1994b; Service 2001; Lint 2005; Davis et al. 2011). The most recent mapping effort (Davis et al. 2011, Appendix D) indicates approximately 8.85 million acres of spotted owl nesting/roosting habitat existed on Federal lands and 4.19 million acres existed on non-federal lands at the beginning of the Northwest Forest Plan in 1994/1996. Appendix C includes a discussion of the range-wide habitat baseline.

4.1.2.1. *Northern California Coast Ranges Ecological Section*

The majority of the Mendocino National Forest is located within the Northern California Coast Ranges ecological section (Goudey and Smith 1994). A very small portion (5,000 acres) along the easternmost edge of the Forest is in the Northern California Interior Coast Ranges section (Fig. 2; Miles and Goudey 1997, pp. 6-1 and 7-1; McNab et al. 2007, p. 26). The Northern California Coast Ranges section is approximately 3.8 million acres spanning 10 counties and bordered by three ecological sections: Northern California Coast to the west, Klamath Mountains to the northeast, and the Northern California Interior Coast Ranges to the south and east. This classification and nomenclature differs from that used in the northern spotted owl Recovery Plan, which is based on information gathered from the time of northern spotted owl listing in 1990 (Service 2011, p. III-2 and A-2). There, the Mendocino National Forest is located in the California Coast and California Klamath physiographic provinces and recovery units (Service 2011, p. A-3). Although the differences in nomenclature can be confusing, the Northern California Coast Ranges section more accurately describes the landscape in which the Forest belongs, and Figure 2 illustrates that the Forest in not located within the Klamath Mountains ecological section. The Recovery Plan and critical habitat rule recognized this as well and the Northern California Coast Ranges section was used as a modeling region for both publications and renamed the Interior California Coast (Service 2011, pp. C-12 and C-13; Service 2012b, pp. 71912-71913).

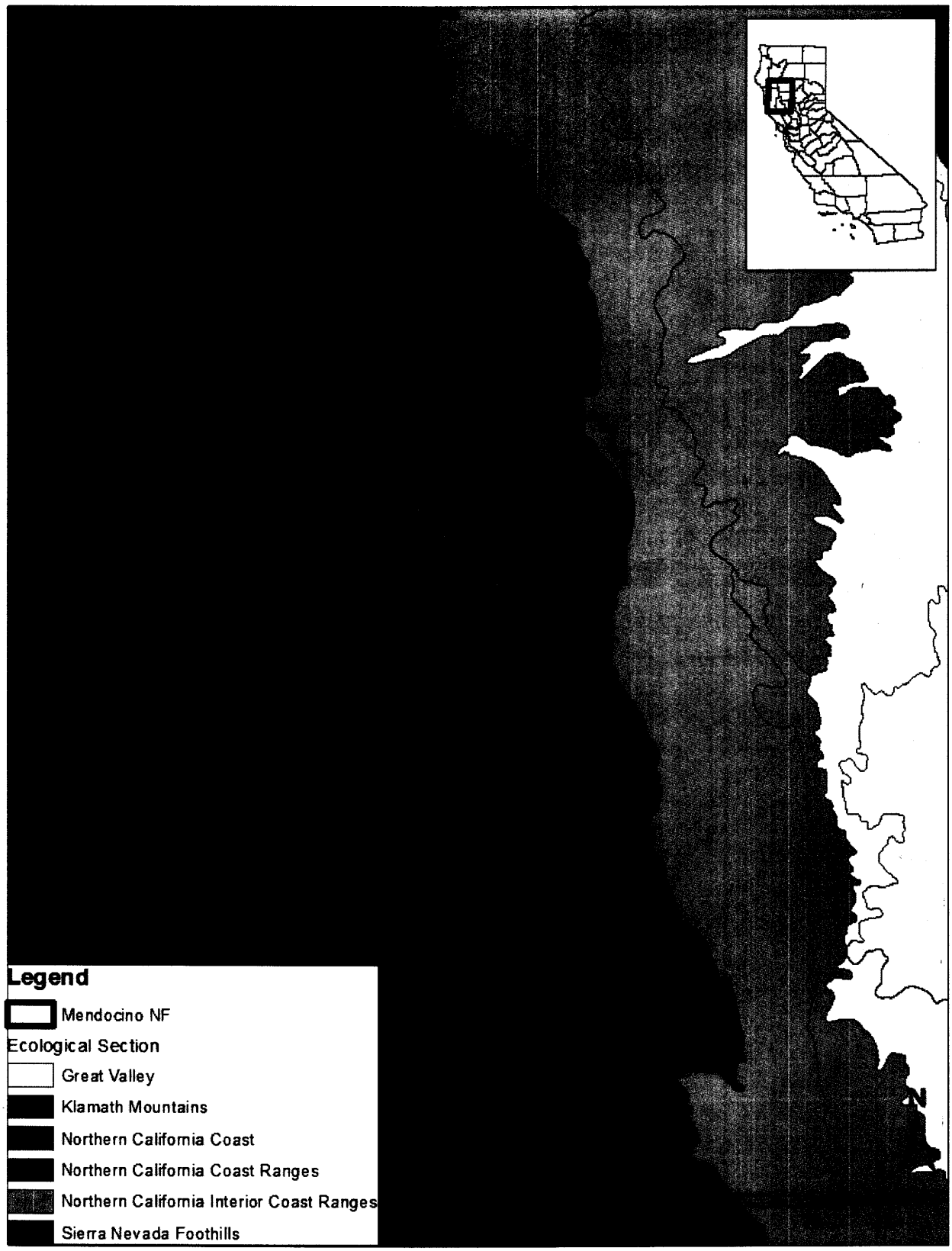


Figure 2. Ecological sections within the area of the Mendocino National Forest.

Vegetation and forest types differ in the Northern California Coast Ranges from those of neighboring sections due to the interactions among topography, geologic lithologies, and regional climate. Mountain ranges in this section are relatively parallel to the coast and are 300 to 8,100 feet in elevation (McNab et al. 2007, p. 26; Miles and Goudey 1997, p. 6-1). The Northern California Coast Ranges has a Mediterranean climate, characterized by cool, wet winters and warm, dry summers (Skinner et al. 2009, p. 79). Although inland, this section is near enough to the coast that marine air still influences the climate (Miles and Goudey 1997, p. 6-1). Over 90 percent of precipitation falls between October and April, with altitude, topography, and proximity to the Central Valley playing a strong role in the amount received (Skinner et al. 2009, p. 79).

True fir and mixed Douglas-fir forests are found at high elevations, with mixed conifer, conifer–hardwoods, and ponderosa pine forests common at lower elevations (McNab et al. 2007, p. 26; Miles and Goudey 1997, p. 6-1). Along the southeastern edge of the section, chaparral and knobcone pine forests become more prevalent (Miles and Goudy 1997, pp. 6-4 to 6-6). High amounts of annual precipitation, which lead to productive forests, combined with a high incidence of lightning strikes has resulted in fire-dependent forest ecosystems (Agee 1993, pp. 283-284). Fires were quite frequent historically and spanned the spectrum of fire severity, which kept surface and ladder fuels from accumulating (Stuart and Stephens 2006, p. 163). A century's worth of fire suppression has increased the risk of large, severe wildfires; events that were rare historically.

The Northern California Coast Ranges includes three northern spotted owl critical habitat units: Interior California Coast, Klamath West, and Redwood Coast. The critical habitat units in this section cover approximately 688,165 acres of Federal land, which is 31 percent of all critical habitat in California (Federal lands comprise approximately 40 percent of the Northern California Coast Ranges ecological section). The Klamath Mountains ecological section accounts for the majority of critical habitat in the state (66 percent; see Section 4.2 for further discussion).

4.1.2.2. *Mendocino National Forest*

The Mendocino National Forest is situated near the southernmost portion of the northern spotted owl's range. Summer temperatures in this area are commonly higher than in other parts of their range. Climate data from Covelo shows that temperatures between 1941 and 2001, on average, were at or above 90°F (32°C) 74 days per year, with most hot days occurring between July and September (Golden Gate Weather Services 2002). Covelo data also show that average maximum temperatures for July and August (from 1948 to 2005) were above 92°F (33°C) (Western Regional Climate Center 2014). Barrows and Barrows (1978), Forsman et al. (1984), and Weathers et al. (2001) all reported that northern spotted owls become stressed at temperatures above 82°F (28°C); however, there is no evidence that individuals have ever been directly killed by high temperatures because they thermoregulate by seeking out cooler roosts in the forest understory and in topographical microclimates. Glenn et al. (2010) found that population growth rate at their southernmost study site in the Oregon Cascades was the highest following years with above-normal rainfall during the growing season, lower winter precipitation, and fewer days less than 90°F. This site, located about 200 miles north of the action area, had the greatest number of days with temperatures at or above 90°F of any within their study area. It is possible that

summers with many hot days are associated with reduced prey populations or foraging success, rather than direct effects to owls, thereby reducing survival and population growth of northern spotted owls (Glenn et al. 2010). High-quality habitat may be much more important in the southern part of the range as a mechanism to avoid heat stress.

Habitat in the Mendocino National Forest is drier and more naturally fragmented than in the northern portion of the Coast Ranges. Climate, aspect, and elevation influence habitat types, resulting in a mosaic of north-facing slopes dominated by mixed-conifer and conifer-hardwood forests, and south-facing slopes either brushy or covered with relatively sparse conifer-hardwood stands dominated by ponderosa pine. Hardwoods contribute significant biomass to woodrats, the northern spotted owl's primary prey in the area. Past logging and severe wildfires have exacerbated the natural habitat fragmentation in the area. The Forest estimated in their Land and Resource Management Plan (1995) that the Forest provides approximately 90,506 acres of high- and medium-quality habitat for northern spotted owls.

Mixed conifer forests in northwestern California have a high incidence of lightning strikes (Agee 1993, p. 283-284) which create large, complex fires that are a cause of natural habitat loss. Within the Klamath Mountains section, pre-settlement fire-return rates averaged 11-17 years at lower elevations and 37 years at higher elevations (Agee 1993, p. 284). Historic fire frequencies on the Mendocino National Forest in mesic forests were similar to those for the Klamath Mountains, but drier areas on the eastside had shorter fire return intervals of 5-10 years (Skinner et al. 2009, p. 88). Prior to the 1850s, fires were mostly low- to moderate-severity resulting in mortality of hardwoods in the understory but retention of large trees in the overstory (Agee 1993, p. 284). The fire suppression regime that was in place for a century nationwide has led to heavy fuel loads and increased stand densities, which has heightened the risk of severe, stand-replacing fires in current times (see Miller et al. 2012 for further discussion).

In addition to using habitat typically defined as suitable habitat, northern spotted owls in this area also use habitat surrounded by more open stands and utilize denser hardwood conifer habitat (USFS 1999). Analysis of microhabitat characteristics of 37 known nest sites on the Forest showed that 67 percent were located on cooler east to northwest aspects, and less than 15 percent of all nest sites were located at or above 5,000 feet in elevation. Only two nest sites were located on warmer west/southeast aspects below 4,300 feet in elevation; one was located in a mostly east-facing steep-walled canyon (USFS 1999).

Most of the Mendocino National Forest was surveyed for northern spotted owls between 1974 and 1995, with systematic surveys in late-successional reserves between 1989 and 1991. More recent surveys have been completed since 2010 as a result of site specific projects, such as timber sales. Based on the information gained through these survey efforts, Forest biologists designated activity centers for each pair and resident single birds, resulting in 226 activity centers across the Forest. An activity center is an area of concentrated activity of either a pair of northern spotted owls or a territorial single northern spotted owl (USFS and BLM 1994a, 1994b).

4.1.2.3. *Grindstone Creek Watershed*

The Smokey Project is located within Grindstone Creek watershed, the majority of which (84 percent) is within the Forest. The remainder is under private ownership (slightly less than 16

percent) or managed by the Bureau of Land Management (less than 1 percent; USFS 1995, p. 7). Late-successional reserves cover 27,554 acres of the watershed and the action area encompasses 32 percent (35,023 acres) of the watershed.

Fire, grazing, and timber harvest have had major influences in the present availability of northern spotted owl habitat in the watershed (Supplemental BA, p. 11). Fires set by Native Americans, along with those naturally ignited, resulted in fire-dependent plant communities (including brush and hardwoods) across large areas. Grazing peaked from 1870 to 1900 and fire was extensively used to manage grazing areas. Since then, the Forest has converted several brush fields to grass for cattle grazing, fuel breaks, and a mosaic of vegetation for wildlife. Harvesting of wood products began in the 1850s, mostly for local use, but high demands for timber after World War II led to large timber harvests at high elevations in the watershed. Timber harvest has greatly decreased since the 1980s, during which time more than 33 million board feet were harvested. Between 1991 and 1995, a total of 573.4 acres of the watershed was harvested, representing an 80 percent decrease from the average acreage harvested between 1948 and 1990 (USFS 1995, pp. 16-17).

In Grindstone Creek watershed, 23 percent of Forest lands have late-successional characteristics. When the Grindstone Creek Watershed Analysis was completed in 1995, there was an estimated 7,795 acres of northern spotted owl nesting/roosting habitat (USFS 1995, p. 32). Analyses completed for this project estimated that 7,412 acres of nesting/roosting habitat, 13,213 acres of foraging habitat, and 24,943 acres of dispersal habitat existed within the watershed.
The 1995 Watershed Analysis concluded that 13 northern spotted owl activity centers existed within the watershed, 11 having pair status and two having territorial single status; however, they had not been verified (USFS 1995, p. 31).

4.1.2.4. *Late-Successional Reserves*

The Northwest Forest Plan established Late-Successional Reserves with the objectives of providing sufficient habitat to support clusters of owls, to allow for dispersal of owls between these reserves, and to protect and enhance conditions of late-successional and old-growth forest (LSOG) ecosystems, which serve as habitat for LSOG associated species. The Mendocino National Forest's Forest-Wide LSR Assessment (USFS 1999) addressed habitat status for LSOG associated species in seven LSRs, and location and condition of 75 individual 100-acre LSRs.

When the assessment was conducted in 1998, approximately 33,471 acres of mid-successional habitat, 40,597 acres of late-successional habitat, and 67,297 acres of old-growth habitat existed in the seven LSRs on the Mendocino National Forest. Late-successional habitat in these seven LSRs was estimated to grow to 99,254 acres by 2048, in the absence of any large-scale disturbances. According to the LSR Assessment, the seven LSRs are at 70 percent of their goal overall to the contribution of recovery (ratio of the number of activity centers to pair goals established in the 1992 Recovery Plan); systematic spotted owl surveys of the LSRs have not been conducted since this LSR Assessment was completed 15 years ago.

The majority of the Smokey Project occurs within the Buttermilk LSR (RC 309). The Buttermilk LSR includes approximately 65,803 acres of Forest lands and 854 acres of private lands. It is the largest LSR in the Forest, and functions as the link between the Yolla Bolly-Middle Eel

Wilderness and the Grizzly LSR (RC 310). The Buttermilk LSR is located approximately 15 miles northwest of Elk Creek, California and encompasses portions of the Grindstone, Thomes Creek, and Middle Fork Eel watershed. When the Forest's LSR Assessment was completed in 1999, an estimated 18,030 acres of nesting/roosting habitat and 13,897 acres of foraging habitat were available in the Buttermilk LSR. A total of 28 activity centers were confirmed within this LSR; however, most of the LSR has not been surveyed to determine if northern spotted owls are still present at these activity centers. Most of the 1.3-mile home ranges of the activity centers within the LSR overlap and extend beyond the LSR boundaries (USFS 1999, p. A1-9).

In 2001, an interagency team rated the functionality of these LSRs based on the average probability of owl occupancy and the sum probability of colonization (Service 2001). Unlike the LSR Assessment, this effort focused solely on northern spotted owls and their habitats. The Buttermilk LSR was rated as sufficiently providing for the northern spotted owl because the average probability of spotted owl presence is greater than 0.45 and the sum of probability of colonization is high.

4.1.3. Threats

The Recovery Plan for the northern spotted owl (Service 2011) indicates that past and current habitat loss from timber harvest and wildfire, and competition from barred owls are the most pressing threats to northern spotted owl recovery. Addressing the threats associated with past and current habitat loss must be conducted simultaneously with addressing the threat from barred owls (Service 2011, p. I-8). Within fire-dependent forests, northern spotted owls have adapted to withstand fires of variable sizes and severities. However, fire is often considered a primary threat to spotted owls because of its potential to rapidly alter habitat (Bond et al. 2009) and is a major cause of habitat loss on Federal lands (Courtney et al. 2004).

Barred owls may be exacerbating the northern spotted owl population decline by reducing northern spotted owl site occupancy, reproduction, and survival (Dark et al. 1998; Gutiérrez et al. 2004; Courtney et al. 2004; Olson et al. 2005; Anthony et al. 2006). Barred owl presence also affects the monitoring and management of northern spotted owls due to a reduction in detectability (Kelly et al. 2003; Courtney et al. 2004; Olson et al. 2005; Crozier et al. 2006).

Most published studies on barred owls in the Pacific Northwest have been ancillary to studies being conducted on northern spotted owls. Because the information on detections of barred owls at the local level has been collected incidental to northern spotted owl surveys, the data are neither consistently collected nor consistently reported, and are usually reported in the literature either as a ratio of barred owls to northern spotted owls or as numbers of barred owls detected over time. Consequently, there is a great deal of uncertainty about the barred owl's pattern of range expansion, its interaction and the consequences of those interactions with northern spotted owls, and the contribution of barred owls to the decline of northern spotted owls both in terms of direct effects (e.g., competition, predation, social harassment, hybridization) or indirect effects (e.g., weather, additional pressure on spotted owls in combination with habitat loss and/or lag effects associated with previous habitat loss) (Dugger et al. 2011, pp. 2463-2467). However, it is apparent that barred owls have greatly and rapidly expanded their distribution within the range of the northern spotted owl and that they have demonstrated negative inter-specific interactions

with the northern spotted owl (Courtney et al. 2004, p. 7-25). Such information is a serious concern for the Service, as identified in the Recovery Plan (Service 2011, pp. I-8 and I-9).

Barred owls were first detected within the boundaries of the Southern Oregon Cascades DSA in 1981 (Dugger et al. 2012, p. 9), within the Willow Creek Study Area in 1991 (Franklin et al. 2013, p. 9), and within the Regional Study Area in 1992 (Franklin et al. 2013, p. 9). Barred owls appear to be competing with northern spotted owls for prey and habitat (Service 2011, p. I-9). The aforementioned study areas were not designed to systematically follow trends in barred owl occupancy, but they have gathered a significant number of anecdotal detections during the course of northern spotted owl surveys. Within the Southern Oregon Cascades DSA, the annual percentage of historic territories with both northern spotted owls and barred owls or barred owls alone has increased from 4.1 percent in 1990 to 30.1 percent in 2012 (Dugger et al. 2012, p. 9). Cumulatively within the Southern Oregon Cascades DSA, 68 percent of the sites have had at least one barred owl detection during the course of the study (Dugger et al. 2012, p. 9).

Beginning in 2008, the Willow Creek and Regional Study Areas initiated barred owl-specific surveys. The proportion of surveyed northern spotted owl territories with barred owl detections in 2012 was 0.35 (n=33), which is slight decrease from 2011 (0.38 [n=36]; Franklin et al. 2013, pp. 10, 21; Franklin et al. 2012, p. 9). The number of barred owls sites increased from 21 in 2011 to 25 in 2012 (Franklin et al. 2012, p. 10; Franklin et al. 2013, p. 10).

4.1.4. Conservation and Recovery

The northern spotted owl Recovery Plan (Service 2011) identifies three main priorities for achieving northern spotted owl recovery: (1) protecting the best remaining habitat, (2) actively managing forests to improve forest health, and (3) reducing competition from barred owls. Forest management recommendations for habitat restoration are dependent on the recovery unit. The range of the northern spotted owl was partitioned into 12 physiographic provinces around the time of listing (Appendix D, Fig. 1; Thomas et al. 1990, p. 61). These provinces were adopted as recovery units in the Recovery Plan, with the exception of the Willamette Valley (Service 2011, pp. III-2 and A-3). The Smokey Fuels Treatment Project is located within the California Klamath physiographic province and recovery unit (Service 2011, p. A-2), which provides connectivity between the other recovery units in the state (California Coast and California Cascades) and Oregon, and provides for the demographic stability of the species (Service 1992a, p. 176).

In general, the Recovery Plan recommends retaining more occupied northern spotted owl sites and unoccupied, high value northern spotted owl habitat on all lands, as well as avoiding forest management activities that are likely to diminish a home range's capability to support northern spotted owl occupancy, survival, and reproduction in the long-term. Due to the unique characteristics of the dynamic, disturbance-prone "dry forests" within this part of the northern spotted owl's range and current scientific uncertainty, the Recovery Plan calls for an adaptive management approach to fire management and northern spotted owl recovery. This active management should be implemented in a way that reconciles the overlapping goals of northern spotted owl conservation, response to climate change, and restoration of dry forest ecological structure, composition and processes, including wildfire and other disturbances (Service 2011, pp. III-20 through III-41). Vegetation management that may have short-term impacts, but is potentially beneficial to occupied northern spotted owl sites in the long-term, meets the goals of

this ecosystem-scale conservation. Such actions may include silvicultural treatments that promote ecological restoration and are expected to reduce future losses of spotted owl habitat and improve overall forest ecosystem resilience to climate change, which should result in more habitat retained on the landscape for longer periods of time (Service 2011, p. I-9).

Specific to the California Klamath physiographic province and recovery unit, the Recovery Plan recommends actively managing for fuels reduction due to the high amount of habitat lost to wildfire (Table 7). There are approximately 1.4 million acres of northern spotted owl habitat in the California Klamath recovery unit (Table 8).

4.2. Status of Critical Habitat

The following focuses on the northern spotted owl's designated critical habitat that will be affected by the proposed action being considered in this consultation. Appendix D of this Opinion includes a complete description of critical habitat designated range-wide in substantial detail. In completing this consultation, the Service has considered all information provided in Appendix D in our assessment of project effects.

4.2.1. Conservation Role of Critical Habitat

Critical habitat contains those areas that are essential to the conservation of the species. The final rule designating critical habitat for the northern spotted owl was published on December 4, 2012 (Service 2012b), and was effective on January 3, 2013. Designated critical habitat for the northern spotted owl includes approximately 9,577,969 acres in 11 units and 60 subunits in California, Oregon, and Washington.

The recovery of the northern spotted owl requires habitat conservation in concert with the implementation of recovery actions (Service 2012b, p. 71879). The conservation role of northern spotted owl critical habitat is to "adequately support the life-history needs of the species to the extent that well-distributed and inter-connected northern spotted owl nesting populations are likely to persist within properly functioning ecosystems at the critical habitat unit and range-wide scales" (Service 2012b, p. 71938). The specific conservation role of the subunit included in the action area is described in the Environmental Baseline (section 4.3.5).

4.2.2. Physical or Biological Features and Primary Constituent Elements

When designating critical habitat, the Service considers "the physical or biological features essential to the conservation of the species and which may require special management considerations or protection" (50 CFR § 424.12; Service 2012b, p. 71897). The primary constituent elements (PCEs) are the specific elements of the physical or biological features that are considered essential to the conservation of the northern spotted owl and are those elements that make areas suitable as nesting, roosting, foraging, and dispersal habitat (Service 2012b, p. 71904). The PCEs should be arranged spatially such that it is favorable to the persistence of populations, survival, and reproductive success of resident pairs, and survival of dispersing individuals until they are able to recruit into a breeding population (Service 2012b, p. 71904).

Some critical habitat subunits may contain all of the PCEs discussed below and support multiple life history requirements of the northern spotted owl, while other subunits may contain only

those PCEs necessary to support the species' particular use of that habitat. All of the areas designated as critical habitat; however, do contain PCE 1, forest type. Therefore, PCE 1 always occurs in concert with at least one additional PCE (Service 2012b, p. 72051). Northern spotted owl critical habitat does not include meadows, grasslands, oak woodlands, aspen woodlands, or manmade structures and the land upon which they are located (Service 2012b, p. 71918).

4.2.2.1. *Primary Constituent Element 1: Forest Types*

Primary forest types that support the northern spotted owl are: Sitka spruce, western hemlock, mixed conifer, mixed evergreen, grand fir, Pacific silver fir, Douglas-fir, white fir, Shasta red fir, redwood/Douglas-fir, and moister ponderosa pine (Service 2012b, p. 72051). On the Mendocino National Forest, forest types include mixed conifer, conifer hardwood, red fir, and the moist end of the ponderosa pine forests.

4.2.2.2. *Primary Constituent Element 2: Nesting and Roosting Habitat*

Nesting and roosting habitat for northern spotted owl provides structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risk for adults and young. In many cases, the same habitat may also provide for foraging. Nesting and roosting habitats must provide: sufficient habitat for foraging by territorial pairs, moderate to high canopy closure (60 to over 80 percent), multilayered and multispecies canopies with large overstory trees (20 to 30 inches dbh), basal area greater than 240 square feet per acre, high diversity of tree diameters, high incidence of large live trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other evidence of decadence), large snags and large accumulations of woody debris on the ground, and sufficient open space beneath the canopy for flight (Service 2012b, p. 72051).

4.2.2.3. *Primary Constituent Element 3: Foraging Habitat*

Across the range of the northern spotted owl, nesting and roosting habitats (PCE 2) also provide foraging opportunities; however, northern spotted owls may use other habitat types for foraging as well. The components of PCE 3 for northern spotted owl foraging habitat in the Klamath and Northern California Interior Coast Ranges are stands of nesting and roosting habitat including other forest types with mature and old-forest characteristics; presence of conifer (incense-cedar, sugar pine, Douglas-fir) and hardwood (bigleaf maple, black oak, live oaks, madrone, shrubs) species, forest patches within riparian zones of low-order streams and edges between conifer and hardwood forest stands, brushy openings and dense young stands or low-density forest patches within a mosaic of mature and older forest habitat, high canopy cover (87 percent at frequently used sites), multiple canopy layers, mean stand diameter greater than 21 inches dbh, increasing mean stand diameter and densities of trees greater than 26 inches increases foraging habitat quality, large accumulations of fallen trees and other woody debris on the ground, and sufficient open space below the canopy for northern spotted owls to fly (Service 2012b, pp. 72051-72052).

4.2.2.4. *Primary Constituent Element 4: Dispersal Habitat*

Northern spotted owl dispersal habitat is habitat that supports the transience and colonization phases of owl dispersal, and in all cases would optimally be composed of nesting, roosting, or foraging habitat (PCE 2 or 3), but which may also be composed of other forest types that occur between larger blocks of northern spotted owl nesting, roosting, or foraging habitat. In cases

where nesting, roosting, or foraging habitats are insufficient to provide for dispersing or nonbreeding owls, the specific dispersal PCEs are: habitat supporting transience phase of dispersal (protection from avian predators, minimal foraging opportunities, younger and less diverse forests that provide some roosting structures and foraging opportunities) and habitat supporting the colonization phase of dispersal (nesting, roosting, and foraging habitat but in smaller amounts than needed to support a nesting pair) (Service 2012b, p. 72052).

4.2.3. Zones of Habitat Associations Used by Northern Spotted Owls

Differences in patterns of habitat associations used by the northern spotted owl across its range suggest four different broad zones of habitat use, which we characterize as the (1) West Cascades/Coast Ranges of Oregon and Washington, (2) East Cascades, (3) Klamath and Northern California Interior Coast Ranges, and (4) Redwood Coast (Fig. 3). Appendix D summarizes the physical and biological features for each of these four zones. The Smokey project is located in the Klamath and Northern California Interior Coast Ranges zone.

4.2.3.1. *Klamath and Northern California Interior Coast Ranges*

The Smokey Project is located in the Interior California Coast unit of critical habitat located within the Klamath and Northern California Interior Coast Ranges zone (Fig. 3; Service 2011, p. C–13). This zone, which includes the Klamath West and Klamath East critical habitat units in southwestern Oregon and northwestern California, is characterized by very high diversity of climatic conditions and vegetation resulting from steep gradients of elevation, dissected topography, and large differences in moisture from west to east. Summer temperatures are high, and northern spotted owls occur at elevations up to 5,800 feet. The western portions of this zone support a diverse mix of mesic forest communities interspersed with drier forest types. Forests of mixed conifers and evergreen hardwoods are typical of the zone. The eastern portions of this zone have a Mediterranean climate with increased occurrence of ponderosa pine. Douglas-fir/dwarf mistletoe is rarely used for nesting platforms in the western part of the northern spotted owl's range, but is commonly used in the east.

The prey base for northern spotted owls in this zone is correspondingly diverse, but dominated by dusky-footed woodrats, bushy-tailed woodrats, and flying squirrels. Northern spotted owls have been well studied in the western Klamath portion of this zone (Forsman et al. 2004, p. 217), but relatively little is known about northern spotted owl habitat use in the eastern portion and the California Interior Coast Range portion of the zone (where the Smokey Fuels Treatment Project is located).

Our habitat association models for this zone suggest that vegetation structure and topographic features are nearly equally important in influencing owl population performance, particularly in the Klamath. High canopy cover, high levels of canopy layering, and the presence of very large dominant trees were all important features of nesting and roosting habitat. Compared to other zones, additional foraging habitat for this zone showed greater divergence from nesting habitat, with much lower canopy cover and tree size. Low to intermediate slope positions were strongly favored. In the eastern Klamath, the presence of Douglas-fir was an important compositional variable in our habitat model (Service 2012b, p. 71904).

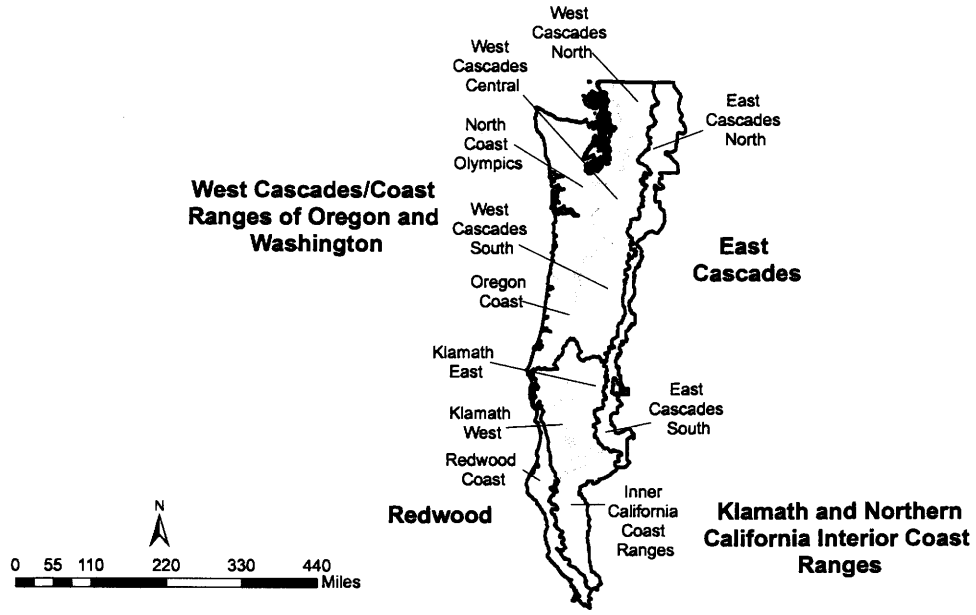


Figure 3. Eleven regions and four zones of habitat associations used by northern spotted owls in Washington, Oregon, and California.

Special Management Considerations

The special management considerations or protections identified by the Service for the Klamath and Northern California Interior Coast Ranges reflect a mix of the nesting, roosting, foraging, and dispersal habitats needed in both moist and dry forest types that are found interspersed across the region and apply to critical habitat units 9, 10, and 11.

In dry forests, such as where the Mendocino National Forest is situated, natural disturbance regimes and vegetation structure, composition, and distribution have been substantially altered since Euro-American settlement. Retention and recruitment of spotted owl habitat may necessitate vegetation and fuels management that influences fire behavior, severity, and distribution to restore more natural vegetation and disturbance regimes and heterogeneity. Similarly, active forest management is called for in younger, homogeneous stands. Active management that retains larger and older trees but reduces the density of smaller trees may accelerate development of habitat structure necessary for northern spotted owl conservation (Service 2012b, p. 71908-71909).

4.2.3.2. *Critical Habitat Unit 11: Interior California Coast*

The Interior California Coast (ICC) unit is located in the far, southeastern portion of the northern spotted owl's range; bordered by the Redwood Coast, Klamath West, and East Cascades South units (Fig. 3). This unit differs markedly from the adjacent redwood coast region. Due to the influence of the adjacent Central Valley, summer temperatures in parts of this unit are among the highest within the northern spotted owl's range (Service 2012b, p. 71935). The unit consists of approximately 941,568 acres divided into eight subunits in Shasta, Trinity, Humboldt, Tehama, Mendocino, Glenn, Colusa, Lake, Sonoma, and Napa counties in California and is under either Federal or State management (Service 2012b, p. 71919, 72068).

4.2.4. Climate Change and Critical Habitat

There is growing evidence that recent climate change has impacted a wide range of ecological systems (Stenseth et al. 2002, entire; Walther et al. 2002, entire; Ådahl et al. 2006, entire; Karl et al. 2009, entire; Moritz et al. 2008, entire; Westerling et al. 2011, p. S459; Marlon et al. 2012, p. E541). Climate change, combined with effects from past management practices, is exacerbating changes in forest ecosystem processes and dynamics to a greater degree than originally anticipated under the NWFP. Environmental variation affects all wildlife populations; however, climate change presents new challenges as systems may change beyond historical ranges of variability. In some areas, changes in weather and climate may result in major shifts in vegetation communities that can persist in particular regions.

Climate change will present unique challenges to the future of northern spotted owl populations and their habitats. Northern spotted owl distributions (Carroll 2010, entire) and population dynamics (Franklin et al. 2000, entire; Glenn et al. 2010, entire; Glenn et al. 2011a, entire; Glenn et al. 2011b, entire) may be directly influenced by changes in temperature and precipitation. In addition, changes in forest composition and structure as well as prey species distributions and abundance resulting from climate change may impact availability of habitat across the historical range of the subspecies. The 2011 Northern Spotted Owl Revised Recovery Plan provides a detailed discussion of the possible environmental impacts to the habitat of the northern spotted owl from the projected effects of climate change (Service 2011, pp. III-5 to III-11).

Because both northern spotted owl population dynamics and forest conditions are likely to be influenced by large-scale changes in climate in the future, we have attempted to account for these influences in our designation of critical habitat by recognizing that forest composition may change beyond the range of historical variation, and that climate changes may have unpredictable consequences for both Pacific Northwest forests and northern spotted owls. Our critical habitat designation also recognizes that forest management practices that promote ecosystem health under changing climate conditions will be important for northern spotted owl conservation.

4.3. Environmental Baseline

The environmental baseline is defined as including "the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process" (50 CFR § 402.02). Such actions may include, but are not limited to, previous timber harvests and other land-management activities. The discussion of the environmental baseline below addresses the current condition of the spotted owl in the action area, the factors responsible for that condition, and the role of the action area in the survival and recovery of the spotted owl.

4.3.1. Current Condition in the Action Area

The action area is defined in 50 CFR § 402.02, as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." The Smokey action area encompasses 35,023 acres (Fig. 4; see Section 2.3 for action area definition) and includes five northern spotted owl home ranges. This section describes the factors responsible for

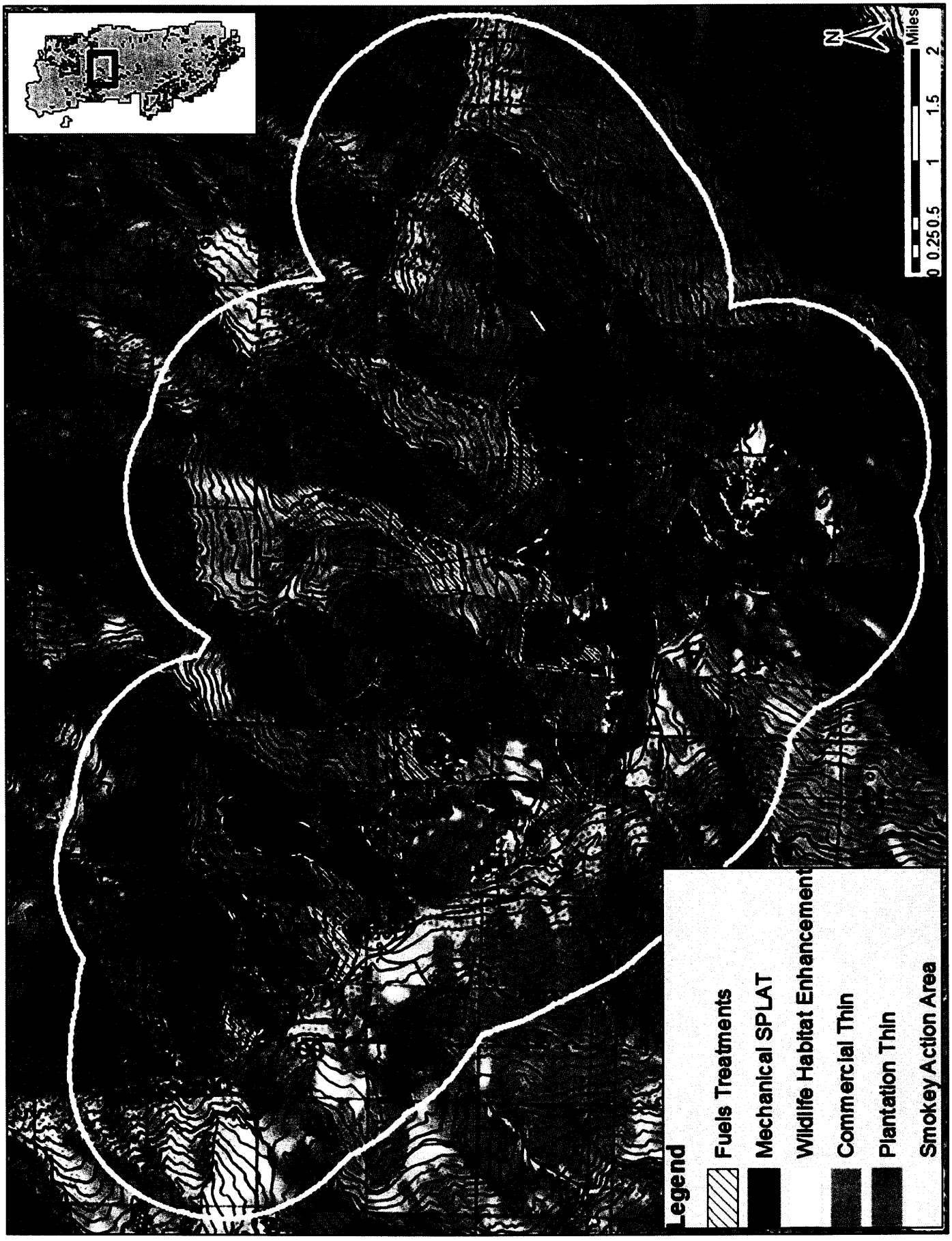


Figure 4. The Smokey Project and its associated action area.

the current condition of the action area. As mentioned in Sections 4.1.4 and 4.2.3, the Smokey Project and action area are located in the California Klamath physiographic province and recovery unit, and critical habitat Subunit ICC 3 in Unit 11 (Interior California Coast).

4.3.1.1. *Previous Federal Activities in the Action Area*

Approximately 13 different timber harvest projects have occurred within the action area since 1964, resulting in treatment of 4,798 acres within the action area (Table 7); however, due to some project overlap, the actual footprint of the treated areas cover 4,478 acres, or 13 percent, of the action area. Approximately 1,500 acres of this treatment resulted in plantation development that represents a change in forest successional stage (e.g., mid-successional forest to early-successional forest).

Table 7. Previous U.S. Forest Service timber harvest projects within the action area (BA p. 23).

Year Implemented	Project	Acres
1964-1966	Burnt Creek	823
1975	Carnation	46
1978-1982	Lake	675
1978-1979	Templeton	339
1979-1983	Lake II	1,197
1981-1984	Butte Creek	142
1984	Snow	627
1985	Atchison	147
1985	Cattle	62
1989	Red Dog	198
1990	Bredehoft	125
1990	Pinto	397
1997	Ditch[1]	20
	Total	4,798

[1]Informal consultation with the Service (TAILS No. 1-12-96-I-6).

4.3.1.2. *Current Federal Activities in the Action Area*

Current Federal activities in the action area include campgrounds, grazing allotments, fuel treatments projects, and hazard tree removal. The Forest maintains campgrounds (such as Plaskett Meadows, Masterson, Telephone, and other dispersed campsites within the action area) for public use associated with hunting, fishing, off-highway vehicle use, and hiking.

The action area overlaps the West Log Springs, Twin Rocks, Hall Ridge, and Alder Springs Range grazing allotments; however, only West Log Springs and Hall Ridge allotments are active (Table 8). The project area lies entirely within the Twin Rocks and Alder Springs allotments which are unused. Only one unit lies within 0.5 mile of any of the range allotment boundaries (SPLAT unit I which is composed mostly of chaparral; 0.25 mile from active allotment).

The Hardin Fuels Treatment Project (TAILS No. 81330-2008-I-0009) overlaps the Smokey action area (Fig. 5). Treatments are similar to those proposed for the Smokey project. Most harvest units have been cut, but 100 acres remain to be harvested within southeast portion of the Smokey action area. Hardin project units are expected to downgrade 16 acres of foraging habitat within the Smokey action area (BA p. 24).

The Snow Basin Hazard Tree Removal and Fuel Reduction Project (TAILS No. 81330-2008-I-0015) overlaps approximately 231 acres with the Smokey action area (Fig. 5). The commercial thinning treatments have been completed, but the fuel reduction treatments (which include pre-commercial thinning and mechanical treatments along with prescribed burning) have been put on hold until the Forest reinitiates consultation for effects to the 2012 northern spotted owl critical habitat designation (Supplemental BA p. 60, Table 4). The Snow Basin Project affected 91 acres of northern spotted owl foraging habitat. Of those acres, foraging habitat function was maintained across 77 acres and foraging habitat was downgraded to dispersal habitat across 14 acres. No nesting/roosting habitat was treated in Snow Basin. For the purposes of this consultation, we are taking a conservative approach and assuming that all foraging habitat treated in Snow Basin occurred within the Smokey action area because the section 7 consultation documents do not specify otherwise.

Table 8. Current Federal activities in the Smokey Action Area and acres of habitat affected (Supplemental BA p. 60).

		Habitat Type				
Project	Project Type	Nesting/ Roosting	Foraging	Dispersal	Effect	Status
West Log Springs	grazing allotment	0	211	36	NLAA[1]	Active
Twin Rocks	grazing allotment	0	52	149	NLAA	Inactive
Hall Ridge	grazing allotment	77	324	0	NLAA	Active
Alder Springs	grazing allotment	9	205	0	NLAA	Inactive
Hardin	fuels treatment	0	16	0	NLAA	Active
Snow Basin[2]	hazard tree removal, fuels treatment	0	91	0	NLAA	On hold

[1]NLAA refers to the "may affect, not likely to adversely affect" effects determination.
[2]Acres reported here for Snow Basin only include those that have been completed thus far.

4.3.1.3. *Fire in the Action Area*

The 1990 Recer Fire is the most recent, significant wildfire in the action area which burned approximately 3,000 acres in the eastern portion of the action area (Supplemental BA p. 12). This high-intensity fire was stand-replacing in greater than 70 percent of the burned area.

4.3.1.4. *Role of the Action Area in the Survival and Recovery of the Species*

As stated in Section 4.1.4, the action area is located within the California Klamath physiographic province and recovery unit (Service 2011, pp. III-1 and A-2). This recovery unit, and therefore the action area, provides connectivity between the other recovery units in the state (California Coast and California Cascades) and Oregon, and provides for the demographic stability of the species (Service 1992a, p. 176).

