8. Species Status through Conclusions

8.1 BALD EAGLE

8.1.1 STATUS OF THE SPECIES: Bald Eagle

8.1.1.1 Range-wide

The bald eagle was federally listed in 1978 as an endangered species in all lower 48 states except Michigan, Minnesota, Wisconsin, Washington, and Oregon, where it was designated as threatened (43 FR 6230-6233). The listing was a result of a decline in the bald eagle population throughout the lower 48 States. The decline was largely attributed to the widespread use of the pesticide DDT and other organochlorine compounds, in addition to habitat loss, disturbance, shooting, electrocution from power lines, poisoning, and a decline in the food base.

The bald eagle was reclassified in 1995 from endangered to threatened as a result of a significant increase in the number of nesting pairs, increased productivity, and expanded distribution (59 FR 35584-35594). Since 1989, the bald eagle nesting population has increased at an average rate of approximately 8 percent per year (64 FR 36454-36464). The national average for fledglings per occupied breeding area is greater than one; therefore, the bald eagle population continues to increase. The bald eagle population in the lower 48 States has increased from approximately 487 active nests in 1963 to an estimated minimum 7,066 breeding pairs today (71 FR 8238-8251). Based on the achievement of recovery goals throughout the lower 48 States, the FWS has proposed to remove the bald eagle from the list of Endangered and Threatened wildlife (71 FR 8238-8251).

In establishing a recovery program for the species in the mid-1970s, the FWS divided the bald eagles of the lower 48 States into five recovery regions, based on geographic location. A separate recovery plan was prepared for each region. The individual recovery plans set forth goals for recovery and identified tasks to achieve those goals. Delisting and reclassification of the bald eagle in the Pacific Recovery Region is not dependent on the progress of bald eagle populations covered by other regional recovery plans. Therefore, for purposes of this analysis, we are evaluating the effects of the action on the Pacific Recovery Area in the context that this area is essential to the survival and recovery of the bald eagle. Based on that context, this Opinion describes how the proposed action affects the condition of the bald eagle in this area.

8.1.1.2 Pacific Recovery Area

A detailed account of the taxonomy, ecology, and reproductive characteristics of the bald eagle is presented in the Pacific Bald Eagle Recovery Plan (USDI 1986), the final rule to reclassify the bald eagle from endangered to threatened in all of the lower 48 states (59 FR 35584-35594), and the proposed rule to delist the bald eagle (64 FR 36454-36464). The most-current information regarding bald eagles in Washington State and a detailed description of their biology and conservation can be found in the Washington State Status Report for the Bald Eagle (Stinson et al. 2001). A summary is provided below.

The delisting goals for the Pacific Recovery Area include: 1) a minimum of 800 nesting pairs; 2) an average reproductive rate of 1.0 fledged young per occupied breeding area per year, with an average success rate for occupied breeding areas of not less than 65 percent over a 5-year period; 3) breeding

population goals attained in at least 80 percent of management zones; and 4) wintering populations that are stable or increasing (USDI 1986).

In the Pacific Recovery Area, population delisting goals have been met since 1995 (71 FR 8238-8251). According to the Pacific Bald Eagle Recovery Plan, the estimated number of nesting pairs for the entire recovery unit in 1985 was 527. However, between 1985 and 2001 the number of nesting pairs of bald eagles for this recovery unit more than tripled, totaling 1,627 nesting pairs. The number of nesting pairs exceeded the recovery goal of 800 in 1990, and has continued to increase. Productivity has averaged approximately 1.0 young per nesting pair since 1990. In 1998, six of the seven Pacific Region States reported an average success rate of 75 percent. Distribution of nesting pairs among management zones was achieved in 1999, with the Olympic Peninsula and Central California Coast meeting their recovery goals. The Pacific Recovery Plan identifies 47 management zones with recovery goals identified for 37 of the zones. As of 1999, 30 of the 37 targeted management zones had met their goals, or 81 percent of the zones. Of the 30 zones where target levels have been met, at least 11 have more than doubled the established objective. At least three zones where no targets were set have one or more nesting pairs of bald eagles. Data indicate that the objective of stable to increasing trends in wintering populations of bald eagles has been attained on the average for the recovery region (71 FR 8238-8251).

Wintering populations have been tracked in the Pacific and many other States using the mid-winter bald eagle surveys. Wintering populations are difficult to assess because bald eagle concentrations depend upon weather and food supply and consequently will vary from year to year. With these constraints, the information suggests that Washington, Oregon, Idaho, and California have experienced an increasing trend in wintering populations of 1.5 to 4.5 percent, while Nevada and Montana report a decline of about 2.5 percent for 1986-2000. As of 2002, the Pacific Coast Region's counts increased at 1.6 percent per year, and the Great Basin counts increased 1.3 percent per year (71 FR 8238-8251).

Of the seven states covered in the Pacific Recovery Area, Washington State supports the largest breeding and wintering populations (USDI 1986). Most nesting territories in Washington are located on the San Juan Islands, along the coastline of the Olympic Peninsula, along the Straits of Juan de Fuca, Puget Sound, Hood Canal, and the Columbia River. Wintering concentration areas in Washington are along salmon spawning streams and waterfowl wintering areas (Stinson et al. 2001). Stinson et al. (2001) indicated that wintering bald eagle populations are increasing in Washington.

8.1.1.3 Conservation Needs of the Bald Eagle in the Pacific Recovery Area

Habitat

Nesting and wintering habitats are critical to the continued survival of the bald eagle (64 FR 36454-36464). Development-related habitat loss has been a significant threat to bald eagles in the Pacific Recovery Area of Washington, Idaho, Nevada, California, Oregon, Montana, and Wyoming (59 FR 35584-35594), although availability of habitat does not appear to be limiting bald eagle populations at this time (64 FR 36454-36464). Urban and recreational development, logging, mineral exploration and extraction, and other forms of human activities can adversely affect the suitability of breeding, wintering, and foraging habitat. While individual and small-scale actions may not appear to significantly affect the species as a whole, the cumulative long-term effects throughout the recovery area pose an important threat to the recovery of the species (64 FR 36454-36464).

Availability of suitable trees for nesting and perching is critical for maintaining bald eagle populations. The primary objective of the bald eagle recovery process is to provide secure habitat for bald eagles

within the recovery area, and to increase population levels in specific geographic areas to the extent that the species can be delisted. Achieving the recovery goal of increasing the number of nesting pairs within the recovery area requires protection of existing habitat for breeding and wintering bald eagles, and restoring habitat that has been lost due to development or habitat modification.

Nesting Habitat

Suitable habitat for bald eagles is characterized by accessible foraging areas and trees that are large enough for nesting and roosting (Stalmaster 1987). Food availability, such as aggregations of waterfowl or salmon runs, is a primary factor attracting bald eagles to wintering areas and influences nest and territory distribution (Stalmaster 1987; Keister et al. 1987).

Bald eagles generally nest in the same territories each year and often use the same nest repeatedly, although alternate nests in the territory may be used as well. Bald eagle nests in the Pacific Recovery Area are usually located in uneven-age stands of coniferous trees with old-growth forest components (USDI 1986) that are located within 1 mile of large bodies of water (Stalmaster 1987). Several factors, such as relative tree height, diameter, tree species, form, position on the surrounding topography, distance from the water, and distance from disturbance, influence nest site selection. Anthony and Isaacs (1989) found that bald eagles construct nests in Douglas-fir (*Pseudotsuga menziesii*) or Sitka spruce *(Picea sitchensis*) trees with an average diameter of 170.7 centimeter diameter at breast height and a height of 185.7 feet (56.6 meters) in Douglas-fir forests, and an average diameter of 67.2 inches (106.8 centimeters) diameter at breast height and a height of 126.6 feet (38.6 meters) in mixed-conifer forests. Suitable perch trees, which bald eagles use for guarding the nest, loafing, and foraging, are also a component of suitable nesting habitat (Stalmaster 1987; Buehler 2000a).

Wintering Habitat

Wintering bald eagles typically congregate in large aggregations where, most importantly, food is abundant (see Foraging section below). Suitable perch sites adjacent to foraging areas and winter roost habitat are also necessary. In Washington, these criteria are typically met where waterfowl and salmon populations are present, as well as in marine areas (Stinson et al. 2001).

When foraging, bald eagles select perches that provide an unobstructed view of the surrounding area, generally the tallest trees in the area. Tree species commonly used in Washington for winter perching include black cottonwood (*Populus trichocarpa*), bigleaf maple (*Acer macrophyllum*), Douglas-fir, or Sitka spruce (Stalmaster and Newman 1979).

Wintering bald eagles often roost at communal sites, which provide shelter during inclement weather. Bald eagles may roost communally in single trees or large forest stands of uneven ages. Bald eagles may remain at their daytime perches throughout the night, but typically gather at large communal roosts in the evening.

Communal night roosting sites are traditionally used year after year. Roost trees are usually the largest and have the most-open structure (Keister and Anthony 1983; Watson and Pierce 1998a). They are often located in areas that provide a more-favorable microclimate during inclement weather (Keister et al. 1985; Knight et al. 1983; Watson and Pierce 1998a). Prey sources may be available in the general vicinity, but for roosting bald eagles, close proximity to food is not as critical as the need for shelter. In Washington, 26 roosts studied by Watson and Pierce (1998a) were all within 3,609 feet (1,100 meters) of

foraging areas. However, Stalmaster (1987), in reviewing a variety of studies, found that only 40 percent were within 3,280 feet (1 kilometer) of water.

Human Disturbance

Human disturbance is a continuing threat, which may increase with increasing human populations and development (64 FR 36454-36464). Bald eagles vary in their sensitivity to disturbance, but generally nest away from human disturbance (Stinson et al. 2001). Distance, duration, visibility, and position of an activity affect eagle response, with distance being the most-important factor (Grubb and King 1991; Grubb et al. 1992; Watson 2004). The response of nesting bald eagles to human activity can range from behavioral, such as flushing or reduced nest attendance, to nest failure (Fraser et al. 1985; McGarigal et al. 1991; Grubb and King 1991; Grubb et al. 1992; Anthony et al. 1995; Steidl and Anthony 1996; Watson and Pierce 1998a). Wintering bald eagles may also be displaced from foraging areas by human activities (Stalmaster and Newman 1978; Stalmaster and Kaiser 1998). The magnitude of response varies inversely with distance, and increases with duration of disturbance, the number of vehicles or pedestrians per event, visibility, sound, and position in relation to nest (e.g., above, at eye-level, or below the nest) (Grubb and King 1991; Watson 2004). Watson and Pierce (1998a) found that vegetative screening and distance were the two most-important factors determining the impact of disturbances. Effective vegetative screening can dramatically reduce bald eagle response to human activity. Human activities that are distant, quiet, of short duration, out of sight, few in number, and below the nest have the least impact (Grubb and King 1991; Watson 2004).

The effects from disturbance to nesting bald eagles vary, depending on the stage of nesting. In western Washington, most bald eagles engage in courtship behavior in January and February, and begin to incubate their eggs by the third week in March. Young eagles hatch by late April, and generally fledge during early to mid-July (Watson and Pierce 1998a). Adult, parent eagles are very protective of their nest and subsequent eggs and eaglets. However, adults are able to spend time increasing time off the nest as the time from incubation to brooding progresses, (Watson and Pierce 1998a), and the eaglets began to thermoregulate at the age of 15 days (Bortolotti 1984). This indicates that eaglets would be less affected by disruption of adult nest attendance as the nesting season progresses.

Contaminants

Contaminants, in particular organochlorine compounds such as the pesticide DDT, are recognized as one of the primary causes of the decline of bald eagle populations (USDI 1986, 1999). DDT was banned, and registrations cancelled for other toxic persistent chemicals such as dieldrin, heptachlor, and chlordane for all but the most-restricted uses. The use of PCBs (Polychlorinated Biphenyls) also has been phased out. The reduction of these chemicals in the environment has resulted in a reduction of these levels of contaminants in bald eagles and a steady increase in bald eagle numbers (Schmitt and Bunck 1995). However, residues of PCBs and dichloro-diphenylethylene continue to depress productivity in certain locations such as the Channel Islands in California, the Great Lakes, and the Lower Columbia River (64 FR 36454-36464). Bald eagles continue to be affected by accumulated chemicals such as mercury (64 FR 36454-36464), and poisoned by lead, organophosphorus, and carbamate (Franson et al. 1995).

Foraging

An important component of bald eagle nesting and wintering habitat is a consistent source of food. Fish and waterfowl are typically the most-important food resources for bald eagles (Stalmaster 1987). Coastal and estuarine areas provide abundant prey resources, including seabirds and marine invertebrates (e.g.,

crabs and shellfish) (Watson et al. 1991; Watson and Pierce 1998b). The availability of food resources is critical during brood rearing, when food limits survival of young (Stalmaster 1987).

Food resources govern the distribution of bald eagles in the winter. In Washington, salmon carcasses, particularly those of chum salmon (*Oncorhynchus keta*), are the most important food source (Watson and Pierce 2001). Because survival of bald eagles in their first year is typically low (Stalmaster 1987), winter food availability is important for survival. Stalmaster and Kaiser (1998) and Hansen and Hodges (1985) also have suggested that winter food shortages or disrupted winter foraging may result in reduced reproductive rates.

8.1.1.4 Summary of Bald Eagle Status in the Pacific Recovery Area

Current data indicate that the bald eagle population in the Pacific Recovery Area continues to increase, and recovery objectives have been met. The recovery of the bald eagle is due in part to habitat protection and management actions, and the reduction in levels of persistent organochlorine pesticides (such as DDT) occurring in the environment. Due to the achievement of recovery goals throughout the lower 48 States, the bald eagle is currently proposed for delisting under the ESA (71 FR 8238-8251).

8.1.2 ENVIRONMENTAL BASELINE: Bald Eagle

8.1.2.1 Analysis Methods

We used GIS to estimate the number of bald eagle nest sites and communal roost sites that are located on or adjacent to FPHCP covered lands. Bald eagle sites are based on point locations documented in the WDFW Priority Habitats and Species database. Based on management recommendations listed in the Pacific Bald Eagle Recovery Plan (USDI 1986), we selected 0.5 mile and 0.25 mile radius circles to identify the number of bald eagle sites that may be affected by FPHCP covered activities. We used maps of spotted owl habitat developed by Davis and Lint (2005) to evaluate the amount of mature conifer habitat in riparian zones, and timber harvest information was derived from Healey et al. (2003). The GIS map data used in this analysis are derived from satellite imagery. The GIS values presented in the following analyses are estimates only, and are not intended to be interpreted as absolute values. It is important to note that all values reported here are general estimates based on our interpretation of the GIS data. (For more information on the FWS's GIS analysis used to derive these estimates, refer to the GIS memo in the administrative record for this Opinion).

8.1.2.2 Bald Eagles in Washington

Bald eagles can be found in all the forested parts of Washington throughout the year, but they are substantially more abundant in the coastal regions. Nearly 40 percent of bald eagle nest sites in Washington are located in the San Juan, Soleduc, Island, and Kitsap WRIAs (Table 8-1). In Washington, nearly all bald eagle nests are located within 1 mile of a lake, river, or marine shoreline, and most are within 450 to 1,000 feet of the shore (mean = 635 feet from water) (Stinson et al. 2001). The seasonal home range that contains the foraging and nesting habitat of a pair averages about 2.6 square miles in the Puget Sound region, and about 8.5 square miles in the Columbia River estuary (Stinson et al. 2001). Core use areas (which include the nest tree, key perch trees, and the most frequently used foraging perches) and lengths of shoreline used by bald eagles are much smaller, averaging about 0.73 square miles and 2.36 miles, respectively, within 55 Puget Sound territories (Watson and Pierce 1998a). Territories vary in size depending upon habitat types, with progressively larger ranges found on lakes, rocky marine shorelines,

rivers, and marine embayments. Important habitats in bald eagle territories are riparian areas along rivers, streams, lakes, sloughs, and reservoirs; coastal estuaries and beaches; freshwater beaches; and mature and old-growth forest within 1 mile of shorelines.

Watson et al. (2002) determined that the nesting bald eagle population in Washington during the period from 1980 through 1998 had increased at an exponential, annual rate of 10 percent as adult eagles have reoccupied habitat vacated during the period of widespread persecution and DDT use. Productivity and nest success of bald eagles affected by contaminants along Hood Canal and the Columbia River estuary also increased during the study period, and by 1998, the bald eagle population was widely distributed across the State and there were indicators that the population had stabilized (Watson et al. 2002).

There are currently 2,057 documented bald eagle nest locations in Washington (WDFW 2005b). Not all nest locations are likely to be currently occupied, because many bald eagle territories have multiple nest sites. Other nest sites may no longer exist due to blowdown, decay, or other causes, although these sites may not yet have been removed from the WDFW database that tracks nest sites and wintering areas. In 1998, WDFW estimated there were 664 occupied nests in the State, with a wintering population of 3,500 to 4,000 bald eagles (Stinson et al. 2001). Population modeling completed by Watson et al. (2002) indicated an ecological carrying capacity of 733 breeding pairs in Washington, suggesting the available habitat in Washington may be nearing saturation. The breeding population of bald eagles in Washington has increased steadily in the past 20 years, two-thirds of the nest sites are located on private lands. Only about 10 percent of bald eagle nests are on lands where their habitat could be considered secure in the absence of habitat protection rules (i.e., National Parks, Wildlife Refuges, etc.).

8.1.2.3 Bald Eagles on FPHCP Covered Lands

Of the 2,057 bald eagle nest sites documented in Washington, 1,068 sites are located on FPHCP lands (52 percent) and 1,778 sites (86 percent) are located within 0.5 miles of FPHCP covered lands. Of the 272 communal roost sites in Washington, 211 sites (78 percent) occur within 0.25 miles of FPHCP covered lands (Table 8-1). Relatively few bald eagle nest sites (n = 93, or 4 percent) are located in the FPHCP RMZs along Type S or Type F streams. The majority of bald eagle nest sites are either located along marine shorelines, or are located farther than 150 to 200 feet from rivers or streams beyond RMZs.