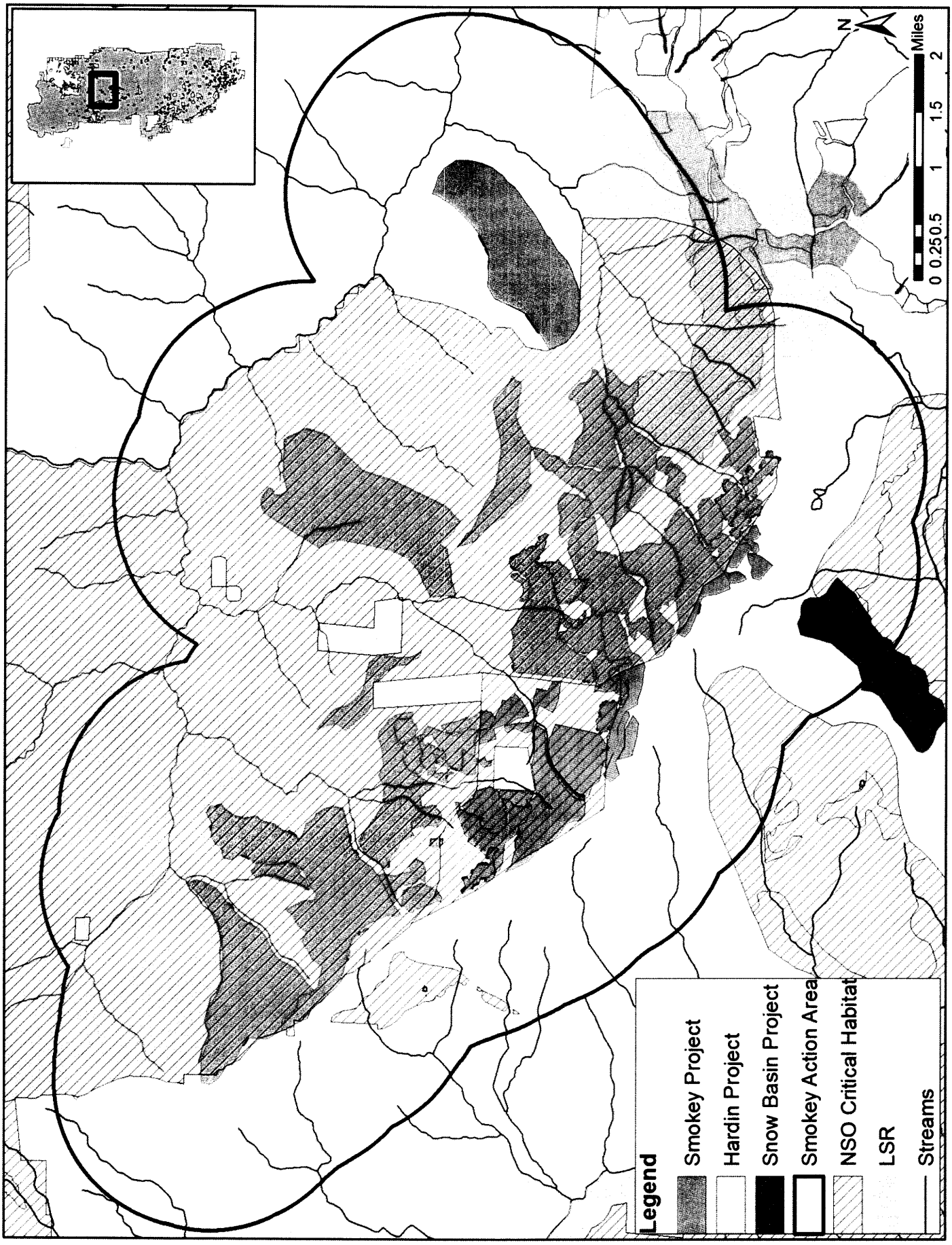


Figure 5. Current Federal activities in the Smokey Action Area.

4.3.2. Northern Spotted Owls in the Action Area

This section describes the current condition of the northern spotted owl in the action area in terms of numbers, distribution, and reproduction.

4.3.2.1. *Northern Spotted Owl Survey Results*

Past northern spotted owls surveys (pre-2000) identified five activity centers (1049, 3006, 3007, 3009, and 3048) within the action area, with presence confirmed most years (Table 9, Fig. 6). Surveys are being conducted in association with this project, confirming the presence of the species within the project area. In 2010 and 2011, northern spotted owl surveys followed the 1992 survey protocol (Service 1992b; North State Resources, Inc. 2010; NRM Corporation 2011). Under the 1992 protocol, surveyors visited each survey station three times for 2 years. No surveys were conducted in 2012. The northern spotted owl surveys conducted in 2013 followed the 2012 survey protocol (MGW Biological 2013), which in general, recommends six visits per survey station for 2 years (Service 2012a). Northern spotted owl surveys will continue until the timber harvest portions of the Project have been completed (J. Ruhl pers. comm. 2014a).

In 2010, there were 10 northern spotted owl detections within the action area associated with three activity centers: 3006, 3009, and 3048 (North State Resources, Inc. 2010; Table 9). One barred owl detection occurred within the home range of activity center 3009 (Table 9). North State Resources, Inc. (2010) surveyors performed barred owl surveys at survey stations when spotted owls were not detected. Late-season snowpack affected accessibility of the action area during the 2010 survey season (North State Resources, Inc. 2010).

In 2011, there were 12 northern spotted owl detections within the action area associated with the same activity centers as in 2010: 3006, 3009, and 3048 (NRM Corporation 2011; Table 9). Two barred owl detections occurred within the home range of activity center 3009 (Table 9). Late-season snowpack affected accessibility in the survey area during the 2011 survey season (NRM Corporation 2011).

In 2013, there were eight northern spotted owl detections within the action area associated with spotted owl pairs at the same activity centers as the most recent survey efforts: 3006, 3009, and 3048 (MGW Biological 2013; J. Ruhl pers. comm. 2014a; Table 9). One barred owl pair (two separate detections) occurred within the home range of activity center 3009 (Table 9).

Table 9. Northern spotted owl observation data from 1974 to 2013 for home ranges overlapping the action area (adapted from Smokey BA Table 14 and J. Ruhl pers. comm. 2014b).

Activity Center	Observation Data	Protocol Used*
1049[†]	1974 – Pair	1 visit
	1981 – Pair	3 visits
	1982 – Pair	8 visits
	1983 – Single	6 visits
	1989 – Single	3 visits
	1991 – Pair	3 visits
	1992 – Pair	1 historic visit
	2002 – Pair and 2 juveniles	3 visits
	2003 – Pair, determined non-nesting	1992
	2006 – Pair, determined non-nesting	Unknown
	2008 – Pair, nesting status not determined	1992
	2010 – No detection	3 visits (1992)
	2011 – No detection	1992
	2013 – No detection	6 visits (2012)
3006	1974 – Male	Unknown
	1982 – Single	4 visits
	1984 – Male	5 visits
	1987 – Pair	2 visits
	1988 – Pair and 1 juvenile	3 visits
	1989 – Male (single)	6 visits
	1990 – Single	4 visits
	1991 – Pair	5 visits
	1992 – Male (single) and Female (single)	6 visits
	2005 – None	3 historic visits
	2010 – 2 singles	2 visits (1992)
	2011 – Pair	1992
	2013 – Pair, likely nesting (not confirmed)	3 visits (2012)[‡]
3007	1982 – Male (single)	2 visits
	1987 – Female	1 visit
	1988 – Single	2 visits
	2010 – No detection (partial home range coverage)	3 visits (1992)
	2011 – No detection (partial home range coverage)	3 visits (1992)
	2013 – No detection (partial home range coverage)	6 visits (2012)
3009[†]	1991 – Male	3 visits
	2005 – None	1 historic visit
	2008 – None	1 historic visit
	2010 – 1 Male, 1 Female	2 visits (1992)
	2011 – Pair, nesting status not determined	2 visits (1992)
	2013 – Pair, nesting status not determined	3 visits (2012)[‡]
3048	1982 – Pair	1 historic visit
	1991 – Male, Female	3 visits
	1992 – Male	3 visits
	2004 – None	1 historic visit
	2010 – Pair, likely non-nesting (not confirmed)	6 visits
	2011 – Pair, nesting status not determined	2 visits (1992)
	2013 – Pair, nesting	1 visit (2012)[‡]

*"Protocol" refers to the number of visits that were made to the activity center to determine pair or nesting status. Year in parentheses denotes survey protocol used. "Historic visit" refers to survey efforts focused only at the historic activity center site.

[†]Barred owl detection in 2010, 2011, and 2013 (see Section 4.3.3.4).

[‡]2012 survey protocol was followed, but fewer than six visits were necessary to determine pair and/or nesting status.

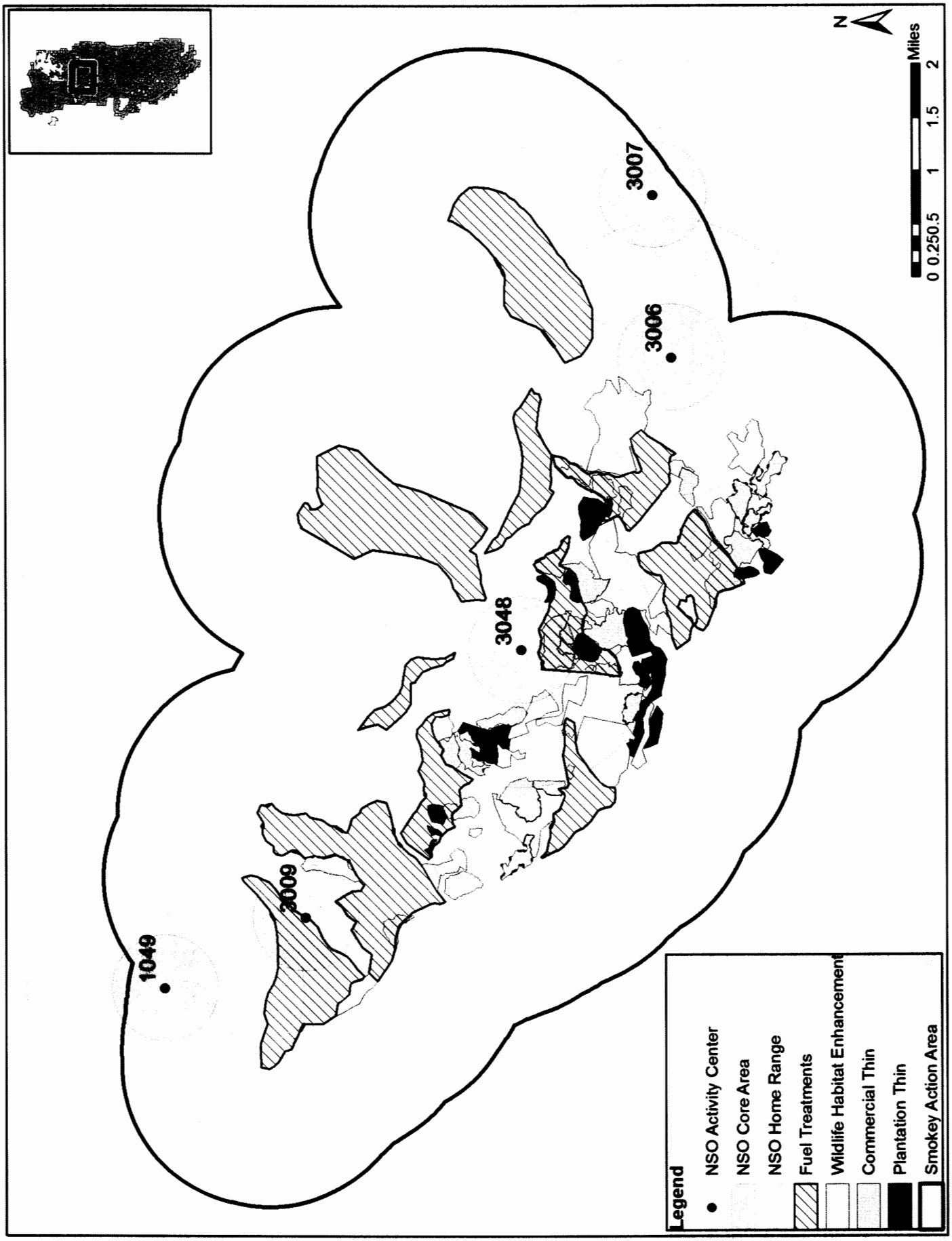


Figure 6. Northern spotted owl activity centers occurring within the Smokey action area.

4.3.2.2. *Northern Spotted Owl Activity Centers*

This section describes the role of the action area in the survival and recovery of the species by evaluating the occupancy and habitat trends for each activity center in the action area. For the purposes of this Opinion, suitable northern spotted owl habitat was estimated by the Forest using a 1993 GIS vegetation cover layer with adjustments made based on 2003, 2005, and 2006 aerial photography and field review. The 1993 GIS vegetation layer uses the following habitat definitions (Appendix E): nesting/roosting habitat includes those stands that are classified as M3G, M4G, and M6G stands and foraging habitat refers to M4P, R4X, D4X (representing D4P and D4G) stands. Dispersal is defined as conifer stands meeting at least '11-40' conditions (i.e., an average conifer of at least 11 inches dbh and at least 40 percent canopy closure).

The 35,023-acre action area contains 4,225 acres of nesting/roosting habitat, 7,826 acres of foraging habitat, and 11,197 acres of dispersal habitat (Table 10). An additional 9,306 acres of the action area is non-suitable (Table 10). The 6,337 acres of project units include 532 acres of nesting/roosting habitat, 1,790 acres of foraging habitat, and 2,138 acres of dispersal habitat (Table 10).

Table 10. Amount of northern spotted owl habitat within the local area of the Project by ownership (see BA, p. 41).

	Forest Ownership					
Area	Nesting/ Roosting	Foraging	Dispersal	Non-suitable	Private Ownership	Total Area
Project	532	1,790	2,138	1,877	0	6,337
Action	4,225	7,826	11,197	9,306	2,469	35,023
Watershed	7,412	13,213	24,943	46,846	5,500	97,914
Total	12,169	22,829	38,278	58,029	7,969	

The quality of a northern spotted owl home range is related to the amount and location of suitable habitat used for nesting, roosting, and foraging. In the California Klamath physiographic province and recovery unit, the home range is a 1.3-mile radius circle around an activity center or known nest tree for a total of 3,398 acres. While it is recognized that actual northern spotted owl home ranges likely conform to the distribution of high-quality habitat and are therefore non-circular, the circular analysis represents a reasonable approximation of the area within which territorial owls obtain resources (Service 2009, p. 19). Two terms are frequently used to describe a home range:

core area – the innermost 500 acres delineated by a 0.5-mile radius circle around the activity center; used most heavily during the breeding season

outer ring – the remainder of the home range (2,898 acres), excluding the core area, used year-round

The Service recommends that a site be above 80 percent suitable habitat within the core area and 40 percent suitable habitat across the entire home range to provide a functional home range in relation to reproductive success and survival of the pair (Table 11; Service 2009, pp. 73-74). The Service's (2009) habitat retention guidelines were developed to evaluate the potential for incidental take of northern spotted owls on private timber lands. Although the guidelines were

not developed for Federal lands, they can be used as a starting place for evaluating the potential for incidental take of northern spotted owls on Federal lands. Furthermore, the guidelines were developed for the entire Klamath Mountains region in California, and general habitat use information for the northern spotted owl was used in their development rather than site-specific information. For example, the guidelines do not take into account the nuances in topography, climate, and habitat present at the project- or stand-scale. Therefore, some activity centers may fall below the recommended guidelines, but still function to support northern spotted owl survival and reproduction. Proposed projects that occur within northern spotted owl home ranges and protect, enhance, and/or restore northern spotted owl habitat (see Sections 4.4.1.3 and 4.4.2.2.4) are consistent with the Recovery Plan (Service 2011) and/or critical habitat rule (Service 2012b).

Table 11. Minimum acres recommended for northern spotted owl home ranges (Service 2009).

Core Area			Entire Home Range		
Habitat	Acres	Percent	Habitat	Acres	Percent
Nesting/Roosting	250	50	Nesting/Roosting Foraging	1,336*	40
Foraging	150	30			
Total	400	80		1,336	40

*For the entire home range, the individual amounts of nesting/roosting and foraging habitat is not essential; both are combined to determine the total amount of suitable habitat available.

4.3.2.2.1. Activity Center 1049

Detections and Occupancy

Surveys conducted from 2002 to 2008 confirmed a pair of northern spotted owls at AC 1049 (Table 9). Nesting status was not determined in 2008, but a pair with two juveniles was recorded in 2002. Surveys in 2003 and 2006 confirmed non-nesting status. In 2010, 2011, and 2013 only the area south of Board Ridge (south and outside of the historic core area) was surveyed within the activity center's home range, in the area where this activity center overlaps with activity center 3009. No spotted owls associated with AC 1049 were detected in 2010, 2011, or 2013. Barred owls were recorded at both call points within this area.

Habitat Availability

The core area of activity center 1049 is located on the east-facing slope of Board Creek. This core area consists of large contiguous blocks of suitable habitat interspersed with three smaller previously harvested areas. Habitat within the home range (on three sides of the core area) is mainly smaller patches of conifer, hardwood, grassland, chaparral, and knobcone pine. This home range overlaps about one-third of the home range associated with activity center 3009, but their core areas do not intersect (Fig. 6).

The core area is slightly below the recommended 50 percent nesting/roosting habitat and contains more than the recommended 30 percent foraging habitat (Table 12). There is 46 percent suitable habitat available in the entire home range, more than the recommended 40 percent within the entire home range. The home range contains 308 acres of privately owned lands not considered in this analysis because habitat data is unavailable for private lands.

Table 12. Current condition of northern spotted owl activity center 1049.

Habitat	Core Area		Home Range	
	Acres	% Suitable	Acres	% Suitable
Nesting/Roosting*	238	48	718	46
Foraging	176	35	821	
Total	414	83	1,539	46

*Below nesting/roosting habitat recommended for the core area (see Table 11).

4.3.2.2.2. Activity Center 3006

Detections and Occupancy

Surveys conducted in 2010 revealed two single adults at AC 3006 (Table 9). A pair of spotted owls was detected in 2011 and 2013, and although it is suspected that they nested in 2013, this was not confirmed. Surveys in 2005 recorded no northern spotted owls, while surveys dating back to 1974 confirmed single adults. Reproductive status was last confirmed in 1988.

Habitat Availability

The habitat within the home range of activity center 3006 consists of one large contiguous block of mid- to late-successional forest surrounded by chaparral, early-successional conifer stands, and small patches of conifer/hardwood and pure hardwood. The core area currently contains 58 percent suitable nesting/roosting habitat and 34 percent suitable foraging habitat on Forest lands, exceeding the recommended amounts (Table 13). The entire home range also exceeds the recommended suitable habitat amounts (68 percent, Table 13). This home range overlaps approximately one-third of AC 3007 on the east (Fig. 6), but prominent ridges separate both core areas. Activity center 3006 is located solely on Forest lands.

Table 13. Current condition of northern spotted owl activity center 3006.

Habitat	Core Area		Home Range	
	Acres	% Suitable	Acres	% Suitable
Nesting/Roosting	289	58	1,524	68
Foraging	170	34	758	
Total	459	92	2,282	68

4.3.2.2.3. Activity Center 3007

Detections and Occupancy

Surveys have not been conducted at AC 3007 since the 1980s and reproductive status was not determined (Table 9). Limited surveying of this activity center occurred in 2010, 2011, and 2013, covering portions of the western side of this activity center. No spotted owl detections occurred in any of those 3 years; however, the entire home range was not surveyed. The survey station was located between Kill Dry and Hardin Ridges, outside of the core area, where the home ranges of AC 3006 and AC 3007 overlap.

Habitat Availability

The habitat within the home range of activity center 3007 is a large, contiguous block of mid- to late-successional forest surrounded by chaparral, early-successional conifer stands, and small

patches of conifer/hardwood and pure hardwood. The abundance of early-successional and shrub habitat surrounding the older forest likely provides foraging opportunities along edges of habitat transition.

The core area contains more than the 50 percent recommended nesting/roosting habitat (60%), but less than the recommended 30 percent foraging habitat (16 percent, Table 14). The entire home range exceeds the recommended amount of 40 percent suitable habitat (45 percent, Table 14). This home range overlaps about one-third of home range 3006; however, the two core areas do not intersect (Fig. 6). The outer ring includes 149 acres of privately owned lands not considered in this analysis because habitat data is unavailable for private lands.

Table 14. Current condition of northern spotted owl activity center 3007.

	Core Area		Home Range	
Habitat	Acres	% Suitable	Acres	% Suitable
Nesting/Roosting	301	60	801	45
Foraging*	82	16	700	
Total	383	76	1,501	45

*Below foraging habitat recommended for the core area (see Table 11).

4.3.2.2.4. Activity Center 3009

Detections and Occupancy
Surveys in 2010 at AC 3009 detected one male and one female in 2011 and a pair of northern spotted owls in 2013 (Table 9). In 2010 and 2011, barred owls were detected in the northwestern portion of the core area and home range, and in 2013, one barred owl pair was detected in the southeastern portion of the outer ring near the core area. It is unlikely that this northern spotted owl pair will nest during project implementation since nesting has not been recently documented and because of the resident barred owl pair.

Habitat Availability
The habitat within the home range of activity center 3009 consists mostly of contiguous, linear, mid- to late-successional forest, surrounded by grassland/hardwood, early-successional conifer stands, and small patches of conifer/hardwood, pure hardwood, and small plantations. Several connected, steep drainages occur within the core area and home range and likely provide favorable microhabitat conditions (e.g., cooler summer temperatures) for this activity center.

The core area is below the recommended amounts for nesting/roosting (32 percent) and foraging habitat (28 percent); however, suitable habitat for the entire home range is above the recommended amount (47 percent; Table 15) and is supporting a pair of northern spotted owls. This home range overlaps approximately one-third of the home range of activity center 1049, but their core areas do not overlap (Fig. 6). The outer ring includes 114 acres of privately owned lands not considered in this analysis because habitat data is unavailable for private lands. The two activity centers are over 2 miles apart, but occur within the same large, steep drainage.

Table 15. Current condition of northern spotted owl activity center 3009.

Habitat	Core Area		Home Range	
	Acres	% Suitable	Acres	% Suitable
Nesting/Roosting*	162	32	750	47
Foraging*	138	28	810	
Total	300	60	1,560	47

*Below suitable habitat recommended for the core area (see Table 11).

4.3.2.2.5. Activity Center 3048

Detections and Occupancy

A pair of northern spotted owls was recorded at activity center 3048 in 2010 and 2011, and in 2013 and 2014, nesting status of the pair was confirmed (Table 9; J. Ruhl, pers. comm. 2014c). In 2011, the activity center site was moved from its historic location to be centered at a known roost location (L. Angerer, pers. comm. 2011). The nest tree was located in 2014, nearly identical in location to the 2011 roosting location (MGW Biological 2013). Prior to 2010, northern spotted owls had not been detected at this activity center since 1992.

Habitat Availability

The habitat within the home range of activity center 3048 is mostly one large, contiguous block of mid- to late-successional forest surrounded by early-successional conifer stands, small patches of conifer/hardwood, plantations, and grassland/hardwood. Several drainages run through the core area and home range, providing connectivity of suitable microhabitats preferred by northern spotted owls.

The core area is far below the recommended 50 percent of nesting/roosting habitat (15 percent) and is above the recommended 30 percent for foraging habitat (46 percent; Table 16), but supports a pair of nesting northern spotted owls.[1] Suitable habitat in the entire home range is above the recommended 40 percent (Table 16). This activity center is located solely on Forest-managed lands (Fig. 6).

Table 16. Current condition of northern spotted owl activity center 3048.

Habitat	Core Area		Home Range	
	Acres	% Suitable	Acres	% Suitable
Nesting/Roosting*	76	15	282	42
Foraging	232	46	1,165	
Total	308	61	1,447	42

*Below nesting/roosting habitat recommended for the core area (see Table 9).

[1] The amount of nesting/roosting and foraging habitat presented here differs from that stated in the BA. In November 2011, the activity center site was moved to its current location and a new habitat and effects analysis was completed (L. Angerer, pers. comm. 2011). This occurred after the final BA was submitted in June 2011.

4.3.3. Barred Owls in the Action Area

The action area has not been surveyed for barred owls; however, any incidental barred owl response was noted during spotted owl surveys. Barred owls have been detected within the action area in 2010, 2011, and 2013 where activity centers 1049 and 3009 overlap (Section 4.3.2.1, Table 9). The first barred owl pair was confirmed in 2013, prior to that, only single barred owls had been detected (Section 4.3.2.1, Table 13). The presence of barred owls in the action area has similar implications for northern spotted owls as in other portions of the northern spotted owl range, such as reduced northern spotted owl detectability, reduced site occupancy, reduced likelihood of nesting, and reduced survival. We cannot conclusively state what effects the barred owl pair is having on the northern spotted owls in activity center 3009 since nesting status, nor young, have been confirmed at the site (Table 9).

4.3.4. Condition of Designated Critical Habitat in the Action Area

This section describes the current condition of designated critical habitat for the northern spotted owl in the action area in terms of the primary constituent elements that make up the critical habitat (see Section 4.2.2): PCE 2 (nesting/roosting habitat), PCE 3 (foraging habitat), and PCE 4 (dispersal habitat). In our analysis below, we consider each PCE to be a discreet, unique category, but recognize that there is overlap between the PCEs (Service 2012b, pp. 72051-72052). For example, PCE 2 (nesting/roosting habitat) can also provide for northern spotted owls' foraging and dispersal needs. While our form of characterization differs from the method used by the Forest (Supplemental BA, p. 9), the number of acres treated remains the same and displays the same values in an alternate way (see Section 4.3.4.1 below).

4.3.4.1. *Designated Critical Habitat in the Action Area*

The Smokey Fuels Treatment Project action area encompasses 19,068 acres of designated critical habitat, which accounts for 54 percent of the action area (Fig. 7, Table 17). Table 3 in the Supplemental BA (p. 13) reports a greater number of PCE 3 and 4 acres in the action area than we consider, but this is an artifact of the method used by the Forest. The Forest considered the PCEs inclusive categories (Supplemental BA, p. 8) and combined the acres of each habitat type. Therefore, although it seems as if a greater number of acres of each PCE are present in the action area, it is only a matter of addition (Table 18): the Forest's calculation of PCE 3 is a summation of the acres of PCE 2 and PCE 3, and PCE 4 is the summation of PCE 2, PCE 3, and PCE 4 acres. As mentioned above, we will treat the PCEs as discreet categories throughout this Opinion.

Table 17. Critical habitat availability (PCEs) on National Forests in the unit, subunit, and Smokey action area.

Scale	PCE 2 (nesting/roosting)	PCE 3 (foraging)	PCE 4 (dispersal)	Unsuitable[1]
Unit ICC	322,548	222,499	177,811	235,531
Subunit ICC 3	33,355	21,737	24,845	21,250
Action area	3,261	4,584	8,136	3,087

[1]Unsuitable habitat includes manmade structures, meadows, grasslands, and oak and aspen woodlands (Service 2012b, p. 72052).

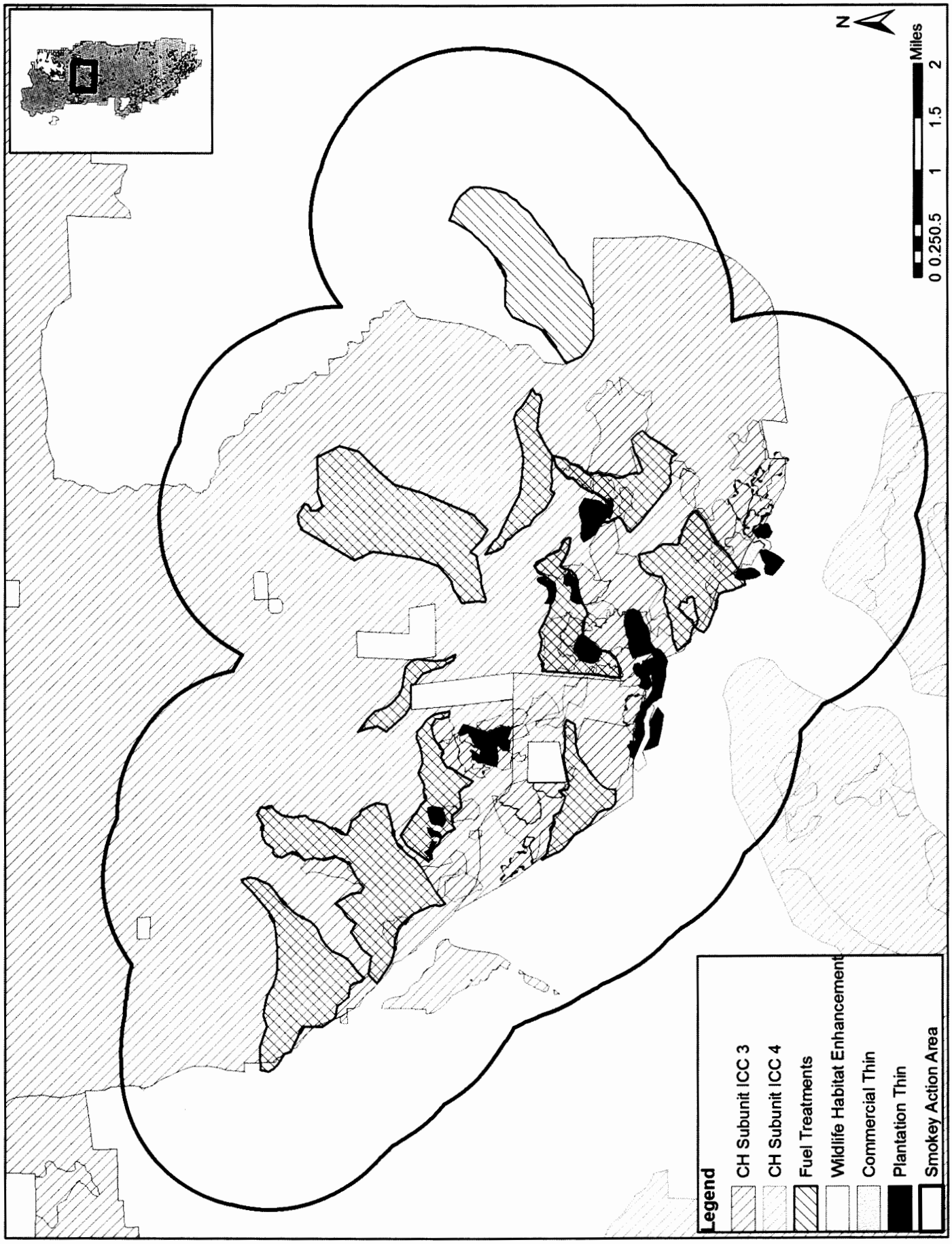


Figure 7. Smokey Project area in relation to northern spotted owl critical habitat (CH).

Table 18. Comparison between critical habitat PCEs within the action area as displayed by the Mendocino National Forest and the Service (Supplemental BA, p. 13).

	PCE 2	PCE 3	PCE 4
Service	3,261	4,584	8,136
Forest	3,261	7,845	15,981
Difference	0	3,261	7,845

As mentioned in Section 4.2.3.1, the action area is located within Subunit 3 of critical habitat Unit 11, the Interior California Coast. Subunit ICC 3 consists of approximately 104,729 acres in Trinity, Tehama, and Mendocino counties; 101,187 acres of which are managed by the Mendocino and Six Rivers National Forests (Table 17). Because the number of acres within each PCE have not been calculated for Bureau of Land Management lands, the PCE baseline for ICC 3 only includes those acres under the jurisdiction of the U.S. Forest Service (which account for 96.6 percent of the subunit). Our analysis of effects to the subunit will therefore be more conservative than if we also considered PCEs under jurisdiction of the Bureau of Land Management.

Subunit ICC 3 is expected to function for demographic support and provide north-south connectivity between subunits (Service 2012b, p. 71936). Special management considerations or protections are required in ICC 3 to address threats to the essential physical or biological features from current and past timber harvest, losses due to wildfire and the effects on vegetation from fire exclusion, and competition with barred owls (Service 2012b p. 71936).

The action area also includes portions of subunit ICC 4 (Fig. 7). However, project units are only located within ICC 3 and no effects will be incurred on ICC 4. Therefore, it is unnecessary to include ICC 4 in our analysis.

4.3.4.2. *Federal Activities in Designated Critical Habitat*

The Hardin Fuels Treatment Project is the only active forestry project located within ICC 3 and within the Smokey action area (Section 4.3.1.2; Table 19; Fig. 8; Supplemental BA, p. 13). During informal section 7 consultation with the Forest, we concurred that the Hardin Project was not likely to adversely affect northern spotted owls or critical habitat. The Tatham Ridge Fuels Treatment Project (TAILS No. 12B0079-13I0038) also occurs in subunit ICC 3, but has not been implemented (Section 4.3.1.2; Table 19; Fig. 8). We concurred with the Forest that the Tatham Project was not likely to adversely affect northern spotted owls or critical habitat, because all acres proposed for treatment are expected to maintain PCE function. The grazing allotments discussed in Section 4.3.1.2 are in the action area but not within designated critical habitat (Supplemental BA, p. 13).

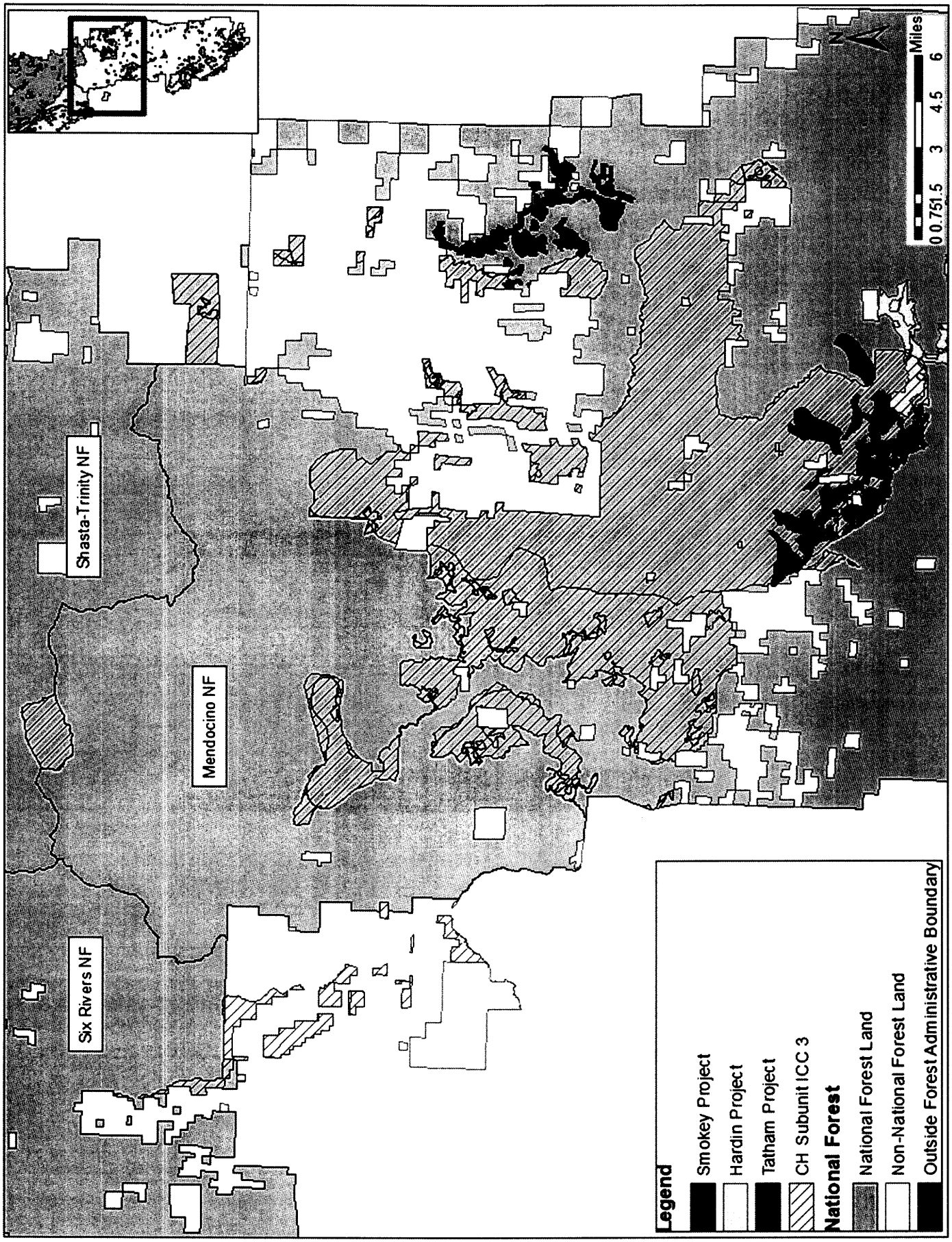


Figure 8. Federal projects in critical habitat subunit ICC 3.

Table 19. Ongoing Federal actions within NSO Critical Habitat Subunit ICC 3.

Project	PCE 2	PCE 3	PCE 4	Determination	Status
Hardin	386	222	24	NLAA	Project In Progress
Tatham[1]	3	0	48	NLAA	Consultation Complete

[1]Tatham is not in the Smokey action area (see Fig. 5), but is in the same critical habitat subunit (Fig. 8).

4.3.4.3. *State or Private Activities in Designated Critical Habitat*

Subunit ICC 3 is composed solely of Federal lands and no critical habitat was designated on private land; therefore, no State or private activities will occur in the subunit.

4.4. Effects of the Proposed Action

The implementing regulations for section 7 of the Endangered Species Act define "effects of the action" as the "direct and indirect effects of an action on the species together with the effects of other activities that are interrelated or interdependent with that action, which will be added to the environmental baseline" (50 CFR § 402.02). Indirect effects are caused by, or result from, the agency action and are later in time, but are still reasonably certain to occur. Indirect effects may occur outside of the immediate footprint of the project area, but would occur within the action area (50 CFR § 402.02; Service and NMFS 1998).

4.4.1. Effects to the Northern Spotted Owl

4.4.1.1. *Scientific Basis for Analyzing Effects to the Species*

This section presents an analysis of the effects of the activities proposed in the Smokey Project, including interrelated and interdependent actions, to the northern spotted owl. Effects to northern spotted owls from an agency action can occur through disturbance of individuals, injury or mortality, and/or modification of habitat. The scientific basis and background for these effects are discussed in the three subsequent sections.

4.4.1.1.1. Disturbance

Any disturbance that causes exposure of adult or juvenile northern spotted owls can increase predation risks. A northern spotted owl flushed from its nest may lead to an increased likelihood of predation or injury through the advertisement of the nest's location, advertisement of the adult and juvenile, or premature departure of a nestling from a nest. Predation is presumed the largest cause of northern spotted owl mortality, particularly of juveniles, due to raptors, other owls, and corvids (Forsman et al. 1984, p. 38; Forsman et al. 2002, p. 18; Layman 1985; Verner et al. 1992, p. 67). Human presence alone appears to attract predators, such as corvids (e.g., Forsman et al. 1984, p. 36). Northern spotted owls may respond physiologically to a disturbance by secreting corticosteroids, without exhibiting a significant behavioral response (Appendix C, Section 1.3.2.8).

The effects of noise on northern spotted owls are largely unknown, and whether noise is a concern has been a controversial issue (Appendix C, Section 1.3.2.8). Despite many research challenges, studies conducted on a variety of bird species suggest that disturbance can have a negative effect on fitness and reproductive success (Tremblay and Ellison 1979, pp. 367-368; Andersen et al. 1989, p. 296; Belanger and Bedard 1989, p. 713; Piatt et al. 1990, p. 342; Henson

and Grant 1991). Smoke and heat from prescribed burning may also affect northern spotted owls. Although it has not been conclusively demonstrated, it is anticipated that nesting owls may be negatively affected by heat and smoke intrusion into the nest grove (Appendix C, Section 1.3.2.8).

4.4.1.1.2. Injury or Mortality

Forest management activities can result in direct mortality of adults, eggs, or young. Such cases are rare, but direct mortality due to tree-felling has been documented (Forsman et al. 2002, p. 18). The potential for northern spotted owls to be struck and killed or injured by falling trees during harvesting or exposed to high levels of smoke during prescribed burning is confined to the area relatively close to the nest tree. During timber harvest or prescribed burning, individual adult northern spotted owls can be reasonably expected to move away from the area and avoid injury. However, nesting adult northern spotted owls tending to reproductive activities such as incubation or brooding young may be reluctant to leave the area (Delaney et al. 1999, p. 71), and therefore may be vulnerable to such injury. For example, Bevis et al. (1997, pp. 119-121) documented northern spotted owls' reluctance to leave their territories during the breeding season in the presence of heavy smoke. Foraging owls are not expected to be subject to direct mortality or injury, as they will likely avoid areas with disturbance.

Young-of-the-year, whether in or out of the nest, may also be vulnerable to the effects of tree falling or smoke inhalation, or might disperse prematurely in response to the disturbance and thus be subject to predation, starvation, or injury outside of the nest or nest grove. Because young must be constantly brooded by an adult for up to 2 weeks post-hatching, parental abandonment of the nest could lead to mortality of the young. Potential effects to eggs range from the implications of parental abandonment (Drent 1972; Swenson 1979, pp. 598-601; White and Thurow 1985, p. 14) to destruction during tree falling. These types of direct effects are most likely to occur in nesting/roosting habitat during the breeding season.

4.4.1.1.3. Habitat Modification

Forest management activities, whether intended to address silvicultural/fuels management needs or to facilitate other actions, have the potential to alter habitat characteristics and reduce the quality or change the function of suitable habitat for the northern spotted owl (see Sections 4.2.3.2 – 4.2.3.4 for explanation of suitable habitat). We categorize the degree of change to habitat function using the following terms.

> *Remove* – complete loss of habitat function following an action (e.g., an area that functioned as foraging habitat for northern spotted owls pre-action does not provide any habitat function post-action).
>
> *Downgrade* – pre-action habitat function is downgraded to the next lower habitat function post-action (e.g., an area that functioned as nesting/roosting habitat before the action functions only as foraging habitat after the action).

Maintain – pre-action habitat function is retained post-action and is still available for use by northern spotted owls (e.g., an area that functioned as nesting/roosting habitat before the action still functions as such post-action). Habitat maintained can be further divided to describe the direction and degree of the impact:

Degrade[2] – pre-action habitat quality is diminished post-action, while pre-action habitat function is retained post-action.

Unchanged – pre-action habitat quality is not changed post-action.

Improve – post-action habitat quality exceeds that from pre-action and habitat function is retained.

Landscape-level changes in habitat availability, distribution, and configuration have implications to individual northern spotted owl survival and productivity, as well as to northern spotted owl population dynamics dependent on intensity of treatments and their juxtaposition to habitat and its level of use by northern spotted owls. For example, removal, downgrading, or degradation of habitat within home ranges, and especially close to the nest site, can be expected to have negative effects on northern spotted owls. Bart (1995, p. 943) reported a linear reduction in northern spotted owl productivity and survivorship as the amount of suitable habitat within a home range declined. In addition, many researchers have stressed the importance of habitat availability within a core area around the nest site (Bingham and Noon 1997, p. 129; Franklin et al. 2000, pp. 549, 567, 578; Hunter et al. 1995, pp. 689-692; Meyer et al. 1998, p. 1; Zabel et al. 2003). These studies suggest that habitat changes within these core areas could have disproportionate effects to individual northern spotted owls.

Habitat degradation, although the habitat function is maintained, usually leads to a shorter term change in key habitat components, such as reduction in habitat for a food source or simplification of the vertical canopy layering, which could alter the microclimate properties of a stand. These activities can lead to adverse effects to northern spotted owls, especially when occurring at a large scale (i.e., a large proportion of an activity center and/or home range, or a large portion of the action area) or in important habitat areas.

Northern spotted owl habitat can also benefit from management activities. For example, treatments that create temporary canopy openings or that encourage the development of a shrub and ground cover layer improve habitat for the small animals that serve as prey species. Additionally, treatments that reduce the continuity of dense, relatively uniform forests can reduce the risks of habitat loss by reducing the spread of wildfire into habitat patches (Agee et al. 2000; Ager et al. 2007, p. 45). Moreover, mosaics of forest and other vegetation patches with variable sizes, composition, stand density, vegetation type, and fuel levels could provide resistance and variability of resistance to wildfire and other disturbances, thereby reinforcing similar patch size distributions in the future (Spies et al. 2006). Reducing surface fuels, decreasing crown density, increasing the height to live crown above the ground, and keeping large trees of resistant species are all effective in creating a more fire resilient forest (Agee and Skinner 2005, p. 83). Results from the Fire and Fire Surrogate forest stand treatments study indicate that fire only (i.e.,

[2] As a subcategory of "maintained," habitat degradation means that the quality of habitat is lessened, but the habitat is still functional. Northern spotted owls can use habitat that has been degraded. "Degrade" does not equate to "remove" or "downgrade."

prescribed burning), mechanical plus fire, and mechanical only treatments using whole tree harvest systems are all effective tools in reducing potential fire severity under severe fire weather conditions (Stephens et al. 2009, p. 305).

4.4.1.2. *Effects of the Proposed Action*

Treatments proposed in the Smokey Project, and activities associated with fuel reduction/wildlife habitat enhancement and commercial thinning, have the potential to result in short-term adverse effects to the northern spotted owl and its habitat through disturbance, injury, mortality, and habitat modification; which are described in detail in the following sections. These treatments cover 4,762 acres of the Buttermilk Late-Successional Reserve and 1,575 acres of Matrix lands. A total of 4,460 acres of northern spotted owl habitat will be maintained, but degraded, by commercial thinning and fuel/wildlife habitat enhancement treatments across all project units (Table 20). No suitable northern spotted owl habitat will be downgraded or removed.

Table 20. Total northern spotted owl habitat (in acres) affected by habitat modification in the Smokey Project.

	Habitat Type			
Effect	Nesting/Roosting	Foraging	Dispersal	Total
Removed	0	0	0	0
Downgraded	0	0	0	0
Maintained	532	1,790	2,138	4,460
Total	532	1,790	2,138	

4.4.1.2.1. Effects to Habitat Outside of Activity Centers

This section describes the effects to northern spotted owl habitat that will occur outside of known and historic activity centers/territories (i.e., areas that are not within the 1.3-mile home range of a northern spotted owl). Effects to northern spotted owls and habitat associated with their territories are discussed in Section 4.4.1.2.2. No spotted owls have been detected outside of established territories in the most recent, protocol-level surveys, although it is possible that areas outside of established territories may be used by dispersing owls. Overall, treatments outside of activity centers will affect 77 acres of nesting/roosting habitat, 1,047 acres of foraging habitat, and 1,269 acres of dispersal habitat (Table 21). No dispersal habitat would be removed and all treated dispersal habitat would remain functional for dispersing northern spotted owls; therefore, dispersal habitat will not be discussed in further detail.

Table 21. Acres of northern spotted owl habitat affected by treatments outside of activity centers (see Appendix G).

Treatment	Nest/Roost	Foraging	Dispersal
Fuel Reduction/ Wildlife habitat enhancement	77	765	1,075
Commercial Thinning	0	282	194
Plantation Thinning	0	0	0
Total	77	1,047	1,269

Fuel Reduction/Wildlife Habitat Enhancement Treatments

Fuel reduction/wildlife habitat enhancement treatments will affect 77 acres of northern spotted owl nesting/roosting and 765 acres of foraging habitat outside of established northern spotted owl territories (Table 21). These treatments may reduce coarse woody debris, snags, and understory canopy layering and shrubs. Overstory canopy cover would not be affected by these treatments, and conservation measures will protect northern spotted owl habitat components, including woodrat nests, snags, and down logs (see Section 2.2.5; Supplemental BA, Appendix B). Because burning will occur in the spring when fuel moisture content is highest and fire intensity is lower, habitat effects would be minimal compared to fall burning when fuel moisture content is lower and more intense fires could occur. Low-intensity prescribed fire (i.e., spring burning) is designed to consume surface fuels (e.g., fine flashy fuels and dead branches generally 0 to 3 inches in diameter). Although a small number of snags or logs may be partially or entirely consumed by the fire, the majority of large (i.e., greater than 20 inches in diameter) snags and logs present would not be affected during underburning because of high moisture content. Large snags and coarse woody debris may be removed if they pose a hazard to human safety or occur in densities that may pose a fire risk. For treatment units within the LSR, a minimum of 6 snags per acre would be left intact and a minimum of 3.2 snags per acre would be left in treatment units outside of the LSR (see Section 2.2.5.5). This limited amount of hazard snags/coarse woody debris removal is not expected to preclude the ability of the stands to function for as nesting and/or roosting habitat; therefore, the effect of removing these components would be insignificant.

Fuel reduction/wildlife habitat enhancement treatments may alter prey habitat by reducing mid- and understory cover (trees less than 10 inches dbh, shrubs, and forest floor vegetation), resulting in a change in prey distribution and abundance. Until prey habitat has recovered, northern spotted owls may use these areas less or even avoid them. However, time staggered implementation of treatments and the presence of untreated foraging habitat elsewhere in the action area will minimize potential negative effects to prey habitat. Understory vegetation is expected to be re-established within 2 to 3 growing seasons post-treatment (Dodson et al. 2008, p. 3137; Harrod et al. 2007, p. 322-323; Metlen and Fiedler 2006, p. 364), and forest floor vegetation (grasses and forbs) is often re-established after one growing season (Supplemental BA, p. 65). Shrub cover and diversity is also likely to increase as a result of treatment (Dodson et al. 2008, pp. 3134- 3139; Metlen and Fiedler 2006, p. 364; Youngblood et al. 2006, p. 161). Northern spotted owls are expected to resume use of the treated habitat areas within 2 to 3 years post-treatment. Where hand-thinning occurs in areas that are currently too dense for northern spotted owls to fly, the effect of this activity would be beneficial by increasing the amount of foraging habitat available when prey populations restabilize.

Commercial Thinning

Commercial thinning will affect 282 acres of northern spotted owl foraging habitat outside of established northern spotted owl territories (Table 21). No nesting/roosting habitat will be commercially thinned. Commercial thinning will reduce overall canopy cover in foraging habitat from 70 to 90 percent to 40 to 60 percent. In addition, vertical forest structure will be simplified through a reduction in understory components, such as suppressed and intermediate trees, shrubs, and hardwoods. The understory will be simplified from pre-action conditions, and in areas where they may contribute to ladder fuels, may be removed altogether. All of these things can lead to

reduced prey abundance and would make the stand less favorable for foraging spotted owls due to reduced concealment from predators, increased temperatures, and fewer low-canopy perches to forage from. To reduce these potential effects, conservation measures will retain and protect important habitat components, such as snags and clumps of shrubs and small trees (see Section 2.2.5).

In many areas where the understory is overly dense and hampers northern spotted owls' ability to fly, thinning of the understory could increase access to foraging areas. Long-term, treatments are expected to increase the health and longevity of stands and accelerate growth towards nesting/roosting quality (see BA, p. 42).

Plantation Thinning

None of the plantations proposed for thinning contain suitable northern spotted owl habitat; therefore, no adverse effects to northern spotted owl habitat would occur from plantation thinning. Long-term, treatment of these overstocked plantations will benefit northern spotted owls by reducing the risk of high severity fire being carried into adjacent stands containing suitable northern spotted owl habitat.

Landings

A new landing, less than 0.5 acre, will be built in commercial thinning unit 29. This unit does not contain nesting/roosting or foraging habitat; therefore, construction of a landing would not affect northern spotted owl habitat.

Felling of Roadside Maintenance/Hazard Trees

Road maintenance associated with the project will occur on existing Forest roads and would not affect northern spotted owl habitat, except for hazard tree felling. Snags and hazard trees, which could provide suitable nesting habitat components and prey habitat within foraging habitat, will be felled adjacent to roads and where they pose a safety risk within the project area. This may result in loss of nesting opportunities for northern spotted owls by removing the trees that contain those structures when they are located within nesting/roosting habitat.

Very little suitable habitat occurs adjacent to major, high-use roads (e.g., Forest Highway 7, Recer Ridge Road), and northern spotted owl use of these areas is probably low due to the high levels of disturbance. Effects of hazard tree felling in these high disturbance areas would be very low to negligible due to a low probability of use by northern spotted owls. The potential use by northern spotted owls is greater within 150 feet of a less-traveled route where hazard tree felling could occur. Hazard tree felling in this area may result in the felling of a current or future nest tree; however, the probability of this occurring within nesting/roosting habitat is low. Prey availability is not expected to be adversely affected by hazard tree felling because felled hazard trees will remain on site and contribute to prey habitat as coarse woody debris. In addition, it is likely that only isolated trees would be removed which would not cause widespread loss of prey habitat.

Temporary Road Construction

Outside of established northern spotted owl territories, approximately 1.7 miles of temporary roads will be constructed within commercial thinning units 2 and 29 to facilitate treatment (additional roads are being built and are discussed in Section 4.4.1.2.2). The road proposed in unit 2 will be built on an existing road bed, but a new road bed will need to be constructed for the road in unit 29. Unit 29 does not contain nesting/roosting or foraging habitat and therefore no suitable habitat would be affected by the temporary road. Both roads will be closed to public access after harvest is complete, which will allow vegetation to grow in the road bed.

Water Drafting

Water drafting is not expected to affect northern spotted owl habitat.

Summary of Effects to Habitat Outside of Activity Centers

All northern spotted owl habitat proposed for treatment by the Project outside of activity centers will be maintained; however, the treatments may lead to short-term degradation in foraging habitat quality. Adverse effects to northern spotted owls may occur due to changes in canopy closure and understory vegetation structure that are likely to affect prey abundance and distribution, alter the microclimate, and decrease cover for concealment. Although current protocol-level surveys of the project area have not detected northern spotted owls outside of known activity centers in, the degradation of habitat could affect the ability of dispersing owls that may use treated areas in the short-term. Understory vegetation, shrubs, and other habitat components are expected to re-stabilize and increase over a period of 2 to 3 growing seasons post-treatment. Long-term benefits of the proposed action include reduced risk of habitat loss from catastrophic wildfire events and improved foraging habitat.

4.4.1.2.2. Effects to Northern Spotted Owls and their Activity Centers

This section describes the effects to northern spotted owls and suitable habitat within known and historic activity centers. The Smokey Project proposes treatment of 494 acres of nesting/roosting habitat and 1,036 acres of foraging habitat within five northern spotted owl home ranges (Table 22). Although some northern spotted owl nesting and roosting habitat may be affected (i.e., degraded) in the short-term, all suitable habitat will be maintained. Furthermore, conservation measures will be implemented to avoid or minimize effects to northern spotted owls and their habitat. A breeding season limited operating period (February 1 through July 10) will be in place around occupied activity centers or nest trees (Section 2.2.5.1), providing protection for nesting northern spotted owls. Staggered implementation of treatments will allow the condition of treated areas to improve before additional treatments are implemented; spreading out short-term negative effects to prey over time and space and reducing additive effects (see Tables 23-26 for proposed implementation schedules). Staggered treatment implementation will also provide the time necessary for previously treated areas to recover and provide refugia for northern spotted owls and/or their prey while the next stage of the project is occurring and new areas are treated.

No dispersal habitat would be removed and all treated dispersal habitat would remain suitable and functional for dispersing northern spotted owls; therefore, dispersal habitat will not be discussed in further detail. Water drafting will not affect northern spotted owls or suitable habitat; therefore, water drafting will not be discussed in further detail. Due to the limited

availability and juxtaposition of suitable habitat and results of current, protocol-level survey efforts, it is not probable that any additional northern spotted owl activity centers (other than those considered below) occur in the action area.

Table 22. Total acres of nesting/roosting (NR) and foraging (F) habitat affected by the Smokey Project in activity centers within the action area.[3]

	Core Area		Outer Ring		Entire Home Range	
Activity Center	NR	F	NR	F	NR	F
1049	0	0	100	11	100	11
3006	2	4	102	144	104	148
3007	0	0	0	0	0	0
3009	47	55	220	256	267	311
3048	23	126	0	440	23	566
				Total	494	1,036

Activity Center 1049

Disturbance, Injury, and Mortality

As discussed in Sections 4.4.1.1.1 and 4.4.1.1.2, the risk of disturbing, injuring, or killing northern spotted owls is higher during the breeding and nesting season within the core area. A pair of northern spotted owls was detected at this activity center from 2002-2008; however, none have been detected in recent surveys (i.e., 2010, 2011, or 2013). The spotted owls at this activity center probably do not use the southern portion of their home range extensively due to topography, overlap with the core area of AC 3009, and the presence of barred owls (Fig. 9; Section 4.3.2.2.1). Because no treatments are proposed within the core area of AC 1049 and the low probability of use, we do not expect disturbance, injury, or mortality of northern spotted owls associated with this activity center.

Habitat Modification Effects

Treatments within AC 1049 are proposed at the far southern portion of the home range in the outer ring. No treatments are proposed in the core area (Fig. 9). Fuel reduction treatments (mastication, understory thinning, and prescribed burning) in SPLAT unit A will occur across 7 percent of this home range in 100 acres of nesting/roosting habitat and 11 acres of foraging habitat (Tables 22 and 23; BA, pp. 56-57).

[3] The sum of nesting/roosting and foraging habitat acres treated in Tables 21 and 22 is greater than the total number of acres reported in Table 20. This is due to the fact that several activity centers overlap and treatment units that are located within the overlap were double counted. Table 20 has the correct total acres of northern spotted owl habitat treated by the Smokey Project.

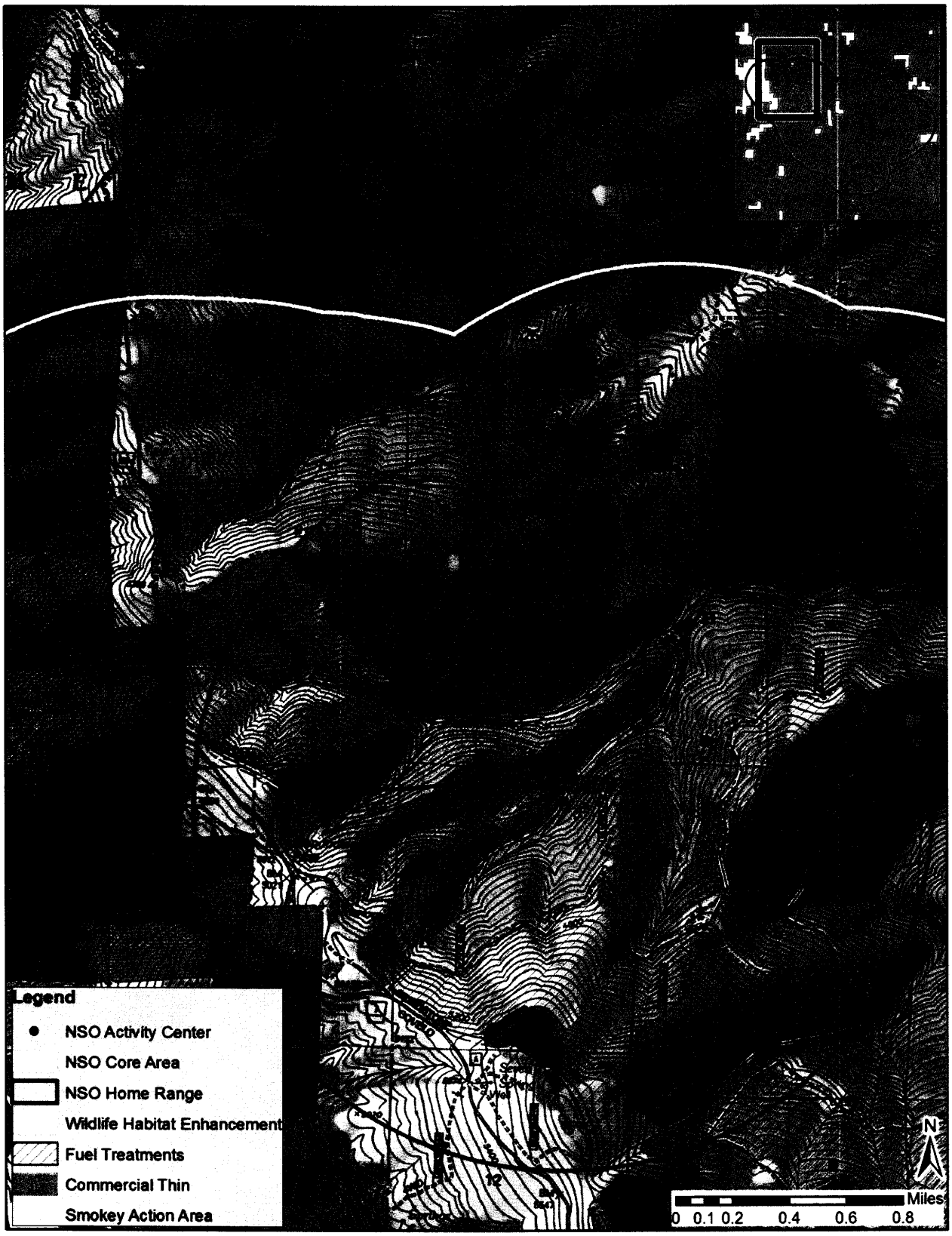


Figure 9. Proposed treatments within the home ranges of Activity Centers 1049 and 3009.

In nesting/roosting habitat, it is possible for fuel reduction treatments to affect overstory canopy cover, large trees with deformities, snags, and coarse woody debris due to the low potential of torching during prescribed burning which, if it occurs, could kill the trees that provide these habitat components, thereby making them unavailable for spotted owl use. However, there is a low probability that torching will occur because of the conservation measures the Forest will implement (removal of ladder fuels, low-intensity prescribed fire, and burning in the spring under moist conditions) as part of the proposed project. Large snags and coarse woody debris may be removed if they pose a hazard to human safety or occur in densities that may pose a fire risk. Because SPLAT unit A is within the LSR, a minimum of 6 snags per acre would be left intact (see Section 2.2.5.5). This limited amount of hazard snag/coarse woody debris removal is not expected to preclude the ability of the stands to function as nesting and/or roosting habitat; therefore, the effect of removing these components would be insignificant to any northern spotted owls using the area.

Fuel reduction treatments may alter foraging habitat by reducing mid- and understory canopy cover (trees less than 10 inches dbh, shrubs, and forest floor vegetation), resulting in a change in prey distribution and abundance. Until prey habitat has recovered, northern spotted owls may use these areas less or even avoid them; however, this will only occur in 11 acres in a home range with abundant amounts of untreated foraging habitat. Understory vegetation is expected to be re-established within 2 to 3 growing seasons post-treatment (Dodson et al. 2008, p. 3137; Harrod et al. 2007, p. 322-323; Metlen and Fiedler 2006, p. 364) and forest floor vegetation (grasses and forbs) is often re-established after one growing season (Supplemental BA, p. 65). Shrub cover and forest floor vegetation is likely to increase and be more diverse as a result of treatment (Dodson et al. 2008, pp. 3134- 3139; Metlen and Fiedler 2006, p. 364; Youngblood et al. 2006, p. 161). Northern spotted owls are expected to increase use of the treated habitat areas within 2 to 3 years post-treatment.

Table 23. Amount of suitable habitat[1] (in acres and percent of available suitable habitat) treated and proposed completion schedule for the activity center 1049 home range (adapted from Table 29 in the Smokey BA).

	Core Area		Entire Home Range[2]		
Treatment	Acres Treated	% of Available	Acres Treated	% of Available	Proposed Completion
Fuels/Habitat Enhancement	0	0%	111	7%	Within 10 years
Total	0	0%	111	7%	

[1]Suitable habitat refers to nesting/roosting and foraging habitat.
[2]Includes core area.

Summary of Effects

Northern spotted owls' use of the proposed treatment area within AC 1049 is likely very low. Fuel reduction/wildlife habitat enhancement treatments are expected to have insignificant and/or discountable effects to breeding, feeding, and/or sheltering northern spotted owls that may be using AC 1049, because no treatments will occur in the core area, no habitat will be removed or downgraded, treatments will be staggered over 10 years, and conservation measures will be implemented.

Activity Center 3006

Disturbance, Injury, and Mortality

As discussed in Sections 4.4.1.1.1 and 4.4.1.1.2, the risk of disturbing, injuring, or killing northern spotted owls is higher during the breeding and nesting season within the core area. Two acres of nesting/roosting habitat and 4 acres of foraging habitat would be affected within the core area by fuel treatments (BA, pp. 57-59). However, Kill Dry Ridge provides a visual and physical barrier between the activity center site and proposed treatments in the core area (Fig. 10). A pair of northern spotted owls has been detected at this activity center (Section 4.3.2.2.2); therefore, a limited operating period will be in place to reduce effects from noise disturbance (see Section 2.2.5.1), including a 0.5 mile helitorching LOP. Because of geographic separation and the LOP, we do not expect any disturbance, injury, or mortality of northern spotted owls associated with this activity center.

Habitat Modification Effects

Treatments within AC 3006 are proposed at the periphery of the core area and outer ring of the home range (Fig. 10). Fuel treatments (understory thinning and burning) will affect 2 acres of nesting/roosting habitat and 4 acres of foraging habitat in the core area (Table 22). In the outer ring, mastication, hand thinning, and prescribed burning will affect 102 acres of nesting/roosting habitat and 129 acres of foraging habitat and commercial thinning will affect an additional 15 acres of foraging habitat (Tables 22 and 24). No commercial thinning will occur in nesting/roosting habitat or the core area.

Table 24. Amount of suitable habitat[1] (in acres and percent of available suitable habitat) treated and proposed completion schedule for the activity center 3006 home range (adapted from Table 33 in the Smokey BA).

	Core Area		Entire Home Range[2]		
Treatment	Acres Treated	% of Available	Acres Treated	% of Available	Proposed Completion
Commercial Thin	0	0%	15	0.6%	Within 1 year
Fuels/Habitat Enhancement	6	1%	237	11%	Within 10 years
Total	6	1%	252	12%	

[1]Suitable habitat refers to nesting/roosting and foraging habitat.
[2]Includes core area.

In nesting/roosting habitat, it is possible for fuel reduction treatments to affect overstory canopy cover, large trees with deformities, snags, and coarse woody debris due to the low potential of torching during prescribed burning which, if it occurs, could kill the trees that provide these habitat components, thereby making them unavailable for spotted owl use. However, there is a low probability that torching will occur because of the conservation measures the Forest will implement (removal of ladder fuels, low-intensity prescribed fire, and burning in the spring under moist conditions) as part of the proposed project. Large snags and coarse woody debris may be removed if they pose a hazard to human safety or occur in densities that may pose a fire risk. Because all treated units in this home range are within the LSR, a minimum of 6 snags per acre would be left intact (see Section 2.2.5.5). This limited amount of hazard snag/coarse woody debris removal is not expected to preclude the ability of the stands to function for as nesting

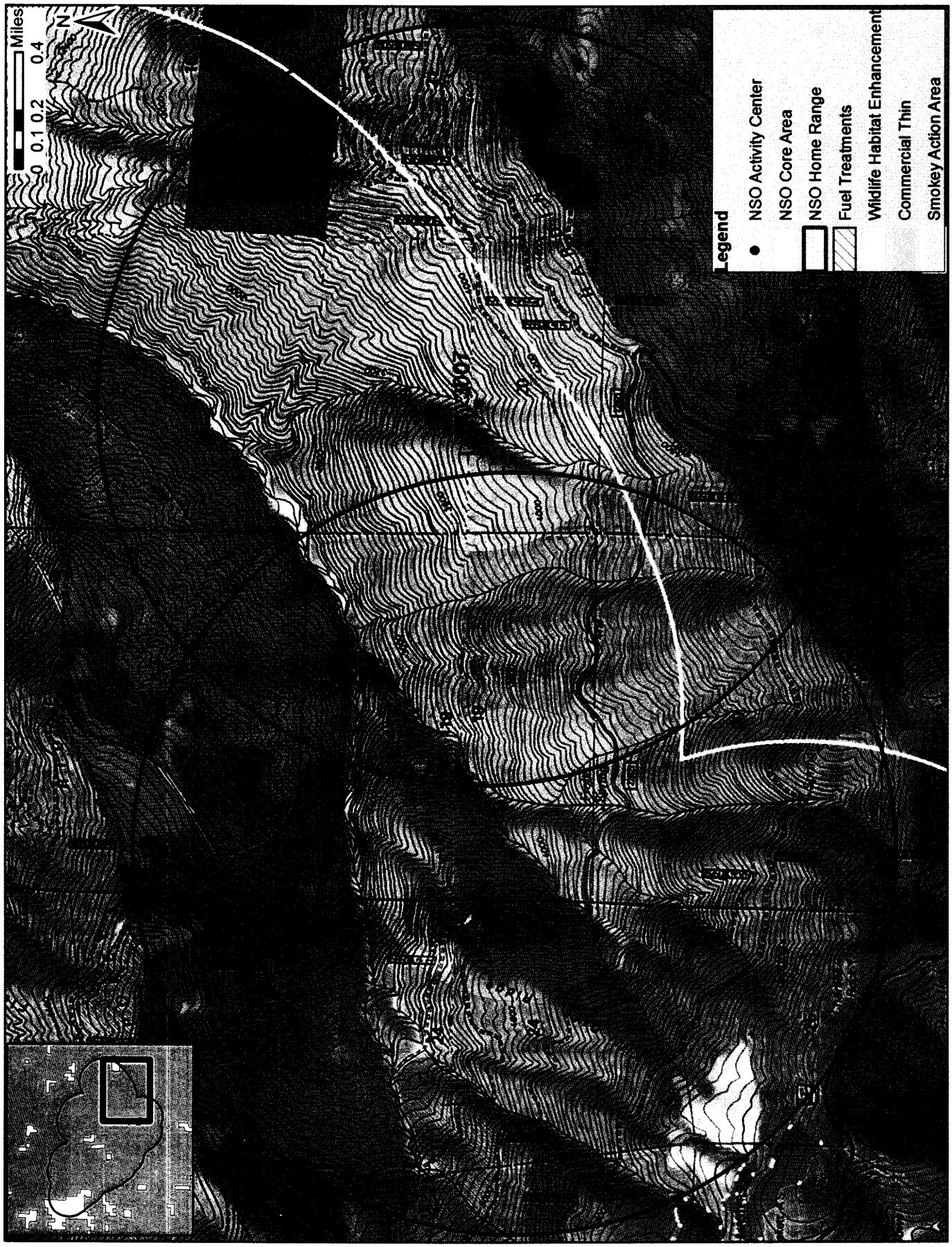


Figure 10. Proposed treatments within the home ranges of Activity Centers 3006 and 3007.

and/or roosting habitat; therefore, the effect of removing these components would be insignificant to the northern spotted owls using the area.

Fuel reduction treatments may alter foraging habitat by reducing mid- and understory canopy cover (trees less than 10 inches dbh, shrubs, and forest floor vegetation), resulting in a change in prey distribution and abundance. Until prey habitat has recovered, northern spotted owls may use these areas less or even avoid them. However, these treatments are expected to have an insignificant effect on northern spotted owls due to staggered implementation of treatments and abundant untreated foraging habitat throughout the home range. Understory vegetation is expected to be re-established within 2 to 3 growing seasons post-treatment (Dodson et al. 2008, p. 3137; Harrod et al. 2007, p. 322-323; Metlen and Fiedler 2006, p. 364) and forest floor vegetation (grasses and forbs) is often re-established after one growing season (Supplemental BA, p. 65). Furthermore, shrub cover and forest floor vegetation is likely to increase and be more diverse as a result of treatment (Dodson et al. 2008, pp. 3134- 3139; Metlen and Fiedler 2006, p. 364; Youngblood et al. 2006, p. 161). Northern spotted owls are expected to resume increased use of the treated habitat areas within 2 to 3 years post-treatment.

Commercial thinning will reduce overstory canopy cover in foraging habitat from 70 to 90 percent to 40 to 60 percent. Foraging habitat proposed for treatment will maintain its function, but short-term degradation in habitat quality may occur from a simplification of vertical forest structure by reducing understory components, such as suppressed and intermediate trees, shrubs, and hardwoods. The understory will be simplified from pre-action conditions, and in areas where they may contribute to ladder fuels, may be removed altogether. All of these things can lead to reduced prey abundance and would make the stand less favorable for foraging spotted owls due to reduced concealment from predators, increased temperatures, and fewer low-canopy perches to forage from. However, these effects will only occur in 15 acres of foraging habitat within AC 3006 (Table 24), which contains abundant amounts of untreated suitable habitat at the core area and home range scales (Table 13) and commercial thinning is expected to be of short duration (1 year; Table 24). Conservation measures (retention of snags, coarse woody debris, and tree clusters, avoidance of woodrat nests, and basal area and canopy cover requirements) will reduce these potential effects to northern spotted owls by maintaining at least minimum foraging habitat characteristics, retaining remnant overstory trees and trees with unique phenotypical differences, promoting size class diversity, and providing cover for wildlife, including northern spotted owl prey species (Section 2.2.5; Supplemental BA, Appendix B).

Summary of Effects

Fuel treatment/wildlife habitat enhancement and commercial thinning are expected to have insignificant and/or discountable effects to the breeding, feeding, and/or sheltering northern spotted owls associated with AC 3006. Although 11 percent of the suitable habitat within this home range will be treated, less than 1 percent of the core area will be treated, no habitat will be removed or downgraded, fuel treatments will be staggered over 10 years, and other conservation measures will be implemented.

Activity Center 3007

Disturbance, Injury, and Mortality
As discussed in Sections 4.4.1.1.1 and 4.4.1.1.2, the risk of disturbing, injuring, or killing northern spotted owls is higher during the breeding and nesting season within the core area. No treatments are proposed within the core area of AC 3007 (Fig. 10; BA, pp. 60-61). No northern spotted owls have been detected in recent surveys (Section 4.3.2.2.3). Nesting/roosting habitat is present within 0.25 mile of SPLAT unit I (but no suitable habitat is in the unit), not all of which has been surveyed. SPLAT unit I is located to the northwest of the core area, on the opposite side of Kill Dry Creek (Fig. 10). When unit I is burned, smoke will most likely settle downslope in the Kill Dry Creek valley and will not rise upslope to the core area of AC 3007. Topographic separation provided by the Kill Dry Creek valley and smoke management guidelines will minimize potential noise and smoke disturbance in nesting/roosting habitat near SPLAT unit I. We do not expect any disturbance, injury, or mortality of northern spotted owls associated with this activity center.

Habitat Modification Effects
No northern spotted owl nesting/roosting or foraging habitat is proposed for treatment within the home range of AC 3007. SPLAT unit I overlaps 160 acres of the home range's outer ring, but no suitable habitat occurs there.

Summary of Effects
Effects to the breeding, feeding, and sheltering of northern spotted owls associated with AC 3007 are expected to be insignificant because no suitable habitat within the home range will be treated.

Activity Center 3009

Disturbance, Injury, and Mortality
As discussed in Sections 4.4.1.1.1 and 4.4.1.1.2, the risk of disturbing, injuring, or killing northern spotted owls is higher during the breeding and nesting season within the core area. A pair of spotted owls has been detected in this home range in 2011 and 2013, although nesting status was not determined (see Section 4.3.2.2.4). It is unlikely that this pair will nest during project implementation since nesting has not been recently documented and because a barred owl pair has taken up residence in this home range near the core area.

Fuel reduction/wildlife habitat enhancement treatments will occur in 47 acres of nesting/roosting habitat and 55 acres of foraging habitat within the core area (Fig. 9; BA, pp. 62-63). High levels of heat and/or smoke during spring burning could lead to short-term unavailability (up to several days) of suitable habitat or avoidance of stands by northern spotted owls during and post-treatment. Disturbance to northern spotted owls is expected to be temporary, lasting for several days, and the non-nesting pair will likely move away from the area and avoid direct injury or mortality. We do not expect direct injury or mortality to northern spotted owls from prescribed burning.

Habitat Modification Effects
Fuel reduction/wildlife habitat enhancement treatments will affect 47 acres of nesting/roosting habitat and 55 acres of foraging habitat within the core area. In the outer ring of the home range,

fuel reduction/wildlife habitat enhancement treatments will affect 220 acres of nesting/roosting habitat and 241 acres of foraging habitat and commercial thinning will affect an additional 15 acres of foraging habitat (Tables 22 and 25; BA, pp. 62-63). No commercial thinning will take place in the core area or in any nesting/roosting habitat.

Table 25. Amount of suitable habitat[1] (in acres and percent of available suitable habitat) treated and proposed completion schedule for the activity center 3009 home range (adapted from BA, Table 40).

	Core Area		Entire Home Range[2]		
Treatment	Acres Treated	% of Available	Acres Treated	% of Available	Proposed Completion
Commercial Thin	0	0%	15	1%	Within 1 year
Fuels/Habitat Enhancement	102	34%	563	36%	Within 10 years
Total	102	34%	578	37%	

[1]Suitable habitat refers to nesting/roosting and foraging habitat.
[2]Includes core area.

In nesting/roosting habitat, it is possible for fuel reduction treatments to affect overstory canopy cover, large trees with deformities, snags, and coarse woody debris due to the low potential of torching during prescribed burning which, if it occurs, could kill the trees that provide these habitat components, thereby making them unavailable for spotted owl use. However, we expect these effects to be discountable due to the conservation measures the Forest will implement (removal of ladder fuels, low-intensity prescribed fire, and burning in the spring under moist conditions). Large snags and coarse woody debris may be removed if they pose a hazard to human safety or occur in densities that may pose a fire risk. Because all treated units in this home range are within the LSR, a minimum of 6 snags per acre would be left intact (see Section 2.2.5.5). This limited amount of hazard snag/coarse woody debris removal is not expected to preclude the ability of the stands to function for as nesting and/or roosting habitat; therefore, the effect of removing these components would be insignificant to the northern spotted owls using the area.

Fuel reduction treatments may alter foraging habitat by reducing mid- and understory canopy cover (trees less than 10 inches dbh, shrubs, and forest floor vegetation), resulting in a change in prey distribution and abundance. Until prey habitat has recovered, northern spotted owls may use these areas less or even avoid them. Understory vegetation is expected to be re-established within 2 to 3 growing seasons post-treatment (Dodson et al. 2008, p. 3137; Harrod et al. 2007, p. 322-323; Metlen and Fiedler 2006, p. 364) and forest floor vegetation (grasses and forbs) is often re-established after one growing season (Supplemental BA, p. 65). Furthermore, shrub cover and forest floor vegetation is likely to increase and be more diverse as a result of treatment (Dodson et al. 2008, pp. 3134- 3139; Metlen and Fiedler 2006, p. 364; Youngblood et al. 2006, p. 161). Treatments will be staggered and northern spotted owls are expected to resume use of the treated habitat areas within 2 to 3 years post-treatment. In a home range where suitable habitat is a limiting factor in the core area, barred owls are established, and the northern spotted owl pair may be attempting to nest; fuel reduction/wildlife enhancement treatments in 34% of the core area may result in adverse effects to the northern spotted owl, despite long-term benefits to habitat.

Commercial thinning will reduce overstory canopy cover in foraging habitat from 70 to 90 percent to 40 to 60 percent. The 15 acres of foraging habitat proposed for treatment will maintain its function, but short-term degradation in habitat quality may occur from a simplification of vertical forest structure by reducing understory components, such as suppressed and intermediate trees, shrubs, and hardwoods. The understory will be simplified from pre-action conditions, and in areas where they may contribute to ladder fuels, may be removed altogether. All of these things can lead to reduced prey abundance and would make the stand less favorable for foraging spotted owls due to reduced concealment from predators, increased temperatures, and fewer low-canopy perches to forage from. Conservation measures (retention of snags, coarse woody debris, and tree clusters, avoidance of woodrat nests, and basal area and canopy cover requirements) will reduce these potential effects by maintaining at least minimum foraging habitat characteristics, retaining remnant overstory trees and trees with unique phenotypical differences, promoting size class diversity, and providing cover for wildlife, including northern spotted owl prey species (Section 2.2.5; Supplemental BA, Appendix B).

Summary of Effects
Adverse effects to the northern spotted owl pair inhabiting AC 3009 are expected due to habitat modification and disturbance of two adults. Although habitat function will be maintained, treatment of a significant portion of suitable habitat in a core area (34 percent) that is below recommended habitat amounts and where barred owls have become established could put additional stress on the northern spotted owl pair. Northern spotted owl foraging behavior will likely change for several years following treatment; however, foraging habitat and prey numbers are expected to recover 2 to 3 years following implementation. Spring burning may result in adverse effects to adults during the breeding season.

Activity Center 3048

Disturbance, Injury, and Mortality
As discussed in Sections 4.4.1.1.1 and 4.4.1.1.2, the risk of disturbing, injuring, or killing northern spotted owls is higher during the breeding and nesting season within the core area. A pair of spotted owls has been detected in this home range in 2010, 2011, and 2013, and nesting status was confirmed in 2013 and 2014 (Section 4.3.2.2.5). The average clutch size for northern spotted owls is two eggs (Appendix C, p. 111). Fuel reduction/wildlife habitat enhancement treatments will occur in 23 acres of nesting/roosting habitat and 34 acres of foraging habitat within the core area (Fig. 11). Commercial thinning will occur in 92 acres of foraging habitat within the core area (Fig.11; BA, pp. 64-66).

High levels of heat or smoke during spring burning could lead to short-term unavailability (up to several days) of suitable habitat, disturbance of nesting adults and/or young during the breeding season, or avoidance of stands during and post-treatment. Adults and/or young could suffer mortality from intense heat, the fire itself, or smoke inhalation if they are reluctant or unable to flee. If burning occurs early in the nesting season, eggs may be destroyed by fire, intense heat, or parental abandonment. If burning occurs later in the nesting season, nestlings could suffer from starvation, increased predation, or death if the adults abandon the nest for an extended amount of time. The Forest may burn in the spring (BA, p. 20), which has the potential to cause direct mortality. We recommend an extended LOP (February 1 – September 15) for those units within 0.25 mile of the nest tree to minimize the potential for take in AC 3048.

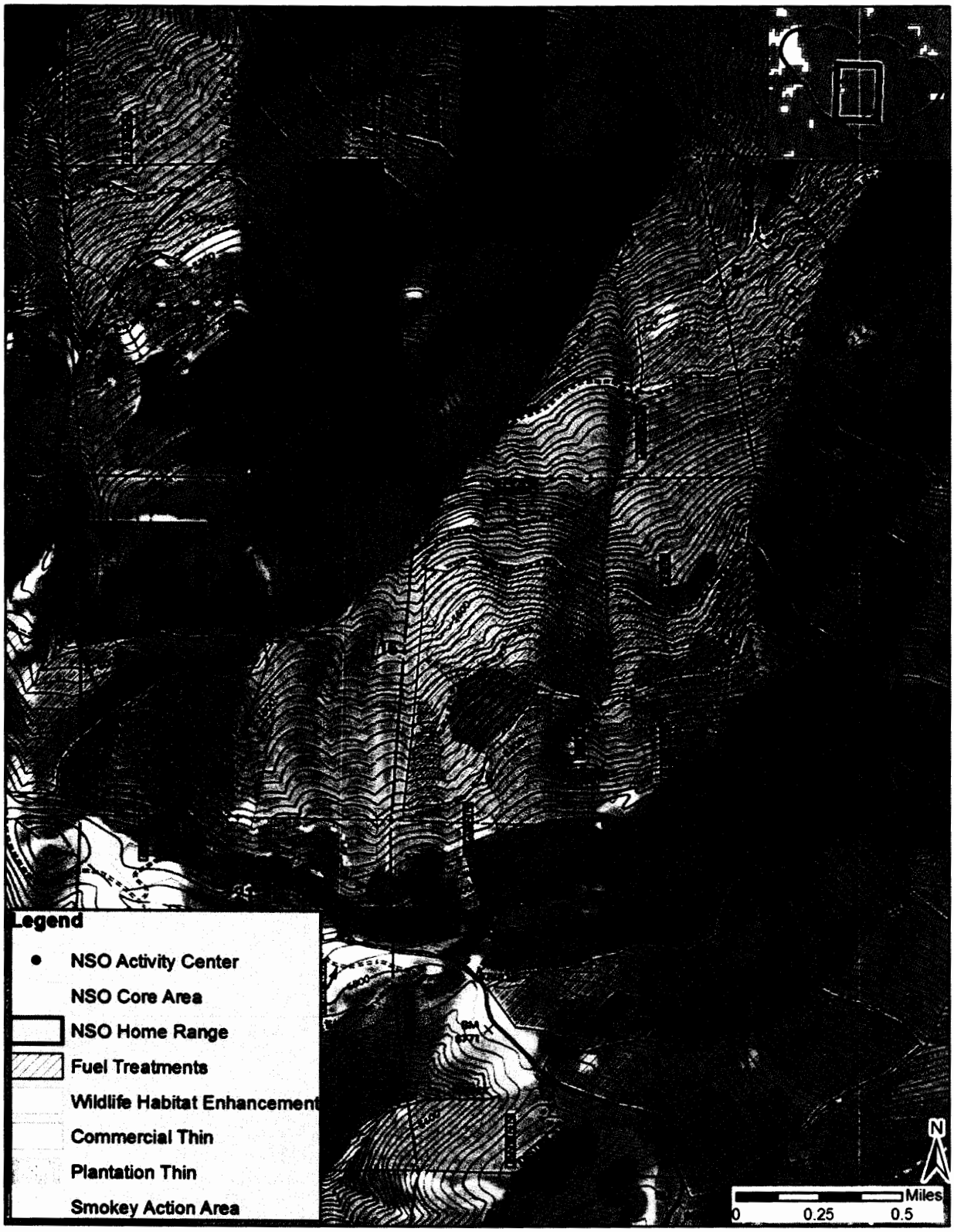


Figure 11. Proposed treatments within the home range of Activity Center 3048.

Habitat modification and fuels treatment activities conducted within 0.25 mile of an active nest during the remainder of the breeding season (July 11 to September 15) have the potential to result in adverse effects to young (see Section 4.4.1.1.1). Young would likely be fledged during this time period, but would not yet be able to fly skillfully, and are still dependent upon adults for feeding and protection from predators. We expect disturbance, injury, and potential mortality of northern spotted owls associated with this activity center if these treatments occur within 0.25 mile of an active nest prior to September 15.

Habitat Modification Effects
Fuel reduction/wildlife habitat enhancement treatments will affect 23 acres of nesting/roosting habitat and 34 acres of foraging habitat within the core area and commercial thinning will affect 92 acres of foraging habitat (Fig. 11, Table 22). In the outer ring of the home range, foraging habitat will be affected by 184 acres of commercial thinning and 256 acres of fuels and habitat enhancement treatments (BA, pp. 64-66). No nesting/roosting habitat in the outer ring will be treated (Tables 22 and 26). No commercial thinning will take place in any nesting/roosting habitat.

Table 26. Amount of suitable habitat[1] (in acres and percent of available suitable habitat) treated and proposed completion schedule for the activity center 3048 home range (adapted from BA, Table 40).

	Core Area		Entire Home Range[2]		
Treatment	Acres Treated	% of Available	Acres Treated	% of Available	Proposed Completion
Commercial Thin	92	30%	276	19%	Within 1 year
Fuels/Habitat Enhancement	57	18%	313	21%	Within 10 years
Total	149	48%	589	40%	

[1]Suitable habitat refers to nesting/roosting and foraging habitat.
[2]Includes core area.

In nesting/roosting habitat, it is possible for fuel reduction treatments to affect overstory canopy cover, large trees with deformities, snags, and coarse woody debris due to the low potential of torching during prescribed burning which, if it occurs, could kill the trees that provide these habitat components, thereby making them unavailable for spotted owl use. However, we expect these effects to be discountable due to the conservation measures the Forest will implement (removal of ladder fuels, low-intensity prescribed fire, and burning in the spring under moist conditions). Large snags and coarse woody debris may be removed if they pose a hazard to human safety or occur in densities that may pose a fire risk. For those treatment units within the LSR (the majority within this home range), a minimum of 6 snags per acre would be left intact (see Section 2.2.5.5). A minimum of 3.2 snags per acre would be left the treatment unit outside of the LSR (units in the southwest quadrant of the home range, see Fig. 11). This limited amount of hazard snag/coarse woody debris removal is not expected to preclude the ability of the stands to function for as nesting and/or roosting habitat; therefore, the effect of removing these components would be insignificant to the northern spotted owls using the area.