Only about seven percent of bald eagle nest sites are located in eastern Washington, and these occur primarily in the Middle Lake Roosevelt, Pend Oreille, and Okanagon WRIAs. Of the 145 bald eagle nest sites in eastern Washington, only 29 sites (20 percent) are located on FPHCP covered lands. However, about 74 percent of the nest sites (n = 107) are located within 0.5 miles of FPHCP covered lands, and therefore may be influenced or directly affected by FPHCP covered activities (Table 8-1).

Table 8-1. Summary of bald eagle nests and communal roosts on FPHCP lands in western Washington, ordered by WRIAs with the highest number of nest sites.

WRIA Number	WRIA Name	Total Bald Eagle Nest Sites by WRIA	Percent of WA Bald Eagle Nest Sites in WRIA	Bald Eagle Nest Sites Located on FPHCP Lands	Percent of Bald Eagle Nest Sites Located on FPHCP Lands	Bald Eagle Nest Sites located within 0.5 miles of FPHCP Lands	Percent of Bald Eagle Nest Sites located within 0.5 miles of FPHCP Lands	Bald Eagle Nest Sites located within 0.25 miles of FPHCP Lands	Percent of Bald Eagle Nest Sites located within 0.25 miles of FPHCP Lands	Number of Nest Sites that have had timber harvested within 0.25 miles of nest (1992-2003)	Percent of Nest Sites that have had timber harvested within 0.25 miles of nest (1992-2003)	Total Bald Eagle Roost Sites by WRIA	Bald Eagle Roost Sites located within 0.25 miles of FPHCP Lands	Percent Bald Eagle Roost Sites located within 0.25 miles of FPHCP Lands
2	San Juan	266	13%	180	68%	262	98%	249	94%	9	3%	1	1	100%
20	Soleduc	204	10%	29	14%	99	49%	84	41%	32	16%	-	-	-
6	Island	163	8%	123	75%	158	97%	145	89%	13	8%	1	-	-
15	Kitsap	158	8%	115	73%	149	94%	142	90%	19	12%	-	-	-
17	Quilcene-Snow	128	6%	76	59%	116	91%	108	84%	14	11%	2	1	50%
3	Lower Skagit / Samish	115	6%	67	58%	109	95%	97	84%	14	12%	16	15	94%
19	Lyre-Hoko	111	5%	59	53%	102	92%	89	80%	25	23%	1	1	100%
1	Nooksack	102	5%	35	34%	90	88%	75	74%	13	13%	54	44	81%
21	Queets-Quinault	73	4%	4	5%	19	26%	13	18%	23	32%	2	1	50%
8	Cedar-Sammamish	56	3%	39	70%	56	100%	56	100%	1	2%	-	-	-
25	Grays/Elochoman	54	3%	39	72%	52	96%	49	91%	13	24%	1	1	100%
24	Willapa	51	2%	25	49%	51	100%	43	84%	8	16%	-	-	-
26	Cowlitz	50	2%	43	86%	50	100%	50	100%	26	52%	1	1	100%
7	Snohomish	46	2%	21	46%	38	83%	35	76%	4	9%	18	17	94%
18	Elwha-Dungeness	42	2%	24	57%	42	100%	41	98%	1	2%	-	-	-
22	Lower Chehalis	40	2%	16	40%	39	98%	38	95%	10	25%	-	-	-
27	Lewis	31	2%	18	58%	31	100%	31	100%	2	6%	20	15	75%
14	Kennedy-Goldsborough	27	1%	17	63%	25	93%	23	85%	9	33%	6	6	100%
28	Salmon-Washougal	27	1%	11	41%	27	100%	22	81%	1	4%	1	1	100%

Table 8-1. Summary of bald eagle nests and communal roosts on FPHCP lands in western Washington, ordered by WRIAs with the highest number of nest sites (continued)

WRIA Number	WRIA Name	Total Bald Eagle Nest Sites by WRIA	Percent of WA Bald Eagle Nest Sites in WRIA	Bald Eagle Nest Sites Located on FPHCP Lands	Percent of Bald Eagle Nest Sites Located on FPHCP Lands	Bald Eagle Nest Sites located within 0.5 miles of FPHCP Lands	Percent of Bald Eagle Nest Sites located within 0.5 miles of FPHCP Lands	Bald Eagle Nest Sites located within 0.25 miles of FPHCP Lands	Percent of Bald Eagle Nest Sites located within 0.25 miles of FPHCP Lands	Number of Nest Sites that have had timber harvested within 0.25 miles of nest (1992-2003)	Percent of Nest Sites that have had timber harvested within 0.25 miles of nest (1992-2003)	Total Bald Eagle Roost Sites by WRIA	Bald Eagle Roost Sites located within 0.25 miles of FPHCP Lands	Percent Bald Eagle Roost Sites located within 0.25 miles of FPHCP Lands
11	Nisqually	22	1%	11	50%	19	86%	17	77%	6	27%	1	1	100%
13	Deschutes	22	1%	14	64%	22	100%	19	86%	5	23%	-	-	-
16	Skokomish-Dosewallips	22	1%	20	91%	22	100%	21	95%	19	86%	8	5	63%
12	Chambers-Clover	21	1%	10	48%	21	100%	21	100%	2	10%	-	-	-
5	Stillaguamish	19	1%	9	47%	18	95%	17	89%	2	11%	23	17	74%
23	Upper Chehalis	19	1%	9	47%	19	100%	16	84%	2	11%	-	-	-
4	Upper Skagit	14	1%	9	64%	9	64%	9	64%	4	29%	59	53	90%
10	Puyallup-White	14	1%	7	50%	13	93%	13	93%	3	21%	1	1	100%
9	Duwamish-Green	12	1%	7	58%	11	92%	11	92%	2	17%	-	-	-
29	Wind-White Salmon	3	<1%	2	67%	2	67%	2	67%	-	-	5	5	100%
	Westside Subtotals	1,912	93%	1,039	54%	1,671	87%	1,536	80%	282	15%	221	186	84%
58	Middle Lake Roosevelt	26	1%	-	-	6	23%	4	15%	Not calculated	Not calculated	1	1	100%
62	Pend Oreille	26	1%	7	27%	25	96%	24	92%	nc	nc	-	-	-
49	Okanogan	15	1%	-	-	13	87%	12	80%	nc	nc	2	1	50%
54	Lower Spokane	11	1%	5	45%	11	100%	11	100%	nc	nc	1	1	100%
59	Colville	11	1%	7	64%	9	82%	8	73%	nc	nc	-	-	-
50	Foster	8	<1%	1	13%	3	38%	3	38%	nc	nc	4	2	50%
53	Lower Lake Roosevelt	8	<1%	-	-	4	50%	1	13%	nc	nc	-	-	-
61	Upper Lake Roosevelt	7	<1%	5	71%	7	100%	7	100%	nc	nc	-	-	-

Table 8-1. Summary of bald eagle nests and communal roosts on FPHCP lands in western Washington, ordered by WRIAs with the highest number of nest sites (continued)

WRIA Number	WRIA Name	Total Bald Eagle Nest Sites by WRIA	Percent of WA Bald Eagle Nest Sites in WRIA	Bald Eagle Nest Sites Located on FPHCP Lands	Percent of Bald Eagle Nest Sites Located on FPHCP Lands	Bald Eagle Nest Sites located within 0.5 miles of FPHCP Lands	Percent of Bald Eagle Nest Sites located within 0.5 miles of FPHCP Lands	Bald Eagle Nest Sites located within 0.25 miles of FPHCP Lands	Percent of Bald Eagle Nest Sites located within 0.25 miles of FPHCP Lands	Number of Nest Sites that have had timber harvested within 0.25 miles of nest (1992-2003)	Percent of Nest Sites that have had timber harvested within 0.25 miles of nest (1992-2003)	Total Bald Eagle Roost Sites by WRIA	Bald Eagle Roost Sites located within 0.25 miles of FPHCP Lands	Percent Bald Eagle Roost Sites located within 0.25 miles of FPHCP Lands
42	Grand Coulee	4	<1%	-	-	4	100%	-	-	nc	nc	5	-	-
48	Methow	4	<1%	-	-	4	100%	3	75%	nc	nc	11	10	91%
60	Kettle	4	<1%	-	-	4	100%	4	100%	nc	nc	-	-	-
52	Sanpoil	3	<1%	-	-	-	-	-	-	nc	nc	-	-	-
55	Little Spokane	3	<1%	3	100%	3	100%	3	100%	nc	nc	-	-	-
57	Middle Spokane	3	<1%	1	33%	3	100%	3	100%	nc	nc	-	-	-
38	Naches	2	<1%	-	-	2	100%	1	50%	nc	nc	-	-	-
39	Upper Yakima	2	<1%	-	-	2	100%	2	100%	nc	nc	1	1	100%
45	Wenatchee	2	<1%	-	-	2	100%	2	100%	nc	nc	-	-	-
30	Klickitat	1	<1%	-	-	1	100%	-	-	nc	nc	6	6	100%
34	Palouse	1	<1%	-	-	1	100%	1	100%	nc	nc	-	-	-
36	Esquatzel Coulee	1	<1%	-	-	-	-	-	-	nc	nc	-	-	-
37	Lower Yakima	1	<1%	-	-	1	100%	1	100%	nc	nc	1	1	100%
40	Alkali-Squilchuck	1	<1%	-	-	1	100%	-	-	nc	nc	12	-	-
46	Entiat	1	<1%	-	-	1	100%	-	-	nc	nc	3	1	33%
	Eastside Subtotals	145	7%	29	20%	107	74%	90	62%	nc	nc	47	24	51%
	Washington Totals	2,057	100%	1,068	52%	1,778	86%	1,626	79%	nc	nc	272	211	78%

Notes: Bald eagle nest sites and communal roost site data are based on the WDFW Priority Habitats and Species database (2005b). Timber harvest information was calculated by using GIS to estimate harvest acres derived from Healey et al. (2003). The Healey et al. (2003) map data depicts stand replacing disturbance associated with timber harvest and wildfire, but does not portray changes associated with partial harvests such as commercial thinning. The values presented here are estimates only, and are not intended to be interpreted as absolute values. It is important to note that all timber harvest estimates generated from the Healey et al. (2003) data are general estimates based on our interpretation of the data.