Fuel reduction treatments may alter foraging habitat by reducing mid- and understory canopy cover (trees less than 10 inches dbh, shrubs, and forest floor vegetation), resulting in a change in prey distribution and abundance. Until prey habitat has recovered, northern spotted owls may use

these areas less or even avoid them. Understory vegetation is expected to be re-established within 2 to 3 growing seasons post-treatment (Dodson et al. 2008, p. 3137; Harrod et al. 2007, p. 322-323; Metlen and Fiedler 2006, p. 364) and forest floor vegetation (grasses and forbs) is often re-established after one growing season (Supplemental BA, p. 65). Furthermore, shrub cover and forest floor vegetation is likely to increase and be more diverse as a result of treatment (Dodson et al. 2008, pp. 3134- 3139; Metlen and Fiedler 2006, p. 364; Youngblood et al. 2006, p. 161). Treatments will be staggered and northern spotted owls are expected to resume use of the treated habitat areas within 2 to 3 years post-treatment.

Commercial thinning will reduce overstory canopy cover in foraging habitat from 70 to 90 percent to 40 to 60 percent. Foraging habitat proposed for treatment will maintain its function, but short-term degradation in habitat quality may occur from a simplification of vertical forest structure by reducing understory components, such as suppressed and intermediate trees, shrubs, and hardwoods. The understory will be simplified from pre-action conditions, and in areas where they may contribute to ladder fuels, may be removed altogether. All of these things can lead to reduced prey abundance and would make the stand less favorable for foraging spotted owls due to reduced concealment from predators, increased temperatures, and fewer low-canopy perches to forage from. Conservation measures (retention of snags, coarse woody debris, and tree clusters, avoidance of woodrat nests, and basal area and canopy cover requirements) will reduce these potential effects by maintaining at least minimum foraging habitat characteristics, retaining remnant overstory trees and trees with unique phenotypical differences, promoting size class diversity, and providing cover for wildlife, including northern spotted owl prey species (Section 2.2.5; Supplemental BA, Appendix B). In a home range with extremely limited nesting/roosting habitat in a core area where nesting northern spotted owls are present, fuel reduction/wildlife enhancement and commercial thinning treatments in 48% of the core area may result in adverse effects to the northern spotted owl, despite long-term benefits to habitat.

One new landing (less than 0.5 acre) will be built in commercial thinning unit 22, which occurs within the home range of AC 3048 (BA, p. 65). This unit does not contain nesting/roosting or foraging habitat; therefore, construction of the landing would not affect northern spotted owl habitat. Approximately 2 miles of temporary roads will be constructed within commercial thinning units 4, 12, 17, and 21, all of which are within the home range of AC 3048. The majority of these roads will be built on existing road beds and are not expected to significantly reduce foraging habitat function. A new road bed will need to be constructed for the road proposed in unit 17. Approximately 12 feet wide and 686 feet long, construction of the road in unit 17 would lead to a linear patch of low canopy closure and removal of the understory across approximately 0.19 acre of foraging habitat. Similar openings, although not linear, occur naturally in foraging habitat, due to insect outbreaks or tree mortality from disturbance events. The effects are expected to be similar to that of commercial thinning, but because of the narrow, linear nature of this road and the insignificant amount of acres involved, it is not expected to significantly reduce foraging habitat function. All roads will be closed to public access after harvest is complete, which will allow vegetation to grow in the road bed.

Summary of Effects

Adverse effects to the northern spotted owl pair inhabiting activity center 3048 are expected due to habitat modification and disturbance of two adults and two eggs and/or young. Although

habitat function will be maintained, treatment of a significant portion of the suitable habitat (48 percent) within a core area that is below recommended habitat amounts and where nesting is occurring in 2014 could put additional stress on the northern spotted owl pair. Northern spotted owl foraging behavior will likely change for several years following treatment; however, foraging habitat and prey numbers are expected to recover 2 to 3 years following implementation. Spring burning may result in adverse effects to adults, young, and/or eggs during the breeding season.

Barred Owl Effects to Northern Spotted Owls

Barred owls have been detected within the action area in the area of overlap between activity centers 1049 and 3009 in 2010, 2011, and 2013 (see Section 4.3.2.1, Table 9; and Fig. 9 above). The presence of the barred owl pair within these home ranges could result in reduced northern spotted owl detectability, reduced site occupancy, reduced likelihood of nesting, and reduced survival. In AC 1049, the presence of the barred owl pair is unlikely to exacerbate the effects of fuel reduction treatment on northern spotted owls for two reasons: no spotted owls have been detected in the southern portion of their home range since 2008 and this area of their home range is likely used very little due to overlap with AC 3009 (northern spotted owls have been detected there in 2011 and 2013). In AC 3009, it is likely that the presence of the barred owl pair will have detrimental effects to the resident northern spotted owl pair. As mentioned above, the combined effects of the action and barred owl presence will likely result in take of northern spotted owls at AC 3009.

4.4.1.2.3. Summary of Effects to Northern Spotted Owls

The Smokey Project will affect 532 acres of nesting/roosting habitat, 1,790 acres of foraging habitat, and 2,138 acres of dispersal habitat used by northern spotted owls within the action area. Proposed treatment areas overlap five northern spotted owl home ranges (Table 27) and will result in adverse effects to northern spotted owls at two of those activity centers (ACs 3009 and 3048). Although the function of all treated habitat will be maintained, short-term degradation of nesting/roosting and foraging habitat quality and a high likelihood of disturbance during the breeding season could result in impairment of essential behavioral patterns, including breeding, feeding, and/or sheltering to northern spotted owls at ACs 3009 and 3048. No northern spotted owls have been detected outside of activity centers; however, short-term degradation of foraging habitat quality outside of known activity centers could affect the ability of dispersing owls to feed and/or shelter in treated areas in the short-term. In the long-term, the proposed action will likely benefit the northern spotted owl by reducing the risk of habitat loss from catastrophic wildfire events and improving foraging habitat.

4.4.1.3. *Consistency with the Northern Spotted Owl Recovery Plan*

For dry forests, the Recovery Plan recommends that vegetation management treatments be emphasized outside of northern spotted owl core areas or high value habitat; be designed and implemented at the landscape level; retain and restore key structural components including large and old trees, large snags, and downed logs; retain and restore stand and landscape-level heterogeneity; and management of roads to address fire risk and wildfires to meet vegetation management objectives where possible (Service 2011, pp. III-34,35).

Table 27. Condition of northern spotted owl core areas and home ranges within the action area after project completion (Federal lands only).

		Core Area		Home Range	
Activity Center	Habitat	Acres	% Suitable	Acres	% Suitable
1049	Nesting/Roosting*	238	48	718	46
	Foraging	176	35	821	
	Total	414	83	1,539	46
3006	Nesting/Roosting	289	58	1,524	68
	Foraging	170	34	758	
	Total	459	92	2,282	68
3007	Nesting/Roosting	301	60	801	45
	Foraging*	82	16	700	
	Total	383	76	1,501	45
3009†	Nesting/Roosting*	162	32	750	47
	Foraging*	138	28	810	
	Total	300	60	1,560	47
3048†	Nesting/Roosting*	76	15	282	42
	Foraging	232	46	1,165	
	Total	308	61	1,447	42

*Below suitable habitat recommendation for the core area (50% nesting/roosting and 30% foraging). These home ranges were below habitat recommendations prior to the Smokey Project (see Tables 12-16).
†Adverse effects expected.

The Smokey Project is consistent with the ecosystem-scale restoration goal of the Recovery Plan because it intends to protect and enhance late-successional forests and habitat by treating hazardous fuels and high stand densities, thus restoring the natural ecosystem and reducing the risk of large, stand-replacing fires that threaten northern spotted owl habitat, as well as allowing fire to return to the project area as a natural process. The proposed action meets most of the recommendations of the Recovery Plan, but is inconsistent with portions of Recovery Action 10.

4.4.1.3.1. Recovery Action 10

Recovery Action 10 (Service 2011, pp. III-43 through III-47) recommends the conservation of northern spotted owl sites and high value northern spotted owl habitat to provide additional demographic support to the northern spotted owl population. The intent of this recovery action is to protect, enhance, and develop habitat in the quantity and distribution necessary to provide for the long-term recovery of northern spotted owls (Service 2011, p. III-34). Sites that contain habitat conditions to support successful reproduction of northern spotted owls should be a priority for conservation, in the following order of importance: known sites with reproductive pairs, known sites with pairs, known sites with resident singles, and historic sites with reproductive pairs, pairs, and resident singles. Prescriptions that implement this recovery action should retain sufficient nesting, roosting, and foraging habitat within the core area and home range to support breeding, feeding, and sheltering.

In the Smokey Project, several of the activity center core areas overlapping the action area are below the recommended amounts of nesting/roosting or foraging habitat (prior to project implementation), but all contain more than the recommended amounts of suitable habitat within the home range. Protocol-level surveys have detected northern spotted owls within the action area (Section 4.3.2.1). No habitat would be removed or downgraded (except approximately 0.19 linear acres created by a temporary road). Degradation of habitat quality, while maintaining habitat function, will result in short-term negative effects to "high value" habitat. Long-term benefits to habitat are expected, however, through reduced risk of stand-replacing wildfire, improved stand health, and promoting future habitat development.

4.4.1.3.2. Recovery Action 32

Recovery Action 32 (Service 2011, pp. III-67 and III-68) emphasizes the need for retention and restoration of well-distributed, older, and more structurally complex multi-layered conifer forests for recovery of the northern spotted owl. Protecting these forests should provide northern spotted owls with high-quality refugia from the negative competitive interactions with barred owls that are likely occurring where the two species' home ranges overlap. Recovery Action 32 further defines these high-quality habitat stands as having large diameter trees, high amounts of canopy cover, and decadent characteristics.

The Smokey Project and action area contain some conifer forests that meet the definition of "high quality" habitat in Recovery Action 32. The actions proposed by the Project meet the intent of this recovery action by striving to improve long-term forest health, resulting in a more resilient forest condition.

4.4.1.3.3. Summary of Effects to Recovery

The proposed action meets many objectives outlined in the Recovery Plan, including design at the landscape level, with treatments placed in context with the surrounding landscape to be most effective and accommodate the natural disturbance regime of the area; and emphasis on protection of key structural components such as larger overstory trees, large snags, and downed logs. Short-term adverse effects to northern spotted owls in the action area due to project implementation are not expected to preclude recovery of the species in the recovery unit or rangewide. Long-term, the Smokey Project will provide benefits to the northern spotted owl through increased resiliency of habitat.

4.4.2. Effects to Northern Spotted Owl Designated Critical Habitat

4.4.2.1. *Scientific Basis for Analyzing Effects to Critical Habitat*

This section presents an analysis of the effects of the activities proposed in the Smokey Project, including interrelated and interdependent actions, on designated critical habitat for the northern spotted owl (Service 2012b). Each vegetation treatment has the potential to result in short-term adverse effects to designated critical habitat through habitat modification; described in detail in the following sections. The degree of change to habitat function will be described by the terms remove, downgrade, or maintain (see Section 4.4.1.1.3 for definitions).
Our accounting of critical habitat acres affected differs from that stated in the Supplemental BA (see Section 4.3.4.1 for explanation and Table 8 in the Supplemental BA [p. 23]). The total acres treated by fuel reduction/wildlife enhancement, plantation thinning, and commercial thinning

remain the same, but we have also incorporated the acres affected by felling of hazard/maintenance trees and road construction. Although there is overlap between the PCEs (Service 2012b, pp. 72051-72052), our analysis treats each PCE as a discrete category.

4.4.2.2. *Effects to Critical Habitat in the Action Area*

The Smokey Project action area overlaps with 5,478 acres of designated critical habitat in subunit ICC 3 (Table 28); 1,259 acres of which are non-functioning critical habitat for northern spotted owls ("unsuitable/other" habitat, Section 4.3.4.1), resulting in 4,219 acres of critical habitat PCEs. Staggered implementation of treatments will allow the condition of treated areas to improve before additional treatments are implemented, spreading out short-term negative effects to prey over time and space and reducing additive effects (Supplemental BA, pp. 33-34). Proposed treatments will affect three PCEs of critical habitat, as discussed in the subsequent sections.

4.4.2.2.1. PCE 2 – Nesting/Roosting Habitat

There are 3,261 acres of northern spotted owl critical habitat containing PCE 2 (nesting/roosting habitat) within the Smokey action area (Table 28). A total of 775 acres of PCE 2 are proposed for treatment in fuels reduction/wildlife habitat enhancement units and felling of roadside hazard/maintenance trees (Table 28). All treated units within PCE 2 will maintain function post-treatment. No plantation thinning or commercial thinning will take place within PCE 2 (Supplemental BA, p. 23).

Insignificant and/or discountable effects to PCE 2 are expected because of the conservation measures assigned to units with nesting/roosting habitat (see Section 2.2.5.3), the scale at which treatment is occurring, and the staggered implementation of treatments. It is possible for fuel reduction treatments to affect canopy cover (the intermediate, predominant, co-dominant, and dominant trees that make up the canopy); the multi-layered, multi-species canopy made up of trees greater than 20-inch dbh; basal area; diversity of tree size; and the incidence of large trees with deformities due to the low potential of torching during prescribed burning which, if it occurs, could kill the trees that provide these habitat components. However, we expect these effects to be discountable due to the conservation measures the Forest will implement in nesting/roosting habitat (removal of ladder fuels prior to burning, low-intensity prescribed fire, and burning in the spring under moist conditions). Fuel reduction treatments will not affect the space beneath the canopy necessary for northern spotted owl flight. Fuel reduction treatments may also affect large snags and coarse woody debris and the limited foraging habitat provided by PCE 2. For example, snags and coarse woody debris may be removed if they pose a hazard to human safety or occur in densities that may pose a fire risk. For treatment units within the LSR, a minimum of 6 snags per acre would be left intact, and a minimum of 3.2 snags per acre would be left in treatment units outside of the LSR (see Section 2.2.5.5). These effects are expected to be insignificant because snag and woody debris removal is not expected to preclude the ability of the stands to function as nesting and/or roosting habitat. Although habitat for northern spotted owl prey species (i.e., foraging habitat) may be degraded in quality by fuel reduction treatments, in this area of the northern spotted owls' range, foraging typically occurs in stands not suitable as nesting/roosting habitat due to the habitat requirements of their primary prey, the woodrat.

Table 28. Amount of critical habitat primary constituent elements (PCEs; acres) proposed for treatment in the Smokey Project within the action area.

	Project Units						ICC 3[1]	
PCE	Fuels/ Wildlife	Plantation Thinning	Commercial Thinning	Hazard Tree Felling	Roads	Total	Untreated	Total[2]
2	532	0	0	243	0.00	775.00	2,486.00	3,261
3	1,164	0	549	428	0.19	2,141.19	2,442.81	4,584
4	1,619	10	345	581	0.62	2,555.62	5,580.38	8,136
Other[3]	989	270	0	NA	NA	1,259.00	1,828.00	3,087
Total	4,304	280	894	1,252	0.81	6,730.81	10,509.19	19,068

[1]Total amount of critical habitat in ICC 3 within the action area only.
[2]The total amount of PCE 2-4 in the action area is 15,981 acres.
[3]When critical habitat was spatially designated, some areas included within the boundaries do not currently function as habitat. These acres are classified as "other" or "unsuitable."

Felling of Roadside Hazard/Maintenance Trees

Although trees classified as roadside hazard/maintenance trees (see Section 2.2.4.1 for definitions) can provide nesting and/or roosting opportunities for northern spotted owls, very little suitable habitat occurs adjacent to major, high-use roads (e.g., Forest Highway 7, Recer Ridge Road). Furthermore, northern spotted owl use of these areas is probably low due to the high levels of disturbance associated with the road. The potential use by northern spotted owls is greater within 150 feet of a less-traveled route, where hazard tree felling could occur. Hazard tree felling in this area may result in the felling of a potential nest tree; however, the probability of this affecting PCE 2 is low.

At the time of consultation, the Forest did not know where roadside hazard trees would be felled, because the contractor had not yet determined the haul routes. The Forest completed a "worst-case" analysis assuming hazard tree felling would occur along all 6.7 miles of roads within the action area that contain critical habitat PCE 2 (Supplemental BA, p. 27). Based on the Forest's calculations, 243 acres of designated critical habitat containing PCE 2 could be affected along roadsides, all of which would degrade habitat quality, but retain habitat function. To reduce effects to PCE 2, only individual trees classified as hazards would be felled (Section 2.2.4.1). The likelihood that every roadside tree will be felled is low, as is the probability that every roadside hazard/maintenance tree functions for nesting and/or roosting. Therefore, we expect the effects from felling roadside hazard/maintenance trees to designated critical habitat containing PCE 2 to be insignificant and discountable.

4.4.2.2.2. PCE 3 – Foraging Habitat

There are 4,584 acres of northern spotted owl critical habitat containing PCE 3 (foraging habitat) within the Smokey action area (Table 28). A total of 2,141.19 acres of PCE 3 are proposed for treatment from fuels reduction/wildlife habitat enhancement, commercial thinning, felling of roadside hazard/maintenance trees, and temporary road construction (Table 28).

Fuel Reduction/Wildlife Habitat Enhancement Treatments

Prescribed burning and related fuels reduction treatments are likely to adversely affect PCE 3 by reducing snags and down woody debris through consumption of fuels and removal of shrubs and small understory trees across 1,164 acres (Table 28; Supplemental BA, pp. 33-35). Fuel reduction treatments may alter prey habitat by reducing cover (trees less than 10 inches dbh, shrubs, and forest floor vegetation), reducing the number of sub-canopy perches, and altering the multi-layered canopy, resulting in a change in prey distribution and abundance for 2 to 3 years post-burn. Although habitat function will be maintained, these effects could lead to short-term degradation of habitat quality of critical habitat containing PCE 3 within the action area.

To reduce effects to components of PCE 3, prescribed burning will be conducted after ladder fuels have been treated and during the spring when fuel moistures are the highest, resulting in low-intensity fire and decreasing the potential torching or of consuming snags and coarse woody debris during burning. This type of fire will greatly reduce the risk of losing important habitat components, such as coarse woody debris and snags, and the risk of crown torching (and associated tree mortality). Clumps of shrubs and conifers, as well as all hardwoods, will be retained to provide multi-layered canopy and prey habitat. In addition, large coarse, woody

debris will be retained at or above required levels and all snags will be retained unless determined a safety hazard (Section 2.2.5; Appendix B). Furthermore, understory vegetation is expected to become re-established within 2 to 3 growing seasons post-treatment (Dodson et al. 2008, p. 3137; Harrod et al. 2007, pp. 322-323; Metlen and Fiedler 2006, p. 364), and shrub cover and diversity is likely to increase as a result of treatment (Dodson et al. 2008, pp. 3134-3139; Metlen and Fiedler 2006, p. 364; Youngblood et al. 2006, p. 161). Prey abundance is expected to increase or return to previous levels within 2 to 3 years post-treatment, once the understory habitat has re-stabilized.

Commercial Thinning

Approximately 549 acres of the action area that contains PCE 3 is likely to be adversely affected by commercial thinning through modification of key habitat components (Table 28; Supplemental BA, pp. 35-37). Canopy cover will be reduced from greater than 70 percent down to 40 to 60 percent, depending on the prescription area, through removal of some large intermediate, dominant, and co-dominant trees. Although habitat function will be maintained, these effects will result in the degradation in quality of PCE 3 within the action area. To reduce the effects to areas containing the primary constituent elements of foraging habitat, the proposed commercial thinning units would retain a minimum of 40 percent canopy cover in foraging habitat, all hardwoods, some understory trees to promote development of an understory, and occasional clumps of trees (provided they do not pose a fire risk).

Foraging habitat proposed for treatment will maintain its function, but short-term degradation in habitat quality may occur from a simplification of vertical forest structure by reducing understory components, such as suppressed and intermediate trees, shrubs, and hardwoods. The understory will be simplified from pre-action conditions, and in areas where they may contribute to ladder fuels, may be removed altogether. All of these things can lead to reduced prey abundance and would make the stand less favorable as foraging habitat due to reduced concealment from predators, increased temperatures, and fewer low-canopy perches to forage from.

Felling of Roadside Hazard/Maintenance Trees

Although snags are not an essential component of foraging habitat, they can provide some habitat for prey and serve as perches for foraging northern spotted owls. At the time of consultation, the Forest did not know where roadside hazard trees would be felled because the contractor had not yet determined the haul routes. The Forest completed a "worst-case" analysis assuming hazard tree felling would occur along all 11.8 miles of roads within the action area that contain PCE 3 (Supplemental BA, p. 38). Based on the Forest's calculations, 428 acres of critical habitat containing PCE 3 could be affected along roadsides, all of which would degrade habitat quality, but retain habitat function. To reduce effects to PCE 3, only individual trees classified as hazards would be felled (Section 2.2.4.1) and felled trees would be left on site as down wood to contribute to prey habitat. The likelihood that every roadside tree is felled is low; therefore, we expect the effects from felling roadside hazard/maintenance trees to designated critical habitat containing PCE 3 to be insignificant and discountable.

Temporary Road Construction

One new temporary road will be created within designated critical habitat in commercial thinning unit 17 (Supplemental BA, p. 39). Construction of this road will decrease canopy cover and remove the understory on approximately 0.19 linear acre (12 feet wide and 694 feet long). This area will be similar to naturally occurring openings in foraging habitat (aside from its linear nature), due to insect outbreaks or tree mortality during wildfires. Although some components of PCE 3 will be removed or decreased (understory vegetation and canopy cover) in this area, we do not expect a change in the area's ability to function as PCE 3.

4.4.2.2.3. PCE 4 – Dispersal Habitat

Dispersal habitat, as defined for critical habitat (Service 2012b, p. 72052), must support the transience and colonization phases of northern spotted owl dispersal. As such, it should provide cover, minimal foraging opportunities, and some roosting structures (transience phase); as well as some nesting, roosting, and foraging habitat (colonization phase), in lesser quantities than needed for a breeding pair. There are 8,136 acres of northern spotted owl critical habitat containing PCE 4 (dispersal habitat) within the Smokey action area (Table 28). Treatments proposed within PCE 4 total 2,555.62 acres from fuels reduction/wildlife habitat enhancement, plantation thinning, commercial thinning, felling of roadside hazard/maintenance trees, and temporary road construction (Table 28).

Fuel Reduction/Wildlife Habitat Enhancement Treatments

Fuel reduction/wildlife habitat enhancement treatments may adversely affect the limited foraging habitat provided by PCE 4 by reducing snags and down woody debris through consumption of fuels and removal of shrubs and small understory trees across 1,619 acres (Table 28; Supplemental BA, pp. 41-42). Fuel reduction treatments may alter the limited prey habitat available by reducing cover (trees less than 10 inches dbh, shrubs, and forest floor vegetation), and reducing the number of sub-canopy perches, resulting in a change in prey distribution and abundance for 2 to 3 years post-burn. Although habitat function will be maintained, these effects could lead to short-term degradation of habitat quality across 1,619 acres of critical habitat containing PCE 4 within the action area. Fuel reduction/wildlife habitat enhancement treatments are not expected to reduce canopy cover that provides protection for dispersing northern spotted owls.

To reduce effects to PCE 4, prescribed burning will be conducted after ladder fuels have been treated and during the spring when fuels moistures are the highest, resulting in low-intensity fire. This type of fire will greatly reduce the risk of losing important habitat components, such as coarse woody debris and snags, and the risk of crown torching (and associated tree mortality). Clumps of shrubs and conifers, as well as all hardwoods, will be retained to provide multi-layered canopy and prey habitat. In addition, large coarse, woody debris will be retained at or above required levels and all snags will be retained unless determined a safety hazard (Section 2.2.5; Appendix B). Furthermore, understory vegetation is expected to become re-established within 2 to 3 growing seasons post-treatment (Dodson et al. 2008, p. 3137; Harrod et al. 2007, pp. 322-323; Metlen and Fiedler 2006, p. 364), and shrub cover and diversity is likely to increase as a result of treatment (Dodson et al. 2008, pp. 3134-3139; Metlen and Fiedler 2006, p. 364;

Youngblood et al. 2006, p. 161). Prey abundance is expected to increase or return to previous levels within 2 to 3 years post-treatment, once the understory habitat has re-stabilized.

Commercial Thinning

Commercial thinning may adversely affect PCE 4 by removing key components of the limited foraging opportunities provided by PCE 4 (Supplemental BA, pp. 42-43) over approximately 345 acres. Although habitat function of PCE 4 will be maintained, commercial thinning may cause short-term degradation in habitat quality through the reduction of canopy cover and simplification of vertical forest structure. Canopy cover would be reduced from greater than 70 percent down to 40 percent to 60 percent, depending on the prescription area, through removal of some large intermediate, dominant, and co-dominant trees. These short-term adverse effects are not expected to affect the ability of treated units to function as PCE 4.

To reduce the effects to the limited foraging component of PCE 4, large coarse, woody debris will be retained at or above required levels and all snags will be retained unless determined a safety hazard (Section 2.2.5; Appendix B). Proposed units will retain a minimum of 40 percent canopy cover wherever foraging habitat is present, all hardwoods, some understory trees to promote development of an understory, and occasional clumps of trees (provided they do not pose a fire risk). No commercial thinning will occur in the limited nesting/roosting component of PCE 4.

Commercial thinning is not expected to impair the ability of canopy cover to provide protection for dispersing northern spotted owls. Most commercial thin units (with the exception of units 25 and 28) will maintain a minimum of 40 percent canopy cover post-treatment. Units 25 and 28 equate to 33 acres and canopy cover will be reduced to 30 percent post-treatment.

Plantation Thinning

Of the 400 acres proposed for plantation thinning in the Project, only 10 acres will occur in PCE 4 (Table 28; Supplemental BA, p. 43). Habitat function, and the ability of northern spotted owls to disperse, will not be impaired by this treatment; therefore, we expect insignificant effects critical habitat containing PCE 4. Long-term, treatment of these overstocked plantations will benefit northern spotted owls by reducing the risk of high severity fire being carried into adjacent stands containing suitable habitat and will accelerate the development of higher quality habitat.

Felling of Roadside Hazard/Maintenance Trees

Hazard/maintenance tree felling will not affect canopy cover that provides protection for dispersing northern spotted owls. Although snags are not an essential component of dispersal habitat, they can provide some habitat for prey and serve as perches or roosts for northern spotted owls. At the time of consultation, the Forest did not know where roadside hazard trees would be felled because the contractor had not yet determined the haul routes. The Forest completed a "worst-case" analysis assuming hazard tree felling would occur along all 15.9 miles of roads within the action area containing PCE 4 (Supplemental BA, p. 38). Based on the Forest's calculations, 581 acres of critical habitat containing PCE 4 could be affected along roadsides, all of which would degrade habitat quality, but retain habitat function. To reduce effects to PCE 4, only individual trees classified as hazards would be felled (Section 2.2.4.1) and

felled trees would be left on site as down wood to contribute to prey habitat. The likelihood that every roadside tree is felled is low, as is the probability that every roadside hazard/maintenance tree functions for roosting or perching. We expect insignificant and discountable effects to designated critical habitat containing PCE 4 from felling of roadside hazard/maintenance trees.

Temporary Road Construction

One new temporary road will be created within designated critical habitat in commercial thinning unit 29 (Supplemental BA, p. 39). Construction of this road will decrease canopy cover on approximately 0.62 linear acres (12 feet wide and 2,236 feet long). Because canopy cover is naturally variable in dispersal habitat, due to insect outbreaks or tree mortality during wildfires, we do not expect the removal of 0.62 acre of habitat to change the ability of unit 29 to function as PCE 4. The effects from temporary road construction are insignificant and not expected to exacerbate the effects to PCE 4 from commercial thinning.

Landings

Two new landings, both less than 0.5 acre, will be built in commercial thinning units 22 and 29. Both units contain dispersal habitat but no foraging habitat (BA, p. 47) and the acres affected have been accounted for in the Commercial Thinning section above. The new landings will create small openings in canopy cover similar to those naturally found in dispersal habitat, due to insect outbreaks or tree mortality during wildfires. These two units will continue to function as PCE 4 and because the effect of this activity is insignificant it is not likely to exacerbate the effects from commercial thinning.

4.4.2.2.4. Summary of Effects to Critical Habitat in the Action Area

The Smokey Project proposes treatment of 532 acres of PCE 2; 1,713 acres of PCE 3; and 1,974 acres of PCE 4 within designated critical habitat for the northern spotted owl in the action area (Table 28). No PCEs will be removed or downgraded by the Project, and the function of all PCEs will be maintained post-action.

No adverse effects to PCE 2 are expected due to the Project. Short-term adverse effects are expected to PCE 3 and 4 due to degradation in habitat quality, even though PCE function will be maintained. The project is expected to adversely affect PCEs 3 and 4 due to changes in canopy closure and understory vegetation structure that are likely to affect prey abundance and distribution. Habitat function is expected to return and begin to improve within 2 to 3 growing seasons post-treatment. Long-term benefits of the proposed action include reduced risk of extreme habitat loss from catastrophic wildfire events and improved foraging habitat.

4.5. Cumulative Effects

Cumulative effects are those effects of future State, Tribal, and private actions that are reasonably certain to occur within the action area. Future Federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed action. Projects that have undergone prior consultation with the Service are considered in the Environmental Baseline (Section 4.3). We will discuss cumulative effects in regard to the species and critical habitat below.

4.5.1. Species

No local, State, or Tribal owned or managed lands occur within the action area, but 2,469 acres of private lands occur within the action area. These private lands receive varying levels of use. Five parcels (240, 160, 160, 80, and 20 acres each) on the east side of Forest Highway 7 appear to have had light to moderate selective timber harvesting in the past and some of them have summer homes. On the west side of Forest Highway 7, two parcels (1,800 and 30 acres) are composed of mostly grassland, oak, and scattered conifer (not likely to be suitable habitat) and are used by a hunt club.

Specific habitat and management data is not available for private lands; therefore, we did not consider this habitat available for use by northern spotted owls. We do not have any information regarding future actions on private lands in the action area; therefore, we believe there are no additive effects to those of the proposed action.

4.5.2. Critical Habitat

No private, State, or locally-owned or managed Tribal lands occur within designated critical habitat within the action area. No private lands were designated as critical habitat in any subunit; therefore, private lands were not considered as part of this analysis.

5. CONCLUSION

5.1. Integration and Synthesis

The integration and synthesis is the final step of the Services' assessment of the risk posed to species and critical habitat (where applicable) as a result of implementing the proposed action. In this section, we add the effects of the action to the environmental baseline and the cumulative effects to formulate the Services' biological opinion on whether the proposed action is likely to: (1) result in appreciable reductions in the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the *Status of the Species* and *Status of Critical Habitat*.

5.1.1. Species

In our *Status of the Species,* we described the factors that have led to the current listing of the northern spotted owl as threatened throughout their range under the Endangered Species Act; past and current habitat loss from timber harvest and wildfire and competition from barred owls are the most pressing threats to northern spotted owl recovery (Service 2011). Consequently, the Recovery Plan recommends avoiding forest management activities that are likely to diminish a home range's capability to support northern spotted owl occupancy, survival, and reproduction in the long-term, as well as conserving occupied and high value habitat (Service 2011). Specific to the California Klamath province and recovery unit, the Recovery Plan recommends actively managing for fuels reduction due to the high amount of habitat lost to wildfire.

The most recent environmental conditions that influence the survival and recovery of the northern spotted owl within the action area include habitat modification from past timber

harvests, habitat loss from wildfire, and the presence of barred owls. In addition, though not directly documented, we anticipate impacts to northern spotted owl prey from illegal marijuana cultivation and associated pollution, in particular rodenticides.

5.1.1.1. *Effects in the Action Area*

5.1.1.1.1. Disturbance, Injury, and Mortality

The Service anticipates the proposed Project will result in adverse effects to northern spotted owls in activity center 3009 in the form of harassment due to disturbance of two adults and to northern spotted owls in AC 3048 in the form of harassment due to disturbance of two adults and harm to two eggs and/or young. There is a high probability that the northern spotted owl pairs at both AC 3009 and AC 3048 will be exposed to smoke and elevated sound levels in the core area of their home range during the breeding season which could result in impairment of essential behavioral patterns, including breeding, feeding, and sheltering. At AC 3048, such harassment of the adults could cause abandonment of the nest or decreased levels of parental care, leading to mortality of the eggs and/or young.

5.1.1.1.2. Habitat Modification Effects

The Service anticipates the proposed Project will result in adverse effects to northern spotted owls in activity centers 3009 and 3048 in the form of harm to four adults (two pairs) due to degradation of habitat quality in the home range. Although habitat function will be maintained at AC 3009, the quality of 578 acres of suitable habitat (267 acres nesting/roosting, 311 acres foraging) will be degraded for 2 to 3 years following treatment. Combined with low amounts of nesting/roosting habitat within the home range and the presence of a barred owl pair, we expect adverse effects to breeding, feeding, and sheltering of northern spotted owls at AC 3009. Habitat function will be maintained at AC 3048; however, habitat quality will be degraded in 589 acres of suitable habitat (23 acres nesting/roosting, 566 acres foraging) for 2 to 3 years following treatment, including in 48 percent of the core area. Combined with low amounts of nesting/roosting habitat within the home range and the high likelihood of a nesting attempt by the northern spotted owl pair in future years, we expect adverse effects to the breeding, feeding, and sheltering of the northern spotted owls at AC 3048.

The proposed action is expected to benefit the northern spotted owls at all five home ranges, and the action area, in the long-term by rendering the habitat more resilient to fire, improving nesting/roosting and foraging habitat, and improving stand resistance to insects and disease.

5.1.1.2. *Effects to the Physiographic Province and Recovery Unit*

Within the California Klamath physiographic province, whose boundary is equivalent to the Recovery Unit, the proposed action would result in the treatment of 532 acres of nesting/roosting habitat, 1,790 acres of foraging habitat, and 2,138 acres of dispersal habitat. All habitat function will be maintained by the Project. There are approximately 1.4 million acres of northern spotted owl habitat in the California Klamath physiographic province and recovery unit, in which the Project is located. Habitat within the project area represents less than 1 percent of the suitable habitat available within the recovery unit. Adverse effects are expected at two activity centers within the recovery unit, but given the short-term nature of the effects, they should not affect the ability of the recovery unit to contribute to the survival and recovery of the species.

5.1.2. Designated Critical Habitat

In our *Status of Critical Habitat,* we identified the areas that contain the physical and biological features that are essential for the conservation of the northern spotted owl, including the primary constituent elements needed to support the life history requirements of the northern spotted owl. Specific to the Interior California Coast unit, the critical habitat designation (Service 2012b) recommends active management in dry forests that restores natural disturbance regimes; restores vegetation structure, composition, and distribution; and improves resiliency to fire.

The most recent environmental conditions influencing designated critical habitat for the northern spotted owl within the action area includes severe departures from historic fire return intervals, habitat modification from past timber harvests, and habitat loss from wildfire.

5.1.2.1. *Effects in the Action Area*

The Service anticipates adverse effects due to the proposed action across 2,141.19 acres of PCE 3 and 2,555.62 acres of PCE 4. Although the function of PCEs 3 and 4 are expected to be maintained, short-term degradation of habitat quality is likely to affect prey abundance and distribution and decrease cover for concealment in the foraging habitat components of PCE 3 and 4. PCE function is expected to return and begin to improve within 2 to 3 growing seasons post-treatment. Insignificant and/or discountable effects are expected in critical habitat containing PCE 2.

The proposed action is expected to benefit designated critical habitat within the action area in the long-term by increasing fire resiliency and improving the function of PCE 2, 3, and 4.

5.1.2.2. *Effects to the Critical Habitat Subunit*

Within subunit ICC 3 of designated critical habitat, the proposed action would result in the treatment of 775 acres of PCE 2; 2,141.19 acres of PCE 3; and 2,555.62 acres of PCE 4 (Table 29). The function of all PCEs will be maintained by the Project. However, adverse effects are anticipated to affect 10.9 percent of PCE 3 within the subunit and 10.6 percent of PCE 4 within the subunit. The short-term nature of these effects should not affect the ability of the subunit to function for demographic support or in providing north-south connectivity between subunits. The Smokey Project will, therefore, not appreciably diminish the function of the designated critical habitat at the subunit level.

Long-term, the project will improve habitat conditions within designated critical habitat and increase the resiliency of the subunit to wildfire. The Project is aligned with the special management considerations or protections for ICC 3 because it is addressing threats to the essential physical or biological features from current and past timber harvest, losses due to wildfire, and the effects on vegetation from fire exclusion.

Table 29. Estimated effects to northern spotted owl critical habitat resulting from Federal actions within subunit ICC 3.

	PCE 2			PCE 3			PCE 4	
Project	**Maintain**	**Downgrade**	**Remove**	**Maintain**	**Downgrade**	**Remove**	**Maintain**	**Remove**
North Pass Wildfire	0	0	1,093	0	0	758	0	873
Hardin	386	0	0	222	0	0	24	0
Tatham Ridge	3	0	0	0	0	0	48	0
Smokey	775	0	0	2,141	0	0	2,556	0
Total	1,164	0	1,093	2,363	0	758	2,628	873
Starting ICC 3 Acres		33,355			21,737		24,845	
% Affected by Actions	3.5%	0.0%	3.3%	10.9%	0.0%	3.5%	10.6%	3.5%
ICC 3 Post-Action		32,262			20,979		23,972	

5.2. Determination

After reviewing the best available scientific and commercial information, the current status of the northern spotted owl and designated critical habitat, the environmental baseline, the effects of the action, and the cumulative effects, it is the Service's biological opinion that implementation of the proposed Smokey Fuels Treatment Project is not likely to jeopardize the continued existence of the northern spotted owl nor adversely modify or destroy designated critical habitat for the northern spotted owl.

INCIDENTAL TAKE STATEMENT

1. INTRODUCTION

Section 9 of the Endangered Species Act and Federal regulation pursuant to section 4(d) of the Act prohibit the taking of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is described as an act which actually kills or injures wildlife, and is further defined by the Service (50 CFR § 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined by the Service (50 CFR § 17.3) as actions that create the likelihood of injury to a listed species by annoying it 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 this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Forest Service so that they become binding conditions of any grant or permit issued to the Forest, as appropriate, in order for the exemption in section 7(o)(2) to apply. The Forest Service has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest Service (1) fails to assume and implement the terms and conditions, or (2) fails to require any contractors to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the effect of incidental take, the Forest Service must report the progress of the action and its effects on the species to the Service as specified in the incidental take statement (50 CFR § 402.14(I)(3)).

2. AMOUNT OR EXTENT OF TAKE

The Service anticipates that a total of two northern spotted owl pairs (four adults) and two eggs and/or young, associated with two activity centers in the action area, could be taken as a result of this proposed Project.

Incidental take is expected to be in the form of *harm* of up to two pairs of northern spotted owls (four adults) associated with degradation of habitat quality in the home range at activity centers 3009 and 3048. In activity center 3009, the quality of 267 acres of nesting/roosting

habitat and 311 acres of foraging habitat will be degraded. In activity center 3048, the quality of 23 acres of nesting/roosting habitat and 566 acres of foraging habitat will be degraded.

Incidental take is also expected to be in the form of *harassment* of up to two pairs of northern spotted owls (the same four adults discussed above) and two eggs and/or young (the average clutch size for northern spotted owls; Appendix C, p. 111) associated with degradation of habitat quality in the home range due to noise and smoke disturbance.

3. EFFECT OF THE TAKE

In the accompanying Biological Opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the northern spotted owl.

4. REASONABLE AND PRUDENT MEASURES

4.1. Reasonable and Prudent Measure No. 1

Minimize the potential for incidental take of adult northern spotted owls and eggs or juvenile northern spotted owls in the action area due to actions occurring during the breeding season within suitable habitat likely to be occupied by northern spotted owls.

4.2. Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the Forest Service shall ensure compliance with the following term and condition, which implements the reasonable and prudent measure described above. This term and condition is non-discretionary.

4.2.1. Limited Operating Period February 1 to September 15

Implement a limited operating period from February 1 to September 15 for any unit containing northern spotted owl nesting/roosting or foraging habitat that is within 0.25 mile of an activity center in which protocol-level surveys have documented nesting.

Based on recent survey results, the Service concludes that a February 1 to September 15 limited operating period shall be implemented for commercial thinning unit 15, 16, and 17 for the life of the Project or unless protocol-level surveys indicate that activity center 3048 is unoccupied or non-nesting status has been determined.

5. MONITORTING REQUIREMENTS

In order to monitor the effects of incidental take, the Federal agency or any applicant must report the progress of the action and its effects on the species to the Service. The reporting requirements are established in accordance with 50 CFR § 13.45 and 18.27 and specified below.

Prior to January 31 of each year, for the duration of the Project, the Forest Service will provide the following:

1) a progress/status update of the proposed project,
2) the amount and type of habitat modified (including the unit label),
3) northern spotted owl survey results, and
4) any changes to project implementation not discussed in the biological assessment.

6. REPORTING REQUIREMENTS

Any dead or injured northern spotted owl must be reported to the Service's Law Enforcement Division (916-414-6660), or to the Arcata Fish and Wildlife Office (707-822-7201), as soon as possible, and turned over to the Law Enforcement Division or a game warden or biologist of the California Department of Fish and Wildlife for care or analysis. The Service is to be notified in writing within 3 working days of the accidental death of, or injury to, a northern spotted owl, or of the finding of any dead or injured northern spotted owl, during implementation of the proposed Project. Notification must include the date, time, and location of the incident or discovery of a dead or injured northern spotted owl, as well as any pertinent information on circumstances surrounding the incident or discovery. The Service contact for this written information is Bruce Bingham, Field Supervisor, Arcata Fish and Wildlife Office, at the address shown on this letterhead.

7. CONSERVATION RECOMMENDATIONS

Sections 2(c) and 7(a)(1) of the Act direct 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 and the ecosystems upon which they depend. 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 proposes the following conservation recommendations:

1) Continue to conduct surveys and gather information about northern spotted owl habitat use on the Forest.
2) Collaborate with the Service to conduct landscape-level northern spotted owl habitat evaluations and use this information to update current management direction.
3) Continue to develop wildland fire use as a tool to restore and conserve northern spotted owl habitat on the Forest. Collaborate and consult with the Service as a partner in planning these efforts in order to avoid and minimize effects to northern spotted owls.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects, or benefiting listed species or their habitat, the Service requests notification in the event of implementation of any of these conservation recommendations.

8. REINITIATION NOTICE

This concludes formal consultation on the action. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may have affected 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 is designated that may be affected by the action.

If you have any questions regarding this biological opinion, please contact Ms. Liisa Schmoele of my staff by email at liisa_schmoele@fws.gov or by phone at (707) 822-7201.

Sincerely,

for Bruce Bingham
Field Supervisor

cc: Jim Ruhl, Forest Wildlife Biologist, Mendocino National Forest

REFERENCES CITED

Ådahl, E., P. Lundberg, and N. Jonzén. 2006. From climate change to population change: the need to consider annual life cycles. Global Change Biology 12:1627-1633.

Agee, J. K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Washington, DC, USA.

Agee, J. K. and C. N. Skinner. 2005. Basic principles of forest fuel reduction treatments. Forest Ecology and Management. 211:83-96.

Agee, J. K., B. Bahro, M. A. Finney, P. N. Omi, D. B. Sapsis, C. N. Skinner, J. W. vanWagtendonk, and C. P. Weatherspoon. 2000. The use of shaded fuelbreaks in landscape fire management. Forest Ecology and Management. 127:55-66.

Ager, A. A, M. A. Finney, B. K. Kerns, and H. Maffei. 2007. Modeling wildfire risk to northern spotted owl (*Strix occidentalis caurina*) habitat in Central Oregon, USA. Forest Ecology and Management 246:45-56.

Andersen, D. E., O. J. Rongstad, and W. R. Mytton. 1989. Response of nesting red-tailed hawks to helicopter overflights. The Condor 91:296-299.

Anthony, R. G., E. D. Forsman, A. B. Franklin, D. R. Anderson, K. P. Burnham, G. C. White, C. J. Schwarz, J. Nichols, J. E. Hines, G. S. Olson, S. H. Ackers, S. Andrews, B. L. Biswell, P. C. Carlson, L. V. Diller, K. M. Dugger, K. E. Fehring, T. L. Fleming, R. P. Gerhardt, S. A. Gremel, R. J. Gutiérrez, P. J. Happe, D. R. Herter, J. M. Higley, R. B. Horn, L. L. Irwin, P. J. Loschl, J. A. Reid, and S. G. Sovern. 2006. Status and trends in demography of northern spotted owls, 1985-2003. Wildlife Monograph 163:1-48.

Barrows, C. W. and K. Barrows. 1978. Roost characteristics and behavioral thermoregulation in the spotted owl. Western Birds 9:1-8.

Bart, J. 1995. Amount of suitable habitat and viability of northern spotted owls. Conservation Biology 9:943-946.

Belanger, L. and J. Bedard. 1989. Response of staging snow geese to human disturbance. Journal of Wildlife Management 53:713-719.

Bevis, K. R., G. M. King, and E. E. Hanson. 1997. Spotted owls and 1994 fires on the Yakama Indian Reservation. Pages 117-122 *in* Proceedings of the Fire Effects on Rare and Endangered Species Habitats Conference. J. M. Greenlee, editor. International Association of Wildland Fire, Coeur D'Alene, Idaho, USA.

Bingham, B. B. and B. R. Noon. 1997. Mitigation of habitat "take": application to habitat conservation planning. Conservation Biology 11:127-139.

Bond, M. L., D. E. Lee, R. B. Siegel, and J. P. Ward, Jr. 2009. Habitat use and selection by California spotted owls in a postfire landscape. Journal of Wildlife Management 73:1116-1124.

Carey, A. B., S. P. Horton, and B. L. Biswell. 1992. Northern spotted owls: influence of prey base and landscape character. Ecological Monographs 62:223-250.

Carroll, C. 2010. Role of climatic niche models in focal-species-based conservation planning: assessing potential effects of climate change on northern spotted owl in the Pacific Northwest, USA. Biological Conservation 143:1432-1437.

Courtney, S. P., J. A. Blakesley, R. E. Bigley, M. L. Cody, J. P. Dumbacher, R. C. Fleischer, A. B. Franklin, J. F. Franklin, R. J. Gutiérrez, J. M. Marzluff, L. Sztukowski. 2004. Scientific evaluation of the status of the northern spotted owl. Sustainable Ecosystems Institute, Portland, Oregon, USA.

Crozier, M. L., M. E. Seamans, R. J. Gutiérrez, P. J. Loschl, R. B. Horn, S. G. Sovern, and E. D. Forsman. 2006. Does the presence of barred owls suppress the calling behavior or spotted owls? The Condor 108:760-769.

Dark, S. J., R. J. Gutiérrez, and G. I. Gould, Jr. 1998. The barred owl (*Strix varia*) invasion in California. The Auk 115:50-56.

Davis, R. J., K. M. Dugger, S. Mohoric, L. Evers, and W. C. Aney. 2011. Northwest Forest Plan—the first 15 years (1994-2008): status and trends of northern spotted owl populations and habitats. U.S. Forest Service General Technical Report PNW-GTR-850, Pacific Northwest Research Station, Portland, Oregon, USA.

Delaney, D. K., T. G. Grubb, P. Beier, L. L. Pater, and M. H. Reiser. 1999. Effects of helicopter noise on Mexican spotted owls. Journal of Wildlife Management 63:60-76.

Dodson, E. K., D. W. Peterson, and R. J. Harrod. 2008. Understory vegetation response to thinning and burning restoration treatments in dry conifer forests of the eastern Cascades, USA. Forest Ecology and Management 255:3130-3140.

Drent, R. 1972. The natural history of incubation. Pages 262-311 *in* D. S. Farner, editor. Breeding biology of birds. National Academy of Science, Washington, D.C., USA.

Dugger, K. M., F. Wagner, R. G. Anthony, and G. S. Olson. 2005. The relationship between habitat characteristics and demographic performance of northern spotted owls in southern Oregon. The Condor 107:863-878.

Dugger, K. M., R. G. Anthony, L. S. Andrews. 2011. Transient dynamics of invasive competition: barred owls, spotted owls, habitat, and the demons of competition present. Ecological Applications. 21(7): 2459-2468.

Dugger K., S. Andrews, E. Fleigel, L. Friar, T. Phillips, T. Tippin, and F. Wagner. 2012. Demographic characteristics and ecology of spotted owls (*Strix occidentalis caurina*) in the southern Oregon Cascades. Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis, USA.

Forsman, E. D., E. C. Meslow, and H. M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. Wildlife Monographs 87:1-64.

Forsman, E. D., I. A. Otto, S. G. Sovern, M. Taylor, D. W. Hays, H. Allen, S. L. Roberts, and D. E. Seaman. 2001. Spatial and temporal variation in diets of spotted owls in Washington. Journal of Raptor Research 35(2):141-150.

Forsman, E. D., R. G. Anthony, J. A. Reid, P. J. Loschl, S. G. Sovern, M. Taylor, B. L. Biswell, A. Ellingson, E. C. Meslow, G. S. Miller, K. A. Swindle, J. A. Thrailkill, F. F. Wagner, and D. E. Seaman. 2002. Natal and breeding dispersal of northern spotted owls. Wildlife Monographs 149:1-35.

Forsman, E. D., R. G. Anthony, E. C. Meslow, and C. J. Zabel. 2004. Diets and foraging behavior of northern spotted owls in Oregon. Journal of Raptor Research 38(3):214-230.

Forsman, E. D., R. G. Anthony, K. M. Dugger, E. M. Glenn, A. B. Franklin, G. C. White, C. J. Schwarz, K. P. Burnham, D. R. Anderson, J. D. Nichols, J. E. Hines, J. B. Lint, R. J. Davis, S. H. Ackers, L. S. Andrews, B. L. Biswell, P. C. Carlson, L. V. Diller, S. A. Gremel, D. R. Herter, J. M. Higley, R. B. Horn, J. A. Reid, J. Rockweit, J. Schaberl, T. J. Snetsinger, and S. G. Sovern. 2011. Population demography of northern spotted owls. Studies in Avian Biology, Volume 40. University of California Press, Berkeley, USA.

Franklin, A. B., D. R. Anderson, R. J. Gutiérrez, and K. P. Burnham. 2000. Climate, habitat quality, and fitness in northern spotted owl populations in northwestern California. Ecological Monographs 70:539-590.

Franklin, A. B., P. C. Carlson, J. T. Rockweit, W. Lanier, B. R. Barry, A. Rex, T. Zaffarano, J. Shrum, and K. Wilson. 2012. Monitoring the population ecology of spotted owls (*Strix occidentalis caurina*) in northwestern California: annual results, 2011. Annual progress report for Region 5, U.S. Department of Agriculture Forest Service. Colorado State University, Fort Collins, USA.

Franklin A. B., P. C. Carlson, J. T. Rockweit, A. Rex, T. Zaffarano, B. Rubek, D. Hecht, S. Philibosian, and K. Wilson. 2013. Monitoring the population ecology of spotted owls (*Strix occidentalis caurina*) in northwestern California: annual results, 2012. Annual progress report for Region 5, U.S. Department of Agriculture Forest Service. Colorado State University, Fort Collins, USA.

Gaines, W. L., R. J. Harrod, J. Dickinson, A. L. Lyons and K. Halupka. 2010. Integration of northern spotted owl habitat and fuels treatments in the eastern Cascades, Washington, USA. Forest Ecology and Management 260:2045–2052.

Glenn, E. M., R. G. Anthony, and E. D. Forsman. 2010. Population trends in northern spotted owls: associations with climate in the Pacific Northwest. Biological Conservation 143:2543-2552.

Glenn, E. M., R. G. Anthony, E. D. Forsman, and G. S. Olson. 2011a. Local weather, regional climate, and annual survival of the northern spotted owl. The Condor 113:159-176.

Glenn, E. M., R. G. Anthony, E. D. Forsman, and G. S. Olson. 2011b. Reproduction of northern spotted owls: the role of local weather and regional climate. Journal of Wildlife Management 75:1279-1294.

Golden Gate Weather Services. 2002. California average monthly days >= 90 degrees. <http://ggweather.com/climate/temp_gt90.htm>. Accessed 2 April 2014.

Goudey, C. B. and D. W. Smith, editors. 1994. Ecological units of California: subsections (map). U.S. Forest Service, San Francisco, California, USA.

Gutiérrez, R. J., M. Cody, S. Courtney, and D. Kennedy. 2004. Assessment of the potential threat of the northern barred owl. Pages 7-1 – 7-51 *in* S. P. Courtney, J. A. Blakesley, R. E. Bigley, M. L. Cody, J. P. Dumbacher, R. C. Fleischer, A. B. Franklin, J. F. Franklin, R. J. Gutiérrez, J. M. Marzluff, and L. Sztukowski. 2004. Scientific evaluation of the status of the northern spotted owl. Sustainable Ecosystems Institute, Portland, Oregon, USA.

Harrod, R. J., R. W. Fonda, and M. K. McGrath. 2007. Role of fire in restoration of a ponderosa pine forest, Washington. U.S. Forest Service Proceedings RMRS-P-46CD, Rocky Mountain Research Station, Fort Collins, Colorado, USA.

Henson, P. and T. A. Grant. 1991. The effects of human disturbance on trumpeter swan breeding behavior. Wildlife Society Bulletin 19:248-257.

Hunter, J. E., R. J. Gutiérrez, and A. B. Franklin. 1995. Habitat configuration around spotted owl sites in northwestern California. The Condor 97:684-693.

Karl, T. R., J. M. Melillo, and T. C. Peterson, editors. 2009. Global climate change impacts in the United States. Cambridge University Press, New York, USA.

Kelly, E. G., E. D. Forsman, and R. G. Anthony. 2003. Are barred owls replacing spotted owls? The Condor 105:45-53.

Laymon, S. A. 1985. General habitats and movements of spotted owls in the Sierra Nevada. Pages 66-68 *in* R. J. Gutiérrez and A. B. Carey, editors. Ecology and Management of

the Spotted Owl in the Pacific Northwest. U.S. Forest Service General Technical Report PNW-185, Pacific Northwest Research Station, Portland, Oregon, USA.

Lint, J., technical coordinator. 2005. Northwest Forest Plan – the first 10 years (1994-2003): status and trends of northern spotted owl populations and habitat. U.S. Forest Service General Technical Report PNW-GTR-648, Pacific Northwest Research Station, Portland, Oregon, USA.

Loehle, C., L. Irwin, J. Beebe, and T. Fleming. 2011. Factors influencing the distribution of northern spotted owls in the eastern Cascades, Washington. Northwestern Naturalist 92:19-36.

MGW Biological. 2013. Draft final report: "Smokey" northern spotted owl survey, Mendocino National Forest. McKinleyville, California, USA.

Marlon, J. R., P. J. Bartlein, D. G. Gavin, C. J. Long, R. S. Anderson, C. E. Briles, K. J. Brown, D. Colombaroli, D. J. Hallet, M. J. Power, E. A. Scharf, and M. K. Walsh. 2012. Long-term perspective on wildfires in the western USA. Proceedings of the National Academy of Sciences Early Edition 2012:1-9.

McNab, W. H., D. T. Cleland, J. A. Freeouf, J. E. Keys Jr., G. J. Nowacki, and C. A. Carpenter, compilers. 2007. Description of "ecological subregions: sections of the conterminous United States." U.S. Forest Service GRT-WO-76B, Washington, D.C., USA.

Metlen, K. L. and C. E. Fiedler. 2006. Restoration treatment effects on the understory of ponderosa pine/Douglas-fir forests in western Montana, USA. Forest Ecology and Management 222:355-369.

Meyer, J. S., L. L. Irwin, and M. S. Boyce. 1998. Influence of habitat abundance and fragmentation on northern spotted owls in western Oregon. Wildlife Monographs 139:1-51.

Miles, S. R. and C. B. Goudey. 1997. Ecological subregions of California: section and subsection descriptions. U.S. Forest Service R5-EM-TP-005, Pacific Southwest Region, San Francisco, California, USA.

Miller, J. D., C. N. Skinner, H. D. Safford, E. E. Knapp, and C. M. Ramirez. 2012. Trends and causes of severity, size, and number of fires in northwestern California, USA. Ecological Applications 22:184-203.

Moritz, C., J. L. Patton, C. J. Conroy, J. L. Parra, G. C. White, and S. R. Beissinger. 2008. Impact of a century of climate change on small-mammal communities in Yosemite National Park, USA. Science 322:261-264.

Natural Resources Management [NRM] Corporation. 2011. Smokey project 2011 northern spotted owl surveys; final report. Eureka, California, USA.

North State Resources, Inc. 2010. 2010 northern spotted owl and barred owl surveys; final report. Redding, California, USA.

Olson, G. S., R. G. Anthony, E. D. Forsman, S. H. Ackers, P. J. Loschl, J. A. Reid, K. M Dugger, E. M. Glenn, and W. J. Ripple. 2005. Modeling of site occupancy dynamics for northern spotted owls, with emphasis on the effects of barred owls. Journal of Wildlife Management 69:918-932.

Piatt, J. F., B. D. Roberts, W. W. Lidster, J. L. Wells, and S. A. Hatch. 1990. Effects of human disturbance on breeding least and crested auklets at St. Lawrence Island, Alaska. The Auk 107:342-350.

Rosenberg, D. K. and R. G. Anthony. Characteristics of northern flying squirrel populations in young second- and old-growth forests in western Oregon. Canadian Journal of Zoology 70:161-166.

Sakai, H. F. and B. R. Noon. 1997. Between-habitat movement of dusky-footed woodrats and vulnerability to predation. Journal of Wildlife Management 61:343-350.

Singleton, P., J. F. Lehmkuhl, W. L. Gaines, and S. A. Graham. 2010. Barred owl space use and habitat selection in the eastern Cascades, Washington. Journal of Wildlife Management 74:285-294.

Skinner, C. N., C. S. Abbott, D. L. Fry, S. L Stephens, A. H. Taylor, and V. Trouet. 2009. Human and climatic influences on fire occurrence in California's north coast range, USA. Fire Ecology 5(3):76-99.

Spies, T. A., M. A. Hemstron, A. Youngblood, and S. Hummel. 2006. Conserving old-growth forest diversity in disturbance-prone landscapes. Conservation Biology 20:351-362.

Stenseth, N. C., A. Mysterud, G. Ottersen, J. W. Hurrel, K-S Chan, and M. Lima. 2002. Ecological effects of climate fluctuations. Science 297:1292-1296.

Stephens, S. L., J. J. Moghaddas, C. Edminster, C. E. Fiedler, S. Haase, M. Harrington, J. E. Keeley, E. E. Knapp, J. D. McIver, K. Metlen, C. N. Skinner, and A. Youngblood. 2009. Fire treatment effects on vegetation structure, fuels, and potential fire severity in western. S. forests. Ecological Applications 19:305-320.

Stuart, J. D. and S. L. Stephens. 2006. North Coast bioregion. Pages 147-169 *in* N. G. Sugihara, J. W. van Wagtendonk, K. E. Shaffer, J. Fites-Kaufman, and A. E. Thode, editors. Fire in California ecosystems. University of California Press, Berkeley, USA.

Swenson, J. 1979. Factors affecting status and reproduction of ospreys in Yellowstone National Park. Journal of Wildlife Management 43:595- 601.

Thomas, J. W., E. D. Forsman, J. B. Lint, E. C. Meslow, B. R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. Report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Unpublished interagency document.

Thome, D. M., C. J. Zabel, and L. V. Diller. 1999. Forest stand characteristics and reproduction of northern spotted owls in managed north-coastal California forests. Journal of Wildlife Management 63:44-59.

Tremblay, J. and L. N. Ellison. 1979. Effects of human disturbance on breeding black-crowned night herons. The Auk 96:364-369.

U.S. Fish and Wildlife Service [Service]. 1990. Endangered and threatened wildlife and plants; determination of threatened status for the northern spotted owl. Federal Register 55(123):26114-26194.

Service. 1992a. Draft final recovery plan for the northern spotted owl. Service Pacific Northwest Region, Portland, Oregon, USA.

Service. 1992b. Protocol for surveying proposed management activities that may impact northern spotted owls. Service Pacific Northwest Region, Portland, Oregon, USA.

Service. 2001. A range wide baseline summary and evaluation of data collected through section 7 consultation for the northern spotted owl and its critical habitat: 1994-2001. Unpublished document, Service Pacific Northwest Region, Portland, Oregon, USA.

Service. 2009. Regulatory and scientific basis for U.S. Fish and Wildlife Service guidance for evaluation of take for northern spotted owls on private timberlands in California's northern interior region. Service Yreka Fish and Wildlife Office, Yreka, California, USA.

Service. 2011. Revised recovery plan for the northern spotted owl (*Strix occidentalis caurina*). Service Pacific Northwest Region, Portland, Oregon, USA.

Service. 2012a. Protocol for surveying proposed management activities that may impact northern spotted owls. Revised 2012 January 9. Service Pacific Southwest Region, Sacramento, California, USA.

Service. 2012b. Endangered and threatened wildlife and plants; determination of critical habitat for the spotted owl. Federal Register 77(233):71876-72068.

Service. 2014. Natural resources of concern. <ecos.fws.gov/ipac>. Accessed 2014 May 5.

Service and NOAA National Marine Fisheries Service [NMFS]. 1998. Endangered species consultation handbook; procedures for conducting consultation and conference activities under section 7 of the Endangered Species Act. U.S. Government Printing Office.

U.S. Forest Service [USFS]. 1995. Watershed analysis report: Grindstone Creek watershed. Mendocino National Forest, Willows, California, USA.

USFS. 1999. Mendocino National Forest, Forest wide late-successional reserve assessment. Mendocino National Forest, Willows, California, USA.

USFS and Bureau of Land Management [BLM]. 1994a. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl; standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, Oregon, USA.

USFS and BLM. 1994b. Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, Oregon, USA.

Verner, J., R. J. Gutiérrez, and G. I. Gould Jr. 1992. The California spotted owl: general biology and ecological relations. Pages 55-78 *in* J. Verner, K. S. McKelvey, B. R. Noon, R. J. Gutiérrez, G. I. Gould Jr., technical coordinators. The California spotted owl: a technical assessment of its current status. U.S. Forest Service General Technical Report PNW-GTR-133, Pacific Southwest Research Station, Albany, California, USA.

Walther, G., E. Post, P. Convey, A. Menzel, C. Parmesan, T. J. C. Beebee, J. Fromentin, O. Hoegh-Guldberg, and F. Bairlein. 2002. Ecological responses to recent climate change. Nature 416:389-395.

Ward, J. P. Jr., R. J. Gutiérrez, and B. R. Noon. 1998. Habitat selection by northern spotted owls: the consequences of prey selection and distribution. The Condor 100:79-92.

Weathers, W. W., P. J. Hodum, and J. A. Blakesley. 2001. Thermal ecology and ecological energetics of the California spotted owl. The Condor 103(4):678.

Westerling, A. L., M. G. Turner, E. A. H. Smithwick, W. H. Romme, and M. G. Ryan. 2011. Continued warming could transform Greater Yellowstone fire regimes by mid-21st century. Proceedings of the National Academy of Science 108:1-6.

Western Regional Climate Center. 2014. Covelo, California (042081) period of record monthly climate summary. <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?cacove+nca>. Accessed 2 April 2014.

White, C. M., and T. L. Thurow. 1985. Reproduction of ferruginous hawks exposed to controlled disturbance. The Condor 87:14-22.

Youngblood, A., K. L. Metlen, and K. Coe. 2006. Changes in stand structure and composition after restoration treatments in low elevation dry forests of northeastern Oregon. Forest Ecology and Management 234:143-163.

Zabel, C. J., K. McLelvey, and J. P. Ward, Jr. 1995. Influence of primary prey on home-range size and habitat-use of northern spotted owls (*Strix occidentalis caurina*). Canadian Journal of Zoology 73:433-439.

Zabel, C. J., J. R. Dunk, H. B. Stauffer, L. M. Roberts, B. S. Mulder, and A. Wright. 2003. Northern spotted owl habitat models for research and management application in California (USA). Ecological Applications 13:1027-1040.

Personal Communications Cited

Angerer, Linda. 2011. Mendocino National Forest. Email to Michelle Havens, U.S. Fish and Wildlife Service [Service], Red Bluff Fish and Wildlife Office, dated 2014 November 21.

Angerer, Linda. 2014. Mendocino National Forest. Email to Liisa Schmoele, Service Arcata Fish and Wildlife Office, California, dated 2014 September 10.

Ruhl, Jim. 2014a. Mendocino National Forest. Phone call with Liisa Schmoele, Service Arcata Fish and Wildlife Office, California, dated 2014 April 21.

Ruhl, Jim. 2014b. Mendocino National Forest. Email to Liisa Schmoele, Service Arcata Fish and Wildlife Office, California, dated 2014 April 22.

Ruhl, Jim. 2014c. Mendocino National Forest. Email to Liisa Schmoele, Service Arcata Fish and Wildlife Office, California, dated 2014 April 28.

Schmoele, Liisa. 2014. Service Arcata Fish and Wildlife Office. Memo to project file dated 2014 April 23.

Appendix A. Smokey Prescription and Marking Guides

Stand Diagnosis:

Timber stands in the Smokey project area tend to be heavily stocked with large amounts of down woody material on the forest floor. A mix of species is common except at the highest elevations where red fir is dominant. Tree size ranges from seedling/sapling in the understory to large overstory trees. In mixed species stands, large ponderosa pine and Douglas-fir overtop a younger understory of white fir and other species. Native hardwoods are also present but are being shaded out by surrounding conifers. In pure red fir stands, there is a lack of understory trees due to a dense overstory. Opportunities exist to reduce stocking levels such that desirable stand conditions can be perpetuated and increased while reducing risk of severe disturbance.

Silvicultural Objectives:

- Provide for stand conditions that will protect and perpetuate desirable stand characteristics and provide for improved growth and development of suitable habitat. These characteristics include large overstory trees in a variety of species and condition; snags and down logs sufficient to meet ecosystem needs; sufficient mid-canopy perch trees, a healthy hardwood component; and a healthy regeneration layer that will provide for long-term forest regeneration as part of a mosaic of tree sizes and age classes.

- Restore overcrowded forest stands to levels that will reduce competition for limited moisture and sunlight and improve the health of the trees. There is a need to design treatments to maintain suitable stand growth and vigor over time by providing more space for trees to grow.

- Reduce the severity of wildfire by creating a strategic pattern of fuels treatment areas on the landscape, including: lower density stands, fuelbreaks, and cleared brush fields to break up the continuity of fuels and help reduce the rate of spread and the intensity of wildfire.

- Provide for treatment of existing and created fuels while meeting mitigation measures.

- Maintain existing healthy ponderosa and sugar pine in overstory.

Section 1. Treatment Standards Common to All Units

a. In commercial thinning units, use variable spacing in distributing leave trees to mimic natural stands. Leave tree spacing can be applied with flexibility to ensure that the healthiest desired species are left.

b. Retain healthy hardwoods to assure their presence in the watershed. (Grindstone Watershed Analysis 1995, pg. 113). Promote the health and persistence of hardwoods by removing overtopping conifers or conifers within 15 feet stem distance from healthy hardwoods. Healthy hardwoods will be at least 10 inches DBH with 30 percent or greater live crown and sufficient vigor to warrant protection. Thin conifers around these trees to provide additional sunlight. Retain smaller diameter hardwood where less than 15 sq.ft BA is available.

c. Protect and sustain remnant overstory trees. The largest trees on the landscape have, in most cases, been in place hundreds of years. Protect these legacy trees by falling cut trees away from them; route skid trails away from; and if needed, limit damage from prescribed burning by gently removing duff and ladder fuels around these trees. The protection of the residual stand should be given highest priority in making marking and layout decisions.

d. Retain some understory trees as perch trees. Look for opportunities to retain and promote understory perch trees especially in stands which lack a well-established understory, and where they do not constitute a vertical fuel hazard. Perch trees adjacent to small openings are particularly valuable.

e. Retain at least 2 trees per acre (up to 10 percent of the stand in LSR units) with unique phenotypical differences (such as large limbs or broken tops) compared to the rest of the stand for future wildlife habitat. These may be understory trees serving as perch trees. In units outside the LSR, locate these trees in the portion of GTR ground that is scattered through the unit.

f. Retain existing snags that provide suitable wildlife habitat unless a safety or fuel hazard exists.

g. Maintain required levels of coarse woody debris. Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end (2 logs > 10'length, 1 log > 20' length), averaged over 40 acres.

h. Avoid extended skids (100 feet or more) across slopes steeper than 35 percent.

i. Use paper map pages to note any features of interest in or around each unit, such as existing landings, springs and seeps, arch sites, etc.

j. Timber stratum designations are based on plant species, size of crown, and stand density. Stands within the LSR will be maintained at current stratum levels. For example, stands classified as M4G, (M = mixed conifer, 4 = crowns greater than 25 foot diameter, and G = density 40 percent or greater canopy closure), will be maintained at their current stratum level.

k. Remove conifers around meadows where encroachment into meadows is occurring.

Trees selected for removal will be the poorest condition trees of those in clumps and groups, and leave trees will be chosen for a) Best overall condition of crown and likelihood of long-term survival as determined by presence or absence of insects and/or disease; b) Stand position relative to competing vegetation; c) Need for additional nest and perch trees and snags; and d) Position relative to desirable hardwoods. Understory trees that pose a risk due to ladder fuel potential will be removed, and slash created by treatment activities will be piled and burned, or jackpot burned.

Retain the healthiest dominant and co-dominant trees of all species as first choice leave trees (including hardwood species) on the site. Favor ponderosa, Douglas-fir, sugar pine, hardwoods, and Incense cedar. Other species may be retained to meet density requirements and diversity objectives. Current minimal merchantability diameters (10 inches) will be used. Larger diameter codominant trees may be selected for removal where clumps of large trees

with overlapping crowns provide sufficient residuals for maintenance of canopy cover and basal area.

Moderate or heavily infected blister rust sugar pine should be removed with this activity. This level of infection will equate to dead tops or active bole cankers. Light infection such as occasional flagging of branch tips is acceptable for sugar pine crop trees. Heavily infested Douglas-fir and true fir mistletoe trees should be removed.

Leave trees should exhibit a live crown ratio of 30-40 percent or greater and be generally free from defects such as basal scarring or broken tops. Occasional retention of trees with basal scarring, broken tops and other mechanical damages is acceptable for future wildlife habitat. Limit these to 10 percent of the stand basal area.

Application of the harvest treatment is designed to maintain the vegetative canopy cover in the thinned areas between 40-60 percent. Where clumps of large diameter overstory trees exist within units, larger trees can be removed from clumps to reduce the density of the clump to the residual per acre target. Protect the older stand remnants, especially larger ponderosa pine and sugar pine overstory trees, and hardwood trees during thinning and post-harvest activities.

Selection Criteria for Tree Removal

The following criteria are provided to guide selection of trees to be removed. Indicators of poor condition include the following visual indicators:

Ponderosa Pine: Crown color "fade" in one third or more of the canopy; needle retention of 1-2 years; top bole breakage of 6"+ or involving 33%+ of the original live crown; progressive (on-going) evidence of crown "fade" immediately below dead (spike) top or recently broken out top; recently lightning struck tree with no evidence of healing; evidence of recent successful insect attack (such as frass, or pink-tinged pink pitch tubes); moderate to heavy dwarf mistletoe infection (Hawksworth 4+).

Sugar Pine: Crown color "fade" in at least one-third of the canopy; needle retention of 1-2 years; top bole breakage of 6"+ or involving 33%+ of the original live crown; progressive (on-going) evidence of crown "fade" immediately below dead (spike) top or recently broken out top; recently lightning struck tree with no evidence of healing; bole infection with blister rust (sugar pine); evidence of recent successful insect attack (such as frass, or pink-tinged pink pitch tubes).

Douglas-fir : Yellow or sorrel crown color "fade" in half or more of the canopy; needle retention of 1-2 years throughout the canopy; pitch streamers indicating evidence of successful insect attack on bole; top bole breakage of 10"+ or involving 33%+ of the original live crown; substantial (33%+ of the remaining canopy) progressive (on-going) evidence of crown "fade" immediately below dead (spike) top or recently broken out top; recently lightning struck tree with no evidence of healing; evidence of recent successful insect attack (such as frass).

Incense-cedar: Yellow or sorrel crown color "fade" in at least one-third of the canopy; small "tufts" of off-color, outer extremity branches only remain throughout canopy; pitch streamers indicating evidence of successful insect attack on bole; top bole breakage of 10"+ or involving 50%+ of the original live crown; substantial (33%+ of the remaining canopy) progressive (on-going) evidence of crown "fade" immediately below dead (spike) top or recently broken out top; recently lightning struck tree with no evidence of healing; evidence of recent successful insect attack (such as frass).

White Fir: If an individual white fir meets, or is worse than the described criteria, it should be designated for harvest. High-risk indicators include the following visual indicators: obvious yellow or sorrel crown color "fade" through-out the canopy; needle retention of 1-2 years throughout the canopy, top bole breakage of 4"+ or involving 25%+ of the original live crown; substantial (20%+ of the remaining canopy) progressive (on-going) evidence of crown "fade" immediately below dead (spike) top or recently broken out top; recently lightning struck tree with no evidence of healing; evidence of recent successful insect attack (such as frass); evidence of Scolytus spp. affecting 25% of the branches, or pitch streamers indicating evidence of insect attack on bole.

Section 2. Unit-Specific Direction

Matrix Units

Commercial Thinning (Units 1, 4, 13, 18, 19, 20, 21, 28):

Apply the 15 percent Green Tree Retention (GTR) rule to commercial thinning units or portions thereof in the Matrix. Set aside 15 percent of each unit by area to retain the oldest, most decadent trees. Of this 15 percent, 70 percent can be in clumps, with the remaining 30 percent scattered throughout the unit. Consider logging logistics in designating GTR ground. Locate GTR patches in locations that will not be vulnerable to logging damage, nor in areas that will impede access and harvest operations. To the extent possible, patches and dispersed retention should include the largest, oldest live trees, decadent or leaning trees, and hard snags occurring in the unit (ROD, page C-42).

For units which overlap the LSR/Matrix boundary, the GTR rule will apply only to the portion of the unit that is in the Matrix. The GTR allocation will be taken as 15 percent of the Matrix portion of the unit.

In the balance of the stand, commercial thin to basal area listed in Table 1, except Unit 13, thin to Trees Per Acre. Apply the tree removal criteria in Section 1. In Unit 30, apply a 20 inch dbh diameter limit, removing trees up to 19.9 inches dbh only.

Retain and protect healthy hardwoods and count towards total residual canopy closure objective.

Select leave trees based upon the best phenotypic characteristics, including the following criteria: live crown ratio, crown form, needle color, insect/disease condition, species, and wind firmness. Overall tree condition will be more important for retention than canopy position. Leave tree species preference is to retain vigorous healthy sugar pine and ponderosa pine,

followed by Douglas-fir, incense cedar, and white fir. Retain vigorous second layer mixed conifers with crop tree potential for stand structural diversity which exhibit the following characteristics: live crown ratio of 60% or greater, terminal leader growth of at least 6" per year for each of the last 3 years; no obvious or significant insect, disease, or mechanical injury; good crown form; and good bole form. Protect hardwoods and high quality submerchantable mixed conifers. Harvest, in the priority indicated, until canopy objectives have been met. Prescription objectives are generally based upon crown position.

1: Sanitize/salvage high-risk mixed conifer trees in all crown classes. Sanitation-mark high-risk trees which, because of visual indicators, are not expected to survive beyond a twenty year period. Do not harvest non-infectious cull trees which have no recoverable merchantable volume.

2: Harvest all merchantable, suppressed conifers.

3: Harvest intermediate conifers which exhibit one or more of the following characteristics: live crown ratio (lcr) of < 30%; poor crown form (clearly non-cylindrical); poor needle retention (1-2 years); poor crown color (chlorotic); significant sweep or crook. Additionally, harvest intermediate conifers which are competing within the general crown area of mature hardwood trees.

4: Harvest dominant and codominant conifers which exhibit one or more of the following characteristics: live crown ratio (lcr) of < 20%; poor crown form (clearly non-cylindrical); poor needle retention (1-2 years); poor crown color (chlorotic); significant sweep or crook. Retain and do not count towards total residual canopy closure objective. Fall/treat damaged submerchantable residual.

5. Thin clumpy overstory trees to reduce inter-tree competition and overlapping crowns. Remove excess trees where stocking exceeds two trees within a 33 foot diameter circle.

Management and Mitigation Requirements

1. In commercial thinning units, use variable spacing in distributing leave trees to mimic natural stands. Leave tree spacing can be applied with flexibility to ensure that the healthiest desired species are left.

2. When encountering clumps of three or more overstory trees within 1/50th acre circle (33' diameter), thin clumps using Selection Criteria to choose weakest tree or trees in the clump.

3. Retain healthy hardwoods to assure their presence in the watershed. (Grindstone Watershed Analysis, 1995, pg. 113).

4. Retain two trees per acre with unique phenotypical differences (such as large limbs or broken tops) compared to the rest of the stand for future wildlife habitat. Locate these trees in the portion of GTR ground that is scattered through the unit.

5. Retain existing snags that provide suitable wildlife habitat unless a safety hazard exists.

Late-Successional Reserve Units

Commercial Thinning (Units 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 22, 24, 25, 26, 27, 29, 30).

Commercial thin to basal area listed in Table 1.

Retain and protect healthy hardwoods and count towards total residual canopy closure objective.

Retain the most vigorous predominant (PD), dominant (D) or codominant (CD) trees. Select leave trees based upon the best phenotypic characteristics, including the following criteria: live crown ratio, crown form, needle color, insect/disease condition, species, and wind firmness. Overall tree condition will be more important for retention than canopy position. Leave tree species preference is to retain vigorous healthy sugar pine and ponderosa pine, followed by Douglas-fir, incense cedar, and white fir. Retain vigorous second layer mixed conifers with crop tree potential for stand structural diversity which exhibit the following characteristics: live crown ratio of 60% or greater, terminal leader growth of at least 6" per year for each of the last 3 years; no obvious or significant insect, disease, or mechanical injury; good crown form; and good bole form. Protect hardwoods and high quality submerchantable mixed conifers. Harvest, in the priority indicated, until canopy objectives have been met. Prescription objectives are generally based upon crown position.

1: Harvest all merchantable, suppressed conifers.

2: Harvest intermediate conifers which exhibit one or more of the following characteristics: live crown ratio (lcr) of < 30%; poor crown form (clearly non-cylindrical); poor needle retention (1-2 years); poor crown color (chlorotic); significant sweep or crook. Additionally, harvest intermediate conifers which are competing within the general crown area of mature hardwood trees.

3: Harvest codominant conifers which exhibit one or more of the following characteristics: live crown ratio (lcr) of < 20%; poor crown form (clearly non-cylindrical); poor needle retention (1-2 years); poor crown color (chlorotic); significant sweep or crook. Fall/treat damaged submerchantable residual. Do not harvest codominant trees which would cause substantial residual crop tree damage during yarding/felling operations, or non-infectious cull trees which have no recoverable merchantable volume.

4. Remove no dominant or predominant trees.

Management and Mitigation Requirements

1. Use variable spacing in distributing leave trees to mimic natural stands. Leave tree spacing can be applied with flexibility to ensure that the healthiest desired species are left.
2. When encountering clumps of three or more overstory trees within 1/50th acre circle(33" radius), thin clumps using Selection Criteria to choose weakest tree or trees in the clump.

3. Retain healthy hardwoods to assure their presence in the watershed. (Grindstone Watershed Analysis, 1995, pg. 113).
4. Retain two trees per acre with unique phenotypical differences (such as large limbs or broken tops) compared to the rest of the stand for future wildlife habitat.
5. Retain existing snags that provide suitable wildlife habitat unless a safety hazard exists.

Fuels Reduction:

Yarding of tops will be required to reduce activity fuels. Other remaining activity fuels would be lopped and scattered to a height of no greater than 24" above ground.

Additional fuels treatments following tree removal are anticipated to address fuels reduction objectives, depending on funding opportunities. Treatment may include removal, chipping, tractor piling, handpiling, jackpot or underburning.

On those units which will be underburned, units will be prepared for underburning by slashing damaged and ladder fuel understory conifer trees less than 10 inches in diameter. This activity will utilize either hand treatments such as chainsaw felling, or mechanical equipment.

A cool fire will be utilized to reduce fuel loading while retaining the thinned crop trees. Mortality needs to be minimized in the larger crop tree component.

Reforestation:

Tree planting after the treatment will be unnecessary. Any openings created by the treatments will be small and scattered. Previous experience in the immediate vicinity (Upper Grindstone Watershed, north and east facing slopes) has demonstrated that small openings are very accommodating of natural regeneration via seed fall, and the resulting regeneration is usually abundant and vigorous.

Implementation Quality Assurance Requirements

Marking crews will have sufficient training in insect and disease identification to properly identify mistletoe, stem and root diseases, and blister rust indicators, and to determine severity following established protocols (Region 5 Common Stand Exam, R5
Field Guide appendix). Crews will be proficient in identifying tree species, determining tree health and vigor, and stand density measurements (basal area and canopy closure).

Prior to project implementation, a pre-work conference will be held with marking crew leader and members and District staff to discuss and clarify silviculture prescriptions, marking guidelines, and other contract requirements for layout and sale preparation. During the pre-work, the specific project objectives will be discussed to ensure marking crew understands the context of the prescriptions and objectives of the timber sale. Site visits will be held in conjunction with pre-work conference or prior to marking starting to discuss specific requirements on-site.

As this will be contracted, the Contracting Officer's Representative (COR) will be responsible for conducting inspections on a regular basis to determine accuracy of marking. Payment for contract is based upon accuracy standards included in the contract to ensure marking follows silvicultural prescriptions.

Prescribed by: /s/ *Jesse Rosenquist* **Date: July 13, 2010,**

Table 1. Smokey marking guidelines.

Unit	Acres	Treatment	Logging System	Fuels Treatment	Marking Guidelines[1]	Snag retention guidelines	Coarse Woody Debris	Project Design Criteria Refer to Appendix B, EA for additional information
1	33	Comm Thin to 180 BA in LSR, 120 BA in matrix, apply GTR in Matrix.	Tractor	yard tops, slashing, jackpot burn, underburn	Matrix/LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Do not skid or build landings in meadows or recreation facilities. Limit cutting within 150' of camp area to hazard trees (up to 1/3 of stand) and fuel treatments. Protect perch trees
2	18	Comm Thin to 125 BA. Protect remnant overstory.	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Do not skid or build landings in meadows or recreation facilities. Limit cutting within 150' of picnic area to hazard trees and fuel treatments(up to 1/3 of stand). Protect perch trees
3	43	Comm Thin to 125 BA. Protect remnant overstory	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Do not skid or build landings in meadows or recreation facilities. Limit cutting within 150' of picnic area to hazard trees and fuel treatments. (up to 1/3 of stand) Protect perch trees
4	104	Comm Thin to 150 BA in 3G pockets, 200 BA in 4G pockets, apply GTR in Matrix.	Tractor	yard tops, slashing, jackpot burn, underburn	Matrix/LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height,	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Do not skid or build landings in meadows or recreation facilities. Protect perch trees.

Unit	Acres	Treatment	Logging System	Fuel Treatment	Marking Guidelines	Snag retention guidelines	Coarse Woody Debris	Project Design Criteria
4	104					clumped		
5	59	Comm thin to 150 BA. Focus on heavy clumps.	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Most volume will come from upper portions of unit. Thinning in lower portion will be to reduce clumpiness. Protect most DF, SP, and PP.
6	27	Comm thin to 150 BA. Sanitize White fir and IC, then DF. Protect largest overstory trees.	Cable	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Protect DF, SP, PP. Most removals will be White fir.
7	18	Comm thin from below to 150 BA.	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Protect DF, SP, PP. Most removals will be White fir. Protect perch trees where feasible.
8	26	Thin larger (>20" d) trees to 150 BA, smaller trees to 100 BA.	Cable	slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Protect DF, SP, PP. Most removals will be White fir. Protect perch trees where feasible.
9	22	Comm thin to 125 BA.	Cable	slashing, jackpot	LSR	Retain all, or minimum of 3-5/acre,	Retain existing CWD, maintaining	SP and PP are preferred for retention.

Unit	Acres	Treatment	Logging System	Fuels Treatment	Marking Guidelines[1]	Snag retention guidelines	Coarse Woody Debris	Project Design Criteria Refer to Appendix B, EA for additional information
9	22			burn, underburn		minimum 15"+ dbh; largest available, min. 20 feet height, clumped	minimum 3 logs/acre, 20" large end, averaged over 40 acres.	
10	36	Comm Thin, mostly White fir removal. Thin to 125 BA.	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Give preference to pine on south facing slopes.
11	50	Thin from below, larger stems to 175 BA, smaller stems<20" to 125 BA	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Maintain Perch Trees in Midstory
12	64	Thin from below, larger stems to 175 BA, smaller stems<20" to 125 BA	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Protect Meadows Maintain Perch Trees in Midstory
13	22	Sanitize via Group selection up to 1/10 acre, 1/3 of stand in west ½ ,Comm thin rest of stand to 175 BA	tractor	yard tops, slashing, jackpot burn, underburn	Matrix	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height,	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Maintain Perch Trees in Midstory Protect Meadows

Unit	Acres	Treatment	Logging System	Fuels Treatment	Marking Guidelines[1]	Snag retention guidelines	Coarse Woody Debris	Project Design Criteria Refer to Appendix B, EA for additional information
13	22					clumped		
14	15	Commercial thin, protect largest trees, thin to 150 BA,	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Maintain Perch Trees in Midstory Protect meadows, Thin around meadow edges.
15	10	Thin from below, larger stems to 175 BA, smaller stems<20" to 125 BA	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Maintain Perch Trees in Midstory Protect meadows
16	22	Thin from below, larger stems to 175 BA, smaller stems<20" to 125 BA	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Maintain Perch Trees in Midstory Protect meadows

Unit	Acres	Treatment	Logging System	Fuels Treatment	Marking Guidelines[1]	Snag retention guidelines	Coarse Woody Debris	Project Design Criteria Refer to Appendix B, EA for additional information
17	67	Thin from below, larger stems to 175 BA, smaller stems<20" to 125 BA	Cable	yard tops, slashing, jackpot burn, underburn	LSR	minimum 15"+ dbh; largest available, min. 20 feet height, clumped	minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Maintain Perch Trees in Midstory Protect meadows
18	5	Sanitation Thin/Comm Thin, reduce to 125 to 150 BA	Tractor	yard tops, slashing, jackpot burn,	Matrix	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end,	Maintain Perch Trees in Midstory Protect meadows

Unit	Acres	Treatment	Logging System	Fuels Treatment	Marking Guidelines[1]	Snag retention guidelines	Coarse Woody Debris	Project Design Criteria Refer to Appendix B, EA for additional information
22	2	Thin from below to 150 BA	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Maintain perch trees in midstory
24	31	Thin from below to 150 BA	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Maintain Perch Trees in Midstory
25	5	Thin from below, larger stems to 150 BA, smaller stems<20" to 125 BA	Tractor	yard tops, slashing, jackpot burn, underburn	Matrix	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Maintain Perch Trees in Midstory
26	26	Thin from below, larger stems to 175 BA, smaller stems<20" to 150 BA	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Maintain Perch Trees in Midstory
27	32	Thin from below, larger stems to 175 BA, smaller stems<20" to 150 BA	tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height,	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	Protect riparian reserve and any associated unstable areas.

Unit	Acres	Treatment	Logging System	Fuels Treatment	Marking Guidelines[1]	Snag retention guidelines	Coarse Woody Debris	Project Design Criteria Refer to Appendix B, EA for additional information
28	28	Thin from below to 150 BA	Tractor	yard tops, slashing, jackpot burn, underburn	Matrix	minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, minimum 3 logs/acre, 20" large end, averaged over 40 acres.	
29	39	Thin from below, larger stems to 175 BA, smaller stems<20" to 150 BA	Cable	yard tops, slashing, jackpot burn, underburn	LSR/Matrix	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	
30	24	Thin from below to 150 BA, remove trees up to 19.9 In dbh	Tractor	yard tops, slashing, jackpot burn, underburn	LSR	Retain all, or minimum of 3-5/acre, minimum 15"+ dbh; largest available, min. 20 feet height, clumped	Retain existing CWD, maintaining minimum 3 logs/acre, 20" large end, averaged over 40 acres.	