Most bald eagle nests and communal roost sites are located in western Washington (93 percent). Of these, about 87 percent of bald eagle nest sites and 84 percent of communal roost sites are located within 0.5 miles and 0.25 miles of FPHCP covered lands, respectively. Due to their close proximity to FPHCP lands, bald eagle territories associated with these sites are likely to be influenced or affected by forest practice activities. On the over 6 million acres of FPHCP covered lands in western Washington, there are over 13,000 miles of fish-bearing streams that are potentially important for bald eagle foraging habitat. FPHCP RMZs in this part of the State represent about 13 percent of the total FPHCP acres (Table 8-2). Due to a legacy of past timber harvest, and a predominance of broadleaf forests in some riparian areas, there is relatively little mature conifer or old-forest habitat in the FPHCP RMZs. On average, about 6 percent of RMZ areas are forested with mature conifer habitat (Table 8-2). The paucity of large conifers in the FPHCP RMZs suggests that high-quality nesting sites immediately adjacent to rivers and streams are limited to a relatively small percentage of the current landscape.

Table 8-2. Mature and old-forest habitat in FPHCP riparian management zones (RMZs) in western Washington

PhysiographicProvince	Total FPHCP Acres in Province	Total RMZ Acres on FPHCP Lands	% of Acres on FPHCP Lands in RMZs	Total Mature/Old-Forest Acres in RMZs on FPHCP Lands	% of RMZ area with Mature/Old-Forest Acres on FPHCP Lands
Olympic Peninsula	715,300	113,000	16%	4,200	4%
Western Washington Lowlands	3,941,200	507,200	13%	23,200	5%
Western Washington Cascades	1,430,900	193,800	14%	20,100	10%
Western Washington Totals	**6,087,400**	**814,000**	**13%**	**47,500**	**6%**

Notes: All figures are approximate values derived from GIS data. Mature/old-forest estimates are based on suitable spotted owl habitat maps developed by Davis and Lint (2005) and account for stand-replacing timber harvest and fire losses that occurred from 1992 to 2002 (Healey et al. 2003). Riparian areas include average RMZ widths along Type S, F, and Np streams based on the average 100-year site-potential tree height for site index 2 and 3.

8.1.2.4 Bald Eagle Management Plans

Washington State's bald eagle protection rules of 1986 (WAC 232-12-292) established a legal requirement for private, State, and municipal landowners to reach agreement with WDFW on measures to protect breeding and roosting habitat. These rules are the most important mechanism for the protection of habitat on private lands in Washington (Stinson et al. 2001). Each site-management plan is based on the unique characteristics of individual bald eagles and their territories. Bald eagle management plans under these rules seek to protect nesting and roosting eagles from disturbance, and preserve habitat by protecting large nest, perch, and roost trees, as well as protecting trees that provide a visual screen and windthrow buffers adjacent to nest sites.

As of 2001, over 1,100 bald eagle management plans had been signed by Washington landowners since 1986 (Stinson et al. 2001). About 72 percent of these plans were for residential developments, and 23 percent were for forest practice activities. These management plans represented agreements for 393

discrete bald eagle sites, indicating multiple plans may be developed for a single eagle territory depending on landownership and types of activities. Management plans have been useful, but are not perfect habitat protection because they involve compromises between landowner goals and bald eagle needs. Because each plan is developed for an individual landowner, the plans do not represent comprehensive territory management plans, and each plan is subject to amendments depending upon landowner needs and bald eagle occupancy. The rules do not protect habitat that is not currently occupied by bald eagles. Residential development along the shorelines of Puget Sound is considered to be the most-significant threat to bald eagle habitat in Washington (Stinson et al. 2001).

The FWS generally does not participate in or have oversight in the development of bald eagle management plans. However, the FWS does review many Federal activities in Washington that deal primarily with transportation projects and/or and actions authorized through Army Corps of Engineers permits. For the 5-year period from 2000 to 2004, the FWS completed over 1,800 consultations considering effects to bald eagles, including 40 consultations that documented adverse effects associated with nesting disturbance or loss of habitat. Although there has been some loss of bald eagle habitat associated with these actions, the majority of these activities (98 percent) have had only minor effects to bald eagles, due to the use of seasonal restrictions that minimize disturbance to nesting or roosting bald eagles.

In addition to the bald eagle management plans described above, activities must be in compliance with the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§703-712); the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§668-668d); and other applicable rules and regulations, such as the Washington State Shoreline Management Act discussed below.

Washington Forest Practices Rules and Shoreline Management Act

Under the Washington Forest Practices Rules (WAC 222-16-080), certain activities are considered Class-IV Special activities. These activities include timber harvesting, road construction, aerial application of pesticides, or site preparation within 0.5 miles of a known active nest site documented by WDFW between the dates of January 1 and August 15 (or 0.25 miles at other times of the year) and within 0.25 miles of communal roost sites. These rules are designed to protect nesting bald eagles from disturbance during the nesting season, but do not necessarily preclude timber harvest within the nesting territory. A review of timber harvest in western Washington from the period from 1992 to 2002 indicates that 282 bald eagle nest sites (15 percent) have had clearcut timber harvest located within 0.25 miles of the nest site (Table 8-3). Under the bald eagle protection rules, landowners that intend to harvest timber near a bald eagle nest are required to work with WDFW to develop a bald eagle management plan for the area surrounding the nest. Upon completion of such a plan with WDFW (WAC 222-16-080 (6)(d)), a landowner is then exempt from the Class IV special rules if the landowners activities are consistent with the bald eagle management plan.

The Shoreline Management Act also provides some protection for bald eagle habitat along major rivers, lakes, and marine shorelines. The current regulation restricts timber harvest to 30 percent of the volume of timber every 10 years within a buffer that extends 200 feet from the "shorelines of statewide significance." These shoreline areas provide important perching and roosting habitat for bald eagles, particularly along the marine shorelines of Puget Sound. However, if the land within the shoreline buffers is converted to non-forestry uses (such as residential development), the timber can be clearcut (unless restricted by other regulations) (Stinson et al. 2001). Counties have the discretion to create their own shoreline management guidelines for residential areas that supersede the State's shoreline rules. These

guidelines may be more or less restrictive than the State's shoreline rules, and many counties now use an abbreviated bald eagle management plan template developed by WDFW that is tailored for residential developments (Stinson et al. 2001). Conversion information available from WDNR's forest practice applications database indicates that 53,821 acres of forestland were converted to other uses between 1997 and 2003, with an average of 7,687 acres per year statewide (USFWS and NMFS 2005:3-20). The rate at which timber lands are being converted to non-forestry uses in the shoreline areas is unknown, but only about one percent of bald eagle management plans reviewed were for this type of activity. Residential developments located primarily in Island, Kitsap, and San Juan Counties accounted for over 70 percent of bald eagle site-management plans (Stinson et al. 2001).

Table 8-3. Changes to NRF[1] habitat acres from activities subject to ESA section 7 consultations and other causes range-wide from May 1994 to April 2004 (the first decade of the Northwest Forest Plan).

Northwest Forest Plan Group/Ownership		ESA Section 7 Consultation Habitat Changes[2]		Other Habitat Changes[3]	
		Removed/ Downgraded	Degraded	Removed/ Downgraded	Degraded
Federal -Northwest Forest Plan	Bureau of Land Management	61,015	8,627	760	0
	Forest Service	88,650	414,868	11,557	5,109
	National Park Service	908	2,861	0	0
	Multi-agency[4]	15,175	23,314	0	0
	NWFP Subtotal	165,748	449,670	12,317	5,109
Other Management and Conservation Plans (OMCP)	Bureau of Indian Affairs and Tribes	99,062	27,890	0	0
	Habitat Conservation Plans	295,889	14,430	0	0
	OMCP Subtotal	394,951	42,320	0	0
Other Federal Agencies & Lands[5]		241	1	28	70
Other Public & Private Lands[6]		10,323	878	30,240	20,949
TOTAL Changes		**571,263**	**492,869**	**42,585**	**26,128**

Source: Table A from the FWS Northern Spotted Owl Consultation Effects Tracker (web application and database) Feb. 23, 2006.

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

2 Includes both effects reported by U.S. Fish and Wildlife Service (2001a) and subsequent effects compiled in the Northern Spotted Owl Consultation Effects Tracker (web application and database).