Appendix B. Snag and Coarse Woody Debris Retention Guidelines

1) in the LSR - maintain a **minimum** average of 6 per acre; and **2)** in Matrix lands - maintain a **minimum** average of 3.2 per acre. These snags would be averaged over 40 acres with the following specifications:

a) 80% of the snags should be "hard" (trees with sound wood). Of that 80%:

1) 75% of the snags/acre = 15 inches dbh or greater, greater than 20 feet high

2) 9% of the snags/acre = 17 inches dbh or greater, greater than 20 feet high

3) 4% of the snags/acre = 20 inches dbh or greater, greater than 40 feet high

4) 12% of the snags/acre = 24 inches dbh or greater, greater than 40 feet high

b) 20% of the snags should be "soft" (decaying wood) and 15 inches or greater dbh

c) the type of species retained would be the same proportion as what occurs naturally in the project area. Avoid single tree species retention.

d) when felling snags, **retain the highest stump possible**, as safety allows.

If the required number of large snags is not present in the area, then retain the largest snags in the next size category. All oak snags should be retained if they do not pose a safety or fuels hazard. They do not count toward the number of snags to be retained.

All oak snags would be retained if they do not pose a safety or fuels hazard. They do not count toward the number of snags to be retained as described above.

All large logs would be maintained unless they contribute to dangerous fuels levels as determined by the wildlife biologist and district fuels officer. If the amount of coarse woody debris greater than 20 inches diameter at the large end is abundant enough to cause a hazardous fuels condition, a portion of these logs may be treated/removed. The smallest ends of the logs would be removed first until fuel objectives are met. A minimum of three logs per acre of this size would be maintained; however, the maximum number possible would be retained while still meeting fuels purposes. Where coarse woody debris is deficit, yarding of unutilized material would be included in the timber contract until the required numbers and size classes are met.

All coarse woody debris greater than 20 inches diameter at the large end and 10 or more feet in length (preferably 20 feet or greater), would be protected during fuels treatments and burning.

Appendix C. Status of the Species

1. STATUS OF THE NORTHERN SPOTTED OWL

1.1. 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, p. 26114). The northern spotted owl was originally listed with a recovery priority number of 3C, but that number was changed to 6C in 2004 during the 5-year review of the species (USDI FWS 2004, p. 55). Priority numbers are assigned on a scale of 1C (highest) to 18 (lowest). This number reflects a high degree of threat, a low potential for recovery, and the owl's taxonomic status as a subspecies (USDI FWS 1983b, p. 51895). The "C" reflects conflict with development, construction, or other economic activity (USDI FWS 1983a, p. 43104). The most recent 5-year status review was completed on September 29, 2011, and did not propose changes to the listing status or introduce any new threats (USDI FWS 2011a).

1.2. Life History

1.2.1. Taxonomy

The northern 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, pp.741-742; Barrowclough et al. 1999, p. 928; Haig et al. 2004, p. 1354), morphological (Gutiérrez et al. 1995, p. 2), and biogeographic information (Barrowclough and Gutiérrez 1990, p.741-742). 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, p.2). Recent studies analyzing mitochondrial DNA sequences (Haig et al. 2004, p. 1354; Chi et al. 2004, p. 3; Barrowclough et al. 2005, p. 1117) and microsatellites (Henke et al., unpubl. data, p. 15) 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 Nevada, appears to be stable (Barrowclough et al. 2005, p. 1116).

Funk et al. (2008, pp. 1-11) tested the validity of the three current recognized subspecies of spotted owls and found them to be valid. During this genetics study, bi-directional hybridization and dispersal between northern spotted owls and California spotted owls centered in southern Oregon and northern California was discovered. In addition, a discovery of introregression of Mexican spotted owls into the northernmost parts of the northern spotted owl populations in Washington was made, indicating long-distance dispersal of Mexican spotted owls into the northern spotted owl range (Funk et al. 2008, pp. 1-11). Some hybridization of northern spotted owls with barred owls has been recorded (Hamer et al. 1994, pp. 487-491; Dark et al. 1998, pp. 50-56; Kelly 2001, pp. 33, 38).

1.2.2. Physical Description

The northern spotted owl is a medium-sized owl and is the largest of the three subspecies of spotted owls (Gutiérrez et al. 1995, p. 2). It is approximately 46 to 48 centimeters (18 inches to

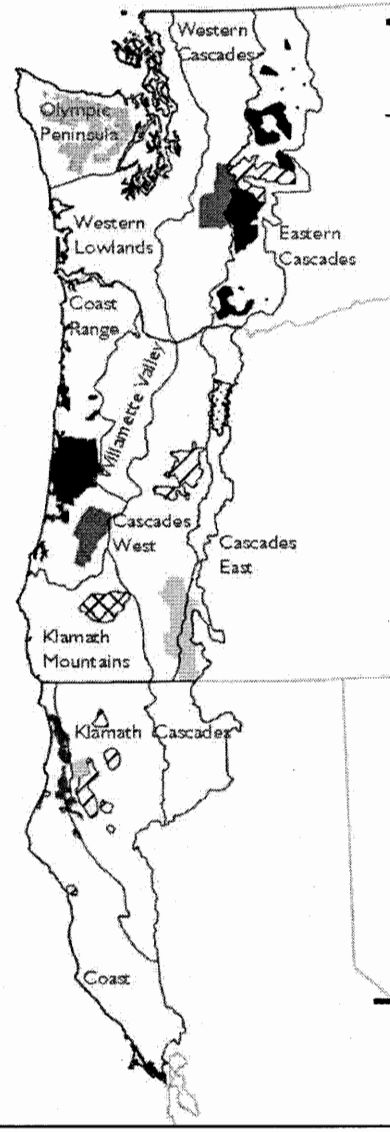
19 inches) long and the sexes are dimorphic, with males averaging about 13 percent smaller than females. The mean mass of 971 males taken during 1,108 captures was 580.4 grams (1.28 pounds) (out of a range 430.0 to 690.0 grams) (0.95 pound to 1.52 pounds), and the mean mass of 874 females taken during 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 2011b, p. A-1). The northern 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, p. 493). The northern spotted owl superficially resembles the barred owl, a species with which it occasionally hybridizes (Kelly and Forsman 2004, p. 807). Hybrids exhibit physical and vocal characteristics of both species (Hamer et al. 1994, p. 488).

1.2.3. 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 1990a, p. 26115). 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 (USDI FWS 2011b, p. III-1; 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
- 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 (USDI FWS 2011b, pp. B-1 to B-4; Thomas and Raphael 1993).



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

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

1.2.4. Behavior

Northern spotted owls are primarily nocturnal (Forsman et al. 1984, pp. 51-52) and spend virtually their entire lives beneath the forest canopy (Courtney et al. 2004, p. 2-5). They are adapted to maneuverability beneath the forest canopy rather than strong, sustained flight (Gutiérrez et al. 1995, p. 9). They forage between dusk and dawn and sleep during the day with peak activity occurring during the two hours after sunset and the two hours prior to sunrise (Gutiérrez et al. 1995, p. 5; Delaney et al. 1999a, p. 44). They will sometimes take advantage of vulnerable prey near their roosts during the day (Layman 1991, pp. 138-140; Sovern et al. 1994, p. 202).

Northern spotted owls seek sheltered roosts to avoid inclement weather, summer heat, and predation (Forsman 1975, pp. 105-106; Barrows and Barrows 1978; Barrows 1981; Forsman et al. 1984, pp. 29-30). Northern spotted owls become stressed at temperatures above 28°C, but there is no evidence to indicate that they have been directly killed by temperature because of their ability to thermoregulate by seeking out shady roosts in the forest understory on hot days (Barrows and Barrows 1978; Forsman et al. 1984, pp. 29-30, 54; Weathers et al. 2001, pp. 678, 684). During warm weather, spotted owls seek roosts in shady recesses of understory trees and occasionally will even roost on the ground (Barrows and Barrows 1978, pp. 3, 7-8; Barrows 1981, pp. 302-306, 308; Forsman et al. 1984, pp. 29-30, 54; Gutiérrez et al. 1995, p. 7). Glenn et al. (2010, p. 2549) found that population growth was negatively associated with hot summer temperatures at their southernmost study area in the southern Oregon Cascades, indicating that warm temperatures may still have an effect on the species. Both adults and juveniles have been observed drinking water, primarily during the summer, which is thought to be associated with thermoregulation (Gutiérrez et al. 1995, p. 7).

Spotted owls are territorial; however, home ranges of adjacent pairs overlap (Forsman et al. 1984, p. 22; Solis and Gutiérrez 1990, p. 746) suggesting that the area defended is smaller than the area used for foraging. They will actively defend their nests and young from predators (Forsman 1975, p. 15; Gutiérrez et al. 1995, p. 11). 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, p. 4). 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, p. 822). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutiérrez 1996, p. 4).

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, p. 10).

1.2.5. Habitat Relationships

1.2.5.1. *Home Range*

Home-range sizes vary geographically, generally increasing from south to north, which is likely a response to differences in habitat quality (USDI FWS 1990a, p. 26117). 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, pp. IX-15)) vary by province and range from 2,955 acres in the Oregon Cascades (Thomas et al. 1990, p. 194) to 14,211 acres on the Olympic Peninsula (USDI FWS 1994a, p. 3). Zabel et al. (1995, p. 436) 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, p. 22; Solis and Gutiérrez 1990, p. 746), 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 (approximately 20 percent of the home range), often referred to as the core area (Bingham and Noon 1997, pp. 133-135). 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, p. 134). 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, pp. 21-22; Sisco 1990, p. iii).

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, pp. 98-99; Bart 1995, p. 944).

1.2.5.2. *Habitat Use and Selection*

Forsman et al. (1984, pp.15-16) 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, p. 27; Forsman et al. 1984, pp. 15-16).

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 diameter at breast height [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, p. 19). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001, p. 686) and protection from predators (Franklin et al. 2000, p. 578).

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, p. 30; Hershey et al. 1998, p. 1402). 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, p. 40; Buchanan et al. 1995, p. 1402; Hershey et al. 1998, p. 1404).

Roost sites selected by spotted owls have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978, p. 3; Forsman et al. 1984, pp. 29-30; Solis and Gutiérrez 1990, pp. 742-743). These habitats are usually multi-layered forests having high canopy closure and large diameter trees in the overstory.

Foraging habitat is the most variable of all habitats used by territorial spotted owls (Thomas et al. 1990; USDI FWS 2011b, p. G-2). Descriptions of foraging habitat have ranged from complex structure (Solis and Gutiérrez 1990, pp. 742-744) to forests with lower canopy closure and smaller trees than forests containing nests or roosts (Gutiérrez 1996, p. 5). Foraging habitat for northern spotted owls provides a food supply for survival and reproduction. Foraging activity is positively associated with tree height diversity (North et al. 1999, p. 524), canopy closure (Irwin et al. 2000, p. 180; Courtney et al. 2004, pp. 5-15), snag volume, density of snags greater than 20 in (50 cm) dbh (North et al. 1999, p. 524; Irwin et al. 2000, pp. 179-180; Courtney et al. 2004, pp. 5-15), density of trees greater than or equal to 31 in (80 cm) dbh (North et al. 1999, p. 524), volume of woody debris (Irwin et al. 2000, pp. 179-180), and young forests with some structural characteristics of old forests (Carey et al.1992, pp. 245-247; Irwin et al. 2000, pp. 178-179). Northern spotted owls select old forests for foraging in greater proportion than their availability at the landscape scale (Carey et al. 1992, pp. 236-237; Carey and Peeler 1995, p. 235; Forsman et al. 2004, pp. 372-373), but will forage in younger stands with high prey densities and access to prey (Carey et al. 1992, p. 247; Rosenberg and Anthony 1992, p. 165; Thome et al. 1999, pp. 56-57).

Dispersal habitat is essential to maintaining stable populations by filling territorial vacancies when resident northern spotted owls die or leave their territories, and to providing adequate gene flow across the range of the species. 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 2011b, p. G-1). Dispersal habitat may include younger and less diverse forest stands than foraging habitat, such as even-aged, pole-sized stands, but such stands should contain some roosting structures and foraging habitat to allow for temporary resting and feeding for dispersing juveniles (USDI FWS 2011b, p. G-1). Forsman et al. (2002, p. 22) found that spotted owls could disperse through highly fragmented forest landscapes. However, the stand-level and landscape-level attributes of forests needed to facilitate successful dispersal have not been thoroughly evaluated (Buchanan 2004, p. 1341).

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, p. 158; Diller and Thome 1999, p. 275). 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, p. 304). 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, p. 41).

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, p. 437).

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, pp. 24-25; Carey et al. 1990, pp. 14-15; Thomas et al. 1990; Forsman et al. 2005, pp. 372-373). Glenn et al. (2004, pp. 46-47) 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, p. 62) 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, p. 436) 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, p. 1038; Franklin et al. 2000, pp. 573-579; Meyer et al. 1998, p. 43). In Oregon Klamath and Western Oregon Cascade provinces, Dugger et al. (2005, p. 876) 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, pp. 873-874). 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, p. 876) 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. (2006). Olson et al. (2004, pp. 1050-1051) 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, pp. 1049-1050) 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. In a large-scale demography modeling study, Forsman et al. (2011, pp. 1-2) found a positive correlation between the amount of suitable habitat and recruitment of young.

1.2.6. 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, p. 5). 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, p. 93; Franklin 1992, p. 821; Forsman et al. 2002, p. 17). 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, pp. 32-34; Anthony et al. 2006, p. 28), and renesting after a failed nesting attempt is rare (Gutiérrez 1996, p. 4). 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, p. 4).

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, p. 32). 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 1990a; Forsman et al. 1984, p. 38). 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, p. 38). Telemetry and genetic studies indicate that close inbreeding between siblings or parents and their offspring is rare (Haig et al. 2001, p. 35; Forsman et al. 2002, p. 18). Hybridization of northern spotted owls with California spotted owls and barred owls has been confirmed through genetic research (Hamer et al. 1994, pp. 487-492; Gutiérrez et al. 1995, pp. 2-3; Dark et al. 1998, p. 52; Kelly 2001, pp. 33-35; Funk et al. 2008, pp. 161-171).

1.2.7. 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, p. 13). Natal dispersal occurs in stages, with juveniles settling in temporary home ranges between bouts of dispersal (Forsman et al. 2002, pp. 13-14; Miller et al. 1997, p. 143). The median natal dispersal distance is about 10 miles for males and 15.5 miles for females (Forsman et al. 2002, p. 16). Dispersing juvenile spotted owls experience high mortality rates, exceeding 70 percent in some studies (USDI FWS 1990a; Miller 1989, pp. 32-41). Known or suspected causes of mortality during dispersal include starvation, predation, and accidents (Miller 1989, pp. 41-44; USDI FWS 1990a; Forsman et al. 2002, pp. 18-19). Parasitic infection may contribute to these causes of mortality, but the relationship between parasite loads and survival is poorly understood (Hoberg et al. 1989, p. 247; Gutiérrez 1989, pp. 616-617; Forsman et al. 2002, pp. 18-19). 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, pp. 697-698).

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, p. 22). 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, p. 22). 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, p. 35).

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, pp. 20-21). Breeding dispersal distances were shorter than natal dispersal distances and also are apparently random in direction (Forsman et al. 2002, pp. 21-22). In California spotted owls, a similar subspecies, the probability for dispersal was higher in younger owls, single owls, paired owls that lost mates, owls at low quality sites, and owls that failed to reproduce in the preceding year (Blakesley et al. 2006, p.77). Both males and females dispersed at near equal distances (Blakesley et al. 2006, p. 76). In 72 percent of observed cases of dispersal, dispersal resulted in increased habitat quality (Blakesley et al. 2006, p. 77).

Dispersal can also be described as having two phases: transience and colonization (Courtney et al 2004, p. 5-13). Fragmented forest landscapes are more likely to be used by owls in the transience phase as a means to move rapidly between denser forest areas (Courtney et al 2004, p. 5-13; USDI FWS 2012, p. 14086). Movements through mature and old growth forests occur during the colonization phase when birds are looking to become established in an area (Miller et al 1997, p. 144; Courtney et al 2004, p. 5-13). Transient dispersers use a wider variety of forest conditions for movements than colonizing dispersers, who require habitats resembling nesting/roosting/foraging habitats used by breeding birds (USDI FWS 2012, p. 14086). Dispersal success is likely highest in mature and old growth forest stands where there is more likely to be adequate cover and food supply (USDI FWS 2012, p. 14086).

1.2.8. Food Habits

Spotted owls are mostly nocturnal, although they also forage opportunistically during the day (Forsman et al. 1984, p. 51; 2004, pp. 222-223; Sovern et al. 1994, p. 202). 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, pp. 40-41) in Washington and Oregon, while dusky-footed wood rats (*Neotoma fuscipes*) are a major part of the diet in the Oregon Klamath, California Klamath, and California Coastal provinces (Forsman et al. 1984, pp. 40-42; 2004, p. 218; Ward et al. 1998, p. 84; Hamer et al. 2001, p. 224). 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, pp. 40-43; 2004, p. 218; Ward et al. 1998; p. 84; Hamer et al. 2001, p.224).

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, pp. 4-27). For example, Rosenberg et al. (2003, p. 1720) showed a strong correlation between annual reproductive success of spotted owls (number of young per territory) and abundance of deer mice (*Peromyscus maniculatus*) (r^2 =

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, p. 1723). Ward (1990, p. 55) 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 *Peromyscus*, in the spotted owl diet should not be underestimated (Forsman et al. 2001, p. 148; 2004, pp. 218-219). In the southern portion of their range, where woodrats are a major component of their diet, northern spotted owls are more likely to use a variety of stands, including younger stands, brushy openings in older stands, and edges between forest types in response to higher prey density in some of these areas (Forsman et al. 1984, pp. 24-29).

1.2.9. 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, p. 5). 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, p. 576).

Annual variation in population parameters for spotted owls has been linked to environmental influences at various life history stages (Franklin et al. 2000, p. 581). 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, p. 805), 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, p. 1). Annual variation in breeding may be related to weather (i.e., temperature and precipitation) (Wagner et al. 1996, p. 74; Zabel et al. 1996, p.81 *In*: Forsman et al. 1996) and fluctuation in prey abundance (Zabel et al. 1996, pp.437-438).

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, pp. 581-582). Specifically, weather could have increased negative effects on spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin et al. 2000, pp. 581-582). 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, p. 583).

Olson et al. (2005, pp. 930-931) 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.

1.3. Threats

1.3.1. 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, p. 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 1992a, pp. 33-41). These threats were characterized for each province as severe, moderate, low, or unknown (USDI FWS 1992a, pp. 33-41). 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, pp. 11-8 to 11-9). However, great horned owls (*Bubo virginianus*), an effective predator on spotted owls, are closely associated with fragmented forests, openings, and clearcuts (Johnson 1992, p. 84; Laidig and Dobkin 1995, p. 155). As mature forests are harvested, great horned owls may colonize fragmented forests, thereby increasing spotted owl vulnerability to predation.

1.3.2. New Threats

The Service conducted a 5-year review of the spotted owl in 1994 (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, pp.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 percent of the range-wide habitat base over a 10-year period)" (Courtney and Gutiérrez 2004, pp.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, pp. 11-8).

Threats, as identified in the 2011 Revised Recovery Plan for the Northern Spotted Owl, continue to emphasize that habitat loss and barred owls are the main threats to northern spotted owl recovery (USDI FWS 2011b, Appendix B).

1.3.2.1. *Barred Owls (Strix varia)*

With its recent expansion to as far south as Marin County, California (Gutiérrez et al. 2004, pp. 7-12 to 7-13; Steger et al. 2006, p.106), the barred owl's range now completely overlaps that of the northern spotted owl. Barred owls may be competing with spotted owls for prey (Hamer et al. 2001, p.226) or habitat (Hamer et al. 1989, p.55; Dunbar et al. 1991, p. 467; Herter and Hicks 2000, p. 285; Pearson and Livezey 2003, p. 274). In addition, barred owls physically attack spotted owls (Pearson and Livezey 2003, p. 274), and circumstantial evidence strongly indicated that a barred owl killed a spotted owl (Leskiw and Gutiérrez 1998, p. 226). 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, p. 46; Pearson and Livezey 2003, p. 267; Olson et al. 2005, p. 921). Recent research has shown that the two species of owls share similar habitats and are likely competing for food resources (Hamer et al. 2001, p. 226). Research on barred owls and their interactions with northern spotted owls is lacking, but necessary to determine the specific effects barred owls may have on northern spotted owls and their habitat. Forsman et al. (2011, pp. 69-70) found that the presence of barred owls led to a decrease in fecundity, apparent survival, and caused a decline in populations in most of the demography study areas included in their large scale modeling effort. 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 evaluate quantitatively 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, though they are generalists, likely compete with northern spotted owls for prey resources (Hamer et al. 2001, p. 226; Gutiérrez et al. 2007, p. 187; Livezey and Fleming 2007, p. 319). The only study comparing northern spotted owl and barred owl food habits in the Pacific Northwest indicated that barred owl diets overlap strongly (76 percent) with northern spotted owl diets (Hamer et al. 2001, pp. 221, 226). Barred owl diets are more diverse than northern spotted owl diets and include species associated with riparian and other moist habitats (e.g. fish, invertebrates, frogs, and crayfish), along with more terrestrial and diurnal species (Smith et al. 1983; Hamer et al. 2001; Gronau 2005). Even though barred owls may be taking northern

spotted owls' primary prey only as a generalist, northern spotted owls may be affected by a sufficient reduction in the density of these prey items due to barred owls, leading to a depletion of prey to the extent that the northern spotted owl cannot find an adequate amount of food to sustain maintenance or reproduction (Gutiérrez et al. 2007, p. 187; Livezey and Fleming 2007, p. 319).

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 et al 1989, p. 34; Iverson 1993, p.39). However, recent studies conducted in the Pacific Northwest show that barred owls frequently use mature and old-growth forests (Pearson and Livezey 2003, p. 270; Gremel 2005, Schmidt 2006, p. 1; Singleton et al. 2010, pp. 290-292). 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, p. 1).

The presence of barred owls has been reported to reduce spotted owl detectability, site occupancy, reproduction, and survival. Olson et al. (2005, p. 924) 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, p. 51). Pearson and Livezey (2003, p. 271) 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, p. 11) 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, p. 928) 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 HJ Andrews study area, 12 percent in the Coast Range study area, and 15 percent in the Tyee study area. In contrast, Bailey et al. (2009, p. 2983), when using a two-species occupancy model, showed no evidence that barred owls excluded northern spotted owls from territories in Oregon. Most recently, preliminary results from a barred owl and northern spotted owl radio-telemetry study in Washington reported two northern spotted owls fleeing their territories and traveling 6 and 15 miles, believed to be as a result of frequent direct encounters with barred owls (Irwin et al. 2010, pp. 3-4). Both northern spotted owls were subsequently found dead (Irwin et al. 2010, p. 4).

Olson et al. (2004, p. 1048) 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, p. 89) was unfounded because of small sample sizes

(Livezey 2005, p. 102). 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 2011b, p. B-11). Anthony et al. (2006, p. 32) 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. Dugger et al. (2011, pp. 2463-2467) confirmed the synergistic effects of barred owls and territory habitat characteristics on extinction and colonization rates of territories by northern spotted owls. Extinction rates of northern spotted owl territories nearly tripled when barred owls were detected (Dugger et al. 2011, p. 2464).

Monitoring and management of northern spotted owls has become more complicated due to their possible reduced detectability when barred owls are present (Kelly et al. 2003, pp. 51-52; Courtney et al. 2004, p. 7-16 ; Olson et al. 2005, p. 929; Crozier et al. 2006, p.766-767). Evidence that northern spotted owls were responding less frequently during surveys led the Service and its many research partners to update the northern spotted owl survey protocol. The recent changes to the northern spotted owl survey protocol were based on the probability of detecting northern spotted owls when barred owls are present (See USDI FWS Memorandum dated February 7, 2011, "2011 Northern Spotted Owl Survey Protocol" and attached "Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls" for guidance and methodology).

In a recent analysis of more than 9,000 banded spotted owls throughout their range, only 47 hybrids were detected (Kelly and Forsman 2004, p. 807). 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, p. 808).

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, pp. 739-740; Olson et al. 2005, pp. 930-931). 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 northern spotted owls have been already fully realized" (Gutiérrez et al. 2004, pp. 7-38). In Oregon, Dugger et al. (2011, p. 2466) reported that some northern spotted owl pairs retained their territories and continued to survive and successfully reproduce during their study even when barred owls were present, but that the effects of reduced old growth forest in the core habitat areas were compounded when barred owls were present.

1.3.2.2. *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. However, fire is often considered a primary threat to spotted owls because of its potential to alter habitat rapidly (Bond et al. 2009, p. 1116) and is a major cause of habitat loss on Federal lands (Courtney et al. 2004, executive summary). Bond et al. (2002, p. 1025) 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, p. 1026). In a preliminary study conducted by Anthony and Andrews (2004, p. 8) in the Oregon Klamath 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, p. 125). 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 (Gaines et al. 1997, p. 126). 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. 1998, pp. 2-3). 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 understand further the relationship between fire and spotted owl habitat use. Overall, we can conclude that fires are a change agent for northern spotted owl habitat, but there are still many unknowns regarding how much fire benefits or adversely affects northern spotted owl habitat (USDI FWS 2011b, p. III-31).

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, p. 26183). 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, p. 110) suggested that 12 percent of late-successional forest rangewide would likely be negatively impacted by wildfire during the first 5 decades of the Northwest Forest Plan. Currently, the overall total amount of habitat affected by wildfires has been relatively small (Lint 2005, p. v). 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, pp. 12-11). 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, p. 77).

1.3.2.4. *West Nile Virus*

West Nile virus (WNV), caused by a virus in the family Flaviviridae, has killed millions of wild birds in North America since it arrived in 1999 (McLean et al. 2001; Caffrey 2003; Caffrey and

Peterson 2003, pp. 7-8; Marra et al. 2004, p. 393). 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, p. 3111; Komar et al. 2001). 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; Blakesley et al. 2004, pp. 8-31), but it is unknown how WNV will ultimately affect spotted owl populations. Susceptibility to infection and the mortality rates of infected individuals vary among bird species (Blakesley et al. 2004, pp. 8-33), but most owls appear to be quite susceptible. For example, breeding Eastern screech owls (*Megascops asio*) in Ohio experienced 100 percent mortality (T. Grubb pers. comm. in Blakesley et al. 2004, pp. 8-33). Barred owls, in contrast, showed lower susceptibility (B. Hunter pers. comm. in Blakesley et al. 2004, pp. 8-34). 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.

Blakesley et al. (2004, pp. 8-35) offer competing propositions for the likely outcome of spotted owl populations being infected by WNV. One scenario 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 scenario 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, northern spotted owls has been recorded; however, WNV is a potential threat of uncertain magnitude and effect (Blakesley et al. 2004, pp. 8-34).

1.3.2.5. *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. The disease is now known to extend over 650 km from south of Big Sur, California to Curry County, Oregon (Rizzo and Garbelotto 2003, p. 198), and has reached epidemic proportions in oak (Quercus spp.) and tanoak (*Lithocarpus densiflorus*) forests along approximately 300 kilometers of the central and northern California coast (Rizzo et al. 2002, p. 733). 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, p. 733). 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, p. 441). It has been found in several different forest types and at elevations from sea level to over 800 m. During a study completed between 2001 and 2003 in California, one-third to one-half of the hiker's present in the study area carried infected soil on

their shoes (Davidson et al. 2005, p. 587), creating the potential for rapid spread of the disease. 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, pp. 11-8).

1.3.2.6. *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, p. 922; Haig et al. 2004, p. 36). 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, pp. 11-9). A 2004 study (Harestad et al. 2004, p. 13) indicates that the Canadian breeding population was estimated to be less than 33 pairs and annual population decline may be as high as 35 percent. In 2007, a recommendation was made by the Spotted Owl Population Enhancement Team to remove northern spotted owls from the wild in British Columbia (USDI FWS 2012, p. 14078). This recommendation resulted in the eventual capture of the remaining 16 wild northern spotted owls in British Columbia for a captive breeding program (USDI FWS 2012, p. 14078). 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. Hybridization of northern spotted owls with California spotted owls, Mexican spotted owls, and barred owls has been confirmed through genetic research (Funk et al. 2008, p. 1; Hamer et al. 1994, p. 487; Gutiérrez et al. 1995, p. 3; Dark et al. 1998, p. 50; Kelly 2001, pp. 33-35).

1.3.2.7. *Climate Change*

Climate change, combined with effects from past management practices is influencing current forest ecosystem processes and dynamics by increasing the frequency and magnitude of wildfires, insect outbreaks, drought, and disease (Service 2011b, pp. III-5 - III-11). In the Pacific Northwest, mean annual temperatures rose 0.8° C (1.5° F) in the 20th century and are expected to continue to warm from 0.1° to 0.6° C (0.2° to 1° F) per decade (Mote and Salathe 2010, p. 29). Climate change models generally predict warmer, wetter winters and hotter, drier summers and increased frequency of extreme weather events in the Pacific Northwest (Salathe et al. 2010, pp. 72-73).

Predicted climate changes in the Pacific Northwest have implications for forest disturbances that affect the quality and distribution of spotted owl habitat. Both the frequency and intensity of wildfires and insect outbreaks are expected to increase over the next century in the Pacific Northwest (Littell et al. 2010, p. 130). One of the largest projected effects on Pacific Northwest forests is likely to come from an increase in fire frequency, duration, and severity. Westerling et al. (2006, pp. 940-941) analyzed wildfires and found that since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period from 1970-1986. The total area burned is more than 6.5 times the previous level and the average length of the fire season during 1987-2003 was 78 days longer compared to 1978-1986 (Westerling et al. 2006, p. 941). The area burned annually by wildfires in the Pacific Northwest is expected to double or triple by the 2080s (Littell et al. 2010, p. 140). Wildfires are now the

primary cause of spotted owl habitat loss on Federal lands, with over 236,000 acres of habitat loss attributed to wildfires from 1994 to 2007 (Davis et al. 2011, p. 123).

Potential changes in temperature and precipitation have important implications for spotted owl reproduction and survival. Wet, cold weather during the winter or nesting season, particularly the early nesting season, has been shown to negatively affect spotted owl reproduction (Olson et al. 2004, p. 1039, Dugger et al. 2005, p. 863), survival (Franklin et al. 2000 pp. 576-577, Olson et al. 2004, p. 1039, Glenn et al. 2011, p. 1279), and recruitment (Glenn et al. 2010, pp.2446-2547). Cold, wet weather may reduce reproduction and/or survival during the breeding season due to declines or decreased activity in small mammal populations so that less food is available during reproduction when metabolic demands are high (Glenn et al. 2011, pp. 1288-1289). Cold, wet nesting seasons may increase the mortality of nestlings due to chilling and reduce the number of young fledged per pair per year (Franklin et al. 2000, p.557, Glenn et al. 2011, p. 1286).

Drought or hot temperatures during the summer have also been linked to reduced spotted owl recruitment (Glenn et al. 2010, p. 2549). Drier, warmer summers and drought conditions during the growing season strongly influence primary production in forests, food availability, and the population sizes of small mammals that spotted owls prey upon (Glenn et al. 2010, p. 2549).

In summary, climate change is likely to exacerbate some existing threats to the spotted owl such as the projected potential for increased habitat loss from drought-related fire, tree mortality, insects and disease, as well as affecting reproduction and survival during years of extreme weather.

1.3.2.8. *Disturbance*

Northern 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, p. 925). 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, pp. 517-518; Saplosky et al. 2000, p. 1). In avian species, the secretion of corticosterone is the primary non-specific stress response (Carsia and Harvey 2000, p. 517). The quantity of this hormone in feces can be used as a measure of physiological stress (Wasser et al. 1997, p. 1019). Recent studies of fecal corticosterone levels of northern spotted owls indicate that low intensity noise of short duration and minimal repetition does not elicit a physiological stress response (Tempel and Gutiérrez 2003, p. 698; Tempel and Gutiérrez 2004, p. 538). However, prolonged activities, such as those associated with timber harvest, may increase fecal corticosterone levels depending on their proximity to northern spotted owl core areas (Wasser et al. 1997, p.1021; Tempel and Gutiérrez 2004, p. 544).

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 Skagan 1988, pp. 355-358).

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.

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, p. 314) and helicopter overflights can reduce prey delivery rates to nests (Delaney et al. 1999, p. 70). 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, p. 14; Andersen et al. 1989, p. 296; McGarigal et al. 1991, p. 5).

Although it has not been conclusively demonstrated, it is anticipated that nesting spotted owls may be disturbed by heat and smoke as a result of burning activities during the breeding season. Smoke and heat may serve as a disturbance to nesting owls or their young by causing them to avoid important foraging areas or fleeing the nest area prematurely, thereby reducing fitness and increasing the probability of predation. When radio-tracking northern spotted owls during the 1994 fire season on the Yakama Indian Reservation, Bevis et al. (1997, pp. 119-121) noted that post-fire locations appeared to shift outside of the fire area, however, adult and juvenile owls were recorded within their activity center during July, even when low intensity ground fire and thick smoke were present. They concluded that smoke alone did not drive owls off of their territories (Bevis et al. 1997, p. 121); however, these findings could indicate the reluctance of adults and young to leave their territories during the early nesting season.

1.4. 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:

1.4.1. 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;
2. Suitable habitat conditions and spacing between local spotted owl populations throughout its range that facilitate survival and movement;
3. Suitable habitat distributed across a variety of ecological conditions within the northern spotted owl's range to reduce risk of local or widespread extirpation;
4. 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
5. In areas of significant population decline, sustain the full range of survival and recovery options for this species in light of significant uncertainty.

1.4.2. 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 understand better 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.

1.4.3. 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 ISC's Conservation Strategy (Thomas et al. 1990); they continued with the designation of critical habitat (USDI FWS 1992a), the Draft Recovery Plan (USDI FWS 1992b), 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.

1.4.4. Federal Contribution to Recovery

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 included land use allocations which would provide for population clusters of northern spotted owls (i.e., demographic support) and maintain connectivity between population clusters. Certain land use allocations in the plan contribute to supporting population clusters: 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 were 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 1994b) which would persist into future managed timber stands.

The NWFP with its rangewide system of LSRs was based on work completed by three previous studies (Thomas et. al. 2006): the 1990 Interagency Scientific Committee (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 1992b) 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, p. II-31; USDA FS and USDI BLM 1994a, 1994b, p. 3&4-229). Based on the results of the first decade of monitoring, Lint (2005, p. 18) 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, p. 18; Noon and Blakesley 2006, p. 288). Bigley and Franklin (2004, pp. 6-34) 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 with 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, p. 6-34). The Revised Recovery Plan builds on the NWFP and recommends continued implementation of the NWFP and its standards and guides (USDI FWS 2011b, p. I-1).

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. 2006, pp. 33-34) 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, p. 9-12; Lint 2005, p. 87). Even with the population decline, Courtney et al (2004, p. 9-15) 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 northern spotted owl population declines, indicates that the spotted owl continues to meet the definition of a threatened species (USDI FWS 2004, p. 54). 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.

On June 28, 2011 the Service published the Revised Recovery Plan for the Northern Spotted Owl (USDI FWS 2011b). The recovery plan identifies threats from competition with barred owls, ongoing loss of northern spotted owl habitat as a result of timber harvest, loss or modification of northern spotted owl habitat from uncharacteristic wildfire, and loss of amount and distribution of northern spotted owl habitat as a result of past activities and disturbances (USDI FWS 2011b, p. II-2 and Appendix B). To address these threats, the current recovery strategy identifies five main steps: 1) development of a range-wide habitat modeling framework; 2) barred owl management; 3) monitoring and research; 4) adaptive management; and 5) habitat conservation and active forest restoration (USDI FWS 2011b, p. II-2). The recovery plan lists recovery actions that address each of these items, some of which were retained from the 2008 recovery plan. The Managed Owl Conservation Areas and Conservation Support Areas recommended in the 2008 recovery plan are not a part of the recovery strategy outlined in the revised recovery plan. The Service completed a range-wide, multi-step habitat modeling process to help evaluate and inform management decisions and critical habitat development (USDI FWS 2011b, Appendix C).

The final recovery plan (USDI FWS 2011b) recommended implementing a robust monitoring and research program for the spotted owl. The recovery plan encourages these efforts by laying out the following primary elements to evaluate progress toward meeting recovery criteria: monitoring spotted owl population trends, comprehensive barred owl research and monitoring, continued habitat monitoring; inventory of spotted owl distribution, and; explicit consideration for climate change mitigation goals consistent with recovery actions (USDI FWS 2011b, p. II-5). The revised recovery plan also strongly encourages land managers to be aggressive in the implementation of recovery actions. In other words, land managers should not be so conservative that, to avoid risk, they forego actions that are necessary to conserve the forest ecosystems that are necessary to the long-term conservation of the spotted owl. But they should also not be so aggressive that they subject spotted owls and their habitat to treatments where the long-term benefits do not clearly outweigh the short-term risks. Finding the appropriate balance to this dichotomy will remain an ongoing challenge for all who are engaged in spotted owl conservation (USDI FWS 2011b, p. II-12). The revised recovery plan estimates that recovery of the spotted owl could be achieved in approximately 30 years (USDI FWS 2011b, p. II-3).

1.4.5. Conservation Efforts on Non-Federal Lands

In the report from the Interagency Scientific Committee (Thomas et al. 1990, p. 3, p. 272), the draft recovery plan (USDI FWS 1992b), and the report from the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993, p. IV-189), 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 U.S. Fish and Wildlife 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. 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 17 current and ongoing conservation plans including Habitat Conservation Plans (HCPs) and Safe Harbor Agreements (SHAs) that have incidental take permits issued for northern spotted owls—eight in Washington, three in Oregon, and six in California (USDI FWS

2011b, p. A-15). The conservation plans range in size from 76 acres to more than 1.8 million acres, although not all acres are included in the mitigation for northern spotted owls. In total, the conservation plans cover approximately 3 million acres (9.4 percent) of the 32 million acres of non-Federal forest lands in the range of the northern spotted owl. The period of time that the HCPs will be in place ranges from 20 to 100 years. While each conservation plan 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 nesting habitat
- Forest harvest that maintains or develops foraging habitat
- Forest management that maintains or develops dispersal habitat
- Deferral of harvest near specific sites

1.4.5.1. *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, pp. 11-15; Buchanan et al. 1994, p. ii). 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, p. 9). Spotted owl-related HCPs in Washington generally were intended to provide demographic or connectivity support (USDI FWS 1992b, p. 272). There are over 2.1 million acres of land in six HCPs and two SHAs (USDI FWS 2011b, p. A-15). Some of these CPs focus on providing nesting/roosting habitat throughout the area or in strategic locations; while others focus on providing connectivity through foraging habitat and/or dispersal habitat. In addition, there is a long term habitat management agreement covering 13,000 acres in which authorization of take was provided through an incidental take statement (section 7) associated with a Federal land exchange (USDI FWS 2011b, p. A-15).

1.4.5.2. *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, p. 64). 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 (USDI FWS 2011b, p. A-16). On July 27, 2010, the Service completed a programmatic SHA with the Oregon Department of Forestry that will enroll up to 50,000 acres of non-federal lands within the State over 50 years. The primary intent of this programmatic SHA is to increase time between harvests and to lightly to moderately thin younger forest stands that are currently not habitat to increase tree diameter and stand diversity (USDI FWS 2011b, p. A-16).

1.4.5.3. *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, pp. 85-87). 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, pp. 85-87). The California Department of Fish and Game initially reviewed all timber harvest plans to ensure that take was not likely to occur; the U.S. Fish and Wildlife Service took over that review function in 2000. Several large industrial owners operate under spotted owl management plans that have been reviewed by the U.S. Fish and Wildlife Service and that specify basic measures for spotted owl protection. Four HCPs and two SHAs authorizing take of spotted owls have been approved; these HCPs cover more than 622,000 acres of non-Federal lands. Implementation of these plans is intended to provide for spotted owl demographic and connectivity support to NWFP lands (USDI FWS 2011b, p. A-16).

1.5. 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, pp. 4-19).

1.5.1. Range-wide Habitat and Population Trends

1.5.1.1. *Range-wide Habitat Baseline*

The Service has used information provided by the USFS, BLM, and National Park Service to update the habitat baseline conditions by tracking relative habitat changes over time on Federal lands for northern spotted owls on several occasions, since the northern spotted owl was listed in 1990 (USDA and USDI 1994b, USDI 2001, Lint 2005, Davis et al. 2011). The estimate of 7.4 million acres used for the NWFP in 1994 (USDA and USDI 1994b) was believed to be representative of the general amount of northern spotted owl habitat on NWFP lands at that time. The most recent mapping effort (Davis et al. 2011, Appendix D, Table D) indicates approximately 8.85 million acres of spotted owl nesting/roosting habitat existed on Federal lands and 4.19 million acres existed on non-federal lands at the beginning of the NWFP in 1994/1996. Davis et al. (2011, pp. 28-30) further evaluated changes in spotted owl nesting/roosting habitat using data from California that covered 14 years from 1994 to 2007, and data from Oregon and Washington that covered 10 years from 1996 to 2006. Although the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects, the Service has evaluated the map for use in tracking provincial and range-wide habitat trends and now considers these data as the best available information on the distribution and abundance of extant spotted owl habitat within its range as of 2006 for Oregon and Washington, and 2007 for California, when the base imagery was collected.

Periodic range-wide evaluations of habitat, as compared to the Final Supplemental Environmental Impact Statement (FSEIS; USDA and USDI 1994b), are necessary to determine if the rate of potential change to northern spotted owl habitat is consistent with the change anticipated in the NWFP: a reduction in suitable habitat of approximately 2.5 percent per decade

(USDA and USDI 1994a, p. 46). In particular, the Service considers habitat effects that are documented through the section 7 consultation process since 1994. In general, the analytical framework of these consultations focuses on the reserve and connectivity goals established by the NWFP land-use allocations (USDA and USDI 1994a), with effects expressed in terms of changes in suitable northern spotted owl habitat within those land-use allocations.

In 2001, the Service conducted the first assessment of habitat baseline conditions since implementation of the NWFP (USDI 2001). The Service determined that actions and effects were consistent with the expectations for implementation of the NWFP from 1994 to June 2001 (USDI 2001). 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 are consistent with expected habitat changes under the NWFP.

In February 2013, the Service adopted the 2006/07 satellite imagery data on spotted owl habitat as the new range-wide habitat baseline for Federal lands. On that basis, the assessment of local, provincial and range-wide spotted owl habitat status in this and future Opinions as well as Biological Assessments will rely on these 2006/07 habitat data to characterize changes in the status of spotted owl habitat.

1.5.1.2. *Service's Consultation Database*

To update information considered in 2001 (USDI 2001), the Service designed the Consultation Effects Tracking System database in 2002, which recorded impacts to northern spotted owls and their habitat at different spatial and temporal scales. In 2011, the Service replaced the Consultation Effects Tracking System with the Consulted on Effects Database located in the Service's Environmental Conservation Online System (ECOS). The ECOS Database corrected technical issues with the Consultation Effects Tracking System. Data are currently entered into the ECOS Database under various categories including; land management agency, land-use allocation, physiographic province, and type of habitat affected.

1.5.1.3. *Range-wide Consultation Effects: 1994 to September 11, 2014*

Between 1994 and September 11, 2014, the Service has consulted on the proposed removal/downgrade of approximately 204,255 acres (2.3 percent) of the 8.854 million acres of northern spotted owl nesting/roosting habitat estimated by Davis et al. (2011) to have occurred on Federal lands (Table 1). These changes in suitable northern spotted owl habitat are consistent with the expectations for implementation of the NWFP, which anticipated a rate of habitat harvested at 2.5 percent per decade (USFS and BLM 1994a).

The Service tracks habitat changes on non-NWFP lands through consultations for long-term Habitat Conservation Plans, Safe Harbor Agreements, or Tribal Forest Management Plans. Service consultations conducted since 1992 have documented the eventual loss of over 483,418 acres of habitat on non-NWFP lands. Most of these losses have yet to be realized because they are part of large-scale, long-term Habitat Conservation Plans. However, the NWFP 15-year monitoring report documented habitat losses on non-federal lands associated with timber harvest continues to occur at a rate of approximately 2 percent per year in Oregon and Washington, and at a lesser rate in California (Davis et al. 2011, pp. 123-124).

Table 1. Range-wide Aggregate of Changes to NRF[1] Habitat Acres from Activities Subject to Section 7 Consultations and Other Causes (1994 to September 11, 2014).

	Consulted On Habitat Changes[2]		Other Habitat Changes[3]	
Land Ownership	Removed/ Downgraded	Maintained/ Improved	Removed/ Downgraded	Maintained/ Improved
NWFP (FS, BLM, NPS)	204,255	547,471	251,276	39,720
Bureau of Indian Affairs/Tribes	111,662	28,372	2,398	0
Habitat Conservation Plans/Safe Harbor Agreements	303,007	14,539	N/A	N/A
Other Federal, State, County, Private Lands	68,713	28,447	2,392	0
Total Changes	687,637	618,829	256,066	39,720

[1]Nesting, roosting, foraging (NRF) 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, Oregon, and California, but does not include foraging only (F) for California.

[2]Includes both effects reported in Service 2001 and subsequent effects reported in the Northern Spotted Owl Consultation Effects Tracking System (web application and database.)

[3]Includes effects to suitable NRF habitat (as generally documented through technical assistance, etc.) 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.

1.5.1.4. *Range-wide Consultation Effects: 2006/2007 to September 11, 2014*

The Service updated the ECOS Database to reflect the 2006/2007 habitat baseline developed for the NWFP 15-year monitoring report (Davis et al. 2011, Appendix D, Table D). This mapping effort accounted for habitat loss due to wildfire, harvest, insects and disease, and indicates approximately 8.555 million acres of spotted owl nesting/roosting habitat existed on Federal lands in 2006/2007. Because the data developed for the NWFP monitoring program is only current through 2006/2007, the Service continues to rely on information compiled in the spotted owl consultation database to summarize current owl habitat trends at provincial and range-wide scales. Table 2 summarizes the habitat impacts on Federal lands that have occurred since 2006/2007.

Table 2. Summary of northern spotted owl suitable habitat (NRF[1]) acres removed or downgraded as documented through Section 7 consultations on all Federal Lands within the Northwest Forest Plan area. Environmental baseline and summary of effects by state, physiographic province, and land use function from 2006 to September 11, 2014.

		Evaluation Baseline (2006/2007)[3]			Habitat Removed/Downgraded[4]								
					Land Management Effects			Habitat Loss from Natural Events					
	Physiographic Province[2]	Nesting/ Roosting Acres in Reserves	Nesting/ Roosting Acres in Non-Reserves	Total Nesting/ Roosting Acres	Reserves[5]	Non-Reserves	Total	Reserves[5]	Non-Reserves	Total	Total NRF Removed/ Downgraded	% Provincial Baseline Affected	% Range-wide Effects
WA	Eastern Cascades	462,400	181,100	643,500	2,700	2,238	4,938	1,559	132	1,691	6,629	1.03	6.07
	Olympic Peninsula	729,000	33,400	762,400	6	0	6	0	1	1	7	0	0.01
	Western Cascades	1,031,600	246,600	1,278,200	529	831	1,360	3	0	3	1,363	0.11	1.25
	Western Lowlands	24,300	0	24,300	0	0	0	0	0	0	0	0	0
OR	Cascades East	248,500	128,400	376,900	2,994	7,484	10,478	7,639	1,981	9,620	20,098	5.33	18.41
	Cascades West	1,275,200	939,600	2,214,800	1,183	22,997	24,180	0	0	0	24,180	1.09	22.15
	Coast Range	494,400	113,400	607,800	750	1,623	2,373	0	0	0	2,373	0.39	2.17
	Klamath Mountains	549,400	334,900	884,300	2,985	5,367	8,352	1,468	3,696	5,164	13,516	1.53	12.38
	Willamette Valley	700	2,600	3,300	0	0	0	0	0	0	0	0	0
CA	Cascades	101,700	102,900	204,600	10	1	11	325	0	325	336	0.16	0.31
	Coast	132,900	10,100	143,000	274	1	275	0	175	175	450	0.31	0.41
	Klamath	910,900	501,200	1,412,100	75	649	724	19,072	20,409	39,481	40,205	2.85	36.83
	Total	**5,961,000**	**2,594,200**	**8,555,200**	**11,506**	**41,191**	**52,697**	**30,066**	**26,394**	**54,460**	**109,157**	**1.28**	**100**

Table 2 Notes:
[1]Nesting, roosting, foraging (NRF) habitat. In WA/OR, the values for Nesting/Roosting habitat generally represent the distribution of suitable owl habitat, including foraging habitat. In CA, foraging habitat occurs in a much broader range of forest types than what is represented by nesting/roosting habitat. Baseline information for foraging habitat as a separate category in CA is currently not available at a provincial scale in this database; however, California consultations use locally derived information to assess effects to foraging only.
[2]Defined in the Revised Recovery Plan for the Northern Spotted Owl (Service 2011) as Recovery Units as depicted on page A-3.
[3]Spotted owl nesting and roosting habitat on all Federal lands (includes USFS, BLM, NPS, DoD, Service, etc.) as reported by Davis et al. 2011 for the Northwest Forest Plan 15-Year Monitoring Report (PNW-GTR-80, Appendix D). NR habitat acres are approximate values based on 2006 (OR/WA) and 2007 (CA) satellite imagery.
[4]Estimated NRF habitat removed or downgraded from land management (timber sales) or natural events (wildfires) as documented through section 7 consultations or technical assistance. Effects reported here include all acres removed or downgraded from 2006 to present. Effects in California reported here only include effects to Nesting/Roosting habitat. Foraging habitat that is independent of Nesting/Roosting habitat but is removed or downgraded in California is not summarized in this table.
[5]Reserve land use allocations under the NWFP intended to provide demographic support for spotted owls include LSR, MLSA, and CRA. Non-reserve allocations under the NWFP intended to provide dispersal connectivity between reserves include AWA, AMA, and MX.

Habitat loss from Federal lands since 2006/2007 due to land management activities and natural events has varied among the individual provinces with most of the impacts concentrated within the 'Non-Reserves' land-use allocations relative to the 'Reserve' land-use allocations (Table 2). When habitat loss is evaluated as a proportion of the affected acres range-wide, the most pronounced losses have occurred within Oregon (55.1 percent; especially within its Cascades West [22.15 percent] and Cascades East [18.41 percent] provinces; Table 2), followed by California (37.5 percent; with nearly all [36.8 percent] from the Klamath Province; Table 2). In contrast, much smaller habitat losses have occurred in Washington (7.3 percent; Table 2). When habitat loss is evaluated as a proportion of provincial baselines, the Oregon Cascades East (5.33 percent), and the California Klamath (2.85 percent) provinces have proportional losses greater than the loss of habitat across all provinces (1.28 percent; Table 2).

Of the total Federal acres consulted on for 'Habitat Removed/Downgraded' in Table 2, approximately 52,697 acres (0.6 percent) of 8.55 million acres of northern spotted owl habitat were removed/downgraded as a result of land management activities. Of these activities 46,730 acres were a result of timber harvest (Table 3). Table 2 also estimates northern spotted owl habitat lost due to 'Natural Events' (e.g., wildfires, wind throw, disease) at 54,460 acres range-wide, with the California Klamath province contributing the majority (39,481 acres or 72 percent) of habitat lost, followed by the Oregon Cascades East province (9,620 acres or 18 percent).

Table 3. Summary of northern spotted owl suitable habitat (NRF)[1] acres removed or downgraded on Federal lands within the Northwest Forest Plan area through timber harvest, natural disturbance, or other management actions as documented through section 7 consultation and technical assistance. Range-wide changes by land-use function from 2006 to September 11, 2014.

Suitable Habitat (NRF) Effects	Reserves LSR, MLSA, CRA[3]	Non-reserves AWA, AMA, Matrix[3]	Totals
Evaluation Baseline (2006/2007)[2]	5,961,000	2,594,200	8,555,200
Removed/Downgraded (timber harvest only)[4]	8,100	38,630	46,730
Removed/Downgraded (other management activities)[5]	3,406	2,561	5,967
Subtotal	11,506	41,191	52,697
Removed/Downgraded (natural disturbance)[6]	30,066	26,394	56,460
Total net change	41,572	67,585	109,157
Baseline balance	**5,919,428**	**2,526,615**	**8,446,043**
Habitat Maintained[7]	37,609	62,859	100,468

[1]Nesting, roosting, foraging (NRF) habitat. In WA/OR, the values for Nesting/Roosting habitat generally represent the distribution of suitable owl habitat, including foraging habitat. In CA, foraging habitat occurs in a much broader range of forest types than what is represented by nesting/roosting habitat. Baseline information for foraging habitat as a separate category in CA is currently not available at a provincial scale. Effects to spotted owl habitat in California reported here include effects to Nesting/Roosting habitat only. Foraging habitat removed or downgraded in California is not summarized in this table; California consultations use locally derived information to assess effects to foraging only.

[2]Spotted owl nesting and roosting habitat on all Federal lands (includes USFS, BLM, NPS, DoD, Service, etc.) as reported by Davis et al. 2011 for the Northwest Forest Plan 15-Year Monitoring Report (PNW-GTR-80, Appendix D). NR habitat acres are approximate values based on 2006 (OR/WA) and 2007 (CA) imagery.

[3]Reserve land use allocations under the NWFP intended to provide demographic support for spotted owls include LSR, MLSA, and CRA. Non-reserve allocations under the NWFP intended to provide dispersal connectivity between reserves include AWA, AMA, and MX.

[4]NRF habitat removed or downgraded from timber harvest on Federal lands.

[5]NRF habitat removed or downgraded from recreation, roads, minerals, or other non-timber programs.

[6]NRF habitat losses resulting from wildfires, insect and disease, windthrow or other natural causes.

[7]Habitat maintained means that stands have been modified by management, but the habitat function remains the same.

1.5.1.5. *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 and others (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. In the greater than 30 inch dbh size class, the net area increased by only an estimated 102,000 to 127,000 acres (Moeur et al. 2005). 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 northern spotted owl habitat, the significance of these acres to northern spotted owl conservation remains unknown.

In 2011, Davis et al. produced the second in a series of monitoring reports on northern spotted owl population and habitat trends on Northwest Forest Plan administered lands. They summarized demographic analyses from Forsman et al. (2011) discussed below under trends in numbers, distribution and reproduction, and reported on a new effort using remotely sensed data from 1994 to 2007 to develop "habitat suitability" models, and ultimately suitable habitat maps for the entire range of the northern spotted owl for each of these time periods. They also created change-detection maps and reported on the cause of habitat change during this time period. The authors suggest that because of improvements in remotely sensed vegetation, and change-detection mapping, their habitat maps represent the best available information and should replace the baseline versions used for the first monitoring report. Davis et al. (2011) estimated 8.9 million acres of suitable habitat for the 1994 baseline map, as compared to 7.4 million acres estimated by FEMAT in 1994, and 10.3 million acres estimated by Davis and Lint (2005) for the 10-year report.

Davis et al. (2011) were not able to report on gains in nesting/roosting habitat suitability due to issues with current technology, and the need for additional time to capture the slow process of forest succession. However, they were able to report on gains in recruitment of younger forests or dispersal habitat. They estimated a gain of about 1.26 million ac of dispersal habitat, with the greatest increases in non-reserves than reserves. The largest increase in dispersal habitat was in the Oregon Coast Range province.

Davis et al. (2011) estimated that nesting/roosting habitat declined by 3.4 percent (298,600 ac) rangewide on federal lands since 1994, which is less than the anticipated rate of habitat loss under the NWFP of 5 percent per decade. Most of the loss (79 percent) occurred within reserves and was the result of wildfires. Wildfires also were responsible for about half of the loss in non-reserves. Timber harvest accounted for about 45 percent (37,400 ac) in non-reserves, and 7 percent (16,000 ac) in reserves. The Oregon Klamath province lost the most nesting/roosting habitat (93,730 ac) due to the Biscuit Fire in 2002. They estimated a rangewide loss of about 417,000 ac of dispersal habitat, but like nesting/roosting habitat, most of the loss of dispersal habitat was due to wildfire.

Davis et al. (2011) created a wildfire suitability (likelihood) map for large fires throughout the range of the northern spotted owl. Their goal was to identify landscape-scale areas where large wildfires are more probable. They report that the California Klamath province has the most owl habitat in fire-prone landscapes, followed by the Oregon Western Cascades and Oregon Klamath provinces.

1.5.2. Spotted Owl Population Trends and Distribution

There are no estimates of the historical population size and distribution of spotted owls, although they are believed to have inhabited most old-growth forests throughout the Pacific Northwest prior to modern settlement (mid-1800s), including northwestern California (Service 1989, pp. 2-17).

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 1990a, p. 26114). 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 (Service 1992a, p. 31). 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, p. 9495). The actual number of currently occupied spotted owl locations across the range is unknown because many areas remain unsurveyed (Service 2011b, p. A-2). In addition, many historical sites are no longer 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 above 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; Anthony et al. 2006; Burnham et al. 1994; Forsman et al. 2011; Forsman et al. 1996) to estimate trends in the populations of the spotted owl.

In January 2009, two meta-analyses modeled rates of population change for up to 24 years using the re-parameterized Jolly-Seber method (λ_{RJS}). One meta-analysis modeled the 11 long-term study areas (Table 4), while the other modeled the eight study areas that are part of the effectiveness monitoring program of the NWFP (Forsman et al. 2011, pp. 65-67).

Table 4. Summary of spotted owl population trends from in demographic study areas (Forsman et al. 2011, p. 65).

Study Area	Fecundity	Apparent Survival[1]	λ_{RJS}	Population change[2]
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	0.996	Stationary
Klamath	Declining	Stable	0.990	Stationary
Southern Cascades	Declining	Declining since 2000	0.982	Stationary
NW California	Declining	Declining	0.983	Declining
Hoopa	Stable	Declining since 2004	0.989	Stationary
Green Diamond	Declining	Declining	0.972	Declining

[1]Apparent survival calculations are based on model average.
[2]Population trends are based on estimates of realized population change.

Point estimates of λ_{RJS} 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. 2011, p. 65), 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.

The weighted mean λ_{RJS} 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, p. 23), but the rates are not 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. (2011, p. 65). Forsman et al. (2011, p. 65) 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 λ_{RJS} for the eight demographic monitoring areas (Cle Elum, Olympic, Coast Range, HJ Andrews, Tyee, Klamath, Southern Cascades 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 (Forsman et al. 2011, p. 67). 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.

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. 2011, p. 66). 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 (Forsman et al. 2011, p. 66).

Decreases in adult apparent survival rates were an important factor contributing to decreasing population trends. Forsman et al. (2011, pp. 65-66) 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. 2011, p. 66). 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. (2011, p. 64) express concern for the decline in adult survival rates 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, p. v) suggested immediate action was required to improve the likelihood of recovering the spotted owl population in British Columbia. In 2007, personnel in British Columbia captured and brought into captivity the remaining 16 known wild spotted owls (Service 2011b, p. A-6). Prior to initiating the captive-breeding program, the population of spotted owls in Canada was declining by as much as 10.4 percent per year (Chutter et al. 2004, p. v). The amount of previous interaction between spotted owls in Canada and the United States is unknown.

1.5.3. Spotted Owl Recovery Units

The 2011 Final Revised Recovery Plan for the Northern Spotted Owl determined that the 12 existing physiographic provinces meet the criteria for use as recovery units (USDI FWS 2011b, p. III 1-2). The proposed project is within the Eastern Oregon Cascades Physiographic Province. Recovery criteria, as described in the 2011 Final Revised Recovery Plan (p. 11-3), are measurable and achievable goals that are believed to result through implementation of the recovery actions described in the recovery plan. Achievement of the recovery criteria will take time and are intended to be measured over the life of the plan, not on a short-term basis. The criteria are the same for all 12 identified recovery units. The four recovery criteria are: 1) stable population trend, 2) adequate population distribution, 3) continued maintenance and recruitment of northern spotted owl habitat, and 4) post-delisting monitoring (USDI FWS 2011b, p III-3).

The California Klamath physiographic province and recovery unit covers approximately six million acres and extends from the Oregon-California border south to the Clear Lake Basin within the Northern California Coast Ranges. Since 2006/2007, there has been a 40,202-acre (2.85 percent) reduction in the amount of habitat within the California Klamath physiographic province and recovery unit (Table 2). Of the 40,202-acre reduction in habitat, 39,481 acres were associated with natural events and 721 acres were associated with actions on NWFP lands.

As discussed in Section 3.5.1, demographic data are used to evaluate trends in northern spotted owl populations. Annual reports from two of these study areas represent the best source of information on population trends that may be occurring in the recovery unit and action area. The Southern Oregon Cascades Demographic Study Area (DSA) is located approximately 170 miles to the north of the Smokey Fuels Reduction Project action area boundary and includes portions of the Rogue River-Siskiyou, Fremont-Winema, and Umpqua National Forests. The Willow Creek and Regional Study Areas are located approximately 85 miles to the northwest of the action area boundary and includes portions of the Six Rivers, Klamath, and Shasta-Trinity National Forests, and lands managed by the Bureau of Land Management.

Southern Oregon Cascades Demographic Study Area

The fiscal year 2012 report from the Southern Oregon Cascades DSA was completed in December of 2012 (Dugger et al. 2012). In 2012, 42 percent of the 170 territories monitored were occupied, which is a 3.5 percent increase from 2011; however, the number of pairs located was the lowest recorded during the study period (Dugger et al. 2012, p. 4). Of the 44 owl pairs detected in 2012, 15 pairs nested and produced an average of 1.46 young per successful pair, which is similar to the average for all years (1.60) of the study (Dugger et al. 2012, p. 6). In 2012, the average number of young fledged per pair (0.5) was less than the average for all years of the study (0.67; Dugger et al. 2012, p. 6).

Willow Creek and Regional Study Areas

The calendar year 2012 report from the Willow Creek and Regional Study Areas was completed in March of 2013 (Franklin et al. 2013). In 2012, 37.2 percent of the 94 territories monitored were occupied, which is a 6.6 percent decrease from 2011; the number of pairs detected also dropped from 32 in 2011 to 27 in 2012 (Franklin et al. 2013, pp. 6, 16; Franklin et al. 2012, pp. 6, 16). Of the 27 owl pairs detected in 2012, 19 pairs nested and 4 of those pairs were monitored for reproductive success with an average of 2.0 young produced, which is above the average for

all years (1.58) of the study (Franklin et al. 2013, pp. 19-21). In 2012, the average number of young fledged per pair (0.35) was less than the average for all years of the study (0.58; Franklin et al. 2013, pp. 20-21).

LITERATURE CITED

Andersen, D. E., O.J. Rongstad, and W. R. Mytton. 1989. Response of nesting red-tailed hawks to helicopter overflights. The Condor 91:296-299.

Anderson, D.R. and K.P. Burnham. 1992. Demographic analysis of northern spotted owl populations. Pages 66-75 *in* Draft final recovery plan for the northern spotted owl: Appendix C. USDI Fish and Wildlife Service, Portland, Oregon.

Anthony, R.G., E.D. Forsman, A.B. Franklin, D.R. Anderson, K.P. Burnham, G.C.White, C.J. Schwarz, J. Nichols, J.E. Hines, G.S. Olson, S.H. Ackers, S. Andrews, B.L. Biswell, P.C. Carlson, L.V. Diller, K.M. Dugger, K.E. Fehring, T.L. Fleming, R.P. Gerhardt, S.A. Gremel, R.J. Gutiérrez, P.J. Happe, D.R. Herter, J.M. Higley, R.B. Horn, L.L. Irwin, P.J. Loschl, J.A. Reid, and S.G. Sovern. 2006. Status and trends in demography of northern spotted owls, 1985-2003. Status and trends in demography of northern spotted owls, 1985–2003. Wildlife Monograph No. 163.

Anthony, R.G., and L.S. Andrews. 2004. Summary Report – Winter habitat use by spotted owls on USDI Bureau of Land Management Medford District Lands within the boundaries of the Timbered Rock Fire. Unpublished report, OCWRU, OSU, Corvallis, Oregon.

Anthony, R., S. Andrews, L. Friar , T. O'Brien, T. Phillips, D. Strejc, and F. Wagner, 2008. Demographic Characteristics and Ecology of Spotted Owls (*Strix occidentalis caurina*) in the Southern Oregon Cascades. Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon. Unpublished Report.

Bailey, L.L., J.A. Reid, E.D. Forsman, and J.D. Nichols. 2009. Modeling co-occurrence of northern spotted and barred owls: accounting for detection probability differences. Biological Conservation. 142: 2983-2989.

Barrowclough, G.F. and R. J. Gutiérrez. 1990. Genetic variation and differentiation in the spotted owl. Auk 107:737-744.

Barrowclough, G.F., R.J. Gutiérrez, and J.G. Groth. 1999. Phylogeography of spotted owl (*Strix occidentalis*) populations based on mitochondrial DNA sequences; gene flow, genetic structure, and a novel biogeographic pattern. Evolution 53(3):919-931.

Barrowclough, G.F., J.G. Groth, and R.J. Gutiérrez. 2005. Genetic structure, introgression and a narrow hybrid zone between northern and California spotted owls (*Strix occidentalis*). Molecular Ecology 14:1109–1120.

Barrows, C.W., and K. Barrows. 1978. Roost characteristics and behavioral thermoregulation in the spotted owl. Western Birds 9:1-8.

Barrows, C.W. 1981. Roost selection by Spotted Owls: an adaptation to heat stress. Condor 83: 302-309.

Bart, J. 1995. Amount of suitable habitat and viability of northern spotted owls. Conservation Biology 9 (4):943-946.

Bart, J., and E.D. Forsman. 1992. Dependence of northern spotted owls *Strix occidentalis caurina* on old-growth forests in the western USA. Biological Conservation 62:95-100.

Bigley, R. and J. Franklin. 2004. Habitat trends. In: Courtney, S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutiérrez, J.M. Marzluff, L. Sztukowski. 2004. Scientific evaluation of the status of the northern spotted owl. Sustainable Ecosystems Institute. Portland, Oregon. September 2004.

Bingham, B.B, and B.R. Noon. 1997. Mitigation of habitat "take": application to habitat conservation planning. Conservation Biology. 11(1): 127-139.

Blakesley, J.A., D.R. Anderson, and B.R. Noon. 2006. Breeding dispersal in the California spotted owl. The Condor. 108(1): 71-81.

Bond, M.L., R.J. Gutierrez, A.B. Franklin, W.S. LaHaye, C.A. May, and M.E. Seamans. 2002. Short-term effects of wildfires on spotted owl survival, site fidelity, mate fidelity, and reproductive success. Wildlife Society Bulletin 30(4):1022-1028.

Bond, M.L., D.E. Lee, R.B. Siegel, and J.P. Ward, Jr. 2009. Habitat use and selection by spotted owls in a postfire landscape. Journal of Wildlife Management 73(7):1116-1124.

Buchanan, J.B. 2004. Managing habitat for dispersing northern spotted owls - are the current management strategies adequate? Wildlife Society Bulletin 32:1333–1345.

Buchanan, J., E. Hanson, D. Hays, and L.Young. 1994. An evaluation of the Washington Forest Practices Board Wildlife Committee preferred alternative for a spotted owl protection rule. Washington Forest Practices Board Spotted Owl Scientific Advisory Group. Olympia, Washington.

Buchanan, J.B., L.L. Irwin, and E.L. McCutchen. 1995. Within-stand nest site selection by spotted owls in the eastern Washington Cascades. Journal of Wildlife Management 59:301-310.

Buchanan, J.B. and P. Swedeen. 2005. Final briefing report to the Washington State Forest Practices Board regarding spotted owl status and forest practices rules. Washington Department of Fish and Wildlife, Olympia. 84 pp.

Burnham, K.P., D.R. Anderson, and G.C. White. 1994. Estimation of vital rates of the northern spotted owl. Colorado Cooperative Fish and Wildlife Research Unit, Colorado State University, Fort Collins, Colorado, USA.

Caffrey, C. 2003. Determining impacts of West Nile Virus on crows and other birds. American Birds (103rd Count) 57:14-21.

Caffrey, C. and C.C. Peterson. 2003. West Nile Virus may not be a conservation issue in northeastern United States. American Birds (103rd Count) 57:14-21.

California Department of Forestry and Fire Protection. 2007. California Forest Practices Rules: 2001. Title 14, California Code of Regulations, Chapters 4, 4.5, and 10. Sacramento, California.

Campbell, N. A. 1990. Biology. The Benjamin/Cummings Publishing Company, Inc. Redwood City, California.

Carey, A.B., J.A. Reid, and S.P. Horton. 1990. Spotted owl home range and habitat use in southern Oregon coast ranges. Journal of Wildlife Management 54:11–17.

Carey, A. B., S.P. Horton, and B.L. Biswell. 1992. Northern spotted owls: influence of prey base and landscape character. Ecological Monographs 62(2):223-250.

Carey, A.B. and K.C. Peeler. 1995. Spotted owls: resource and space use in mosaic landscapes. Journal of Raptor Research 29(4):223-239.

Carsia, R. V., and S. Harvey. 2000. Adrenals. Chapter 19 *in* G. C. Whittow, editor. Sturkie's Avian Physiology. Academic Press, San Diego, CA.

Chi, T., A. Henke, J. Smith, and C. Brinegar. 2004. Spotted owl mitochondrial DNA haplotyping. San Jose State University. Unpublished results submitted to U.S. Fish and Wildlife Service.

Chutter, M.J., I. Blackburn, D. Bonin, J. Buchanan, B. Costanzo, D. Cunnington, A. Harestad, T. Hayes, D. Heppner, L. Kiss, J. Surgenor, W. Wall, L. Waterhouse, and L. Williams. 2004. Recovery strategy for the northern spotted owl (*Strix occidentalis caurina*) in British Columbia. British Columbia Ministry of Environment, Victoria. 74 pp.

Courtney, S.P. and R.J. Gutiérrez. 2004. Scientific evaluation of the status of the northern spotted owl – threats. In: Courtney, S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutiérrez, J.M. Marzluff, L. Sztukowski. 2004. Scientific evaluation of the status of the northern spotted owl. Sustainable Ecosystems Institute. Portland, Oregon. September 2004.

Courtney, S.P., J.A. Blakesley, R.E. Bigley, M.L. Cody, J.P. Dumbacher, R.C. Fleischer, A.B. Franklin, J.F. Franklin, R.J. Gutiérrez, J.M. Marzluff, L. Sztukowski. 2004. Scientific evaluation of the status of the northern spotted owl. Sustainable Ecosystems Institute. Portland, Oregon. September 2004.

Crozier, M.L., M.E. Seamans, R.J. Gutiérrez, P.J. Loschl, R.B. Horn, S.G. Sovern, and E.D. Forsman. 2006. Does the presence of barred owls suppress the calling behavior or spotted owls? The Condor. 108: 760-769.

Dark, S.J., R.J. Gutiérrez, and G.I. Gould, Jr. 1998. The barred owl (*Strix varia*) invasion in California. The Auk. 115(1): 50-56.

Davidson, J.M., A.C. Wickland, H.A. Patterson, K.R. Falk, and D.M. Rizzo. 2005. Transmission of *Phytophthora ramorum* in mixed-evergreen forest in California. Ecology and Epidemiology. 95(5)587-596.

Davis, R. and J. Lint. 2005. Habitat status and trend. In: Lint, J., tech. coord. Northwest Forest Plan—the first 10 years (1994–2003): status and trends of northern spotted owl populations and habitat. Gen. Tech. Rep. PNW-GTR-648. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 21–82.

Davis, R. J., K. M. Dugger, S. Mohoric, L. Evers, and W. C. Aney. 2011. Northwest Forest Plan—the first 15 years (1994–2008): status and trends of northern spotted owl populations and habitats. Gen. Tech. Rep. PNWGTR-850. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Delaney, D. K., T. G. Grubb, P. Beier, L. L. Pater, and M. H. Reiser. 1999. Effects of helicopter noise on Mexican spotted owls. Journal of Wildlife Management 63:60-76.

Deubel, V., L. Fiette, P. Gounon, M.T. Drouet, H. Khun, M. Huerre, C. Banet, M. Malkinson, and P. Despres. 2001. Variations in biological features of West Nile viruses. Annals of the New York Academy of Sciences 951:195-206.

Diller, L.V. and D.M. Thome. 1999. Population density of northern spotted owls in managed young-growth forests in coastal northern California. Journal of Raptor Research 33: 275–286.

Dugger, K.M., F. Wagner, R.G. Anthony, and G.S. Olson. 2005. The relationship between habitat characteristics and demographic performance of northern spotted owls in southern Oregon. The Condor 107:863-878.

Dugger, K.M., R.G. Anthony, L.S. Andrews. 2011. Transient dynamics of invasive competition: barred owls, spotted owls, habitat, and the demons of competition present. Ecological Applications. 21(7): 2459-2468.

Dugger, K. M., Andrews, S., Fleigel, E., Friar, L., and F. Wagner, 2012. Demographic Characteristics and Ecology of Spotted Owls (*Strix occidentalis caurina*) in the Southern Oregon Cascades. Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon. Unpublished Report.

Dunbar, D.L., B.P. Booth, E.D. Forsman, A.E. Hetherington, and D.J. Wilson. 1991. Status of the spotted owl, *Strix occidentalis*, and barred owl, *Strix varia*, in southwestern British Columbia. Canadian Field Naturalist 105:464-468.

Fitzgerald, S.D., J.S. Patterson, M. Kiupel, H.A. Simmons, S.D. Grimes, C.F. Sarver, R.M. Fulton, B.A. Fulton, B.A. Steficek, T.M. Cooley, J.P. Massey, and J.G. Sikarskie. 2003. Clinical and pathological features of West Nile Virus infection in native North American owls (family *Strigidae*). Avian Diseases 47:602-610.

Folliard, L. 1993. Nest site characteristics of northern spotted owls in managed forest of northwest California. M.S. Thesis. University of Idaho, Moscow, Idaho.

Forsman, E.D. 1975. A preliminary investigation of the spotted owl in Oregon. M.S. thesis, Oregon State University, Corvallis. 127 pp.

Forsman, E.D. 1981. Molt of the spotted owl. Auk 98:735-742

Forsman, E.D., E.C. Meslow, and H.M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. Wildlife Monographs 87:1-64.

Forsman, E.D., S. DeStefano, M.G. Raphael, and R.J. Gutierrez, (editors). 1996. Demography of the northern spotted owl. Studies in Avian Biology No. 17. Cooper Ornithology Society.

Forsman, E.D., I.A. Otto, S.G. Sovern, M. Taylor, D.W. Hays, H. Allen, S.L. Roberts, and D.E. Seaman. 2001. Spatial and temporal variation in diets of spotted owls in Washington. Journal of Raptor Research 35(2):141-150.

Forsman, E.D., R.G. Anthony, J.A. Reid, P.J. Loschl, S.G. Sovern, M. Taylor, B.L. Biswell, A. Ellingson, E.C. Meslow, G.S. Miller, K.A. Swindle, J.A. Thrailkill, F.F. Wagner, and D. E. Seaman. 2002. Natal and breeding dispersal of northern spotted owls. Wildlife Monographs 149:1-35.

Forsman, E.D., R.G. Anthony, E.C. Meslow, and C.J. Zabel. 2004. Diets and foraging behavior of northern spotted owls in Oregon. Journal of Raptor Research 38(3):214-230.

Forsman, E.D., T.J. Kaminski, J.C. Lewis, K.J. Maurice, S.G. Sovern, C. Ferland, and E.M. Glenn. 2005. Home range and habitat use of northern spotted owls on the Olympic Peninsula, Washington. Journal of Raptor Research 39(4):365-377.

Forsman, E. D., R. G. Anthony, K. M. Dugger, E. M. Glenn, A. B. Franklin, G. C. White, C. J. Schwarz, K. P. Burnham, D. R. Anderson, J. D. Nichols, J. E. Hines, J. B. Lint, R. J. Davis, S. H. Ackers, L. S. Andrews, B. L. Biswell, P. C. Carlson, L. V. Diller, S. A. Gremel, D. R. Herter, J. M. Higley, R. B. Horn, J. A. Reid, J. Rockweit, J. Schaberl, T. J. Snetsinger, and S. G. Sovern. 2011. Population demography of northern spotted owls: 1985–2008. Studies in Avian Biology, Monograph No. XX, 2011. Cooper Ornithological Society.

Franklin, A.B. 1992. Population regulation in northern spotted owls: theoretical implications for management. Pp 815-827 in D. R. McCullough and R. H. Barrett (eds.)., Wildlife 2001: populations. Elsevier Applied Sciences, London, England.

Franklin, A.B., K.P. Burnham, G.C. White, R.J. Anthony, E.D. Forsman, C. Sanchez, J.D. Nicols and J. Hines. 1999. Range-wide status and trends in northern spotted owl populations. Colorado Coop. Fish and Wildl. Res. Unit, Fort Collins, Colorado and Oregon Coop. Fish and Wildl. Res. Unit, Corvallis, Oregon. Unpublished report.

Franklin, A.B., D.R. Anderson, R.J. Gutiérrez, and K.P. Burnham. 2000. Climate, habitat quality, and fitness in northern spotted owl populations in northwestern California. Ecological Monographs, 70(4): 539-590.

Funk, W.C., E.D. Forsman, T.D. Mullins, and S.M. Haig. 2008. Introregression and dispersal among spotted owl (Strix occidentalis) subspecies. Evolutionary Applications. 1: 161-171.

Gaines, W.L., R.A. Strand, and S.D. Piper. 1997. Effects of the Hatchery Complex Fires on northern spotted owls in the eastern Washington Cascades. Pages 123-129 in Dr. J.M. Greenlee, ed. Proceedings of the First Conference on Fire Effects on Rare and Endangered Species and Habitats, November 13-16, 1995. International Association of Wildland Fire. Coeur d'Alene, ID.

Garmendia, A.E., H.J. Van Kruiningen, R.A. French, J.F. Anderson, T.G. Andreadis, A. Kumar, and A.B. West. 2000. Recovery and identification of West Nile virus from a hawk in winter. Journal of Clinical Microbiology 38:3110-3111.

Glenn, E.M, M.C. Hansen, and R.G. Anthony. 2004. Spotted owl home-range and habitat use in young forests of western Oregon. Journal of Wildlife Management 68(1):33-50.

Glenn, E.M., R.G. Anthony, and E.D. Forsman. 2010. Population trends in northern spotted owls: associations with climate in the Pacific Northwest. Biological Conservation. 143(11): 2543-2552.

Glenn, E. M., R. Anthony, E. Forsman, and G. Olson. 2011. Reproduction of northern spotted owls: the role of local weather and regional climate. Journal of Wildlife Management 75(6):1279-1294.

Goheen, E.M., E.M. Hansen, A. Kanaskie, M.G. Williams, N. Oserbauer, and W. Sutton. 2002. Sudden oak death caused by *Phytophthora ramorum* in Oregon. Plant Disease 86:441.

Gremel, S. 2005. Factors controlling distribution and demography of northern spotted owls in a reserved landscape. M.S. thesis, University of Washington, Seattle.

Gutiérrez, R.J. 1989. Hematozoa from the spotted owl. Journal of Wildlife Diseases 24:614–618.

Gutiérrez, R.J. 1996. Biology and distribution of the northern spotted owl. Pages 2-5 in E.D. Forsman et al., editors. Demography of the northern spotted owl. Studies in Avian Biology No. 17. Cooper Ornithological Society.

Gutiérrez, R.J., A.B. Franklin, and W.S. LaHaye. 1995. Spotted owl (*Strix occidentalis*) *in*: A. Poole and F. Gill, editors. The birds of North America, No. 179. The Academy of Natural Sciences and The American Ornithologists' Union, Washington, D.C.

Gutiérrez, R. J., M. Cody, S. Courtney, and A. Franklin. 2007. The Invasion of Barred Owls and its Potential Effect on the Spotted Owl: a Conservation Conundrum. Biological Invasions 9:181-196.

Haig, S.M., R.S. Wagner, E.D. Forsman, E.D., and T.D. Mullins. 2001. Geographic variation and genetic structure in spotted owls. Conservation Genetics 2(1):25-40.

Haig, S.M., T.D. Mullins, E.D. Forsman, P. Trail, and L. Wennerberg. 2004. Genetic identification of spotted owls, barred owls, and their hybrids: legal implications of hybrid identity. Conservation Biology 18:1347-1357.

Hamer, T.E., S.G. Seim, and K.R. Dixon. 1989. Northern spotted owl and northern barred owl habitat use and home range size in Washington: preliminary report. Washington Department of Wildlife, Olympia, Washington.

Hamer, T.E., E.D. Forsman, A.D. Fuchs, and M.L. Walters. 1994. Hybridization between barred and spotted owls. Auk 111(2):487-492.

Hamer, T.E., D.L. Hays, C.M. Senger, and E.D. Forsman. 2001. Diets of northern barred owls and northern spotted owls in an area of sympatry. Journal of Raptor Research 35(3):221-227.

Hanson, E., D. Hays, L. Hicks, L. Young, and J. Buchanan. 1993. Spotted Owl Habitat in Washington: A Report to the Washington Forest Practices Board. Washington Forest Practices Board, Spotted owl Advisory Group. Final Report: December 20, 1993. Olympia, Washington. 116 pages.

Harestad, A., J. Hobbs, and I. Blackburn. 2004. Précis of the Northern Spotted Owl in British Columbia. Pages. 12-14 *in* Zimmerman, K., K. Welstead, E. Williams, J. Turner, (editors). Northern Spotted Owl Workshop Proceedings. Forrex Series (online No. 14), Vancouver, British Columbia, Canada.

Henke, A.L., T.Y. Chi, J. Smith, C. Brinegar. *Unpublished Draft*. Microsatellite Analysis of Northern and California Spotted Owls in California. Conservation Genetics Laboratory, Department of Biological Sciences, San Jose State University, San Jose, California.

Hershey, K.T., E.C. Meslow, and F.L. Ramsey. 1998. Characteristics of forests at spotted owl nest sites in the Pacific Northwest. Journal of Wildlife Management 62(4):1398-1410.

Herter, D.R., and L.L. Hicks. 2000. Barred owl and spotted owl populations and habitat in the central Cascade Range of Washington. Journal of Raptor Research 34(4): 279-286.

Herter, D.R., L.L. Hicks, H.C. Stabins, J.J. Millspaugh, A.J. Stabins, and L.D. Melampy. 2002. Roost site characteristics of northern spotted owls in the nonbreeding season in central Washington. Forest Science 48(2):437-446.

Hoberg, E.P., G.S. Miller, E. Wallner-Pendleton, and O.R. Hedstrom. 1989. Helminth parasites of northern spotted owls (*Strix occidentalis caurina*). Journal of Wildlife Diseases 25:246–251

Irwin, L.L., D.F. Rock, and G.P. Miller. 2000. Stand structures used by northern spotted owls in managed forests. Journal of Raptor Research 34(3):175-186.

Irwin, L., D. Rock, and S. Rock. 2010. Spotted owl and barred owl resource selection in southwestern Washington, Progress Report, February 2010. Unpublished Report.

Iverson, W.F. 1993. Is the barred owl displacing the spotted owl in western Washington? M.S. Thesis, Western Washington University, Bellingham, Washington.

Iverson, W.F. 2004. Reproductive success of spotted owls sympatric with barred owls in western Washington. Journal of Raptor Research 38(1):88-91.

Johnson, K. N., J. F. Franklin, J. W. Thomas, and J. Gordon. 1991. Alternatives for management of late successional forests of the Pacific Northwest. A report to the Agriculture and Merchant and Marine Fisheries Committees of the U.S. House of Representative. Scientific Panel on Late Successional Forest Ecosystems, Washington, D.C.

Johnson, D.H. 1992. Spotted owls, great horned owls, and forest fragmentation in the central Oregon Cascades. M.S. Thesis, Oregon State University, Corvallis, Oregon.

Kelly, E.G. 2001. The Range Expansion of the Northern Barred Owl: An Evaluation of the Impact on Spotted Owls. M.S. Thesis. Oregon State University, Corvallis, Oregon. 92 pp.

Kelly, E.G., E.D. Forsman, and R.G. Anthony. 2003. Are barred owls replacing spotted owls? The Condor 105:45-53.

Kelly, E.G. and E.D. Forsman. 2004. Recent records of hybridization between barred owls (*Strix varia*) and northern spotted owls (*S. occidentalis caurina*). Auk 121:806-810.

King, G.M., K.R. Bevis, M.A. Rowe, E.E. Hanson. 1998. Spotted owls use of habitat impacted by 1994 fires on the Yakama Indian Reservation: three years post fire. Unpub. report.

Knight, R.L., and S.K. Skagen. 1998. Effects of recreational disturbance on birds of prey: a review. Pages 355-359 in R.L. Glinski et al., editors. Proceedings of the Southwest Raptor Management Symposium and Workshop, National Wildlife Federation, Washington, D.C.

Komar, N., N.A. Panella, J.E. Burns, S.W. Dusza, T.M. Mascarenhas, and T.O. Talbot. 2001. Serologic evidence for West Nile virus infection in birds in the New York City vicinity during an outbreak in 1999. Emerging Infectious Diseases 7(4):621-5.

LaHaye, W.S., R.J. Guiterrez, and J.R. Dunk. 2001. Natal dispersion of the spotted owl in southern California: dispersal profile of an insular population. The Condor 103:691-700.

Laidig, K.J., and D.S. Dobkin. 1995. Spatial overlap and habitat association of Barred Owls and Great Horned Owls in southern New Jersey. Journal of Raptor Research 29:151–157.

Layman, S.A. 1991. Diurnal foraging by spotted owls. Wilson Bulletin. 103(1): 138-140.

Leskiw, T., and R.J. Gutiérrez. 1998. Possible predation of a spotted owl by a barred owl. Western Birds 29:225–226.

Littell, J. S., E. E. Oneil, D. McKenzie, J. A. Hicke, J. A. Lutz, R. A. Norheim, and M. M. Elsner. 2010. Forest ecosystems, disturbance, and climatic change in Washington State, USA. Climatic Change.

Lint, J., technical coordinator. 2005. Northwest Forest Plan – the first 10 years (1994-2003): status and trends of northern spotted owl populations and habitat. PNW-GTR-648, USDA Forest Service, Pacific Northwest Research Station, Portland, Oregon.

Livezey, K.B. 2005. Iverson (2004) on spotted owls and barred owls: comments on methods and conclusions. Journal of Raptor Research 39(1):102-103.

Livezey, K.B. and T.L. Fleming. 2007. Effects of barred owls on spotted owls: the need for more than incidental detections and correlational analyses. Journal of Raptor Research. 41(4): 319-325.

Marra, P.P., S. Griffing, C. Caffrey, A.M. Kilpatrick, R. McLean, C. Brand, E. Saito, A.P. Dupuis, L. Kramer, and R. Novak. 2004. West Nile Virus and wildlife. BioScience 54(5):393-402.

McGarigal, K., R.G. Anthony, and F.B. Issacs. 1991. Interactions of humans and bald eagles on the Columbia River estuary. Wildlife Monographs 115:1-47.

McLean, R.G., S.R. Ubico, S.E. Docherty, W.R. Hansen, L. Sileo, and T.S. McNamara. 2001. West Nile Virus and transmission and ecology in birds. Annals of the New York Academy of Sciences 951:54-57.

Meyer, J.S., L.L. Irwin, and M.S. Boyce. 1998. Influence of habitat abundance and fragmentation on northern spotted owls in western Oregon. Wildlife Monographs 139: 1-51.

Miller, G.S., S.K. Nelson, and W.C. Wright. 1985. Two-year-old female spotted owl breeds successfully. Western Birds 16:69-73.

Miller, G.S. 1989. Dispersal of juvenile spotted owls in western Oregon. M.S. Thesis. Oregon State University, Corvallis, Oregon.

Miller, G.S., R.J. Small, and E.C. Meslow. 1997. Habitat selection by spotted owls during natal dispersal in western Oregon. Journal of Wildlife Management 61(1):140-150.

Moen, C.A., A.B. Franklin, and R.J. Gutiérrez. 1991. Age determination of subadult northern spotted owls in northwest California. Wildlife Society Bulletin 19:489-493

Moeur, M., T.A. Spies, M. Henstrom, J.R. Martin, J. Alegria, J. Browning, J. Cissel, W.B. Cohen, T.E. Demeo, S. Healey, R. Warbington. 2005. Northwest Forest Plan–The first 10 years (1994-2003): status and trend of late-successional and old-growth forest. Gen. Tech. Rep. PNW-GTR-646. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 142 p.