3 Includes effects to NRF habitat (as documented through technical assistance) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation. Information from all fires occurring since 1994 is not yet available for entry into the database and thus is not included here but is compiled in Table 8-6.

4 The 'Multi-agency' grouping is used to lump a variety of Northwest Forest Plan mixed agency or admin unit consultations that were reported together prior to June 26, 2001, and cannot be separated out.

5 Includes lands that are owned or managed by other Federal agencies not included in the Northwest Forest Plan.

6 Includes lands not covered by Habitat Conservation Plans that are owned or managed by states, counties, municipalities, and private entities. Effects that occurred on private lands from right-of-way permits across U.S. Forest Service and Bureau of Land Management lands are included.

8.1.2.5 Role of the Action Area in the Conservation of the Bald Eagle

The action area constitutes a large area, which is critical to the conservation of bald eagles. The FPHCP covered lands provide important breeding, feeding, and sheltering habitat for over 80 percent of the nesting and wintering bald eagles in Washington.

Existing nest sites and winter communal roost sites should receive similar protection. Overstory trees near these sites should be retained to provide wind breaks and screening from disturbances. Even old unused sites should be protected, as they may be re-used. Thinning and selective harvest can be used to help create proper tree species composition and stand structures. Thinning is needed to create tree characteristics of large well-spaced limbs. These tree characteristics cannot develop within dense stands (USDI 1986). Forest management is helpful in addressing forest health issues. Important sites should be protected from habitat loss and degradation. Disturbance surrounding these sites should be minimized, and these areas should be prioritized for fire suppression. Snags and other potential perch trees should be retained in association with nesting, roosting, perching, and foraging sites.

Foraging areas should be protected. Foraging areas are important for breeding and non-breeding individuals, as well as for wintering birds. An available supply of inland and anadromous fish is important. Helpful measures include fish habitat protection to provide a healthy population of fish, as well as limiting recreation and other disturbances to ensure the supply of fish is available to bald eagles. Water levels should be managed to maintain and restore a supply of fish. Winding and braided rivers should be preserved to ensure deep pools and open gravel bars. Stream and river channelization and levees should be discouraged. In addition, prey should be maintained. Waterfowl make up a significant portion of the bald eagles diet throughout the West. Suitable perch trees in important foraging areas should be retained and developed.

In summary, the action area is important for a variety of reasons: feeding, breeding, and sheltering; and there are a number of factors that should be addressed. These include reducing common forms of mortality and sub-lethal effects of habitat loss and disturbance.

8.1.3 EFFECTS OF THE ACTION: Bald Eagle

8.1.3.1 Summary of How the FPHCP Affects Bald Eagle Habitat

The FPHCP RMZ prescriptions in combination with the existing shoreline management rules will provide for the protection of shoreline trees along the margins of rivers, streams, lakes, marine waters, and wetlands on lands that are managed for timber production. The total RMZ width varies depending on stream type, site class, and stream width. RMZs are defined by the 100-year site-index tree-height (or 200 feet for shoreline management zones), along with any additional protected areas associated with CMZs. The Washington Forest Practices Rules for western Washington include a minimum 50-foot no-harvest buffer, and a limited entry buffer from 50 to 200 feet, from rivers and fish-bearing streams. Overall, the FWS estimates a range of 40 to 60 percent, depending on site class, of the existing trees within the RMZs that will likely be retained in the short-term to provide for the desired future condition of mature, fully stocked riparian stands over time.

The riparian buffers will be managed to retain the largest trees that are immediately adjacent to streams, rivers, and shorelines. These trees will provide potential bald eagle nesting, roosting, and perch trees. Currently, only about five to seven percent of riparian zones in the FPHCP area provide large conifer habitat. As early and mid-seral riparian areas mature over time, large trees suitable for nesting, roosting,

or perching in the FPHCP riparian zones will increase, ultimately improving bald eagle habitat conditions in the RMZs. Riparian thinning has the potential to accelerate the development of larger diameter trees and to promote the development of larger lateral branches which are important habitat features for bald eagles.

Although the development of large trees in the RMZs is expected to be beneficial to bald eagles over the long-term, these narrow shoreline strips of trees do not protect all forested areas that are important for eagles. In Washington, only about 35 percent of bald eagle nests are located within 200 feet of a shoreline (Stinson et al. 2001). The other 65 percent of nest sites are located more than 200 feet from shore. In the absence of an active nest site or a communal roost, there are no provisions in the FPHCP to protect bald eagle habitat beyond the RMZ, or beyond the core use areas protected by bald eagle management plans under the Washington Forest Practices Rules.

Potential bald eagle habitat that is currently unoccupied may be harvested in upland areas and in riparian areas. Only a small portion of this harvest (i.e., Inner and Outer Zone RMZ harvest) is considered an effect of the proposed Permit issuance. Retention of habitat within the RMZ would also be considered an effect of the proposed Permit issuance. Where thinnings are conducted, there would likely be long-term benefits derived for bald eagles as a result of retention of the largest trees and providing for the growth of lateral branches. In many cases, the thinnings will retain too many trees for the realized benefits to be dramatic.

Under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, take includes a variety of actions, but does not provide protection from the harvest or degradation of unoccupied habitat. Also, the ESA does not protect the harvest or degradation of unoccupied habitat. Therefore, the effects discussed above would be "otherwise lawful" so long as they do not violate other State or local laws.

8.1.3.2 Effects of the FPHCP to Bald Eagle Nesting Territories

Over 50 percent (1,068 sites) of the documented bald eagle nests sites in Washington are located on FPHCP covered lands, and about 86 percent (1,778 sites) of nest sites are located within 0.5 miles of FPHCP covered lands (Table 8-1) and are, therefore, likely to be affected or influenced by FPHCP activities. We expect landowners on FPHCP covered lands will continue to work with WDFW to develop bald eagle management plans for any forest practices activities that occur within a 0.5-mile radius of occupied bald eagle nest sites. We expect that activities conducted according to such plans will comport with applicable Federal laws, including the Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, and the ESA. In a recent review cited by Stinson et al. (2001), nearly all bald eagle management plans (97 percent) assigned habitat protection or a combination of habitat protection and timing restrictions to avoid disturbance to nesting bald eagles. The remaining three percent involved only timing restrictions and were typically for forest practice activities. In bald eagle plans prescribing habitat protection measures, four general types of vegetation management strategies were employed, often in combination: no-cut buffers, partial retention of trees, large-tree retention, and tree planting. Partial retention strategies were most frequently used for habitat protection, appearing in 76 percent of bald eagle plans.

Bald eagle management plans are designed to protect the nest tree and provide screening vegetation surrounding the nest tree. Management plans may also provide for the protection of prominent perch trees along shoreline areas adjacent to the nest tree. These plans do not employ set buffer distances that protect all trees within a certain distance from the nest or roost site. The FPHCP will complement the bald eagle site plans by providing for the protection of existing riparian trees, and allowing for the

development of large riparian trees over time both within existing territories, and along all forest shorelines managed for timber production. The bald eagle site plans are designed to protect nesting bald eagles from disturbance in close proximity to the nest during the nesting season, but do not necessarily preclude timber harvest within the nesting territory. A review of timber harvested in western Washington from the period 1992 to 2002 indicates that 282 bald eagle nest sites (15 percent) have had clearcut timber harvest (greater than 1 acre) located within 0.25 miles of the nest site (Table 8-1).

Stinson et al. (2001) provides a review of the effects of habitat alteration and human disturbance to nesting bald eagles. This review indicates that bald eagle pairs vary widely in their response to disturbance depending on previous nesting history, the birds' previous experience with humans, the availability of alternative nest sites, and the amount of development in the area. Assuming the presence of an adequate food supply, the most important factor associated with bald eagle nest locations and success is the presence of large, super-dominant trees (Watson and Pierce 1998a). Timber harvest that results in a loss of nest trees or potential nesting habitat, or prevents trees from attaining the size capable of supporting a nest, reduces the capability of the landscape to support bald eagle nesting territories (Stinson et al. 2001).

Anthony and Isaacs (1989) recommended a 1,312 foot- (400 meter) primary buffer zone around nests to minimize vulnerability of the nest area to blowdown from wind, fire, or insect and disease damage. Anthony and Isaacs' (1989) findings suggested that forest practices (timber harvest and road construction) and associated human activities within 1,312 feet (400 meters) of bald eagle nests were correlated with reduced productivity and reproductive success. Although timber harvest can result in the loss of trees that would otherwise be used by bald eagles, nest productivity and reproductive success is not clearly affected by the loss of a few trees within the territory (Watson and Pierce 1998a). In their study of bald eagles in the Puget Sound area, Watson and Pierce (1998a) concluded that optimal habitat management for bald eagle nest sites would protect habitat within 1,969 feet (600 meters) of the nest site, protect shoreline trees within 4,921 feet (1.5 kilometers) along each shoreline from the nest, and avoid activities within 1,312 feet (400 meters) of the nest during the nesting season to protect bald eagles from potentially adverse effects associated with increased flushing, reduced incubation time, and reduced feeding of eaglets.

We expect that activities implemented under the FPHCP would not remove occupied bald eagle nest trees or important perch trees within the core-use areas of occupied bald eagle territories. If such activities were conducted, they would violate the Washington Forest Practices Rules for bald eagle protection. Further, the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. §§703-712), and the Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. §§668-668d) protect bald eagle nests. Other potential nest and perch trees could be harvested from within active bald eagle territories, leading to eagle avoidance of portions of their territories while timber harvest or road construction activities are underway. Bald eagle nesting territories often encompass several miles of shoreline habitat. Watson and Pierce (1998a) reported that bald eagle core-use areas average 0.73 square miles and the length of shoreline used averaged 2.36 miles in the Puget Sound area. Under the Washington Forest Practices Rules, timber harvesting and road construction within 0.5 miles of a bald eagle nest during the bald eagle nesting season is considered a Class IV-Special activity (WAC 222-16-080). Therefore, we expect that most forest practices activities within a 0.5-mile radius of the nest site would be restricted to the months outside of the bald eagle nesting season (i.e., September through December). This would preclude disturbance to nesting bald eagles in the core-use area surrounding the nest tree, but would not necessarily protect all important perch trees within nesting territories, or provide for the protection and development

of bald eagle habitat beyond the RMZ areas. Nest trees or territories that are vacated by bald eagles for more than five years may also be harvested.

With implementation of the FPHCP, no fewer nesting bald eagles are expected on FPHCP covered lands than currently nest on these lands for the following reasons. We expect that the requirement for bald eagle management plans will adequately protect existing sites and that management of riparian areas will provide potential future habitat. The FPHCP should also protect key habitat for forage species such as fish and waterfowl, to the degree that such habitats are subject to forest practices jurisdiction. There may be additional bald eagle nesting habitat produced as the FPHCP would provide for growth of riparian areas in conjunction with some active management. However, in areas where numbers of bald eagles are limited by spacing of territories or through non-habitat-related mechanisms, there may be no additional territories or nesting sites established. The FPHCP would provide for opportunities on the landscape for bald eagles to feed, breed, and shelter and the FPHCP would not contribute to the negative effects causing the types of mortality (e.g., shooting, trapping, poisons, electrocution, etc.) discussed earlier. Because the conservation role of the action area would be maintained or enhanced by the FPHCP, we believe the few negative effects (e.g., removal of potential, unoccupied nest trees or perch trees) that may result from the proposed FPHCP would not degrade the existing bald eagle population.

We do not anticipate biological effects to bald eagles caused by this action that would result in take. Actions that would result in take (e.g., harvest of active, occupied nest trees) are not authorized by the Permit. Activities that would result in take of bald eagles would invalidate the proposed Permit with respect to covered species.

8.1.3.3 Effects to Wintering Bald Eagle Communal Roost Sites

About 78 percent (211 sites) of communal roost sites in Washington are located within 0.25 miles of FPHCP covered lands (Table 8-1) and are, therefore, likely to be affected or influenced by FPHCP activities. The FWS anticipates that covered activities implemented under the FPHCP would not remove stands that provide communal bald eagle roost sites. Other trees that could provide potential roosting habitat, or provide buffers to adjacent roosting stands could be harvested in close proximity to active roost sites. Over 80 percent of roost-management plans developed in Washington were for forest practices activities, and the majority of these plans used no-harvest or partial-retention buffers to protect bald eagle roosting habitat (Stinson et al. 2001). These plans protect habitat within and immediately adjacent to the roost sites, but do not necessarily protect all of the surrounding forest that contributes to the integrity of the roosting habitat.

Communal roost sites in Washington vary in size (less than 5 acres to greater than 70 acres), are typically located near important foraging areas, and provide some protection from prevailing winds (Watson and Pierce 1998a). Clearcut timber harvest and heavy thinning associated with upland timber harvest can create abrupt forest edges along the FPHCP RMZs. Exposed areas associated with clearcut edges are likely to have increased levels of blowdown and wind damage compared with a contiguous forest stand. This may result in the loss of additional trees in FPHCP RMZs, thereby further reducing the quantity and quality of suitable bald eagle habitat in these areas. The harvest of tree buffers around roost sites, or the loss of roost trees or stands to timber harvest may increase the exposure of wintering bald eagles to inclement weather, potentially affecting the health of wintering bald eagles. The FPHCP will generally complement the roost-management plans by providing for the protection of existing riparian trees, and allowing for the development of large riparian trees over time both within existing roost areas, and along all forested shorelines managed for timber production.

With implementation of the FPHCP, no fewer wintering bald eagles are expected on FPHCP covered lands than currently winter on these lands for the following reasons. We expect that the requirement for bald eagle management plans will adequately protect existing communal roost sites and that management of riparian areas will provide potential future habitat. The FPHCP is expected to protect key habitat for forage species such as fish and waterfowl, to the degree that such habitats are subject to forest practices jurisdiction. There may be additional communal roost sites as the FPHCP would provide for growth of riparian areas in conjunction with some active management. The FPHCP would provide for opportunities on the landscape for wintering bald eagles to feed and shelter, and the FPHCP would not contribute to mortality. Because the conservation role of the action area would be maintained or enhanced, we believe the few negative effects (e.g., loss of potential, unoccupied nest trees and perch trees) that may result from the FPHCP would not degrade the current bald eagle population.

We do not anticipate biological effects to bald eagles caused by this action that would result in take. Actions that would result in take of wintering bald eagles are not authorized by the Permit. Activities that would result in take of wintering bald eagles would invalidate the proposed Permit with respect to covered species.

8.1.4 CUMULATIVE EFFECTS: Bald Eagle

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Cumulative activities were discussed earlier in the section entitled **Comprehensive Cumulative Activities**. Many of these are relevant to bald eagles. Cumulative actions that are particularly relevant to bald eagles are also discussed below.

Upland areas and the stands adjacent to RMZs are likely to be managed on a 40- to 80-year harvest rotation. These rotations essentially preclude the development of large trees suitable for nesting (with the exception of wildlife retention trees), thus limiting the development of potential bald eagle nesting habitat to those areas within the FPHCP that are protected within RMZs, high-hazard slopes, occupied bald eagle territories, or other areas that are protected for marbled murrelet or northern spotted owl conservation. The bald eagle population in Washington has increased substantially in the past 20 years, but two-thirds of the State's nests are on private lands. Conversion of forestland to residential uses near marine waters is the greatest threat to bald eagles in Washington (Stinson et al. 2001). These activities also require bald eagle site-management plans, but they may not provide the highest quality bald eagle habitat due to the proximity to developments and human activities compared with bald eagle habitat in non-developed areas.

8.1.5 CONCLUSION: Bald Eagle

After reviewing the current status of the bald eagle, the environmental baseline for the action area, the effects of the FPHCP, and the cumulative effects, it is the FWS's Opinion that the FPHCP, as proposed, is not likely to jeopardize the continued existence of the bald eagle. No critical habitat has been designated for this species, therefore, none will be affected.

Bald eagles associated with approximately 87 percent of the nesting territories in Washington are expected to be affected by the impacts from habitat removal or alteration. However, several factors serve to limit adverse effects to bald eagles. We anticipate that covered activities implemented under the

FPHCP would not remove habitat that is essential to the integrity of nesting territories from within the core areas of occupied bald eagle nesting territories or communal roost sites. Essential habitat in these areas will be protected and managed through the development of bald eagle site-management plans that will provide for the protection of breeding and wintering bald eagles and maintain bald eagle productivity. Other potential nest, perch, or roost trees could be harvested from within bald eagle territories, or from the limited-entry timber harvesting allowed in RMZs. Although some habitat loss is likely to occur, the potential adverse affects to bald eagle occupancy and productivity would be minimized through the retention of essential habitat and seasonal restrictions to avoid disturbance to nesting and roosting bald eagles.

The bald eagle population in Washington has been increasing steadily for 20 years, despite the fact that most sites are located on private lands and most have been affected by past forest practice activities or residential development. Current State and Federal laws have effectively protected the bald eagle and contributed to its recovery. Numeric delisting goals within the Pacific States Recovery Region have been met since 1995, and goals for nest productivity and average success rates for occupied breeding areas have been met or exceeded (64 FR 36454-36464). Where suitable nesting and roosting habitat does not currently exist, the FPHCP will eventually produce potential nesting and roosting sites in the RMZs. However, it will require several decades for the habitat to develop. Although the development of large trees in the RMZs is expected to be beneficial to bald eagles over the long-term, these narrow shoreline strips of trees do not protect all forested areas that are important for bald eagles. In the absence of an active nest site or a communal roost, there are no provisions in the FPHCP to protect bald eagle habitat beyond the RMZs. These protections will maintain the current distribution of bald eagles on FPHCP lands, but will limit the recovery of suitable habitat in the RMZs.

Based on the information presented above, implementation of the FPHCP is not expected to cause significant adverse effects to the overall reproduction, numbers, and distribution of bald eagles in the Pacific States Bald Eagle Recovery Region. The bald eagle population on FPHCP covered lands is likely to remain stable or increase during the term of the proposed Permit. Implementation of the FPHCP is not expected to cause take of the bald eagle.