Mote P.W. and E.P. Salathé. 2010. Future climate in the Pacific Northwest, Chap 1. In: The Washington climate change impacts assessment: evaluating Washington's future in a changing climate, climate impacts group. University of Washington, Seattle.

Noon, B.R. and J.A. Blakesley. 2006. Conservation of the northern spotted owl under the Northwest Forest Plan. Conservation Biology 20:288–296.

North, M.P., J.F. Franklin, A.B. Carey, E.D. Forsman, and T. Hamer. 1999. Forest structure of the northern spotted owl's foraging habitat. Forest Science 45(4):520-527.

North, M.P., G. Steger, R. Denton, G. Eberlein, T. Munton, and K. Johnson. 2000. Association of weather and nest-site structure with reproductive success in California spotted owls. Journal of Wildlife Management 64(3):797-807.

Olson, G.S., E.M. Glenn, R.G. Anthony, E.D. Forsman, J.A. Reid, P.J. Loschl, and W.J. Ripple. 2004. Modeling demographic performance of northern spotted owls relative to forest habitat in Oregon. Journal of Wildlife Management 68(4):1039-1053.

Olson, G.S., R.G. Anthony, E.D. Forsman, S.H. Ackers, P.J. Loschl, J.A. Reid, K.M Dugger, E.M. Glenn, and W.J. Ripple. 2005. Modeling of site occupancy dynamics for northern spotted owls, with emphasis on the effects of barred owls. Journal of Wildlife Management 69(3):918-932.

Oregon Department of Forestry. 2007. Forest Practices Administrative Rules and Forest Practices Act. Salem, Oregon.

Pearson, R.R., and K.B. Livezey. 2003. Distribution, numbers, and site characteristics of spotted owls and barred owls in the Cascade Mountains of Washington. Journal of Raptor Research 37(4):265-276.

Pierce, D.J., J.B. Buchanan, B.L. Cosentino, and S. Snyder. 2005. An assessment of spotted owl habitat on non-federal lands in Washington between 1996 and 2004. Wildlife Department of Wildlife Research Report.

Rizzo, D.M., M. Garbeloto, J.M. Davidson, G.W. Slaughter, and S.T. Koike. 2002. *Phytophthora ramorum* as the cause of extensive mortality of *Quercus* spp. and *Lithocarpus densiflorus* in California. Plant Disease 86:205-214.

Rosenberg, D.K. and R.G. Anthony. 1992. Characteristics of northern flying squirrel populations in young second- and old-growth forests in western Oregon. Canadian Journal of Zoology 70:161-166.

Rosenberg, D.K., K.A. Swindle, and R.G. Anthony. 2003. Influence of prey abundance on northern spotted owl reproductive success in western Oregon. Canadian Journal of Zoology 81:1715-1725.

Salathe, E.P., L.R. Leung, Y. Qian, and Y. Zhang. 2010. Regional climate model projections for the state of Washington. Climatic Change 102 (1-2):51-75.

Sapolsky, R. M., L. M. Romero, and A. U. Munck. 2000. How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions. Endocrine Reviews 21:55-89.

Schmidt, K. 2006. Northern spotted owl monitoring and inventory, Redwood National and State Parks, 2005 annual report. Redwood National and State Parks, Orick, California.

Singleton, P., S. Graham, W. Gaines, and J. Lehmkuhl. 2005. The ecology of barred owls in fire-prone forests. USDA PNW December 2005 Progress Report; Wenatchee, Washington.

Singleton, P., J.F. Lehmkuhl, W.L. Gaines, and S.A. Graham. 2010. Barred owl space use and habitat selection in the eastern Cascades, Washington. Journal of Wildlife Management. 74(2): 285-294.

Sisco, C.L. 1990. Seasonal home range and habitat ecology of spotted owls in northwestern California. M.S. Thesis. Humboldt State University, Arcata, California.

Solis, D.M., and R.J. Gutiérrez. 1990. Summer habitat ecology of northern spotted owls in northwestern California. The Condor 92:739-748.

Sovern, S.G., E.D. Forsman, B.L. Biswell, D.N. Rolph, and M. Taylor. 1994. Diurnal behavior of the spotted owl in Washington. The Condor 96(1):200-202.

Steger, G.N., L.R. Werner, and T.E. Munton. 2006. First documented record of the barred owl in the southern Sierra Nevada. Western Birds. 37: 106-109.

Swarthout, E.C. and Steidl, R.J. 2001. Flush responses of Mexican spotted owls to recreationists. J. Wildl. Manage. 65(2):312-317.

Tempel, D. J. and R. J. Gutiérrez. 2003. Fecal corticosterone levels in California spotted owls exposed to low-intensity chainsaw noise. Wildlife Society Bulletin 31:698-702.

Tempel, D. J. and R. J. Gutiérrez. 2004. Factors related to fecal corticosterone levels in California spotted owls: implications for assessing chronic stress. Conservation Biology 18:538-547.

Thomas, J.W., E.D. Forsman, J.B. Lint, E.C. Meslow, B.R. Noon, and J. Verner. 1990. A conservation strategy for the northern spotted owl. Report of the Interagency Scientific Committee to address the conservation of the northern spotted owl. Unpublished interagency document. 458 pages.

Thomas, J.W., and M.G. Raphael (Eds.). 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. Report of the Forest Ecosystem Management Assessment Team (FEMAT). July 1993. Portland, OR: USDA Forest Service and the USDI Bureau of Land Management.

Thomas, J.W., M.G. Raphael, R.G. Anthony, E.D. Forsman, A.G. Gunderson, R.S. Holthausen, B.G. Marcot, G.H. Reeves, J.R. Sedell, and D.M. Solis. 1993. Viability assessments and management considerations for species associated with late-successional and old-growth forests of the Pacific Northwest. USDA Forest Service, Portland, Oregon.

Thomas, J.W., J.F. Franklin, J. Gordon, and K.N. Johnson. 2006. The Northwest Forest Plan: origins, components, implementation experience, and suggestions for change. Conservation Biology 20:277–287.

Thome, D.M., C.J. Zabel and L.V. Diller. 1999. Forest stand characteristics and reproduction of northern spotted owls in managed north-coastal California forests, Journal of Wildlife Management 63:44–59.

USDA Forest Service, and USDI Bureau of Land Management. 1994a. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl; standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, Oregon.

USDA Forest Service and USDI Bureau of Land Management. 1994b. Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, Oregon. Two vols. and appendices.

USDI Fish and Wildlife Service. 1983a. Endangered and threatened species listing and recovery priority guidelines. Federal Register 48:43098–43105.

USDI Fish and Wildlife Service. 1983b. Endangered and threatened species listing and recovery priority guidelines: correction. Federal Register 48:51985.

USDI Fish and Wildlife Service. 1989. The northern spotted owl; a status review supplement. USDI Fish and Wildlife Service, Portland, Oregon.

USDI Fish and Wildlife Service. 1990a. Endangered and Threatened Wildlife and Plants; determination of threatened status for the northern spotted owl. Fed. Reg. Vol. 55. 123: 26114-26194. June 26, 1990.

USDI Fish and Wildlife Service. 1990b. The 1990 status review: northern spotted owl: *Strix occidentalis caurina*. Report to the U.S. Fish and Wildlife Service, Portland, Oregon. 95 pages.

USDI Fish and Wildlife Service. 1992a. Endangered and Threatened Wildlife and Plants; determination of critical habitat for the northern spotted owl. Fed. Reg. Vol. 57. 10:1796-1838. January 15, 1992.

USDI Fish and Wildlife Service. 1992b. Draft final recovery plan for the northern spotted owl. USDI Fish and Wildlife Service. 2 Volumes. Portland, Oregon.

USDI Fish and Wildlife Service. 1994a. Letter from D.C. Frederick (Service) to J. Belcher (Washington Department of Natural Resources) dated February 1, 1994, regarding correction to spotted owl home-range data for the Olympic Peninsula. Service, Olympia, Washington.

USDI Fish and Wildlife Service. 1994b. Final biological opinion for the preferred alternative of the Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. *In*: USDA Forest Service, and USDI Bureau of Land Management. 1994. Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl: Appendix G. Portland, Oregon, USA.

USDI Fish and Wildlife Service. 1995. Endangered and threatened wildlife and plants; proposed special rule for the conservation of the northern spotted owl on non-federal lands. Federal Register 60:9483–9527.

USDI Fish and Wildlife Service. 2001. A range wide baseline summary and evaluation of data collected through section 7 consultation for the northern spotted owl and its critical habitat: 1994-2001. Portland, Oregon. Unpublished document. 41 pages.

USDI Fish and Wildlife Service. 2004. Northern Spotted Owl: Five Year Review Summary and Evaluation. USDI Fish and Wildlife Service, Portland, Oregon. 73 pages.

USDI U.S. Fish and Wildlife Service. 2011a. Northern Spotted Owl: Five Year Review Summary and Evaluation. USDI Fish and Wildlife Service, Portland, Oregon. 7 pages.

USDI U.S. Fish and Wildlife Service. 2011b. Revised Recovery Plan for the Northern Spotted Owl, *Strix occidentalis caurina*. U.S. Fish and Wildlife Service, Portland, Oregon. 277 p.

USDI U.S. Fish and Wildlife Service. 2012. Endangered and threatened wildlife and plants; proposed revised designation of critical habitat for the northern spotted owl. Federal Register 77:14062-14165.

USDI Fish and Wildlife Service and USDC National Marine Fisheries Service. 1998. Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act.

Wagner, F.F., E.C. Meslow, G.M. Bennett, C.J. Larson, S.M. Small, and S. DeStefano. 1996. Demography of northern spotted owls in the southern Cascades and Siskiyou, Mountains, Oregon. Pages: 67-76 In: Forsman, E.D., S. DeStefano, M.G. Raphael, and R.J. Gutierrez, (editors). 1996. Demography of the northern spotted owl. Studies in Avian Biology No. 17. Cooper Ornithology Society.

Ward, J. W. Jr. 1990. Spotted owl reproduction, diet and prey abundance in northwest California. M.S. Thesis. Humboldt State University, Arcata, California.

Ward, J. W. Jr., R.J. Gutiérrez, and B.R. Noon. 1998. Habitat selection by northern spotted owls: the consequences of prey selection and distribution. The Condor 100:79-92.

Washington Forest Practices Board. 1996. Permanent rules for the northern spotted owl. Washington Department of Natural Resources, Olympia, Washington.

Wasser, S. K., K. Bevis, G. King, and E. Hanson. 1997. Noninvasive physiological measures of disturbance in the northern spotted owl. Conservation Biology 11:1019-1022.

Weathers, W.W., P.J. Hodum and J.A. Blakesley. 2001. Thermal ecology and ecological energetics of the California spotted owl. The Condor 103(4):678.

Westerling, A. L., H. Hidalgo, D.R. Cayan, and T. Swetnam, 2006: Warming and earlier spring increases Western US forest wildfire activity. Science 313: 940-943.

White, C. M., and T. L. Thurow. 1985. Reproduction of ferruginous hawks exposed to controlled disturbance. The Condor 87:14-22.

Zabel, C. J., K.M. McKelvey, and J.P. Ward, Jr. 1995. Influence of primary prey on home-range size and habitat-use patterns of northern spotted owls (*Strix occidentalis caurina*). Canadian Journal of Zoology 73:433-439.

Zabel C.J., S.E. Salmons, and M. Brown. 1996. Demography of northern spotted owls in southwestern Oregon. Pages 77-82 in E.D. Forsman et al., editors. Demography of the northern spotted owl. Studies in Avian Biology No. 17. Cooper Ornithology Society.

Zabel, C. J., J.R. Dunk, H.B. Stauffer, L.M. Roberts, B.S. Mulder, and A. Wright. 2003. Northern spotted owl habitat models for research and management application in California (USA). Ecological Applications 13(4): 1027-1040.

Appendix D. Status of Critical Habitat

4.2.1. Legal Status

Critical habitat for the northern spotted owl was first designated in 1992 (57 FR 1796), but revised in 2008 (73 FR 47326), and again in 2012 (77 FR 14062). The final rule designating critical habitat for the northern spotted owl was published on December 4, 2012 (Service 2012b), and became effective on January 3, 2013. Critical habitat for the northern spotted owl now includes approximately 9,577,969 acres in 11 units and 60 subunits in California, Oregon, and Washington.

Designation of critical habitat serves to identify those lands that are necessary for the recovery of the listed species. In this case, the Service's primary objective in designating critical habitat was to identify capable and existing essential northern spotted owl habitat and highlight specific areas where management of the northern spotted owl and its habitat should be given highest priority.

4.2.2. Conservation Role of Critical Habitat

Critical habitat contains those areas that are essential to the conservation of the species. The expectation of critical habitat is to ameliorate habitat-based threats. The recovery of the northern spotted owl requires habitat conservation in concert with the implementation of recovery actions that address other, non-habitat-based threats to the species, including the barred owl (Service 2012b, p. 71879). The conservation role of northern spotted owl critical habitat is to "adequately support the life-history needs of the species to the extent that well-distributed and inter-connected northern spotted owl nesting populations are likely to persist within properly functioning ecosystems at the critical habitat unit and range-wide scales" (Service 2012b, p. 71938). The specific conservation role of the subunit included in the action area is described below in the Environmental Baseline (section 4.3.5).

4.2.3. Physical or Biological Features and Primary Constituent Elements

When designating critical habitat, the Service considers "the physical or biological features essential to the conservation of the species and which may require special management considerations or protection" (50 CFR § 424.12; Service 2012b, p. 71897). "These include, but are not limited to: (1) space for individual and population growth and for normal behavior; (2) food, water, air, light, minerals, or other nutritional or physiological requirements; (3) cover or shelter; (4) sites for breeding, reproduction, or rearing (or development) of offspring; and (5) habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species" (Service 2012b, p. 71897). The final critical habitat rule states that "for the northern spotted owl, the physical or biological features essential to the conservation of the species are forested areas that are used or likely to be used for nesting, roosting, foraging, or dispersing" (Service 2012b, p. 71897). The final critical habitat rule for the northern spotted owl provides an in-depth discussion of the physical or biological features, which may be referenced for further detail (Service 2012b, pp. 71897-71906).

The primary constituent elements (PCEs) are the specific elements of the physical or biological features that are considered essential to the conservation of the northern spotted owl and are those elements that make areas suitable as nesting, roosting, foraging, and dispersal habitat (Service 2012b, p. 71904). The PCEs should be arranged spatially such that it is favorable to the

persistence of populations, survival, and reproductive success of resident pairs, and survival of dispersing individuals until they are able to recruit into a breeding population (Service 2012b, p. 71904). Within areas essential for the conservation and recovery of the northern spotted owl, the Service has determined that the PCEs are:

1. Forest types that may be in early-, mid-, or late-seral stages and that support the northern spotted owl across its geographic range;
2. Habitat that provides for nesting and roosting;
3. Habitat that provides for foraging;
4. Habitat to support the transience and colonization phases of dispersal, which in all cases would optimally be composed of nesting, roosting, or foraging habitat, but which may also be composed of other forest types that occur between larger blocks of nesting, roosting, or foraging habitat (Service 2012b, pp. 72051-72052).

Some critical habitat subunits may contain all of the above PCEs and support multiple life history requirements of the northern spotted owl, while some subunits may contain only those PCEs necessary to support the species particular use of that habitat. All of the areas designated as critical habitat, however, do contain PCE 1, forest type. Therefore, PCE 1 always occurs in concert with at least one other PCE (PCE 2, 3, or 4; Service 2012b, p. 72051). Northern spotted owl critical habitat does not include meadows, grasslands, oak woodlands, aspen woodlands, or manmade structures and the land upon which they are located (Service 2012b, p. 71918).

4.2.3.1. *Primary Constituent Element 1: Forest Types*

The primary forest types that support the northern spotted owl are: Sitka spruce, western hemlock, mixed conifer, mixed evergreen, grand fir, Pacific silver fir, Douglas-fir, white fir, Shasta red fir, redwood/Douglas-fir, and moister ponderosa pine (Service 2012b, p. 72051). On the Mendocino National Forest, forest types include mixed conifer, conifer hardwood, red fir, and the moist end of the ponderosa pine forests.

4.2.3.2. *Primary Constituent Element 2: Nesting and Roosting Habitat*

Nesting and roosting habitat for northern spotted owl provides structural features for nesting, protection from adverse weather conditions, and cover to reduce predation risk for adults and young. In many cases, the same habitat may also provide for foraging. Nesting and roosting habitats must provide: sufficient habitat for foraging by territorial pairs, moderate to high canopy closure (60 to over 80 percent), multilayered and multispecies canopies with large overstory trees (20 to 30 inches dbh), basal area greater than 240 square feet per acre, high diversity of tree diameters, high incidence of large live trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other evidence of decadence), large snags and large accumulations of woody debris on the ground, and sufficient open space beneath the canopy for flight (Service 2012b, p. 72051).

4.2.3.3. *Primary Constituent Element 3: Foraging Habitat*

Across the range of the northern spotted owl, nesting and roosting habitats also provide foraging opportunities; however, northern spotted owls may use other habitat types for foraging as well. The components of PCE 3 for northern spotted owl foraging habitat in the Klamath and Northern California Interior Coast Ranges are: stands of nesting and roosting habitat including other forest

types with mature and old-forest characteristics; presence of conifer (incense-cedar, sugar pine, Douglas-fir) and hardwood (bigleaf maple, black oak, live oaks, madrone, shrubs) species, forest patches within riparian zones of low-order streams and edges between conifer and hardwood forest stands, brushy openings and dense young stands or low-density forest patches within a mosaic of mature and older forest habitat, high canopy cover (87 percent at frequently used sites), multiple canopy layers, mean stand diameter greater than 21 inches dbh, increasing mean stand diameter and densities of trees greater than 26 inches increases foraging habitat quality, large accumulations of fallen trees and other woody debris on the ground, and sufficient open space below the canopy for northern spotted owls to fly (Service 2012b, pp. 72051-72052).

4.2.3.4. *Primary Constituent Element 4: Dispersal Habitat*

Northern spotted owl dispersal habitat is habitat that supports the transience and colonization phases of owl dispersal, and in all cases would optimally be composed of nesting, roosting, or foraging habitat (PCE 2 or 3), but which may also be composed of other forest types that occur between larger blocks of northern spotted owl nesting, roosting, or foraging habitat. In cases where nesting, roosting, or foraging habitats are insufficient to provide for dispersing or nonbreeding owls, the specific dispersal PCEs are: habitat supporting transience phase of dispersal (protection from avian predators, minimal foraging opportunities, younger and less diverse forests that provide some roosting structures and foraging opportunities) and habitat supporting the colonization phase of dispersal (nesting, roosting, and foraging habitat but in smaller amounts than needed to support a nesting pair) (Service 2012b, p. 72052).

4.2.4. Special Management Considerations

The special management considerations or protections identified by the Service for the Klamath and Northern California Interior Coast Ranges reflect a mix of the nesting, roosting, foraging, and dispersal habitats needed in both moist and dry forest types that are found interspersed across the region and apply to CHUs 9, 10, and 11.

In moist forests that are currently providing mature and late-successional forest that functions as nesting, roosting, foraging, and dispersal habitats for the northern spotted owl, active management is generally unnecessary to conserve the habitat values of older forests necessary to support northern spotted owl recovery. However, in younger, homogeneous stands, active forest management that retains larger and older trees but reduces the density of smaller trees may accelerate development of habitat structure necessary for northern spotted owl conservation. Alternatively, in dry forests where natural disturbance regimes and vegetation structure, composition, and distribution have been substantially altered since Euro-American settlement, vegetation and fuels management that influences fire behavior, severity and distribution may be necessary to retain and recruit northern spotted owl nesting, roosting, foraging, and dispersal habitats on the landscape, to conserve other biodiversity, and to restore more natural vegetation and disturbance regimes and heterogeneity that are conducive to conservation of the northern spotted owl (Service 2012b, p. 71908-71909).

4.2.5. Current Condition of Northern Spotted Owl Critical Habitat

The current condition of critical habitat incorporates the effects of all past human activities and natural events that led to the present-day status of the habitat (USDI and USDC 1998, pg. 4-19).

4.2.5.1. *Range-Wide Critical Habitat Baseline*

The Service updated the ECOS Database to reflect the 2006/2007 habitat baseline developed for the NWFP 15-year monitoring report (Davis et al. 2011, Appendix D, Table D). This mapping effort indicates that approximately 9.577 million acres of spotted owl critical habitat existed in 2006/2007 (Table 1). As of September 11, 2014 the database reports 11,895 acres have been removed or downgraded from critical habitat range-wide (including habitat loss to natural events). The majority of these impacts originated in the Oregon Cascades and Oregon Klamath Mountains Physiographic Provinces, and less than one-fourth (2,718 acres) occurred in land use allocations under the NWFP that were intended to emphasize maintenance of spotted owl habitat values (i.e., late-successional reserves).

4.2.5.2. *Zones of Habitat Associations Used by Northern Spotted Owls*

Differences in patterns of habitat associations used by the northern spotted owl across its range suggest four different broad zones of habitat use, which we characterize as the (1) West Cascades/Coast Ranges of Oregon and Washington, (2) East Cascades, (3) Klamath and Northern California Interior Coast Ranges, and (4) Redwood Coast (Fig. 4). We configured these zones based on a qualitative assessment of similarity among ecological conditions and habitat associations within the 11 different regions analyzed during the critical habitat designation process (see Service 2012b). These four zones capture the range in variation of some of the physical and biological features essential to the conservation of the northern spotted owl. Summarized below are the physical and biological features for each of these four zones, emphasizing zone-specific features that are distinctive within the context of general patterns that apply across the entire range of the northern spotted owl.

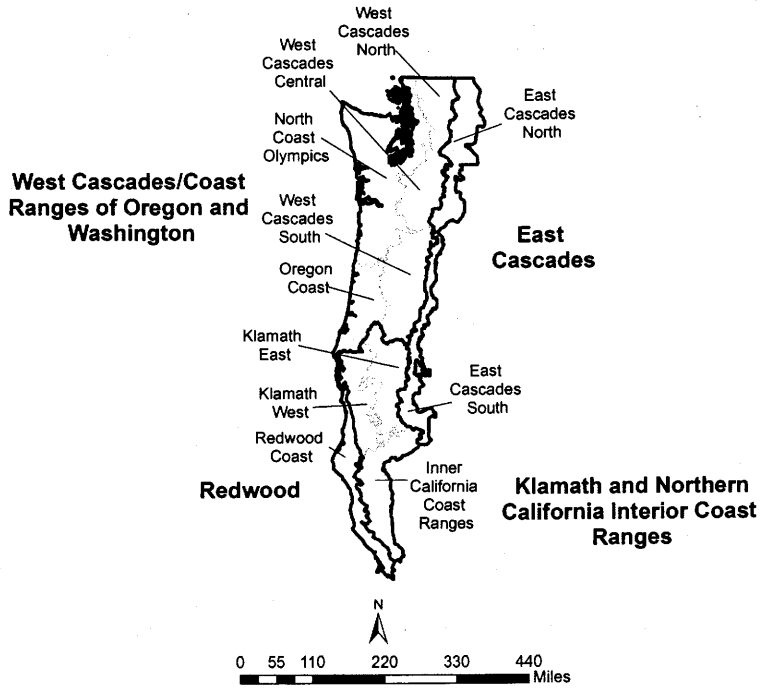


Figure 4. Eleven regions and four zones of habitat associations used by northern spotted owls in Washington, Oregon, and California.

Table 1. Summary of northern spotted owl critical habitat NRF[1] acres removed or downgraded as documented through section 7 consultations on Northwest Forest Plan (NWFP) lands; environmental baseline and summary of effects by state, physiographic province and land use function on September 11, 2014.

Physiographic Province[2]		Evaluation Baseline		Habitat Removed/Downgraded						
				Land-Use Allocations[5]			Habitat Loss to Natural Events	Total	% Provincial Baseline Affected	% Range-wide Effects
		Total Designated CH Acres[3]	Nest/Roost Acres[4]	Reserves	Non-Reserves	Total				
WA	Eastern Cascades	1,022,960	416,069	265	0	265	0	265	0.06	2.23
	Olympic Peninsula	507,165	238,390	6	0	6	0	6	0.00	0.05
	Western Cascades	1,387,567	667,173	18	0	18	0	18	0.00	0.15
OR	Cascades East	529,652	181,065	887	1,262	2,149	0	2,149	1.19	18.07
	Cascades West	1,965,407	1,161,780	244	2,724	2,968	0	2,968	0.26	24.95
	Coast Range	1,151,874	535,602	1	1,132	1,133	0	1,133	0.21	9.53
	Klamath Mountains	911,681	481,577	1,292	1,102	2,394	2,941	5,335	1.11	44.85
CA	Cascades	243,205	98,243	0	0	0	0	0	0.00	0.00
	Coast	149,044	58,278	0	0	0	0	0	0.00	0.00
	Klamath	1,708,787	752,131	5	16	21	0	21	0.00	0.18
	Total	**9,577,342**	**4,590,308**	**2,718**	**6,236**	**8,954**	**2,941**	**11,895**	**0.12%**	**100%**

[1]NRF = nesting, roosting, foraging habitat. In California, suitable habitat is divided into two components: nesting/roosting (NR) habitat, and foraging (F) habitat. The NR component in CA most closely resembles NRF habitat in Oregon and Washington.

[2]Defined in the *2011 Northern Spotted Owl Revised Recovery Plan* (Service 2011) as Recovery Units as depicted on page A-3.

[3]Northern spotted owl critical habitat as designated on December 4, 2012 (77 FR 71876). Total designated critical habitat acres listed here (9,577,342 acres) are derived from GIS data, and vary slightly from the total acres (9,577,969 acres) listed in the Federal Register (-627 acres).

[4]Calculated from GIS data for spotted owl NR habitat generated by Davis et al. 2011 for the Northwest Forest Plan 15-year Monitoring Report. NR habitat acres are approximate values based on 2006 (OR/WA) and 2007 (CA) satellite imagery.

[5]Reserve land use allocations under the NWFP intended to provide demographic support for spotted owls include LSR, MLSA, and CRA. Non-reserve allocations under the NWFP intended to provide dispersal connectivity between reserves include AWA, AMA, and MX.

West Cascade/Coast Ranges of Oregon and Washington
This zone includes five regions west of the Cascade crest in Washington and Oregon (Western Cascades North, Central and South; North Coast Ranges and Olympic Peninsula; and Oregon Coast Ranges; Service 2011, p. C–13). Climate in this zone is characterized by high rainfall and cool to moderate temperatures. Variation in elevation between valley bottoms and ridges is relatively low in the Coast Ranges, creating conditions favorable for development of contiguous forests. In contrast, the Olympic and Cascade ranges have greater topographic variation with many high-elevation areas supporting permanent snowfields and glaciers. Douglas-fir and western hemlock dominate forests used by northern spotted owls in this zone. Root diseases and wind-throw are important natural disturbance mechanisms that form gaps in forested areas. Flying squirrels (*Glaucomys sabrinus*) are the dominant prey, with voles and mice also representing important items in the northern spotted owl's diet.

Our habitat modeling indicates that vegetation structure has a dominant influence on owl population performance, with habitat pattern and topography also contributing. High canopy cover, high density of large trees, high numbers of sub-canopy vegetation layers, and low to moderate slope positions are all important features.

Nesting habitat in this zone is mostly limited to areas with large trees with defects such as mistletoe brooms, cavities, or broken tops. The subset of foraging habitat that is not nesting/roosting habitat generally had slightly lower values than nesting habitat for canopy cover, tree size and density, and canopy layering. Prey species (primarily the northern flying squirrel) in this zone are associated with mature to late-successional forests, resulting in small differences between nesting, roosting, and foraging habitats.

East Cascades
This zone includes the Eastern Cascades North and Eastern Cascades South regions (Service 2011, p. C–13). The East Cascades zone is characterized by a continental climate (cold, snowy winters and dry summers) and a high frequency of natural disturbance due to fires and outbreaks of forest insects and pathogens. Flying squirrels are the dominant prey species, but the diet of northern spotted owls in this zone also includes relatively large proportions of bushy-tailed woodrats (*Neotoma cinerea*), snowshoe hare (*Lepus americanus*), pika (*Ochotona princeps*), and mice (*Microtus spp.*; Forsman et al. 2001, pp. 144–145).

Our modeling indicates that habitat associations in this zone do not show a pattern of dominant influence by one or a few variables (Service 2011, Appendix C). Instead, habitat association models for this zone included a large number of variables, each making a relatively modest contribution (20 percent or less) to the predictive ability of the model. The features that were most useful in predicting northern spotted owl habitat quality were vegetation structure and composition, and topography, especially slope position in the north. Other efforts to model habitat associations in this zone have yielded similar results (e.g., Gaines et al. 2010, pp. 2048–2050; Loehle et al. 2011, pp. 25–28).

Relative to other portions of the northern spotted owls' range, nesting and roosting habitat in this zone includes relatively younger and smaller trees, likely reflecting the common usage of dwarf mistletoe (*Arceuthobium douglasii*) brooms (dense growths) as nesting platforms (especially in

the north). Forest composition that includes high proportions of Douglas-fir is also associated with this nesting structure. Additional foraging habitat in this zone generally resembles nesting and roosting habitat, with reduced canopy cover and tree size, and reduced canopy layering. High prey diversity suggests relatively diverse foraging habitats are used. Topographic position was an important variable, particularly in the north, possibly reflecting competition from barred owls (Singleton et al. 2010, pp. 289, 292). Barred owls, which have been present for over 30 years in the northern portions of this zone, preferentially occupy valley-bottom habitats, possibly compelling northern spotted owls to establish territories on less productive, mid-slope locations (Singleton et al. 2010, pp. 289, 292).

Klamath and Northern California Interior Coast Ranges
This zone includes the Klamath West, Klamath East, and Interior California Coast regions (Service 2011, p. C–13). This region in southwestern Oregon and northwestern California is characterized by very high climatic and vegetative diversity resulting from steep gradients of elevation, dissected topography, and large differences in moisture from west to east. Summer temperatures are high, and northern spotted owls occur at elevations up to 5,800 feet. The western portions of this zone support a diverse mix of mesic forest communities interspersed with drier forest types. Forests of mixed conifers and evergreen hardwoods are typical of the zone. The eastern portions of this zone have a Mediterranean climate with increased occurrence of ponderosa pine. Douglas-fir/dwarf mistletoe is rarely used for nesting platforms in the western part of the northern spotted owl's range, but is commonly used in the east.

The prey base for northern spotted owls in this zone is correspondingly diverse, but dominated by dusky-footed woodrats, bushy-tailed woodrats, and flying squirrels. Northern spotted owls have been well studied in the western Klamath portion of this zone (Forsman et al. 2004, p. 217), but relatively little is known about northern spotted owl habitat use in the eastern portion and the California Interior Coast Range portion of the zone (where the Smokey Fuels Treatment Project is located).

Our habitat association models for this zone suggest that vegetation structure and topographic features are nearly equally important in influencing owl population performance, particularly in the Klamath. High canopy cover, high levels of canopy layering, and the presence of very large dominant trees were all important features of nesting and roosting habitat. Compared to other zones, additional foraging habitat for this zone showed greater divergence from nesting habitat, with much lower canopy cover and tree size. Low to intermediate slope positions were strongly favored. In the eastern Klamath, the presence of Douglas-fir was an important compositional variable in our habitat model (Service 2011, Appendix C).

Redwood Zone
This zone is confined to the northern California coast, and is represented by the Redwood Coast region (Service 2011, p. C–13). It is characterized by a maritime climate with moderate temperatures and generally mesic conditions. Near the coast, frequent fog delivers consistent moisture during the summer. Terrain is typically low-lying (0 to 3,000 feet). Forest communities are dominated by redwood, Douglas-fir–tanoak (*Lithocarpus densiflorus*) forest, coast live oak (*Quercus agrifolia*), and tanoak series. Dusky-footed woodrats are the dominant prey items for northern spotted owls in this zone.

Habitat association models for this zone diverged strongly from models for other zones. Topographic variables (slope position and curvature) had a dominant influence with vegetation structure having a secondary role. Low position on slopes was strongly favored, along with concave landforms.

Several studies of northern spotted owl habitat relationships suggest that stump-sprouting and rapid growth of redwood trees, combined with high availability of woodrats in patchy, intensively managed forests, enables northern spotted owls to occupy a wide range of vegetation conditions within the redwood zone. Rapid growth rates enable young stands to develop structural characteristics typical of older stands in other regions. Thus, relatively small patches of large remnant trees can also provide nesting habitat structure in this zone.

4.2.5.3. *Climate Change and Range-wide Spotted Owl Critical Habitat*

There is growing evidence that recent climate change has impacted a wide range of ecological systems (Stenseth et al. 2002, entire; Walther et al. 2002, entire; Ådahl et al. 2006, entire; Karl et al. 2009, entire; Moritz et al. 2008, entire; Westerling et al. 2011, p. S459; Marlon et al. 2012, p. E541). Climate change, combined with effects from past management practices, is exacerbating changes in forest ecosystem processes and dynamics to a greater degree than originally anticipated under the NWFP. Environmental variation affects all wildlife populations; however, climate change presents new challenges as systems may change beyond historical ranges of variability. In some areas, changes in weather and climate may result in major shifts in vegetation communities that can persist in particular regions.

Climate change will present unique challenges to the future of northern spotted owl populations and their habitats. Northern spotted owl distributions (Carroll 2010, entire) and population dynamics (Franklin et al. 2000, entire; Glenn et al. 2010, entire; Glenn et al. 2011a, entire; Glenn et al. 2011b, entire) may be directly influenced by changes in temperature and precipitation. In addition, changes in forest composition and structure as well as prey species distributions and abundance resulting from climate change may impact availability of habitat across the historical range of the subspecies. The 2011 Northern Spotted Owl Revised Recovery Plan provides a detailed discussion of the possible environmental impacts to the habitat of the northern spotted owl from the projected effects of climate change (Service 2011, pp. III-5 to III-11).

Because both northern spotted owl population dynamics and forest conditions are likely to be influenced by large-scale changes in climate in the future, we have attempted to account for these influences in our designation of critical habitat by recognizing that forest composition may change beyond the range of historical variation, and that climate changes may have unpredictable consequences for both Pacific Northwest forests and northern spotted owls. Our critical habitat designation also recognizes that forest management practices that promote ecosystem health under changing climate conditions will be important for northern spotted owl conservation.

Appendix E. Timber Strata Codes

The following is an explanation of timber strata codes utilized on the **MENDOCINO NATIONAL FOREST** timber stratum maps:

1. FOREST VEGETATION LABEL

Code	Type	
M	Mixed conifer	
P	Ponderosa/Jeffrey Pine	
D	Douglas-fir	
W	White fir	
R	Red fir	
C	Conifer-hardwood	
K	Knobcone pine	
HB	Black oak	
HM	Mixed hardwoods	
HS	Blue oak-grassland savannah	
NB	Barren	Rock outcrops
NW	Water	Lakes, large streams, floodplains
ND	Urban development	Houses, Buildings, lots
NT	Recent fuelbreak clearings	No visible vegetation
NF	Recent fire	Burned areas
NC	Cultivated	Farm fields, orchards
GX	Grass	Glades, other grassy openings
GH	Herbaceous cover	Broad-leafed, non-woody plants
SA	Chaparral	Manzanita and associated shrubs
SC	Chamise	Adenstoma, associated shrubs
SM	Miscellaneous shrubs	Ceonothus, Ribes, Cherry etc.
SR	Riparian shrubs	Streamside, wet meadow shrubs
SH	Shrubby hardwoods	Shrub form hardwoods <25' tall

All of the commercial conifer types above are Regional types, listed in the Regional timber inventory handbook, except the conifer-hardwood type. This type was created by the Mendocino N.F. to recognize the high levels of hardwood stocking in many conifer stands, which occurs on a significant area of the Forest, and the effect this has on timber management and wildlife habitat.

2. SIZE CLASS LABELS FOR CONIFER AND HARDWOOD STANDS

CODE	DESCRIPTION	SIZE CLASS
1	Crowns <5 ft. diameter	Seedlings and saplings
2	Crowns 6-12 ft. diameter	Poles
3	Crowns 13-24 ft. diameter	Small sawtimber
4	Crowns 25-40 ft. diameter	Medium sawtimber
5	Crowns >40 ft. diameter	Large sawtimber
6	Uneven-aged	No predominant size class

3. CROWN CLOSURE CLASS LABELS FOR CONIFER AND HARDWOOD STANDS

CROWN CLOSURE AS % OF AREA WITHIN THE POLYGON PERIMETER

S	Less than 20%
P	20 to 39%
N	40 to 69%
G	70% and above

4. LABEL CONSTRUCTION FOR CONIFER AND HARDWOOD STANDS

A. LABEL CONSISTS OF THREE ELEMENTS WHICH IDENTIFY SPECIES, SIZE CLASS, AND CROWN CLOSURE CLASS - LISTED IN THAT ORDER

FOREST VEGETATION LABEL: The predominant tree species (in terms of area occupied by crowns) is listed. In non-forested areas, the predominant ground cover code is used.

SIZE CLASS: Size class is based on the crown area of predominant sawtimber sized trees. However, if these trees make up less than 20% of the total tree crown area, than the six class is based on the crown area of poles or saplings, whichever are predominant. The uneven-age code (code 6) is applied to stands in which two or more size classes exist, either in layers or intermingled, and no predominant size class can be identified. The uneven-aged code is applied only to conifer stands which have a crown closure of 40% or more.

CROWN CLOSURE CLASS: Crown closure is defined as the ratio of tree species crown area to the total area within the polygon perimeter.

B. PLANTATIONS

Plantations in which trees were not visible on the aerial photos used to make the maps are designated by the single code PL.

Appendix F. Differences Between the Service's 2012 and 2014 Biological Opinions.

We have incorporated current, protocol-level survey results in analyzing effects to northern spotted owls in this biological opinion. Accordingly, the recommendations we have made to the Mendocino National Forest in this Opinion differ from those stated in the 2012 Opinion. This section lists solely those changes compared to past documents; *recommendations that have remained the same are not included here*, but can be found in the main document in Table 6 (Section 2.2.5.1) and Sections 4.4.1.2.2 and 4.4.1.3.

Activity Center 1049

No limited operating period is necessary.

Activity Center 3006

No limited operating period is necessary.

Activity Center 3007

No limited operating period is necessary.

Activity Center 3009

A limited operating period for unit 60 is recommended from February 1 to July 10.

Activity Center 3048

A limited operating period for units F, 15, 16, and 17 is recommended from February 1 to July 10.

Appendix G. Northern Spotted Owl Habitat Treated Outside of Activity Centers.

Table G1. Amount of northern spotted owl habitat (nesting/roosting [NR], foraging [F], and dispersal [D]) proposed for treatment, in acres, in wildlife habitat enhancement units, both within and outside of northern spotted owl activity centers (AC). Modified from tables in the BA (Tables 8, 28, 32, 36, and 39), L. Angerer pers. comm. 2011, and L. Angerer pers. comm. 2014.

	Total Acres				Within Activity Centers				Outside of Activity Centers		
Unit	Unit Acres	NR	F	D	AC #	NR	F	D	NR	F	D
40	66	0	7	33	3006	0	7	33	0	0	0
41	14	0	7	0	none	0	0	0	0	7	0
43	7	0	2	5	none	0	0	0	0	2	5
44	52	0	28	24	none	0	0	0	0	28	24
45	11	0	11	0	3006	0	11	0	0	0	0
46	228	31	56	82	3006	31	56	81	0	0	1
47	216	0	122	88	3048	0	122	67	0	0	21
48	6	0	2	0	3048	0	0	0	0	2	0
49	38	0	33	0	3049	0	33	0	0	0	0
50	5	0	5	0	3048	0	5	0	0	0	0
51	27	0	19	0	3048	0	2	0	0	17	0
52	158	0	15	142	3048	0	8	121	0	7	21
53	42	0	0	42	3048	0	0	42	0	0	0
54	47	0	10	21	3048	0	10	21	0	0	0
55	20	0	10	0	3048	0	10	0	0	0	0
56	22	0	0	14	3048	0	0	14	0	0	0
57	94	0	31	19	none	0	0	0	0	31	19
58	6	0	0	6	none	0	0	0	0	0	6
59	40	6	15	16	3009	0	0	13	6	15	3
60	43	0	29	14	3009	0	29	14	0	0	0
61	35	0	0	0	3009	0	0	0	0	0	0
	Total	37	402	506	NA	31	293	406	6	109	100

Table G2. Amount of northern spotted owl habitat (nesting/roosting [NR], foraging [F], and dispersal [D]) proposed for treatment, in acres, in special land area treatment (SPLAT) units, both within and outside of northern spotted owl activity centers (AC). Modified from tables in the BA (Tables 5, 28, 32, 36, and 39), L. Angerer pers. comm. 2011, and L. Angerer pers. comm. 2014.

	Total Acres				Within Activity Centers				Outside of Activity Centers		
Unit	Unit Acres	NR	F	D	AC #	NR	F	D	NR	F	D
A	519	132	99	136	1049/3009	132	99	136	0	0	0
B	680	135	152	79	3009	135	150	77	0	2	2
C	243	58	34	29	3009/3048	0	18	0	58	16	29
D	91	1	4	71	3048	0	0	1	1	4	70
E	201	0	43	113	3048	0	0	47	0	43	66
F	291	23	95	17	3048	23	95	17	0	0	0
G	787	0	75	547	3048	0	5	0	0	70	547
H	216	0	153	63	3048	0	0	0	0	153	63
I	630	0	19	0	3006/3007[a]	0	19	0	0	0	0
J	256	73	45	61	3006	73	40	4	0	5	57
K	361	0	208	13	none	0	0	0	0	208	13
	Total	422	927	1129	NA	363	426	282	71	656	975

[a] Although Unit I overlaps both AC 3006 and 3007, no suitable habitat within AC 3007 will be treated.

Table G3. Amount of northern spotted owl habitat (nesting/roosting [NR], foraging [F], and dispersal [D]) proposed for treatment, in acres, in commercial thinning units, both within and outside of northern spotted owl activity centers (AC). Modified from tables in the BA (Tables 3, 28, 32, 36, and 39), L. Angerer pers. comm. 2011, and L. Angerer pers. comm. 2014.

	Total			Within AC			Outside of AC	
Unit	Unit Acres	F	D	AC #	F	D	F	D
1	33	15	18	none	0	0	15	18
2	18	12	6	none	0	0	12	6
3	32	20	12	none	0	0	20	12
4	104	104	0	none	0	0	104	0
5	59	23	36	none	0	0	23	36
6	27	20	7	3006	14	7	6	0
7	18	18	0	none	0	0	18	0
8	26	26	0	3006	1	0	25	0
9	22	5	17	none	0	0	5	17
10	36	5	31	3048	5	31	0	0
11	50	10	40	3048	10	40	0	0
12	64	64	0	3048	64	0	0	0
13	22	22	0	3048	22	0	0	0
14	15	15	0	3048	15	0	0	0
15	10	5	5	3048	5	5	0	0
16	22	22	0	3048	22	0	0	0
17	67	67	0	3048	67	0	0	0
18	5	0	5	3048	0	5	0	0
19	19	0	19	3048	0	13	0	6
20	63	63	0	3048	13	0	50	0
21	34	0	34	3048	0	34	0	0
22	2	0	2	3048	0	2	0	0
24	31	31	0	3048	31	0	0	0
25	5	0	5	3048	0	5	0	0
26	26	26	0	3048	22	0	4	0
27	32	0	32	none	0	0	0	32
28	28	0	28	none	0	0	0	28
29	39	0	39	none	0	0	0	39
30	24	15	9	3009	15	9	0	0
	Total	588	345	NA	306	151	282	194

Table G4. Total northern spotted owl habitat treated by the Smokey Project outside of activity centers.

Treatment	Acres Treated		
	Nesting/ Roosting	Foraging	Dispersal
Fuel Reduction/Wildlife habitat enhancement[1]	77	765	1075
Commercial Thinning	0	282	194
Plantation Thinning	0	0	0
Total	77	1,047	1,269

[1]Sum of wildlife habitat enhancement and SPLAT treatment acres (see Tables G1 and G2).