8.2 NORTHERN SPOTTED OWL

8.2.1 STATUS OF THE NORTHERN SPOTTED OWL

8.2.1.1 Legal Status

The northern spotted owl (*Strix occidentalis caurina*) was listed as federally threatened on June 26, 1990 under the ESA. It was listed due to widespread habitat loss across its entire range and the inadequacy of existing regulatory mechanisms to provide for its conservation (U.S. Fish and Wildlife Service 1990a).

8.2.1.2 Life History

Detailed accounts of the taxonomy, ecology, and reproductive characteristics of the northern spotted owl are found in the 1987 and 1990 U.S. Fish and Wildlife Service Status Reviews (U.S. Fish and Wildlife Service 1987, 1990b), the 1989 Status Review Supplement (U.S. Fish and Wildlife Service 1989), the Interagency Scientific Committee (ISC) Report (Thomas et al. 1990), the Forest Ecosystem Management Assessment Team (FEMAT) Report (Thomas and Raphael 1993), the final rule designating the northern

spotted owl as a threatened species (U.S. Fish and Wildlife Service 1990a), and the Scientific Evaluation of the Status of the Northern Spotted Owl (Courtney et al. 2004).

Taxonomy

The northern spotted owl is one of three subspecies of spotted owls currently recognized by the American Ornithologists' Union and is typically associated with old-growth forest habitats throughout the Pacific Northwest. The taxonomic separation of these three subspecies is supported by genetic (Barrowclough and Gutiérrez 1990), morphological (Gutiérrez et al. 1995) and biogeographic information (Barrowclough and Gutiérrez 1990).

Physical Description

The northern spotted owl is a medium-sized owl, approximately 18-19 inches (46-48 centimeters) in length and approximately 1.1-1.9 pounds (490-850 grams) in weight (Gutiérrez et al. 1995), and is the largest of the three subspecies (Gutiérrez et al. 1995). It is dark brown with a barred tail and white spots on the head and breast, and has dark brown eyes that are surrounded by prominent facial disks. Three age classes can be distinguished on the basis of plumage characteristics (Forsman 1981; Moen et al. 1991). The northern spotted owl superficially resembles the barred owl (*Strix varia*), a species with which it occasionally hybridizes (Kelly et al. 2003). Hybrids exhibit characteristics of both species (Hamer et al. 1994).

Current and Historical Range

The current range and distribution of the northern spotted owl extends from southern British Columbia through western Washington, Oregon, and California as far south as Marin County (U.S. Fish and Wildlife Service 1990b). The southeastern boundary of its range is the Pit River area of Shasta County, California. The range of the northern spotted owl is partitioned into 12 physiographic provinces (provinces), based upon recognized landscape subdivisions exhibiting different physical and environmental features (Thomas et al. 1993). These provinces are distributed across the range as follows: four provinces in Washington (Washington Cascades East, Olympic Peninsula, Washington Cascades West, Western Lowlands); five provinces in Oregon (Oregon Coast Range, Willamette Valley, Oregon Cascades West, Oregon Cascades East, Klamath Mountains); and three provinces in California (California Coast, California Klamath, California Cascades). The current range of the northern spotted owl is similar to its historical range where forested habitat still exists. The distribution of habitat is influenced by the natural and human-caused fragmentation of vegetation and natural topography. The northern spotted owl has been extirpated or is uncommon in certain areas. For instance, there have only been a few nesting pairs in southwestern Washington for a number of years, although they have persisted there for the past decade. Timber harvest activities have eliminated, reduced, or fragmented northern spotted owl habitat and decreased overall population densities across its range, particularly within the coastal provinces where habitat reduction has been concentrated (Thomas and Raphael 1993).

Behavior

Northern spotted owls are territorial. However, home ranges of adjacent pairs overlap (Forsman et al. 1984; Solis and Gutiérrez 1990) suggesting that the area defended by an owl pair is smaller than the area they use for foraging. Territorial defense is primarily done through hooting, barking and whistle type calls.

Northern spotted owls are monogamous and usually form long-term pair bonds, although separations of pairs do occur. There are no known examples of northern spotted owl polygyny, although associations of three or more birds have been reported (Gutiérrez et al. 1995).

8.2.1.3 Habitat Relationships

Home Range

Northern spotted owl home range size varies by province. Home range size generally increases from south to north, which is likely in response to decreasing habitat quality (U.S. Fish and Wildlife Service 1990b). Home range size has been linked to habitat type, availability, and abundance of prey (Zabel et al. 1995).

Based on available radio-telemetry data (Thomas et al. 1990), the FWS estimated median annual home range size for the northern spotted owl by province throughout its range. Because the actual configuration of the home range is rarely known, the estimated home range of a northern spotted owl pair is represented by a circle centered upon a northern spotted owl activity center, with an area approximating the provincial median annual home range. For example, estimated home range area varies from 3,340 acres (based on a 1.3-mile radius area) in California to 14,271 acres (based on a 2.7-mile radius circle) in Washington. The FWS uses a 0.7-mile radius circle (984 acres) to delineate the area most heavily used (core area) by northern spotted owls during the nesting season. Variation in the size of the actual core area also varies geographically. For example, northern spotted owls in northern California focused their activities in core areas that ranged from about 167 to 454 acres, with a mean of about 409 acres; approximately half the area of the 0.7-mile radius circle (Bingham and Noon 1997). Northern spotted owls maintain smaller home ranges during the breeding season and often dramatically increase their home range size during fall and winter (Forsman et al. 1984; Sisco 1990).

Although differences exist in natural stand characteristics that influence provincial 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 northern spotted owl abundance and nesting success (Bart and Forsman 1992; Bart 1995).

Habitat Use

Forsman et al. (1984) reported that northern spotted owls have been observed in the following forest types: Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), grand fir (*Abies grandi*s), 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*). In parts of the Oregon Coast Range, northern spotted owls have been recorded in pure hardwood stands (Glenn et al. 2004). In California, northern spotted owls are found from near sea level in coastal forests to approximately 6988 feet (2,130 meters) in the Cascades (Gutiérrez 1996). The upper elevation limit at which northern spotted owls occur decreases gradually with increasing latitude in Oregon and Washington (Lint 2005). In all areas, the upper elevation limit at which northern spotted owls occur corresponds to the transition to subalpine forest, which is characterized by relatively simple structure and severe winter weather (Gutiérrez 1996).

Roost sites selected by northern spotted owls have more complex vegetation structure than forests generally available to them (Barrows and Barrows 1978; Forsman et al. 1984; Solis and Gutiérrez 1990).

These habitats are usually multi-layered forests having high canopy closure and large diameter trees in the overstory.

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

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

Habitat Selection

Northern spotted owls generally rely on older forested habitats because they contain the structures and characteristics required for nesting, roosting, foraging, and dispersal. These characteristics include the following: (1) a multi-layered, multi-species canopy dominated by large overstory trees; (2) moderate to high canopy closure; (3) a high incidence of trees with large cavities and other types of deformities, especially dwarf mistletoe brooms; (4) numerous large snags; (5) an abundance of large, dead wood on the ground; and (6) open space within and below the upper canopy for northern spotted owls to fly (Thomas et al. 1990; U.S. Fish and Wildlife Service 1990b). Forested stands with high canopy closure also provide thermal cover (Weathers et al. 2001), as well as protection from predation. Recent landscape-level analyses in portions of the Klamath Province suggest that a mosaic of late-successional habitat interspersed with other vegetation types may benefit northern spotted owls more than large, homogeneous expanses of older forests (Zabel et al. 2003; Franklin et al. 2000; Meyer et al. 1998).

Dugger et al. (2005) found that apparent survival and reproduction was positively associated with the proportion of older forest near the territory center in the Klamath Province. Survival decreased dramatically when the amount of non-habitat exceeded approximately 50 percent (Dugger et al. 2005). Northern spotted owl territories with habitat fitness potentials (i.e., expressed as a lambda estimate for the territory) of less than 1.0 were generally characterized by less than 40 to 50 percent old forest habitat near the territory center (Dugger et al. 2005). The authors concluded that they found no support for either a positive or negative direct effect of intermediate-aged forest on either survival or reproduction.

Olson et al. (2004) found that survival in the Oregon Coast Range had a quadratic relationship with the amount of late- and mid-seral forest near nesting centers. Reproductive rates fluctuated biennially and were positively related to the amount of edge between late- and mid-seral forests and other habitat classes. Olson et al. (2004) conclude that their result indicated that while mid- and late-seral forests are important to northern spotted owls, a mixture of these forest types with younger forest and non-forest may be best for northern spotted owl survival and reproduction in their study area.

In redwood forests along the coast range of California, northern spotted owls may be found in younger forest stands with structural characteristics of older forests (Thomas et al. 1990). However, northern spotted owls do not generally appear to select for stands of intermediate or younger ages (Solis and Gutiérrez 1990; Thomas et al. 1990). Where northern spotted owls have been found nesting in young forest, such occurrences have been attributed to the presence of large residual trees with cavities (Buchanan et al. 1993), climatic conditions conducive to the use of platform nests (Forsman and Giese

1997), and/or alternate sources of prey that do not rely on cavities for reproduction (Zabel et al. 1995). In Washington, foraging occurs in nesting and roosting habitat, as well as in coniferous forest with smaller trees and less structural diversity, if prey such as the northern flying squirrel are present (Hanson et al. 1993).

In mixed conifer forests of the Eastern Cascade Mountains, Washington, 27 percent of nest sites were in old-growth forests, 57 percent in the understory reinitiation phase of forest stand development, and 17 percent in the stem exclusion phase of forest stand development (Buchanan et al. 1995). In the Western Cascade Mountains, Oregon, 50 percent of northern spotted owl nests were in late-seral/old-growth stands (greater than 80-years-old) and none were found in stands less than 40-years-old (Irwin et al. 2000).

Ward (1990) found that northern spotted owls foraged in areas that had lower variance in prey densities (prey were more predictable in occurrence) within older forests and near ecotones of old forest and brush seral stages. Zabel et al. (1995) showed that northern spotted owl home ranges are larger where flying squirrels are the predominant prey and, conversely, are smaller where woodrats (*Neotoma* spp.) are the predominant prey.

In the Western Washington Cascade Mountains, northern spotted owls used mature/old forests dominated by trees greater than 20 inches (50 centimeters) diameter-at-breast height with greater than 60 percent canopy closure more often than expected for roosting during the non-breeding season and used young forest trees 8 to 20 inches (20 to 50 centimeters) diameter at breast height with greater than 60 percent canopy closure) less often than expected based on availability (Herter et al. 2002).

8.2.1.4 Reproductive Biology

Northern spotted owls exhibit high adult annual survival rates and are relatively long-lived (U.S. Fish and Wildlife Service 1992a; Anthony et al. 2004). Northern spotted owls do not typically reach sexual maturity until after two years of age (Miller et al. 1985; Thomas et al. 1990). Adult females lay an average of 2 eggs per clutch with a range of 1 to 4 eggs. Northern spotted owl pairs do not typically nest every year, nor are nesting pairs successful every year (U.S. Fish and Wildlife Service 1990b). The small clutch size, temporal variability in nesting success, and somewhat delayed maturation all contribute to the relatively low reproductive rate of this species (Gutiérrez 1996).

Nest sites are usually located within stands of old-growth and late-successional forest dominated by Douglas-fir (*Pseudotsuga menziesii*), and they contain structures such as cavities, broken tree tops, or mistletoe (*Arceuthobium* spp.) brooms (Forsman et al. 1984; Blakesley et al. 1992; LaHaye and Gutiérrez 1999). Northern spotted owls do not build their own nests. Most nesting occurs within naturally formed cavities in live trees or snags, but abandoned platform nests of the northern goshawk (*Accipiter gentilis*) and common raven (*Corvus corax*) have also been used (Buchanan et al. 1993). In general, courtship and nesting behavior begins in February to March with nesting occurring from March to June; however, timing of nesting and fledging varies with latitude and elevation (Forsman et al. 1984). After young fledge from the nest, they depend on their parents until they are able to fly and hunt on their own. Parental care continues post-fledging into September (U.S. Fish and Wildlife Service 1990a), and sometimes into October (Forsman et al. 1984). During this time the adults may not roost with their young during the day, but they respond to begging vocalizations by bringing food to the young (Forsman et al. 1984).

Some northern spotted owls are not territorial but either remain as residents within the territory of a pair or move among territories (Gutiérrez 1996). These birds are referred to as "floaters." Floaters have

special significance in northern spotted owl populations because they may buffer the territorial population from decline (Franklin 1992). Little is known about floaters other than that they exist and typically do not respond to calls as vigorously as territorial birds (Gutiérrez 1996).

8.2.1.5 Dispersal Biology

Natal dispersal of northern spotted owls from Oregon and Washington typically begins from mid- to late-September, and it is remarkably synchronous across broad areas (Forsman et al. 2002). When data from many dispersing northern spotted owls are pooled, the direction of dispersal away from the natal site appears random (Miller 1989; Ganey et al. 1998; Forsman et al. 2002). Dispersal direction from individual territories, however, may be non-random in response to the local distribution of habitat and topography (Forsman et al. 2002). Natal dispersal occurs in stages, with juvenile northern spotted owls settling in temporary home ranges between bouts of dispersal (Forsman et al. 2002). Median natal dispersal distance is about 10 miles for males and 15.5 miles for females (Forsman et al. 2002; Miller 1989; Ganey et al. 1998). Successful dispersal of juvenile northern spotted owls may depend on their ability to locate unoccupied suitable habitat in close proximity to other occupied sites (LaHaye et al. 2001).

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

Large non-forested valleys are apparent barriers to natal and breeding dispersal. Forested foothills between valleys may provide the only opportunities for dispersal (Forsman et al. 2002). The degree to which water bodies, such as the Columbia River and Puget Sound, function as barriers to dispersal is unclear. Analysis of genetic structure of northern spotted owl populations suggests adequate rates of gene flow may occur across the Puget Trough between the Olympic Mountains and Washington Cascades and across the Columbia River between the Olympic Mountains and the Coast Range of Oregon (Haig et al. 2001). Both telemetry and genetic studies indicate inbreeding is rare.

Dispersing juvenile northern spotted owls experience high mortality rates, exceeding 70 percent in some studies (U.S. Fish and Wildlife Service 1990a; Miller 1989). Leading known causes of mortality are starvation, predation, and accidents (Miller 1989; U.S. Fish and Wildlife Service 1990a; Forsman et al. 2002). Parasitic infection may contribute to these causes of mortality (Forsman et al. 2002). In a study on habitat use by dispersing juvenile northern spotted owls in the Oregon Coast Range, Klamath and Western Oregon Cascades Provinces (Miller et al. 1997), mature and old-growth forest were used slightly more than expected based on availability during the transient phase and nearly twice its availability during the colonization phase. Closed pole-sapling-sawtimber habitat was used roughly in proportion to availability in both phases; open sapling and clearcuts were used less than expected based on availability during colonization.

8.2.1.6 Food Habits

Composition of prey in the northern spotted owl's diet varies regionally, seasonally, annually, and locally, which is likely in response to prey availability (Carey 1993; Forsman et al. 2001; Forsman et al. 2004). Northern spotted owls are mostly nocturnal (Forsman et al. 1984), but they may forage opportunistically during the day (Laymon 1991; Sovern et al. 1994). Northern flying squirrels and woodrats are usually the predominant prey both in biomass and frequency (Barrows 1980; Forsman et al. 1984; Ward 1990; Bevis

et al. 1997; Forsman et al. 2001; 2004) with a clear geographic pattern of prey availability, paralleling differences in habitat (Thomas et al. 1990). Northern flying squirrels are generally the dominant prey item in the more mesic Douglas-fir/western hemlock forests characteristic of the northern portion of the range, whereas woodrats are generally the dominant prey item in the drier mixed conifer/mixed evergreen forests typically found in the southern portion of the range (Forsman et al. 1984; Thomas et al. 1990; Ward et al. 1998, as reviewed by Courtney et al. 2004). These prey items were found to be co-dominant in the southwest interior of Oregon (Forsman et al. 2001, 2004).

Other prey species such as the red tree vole (*Arborimus longicaudaus),* red backed voles (*Clethrionomys gapperi),* mice, rabbits and hares, birds, and insects may be seasonally or locally important (as reviewed by Courtney et al. 2004). For example, Rosenberg et al. (2003) showed a strong correlation between annual reproductive success of northern 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). Ward (1990) also noted that mice were more abundant in areas selected for foraging by northern spotted owls. Nonetheless, foraging northern spotted owls deliver larger prey to owls on the nest and eat smaller food items themselves to reduce foraging energy costs; therefore, the importance of smaller prey items, like *Peromyscus*, in the northern spotted owl diet should not be underestimated (Forsman et al. 1984, 2001, 2004).

8.2.1.7 Population Dynamics

The northern spotted owl is a relatively long-lived bird; produces few, but large young; invests significantly in parental care; experiences later or delayed maturity; and exhibits high adult survivorship. The northern spotted owl's long reproductive life span allows for some eventual recruitment of offspring, even if recruitment does not occur each year (Franklin et al. 2000).

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

A variety of factors may regulate northern spotted owl population levels. These factors may be density-dependent (e.g., territorial behavior, 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 variation in rate of population growth (Franklin et al. 2000). For example, weather could have increased negative effects on northern spotted owl fitness for those owls occurring in relatively lower quality habitat (Franklin et al. 2000). At some point, lower habitat quality may also cause the population to decline (Franklin et al. 2000).

Olson et al. (2005) used population modeling of site occupancy that incorporated imperfect and variable detectability of northern 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 averaged 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 at one study area and slightly at the other two areas. However, for all northern spotted 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).

8.2.1.8 Threats

Reasons for Listing

The northern 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" (U.S. Fish and Wildlife Service 1990a). More specifically, significant threats to the northern spotted owl included the following: (1) low populations; (2) declining populations; (3) limited habitat; (4) declining habitat; (5) distribution of habitat or populations; (6) isolation of provinces; (7) predation and competition; (8) lack of coordinated conservation measures; and (9) vulnerability to natural disturbance (U.S. Fish and Wildlife Service 1992a). These threats were characterized for each province as severe, moderate, low, or unknown. Declining habitat was recognized as a severe or moderate threat to the northern spotted owl in all 12 provinces, isolation of provinces within 11 provinces, and declining populations in 10 provinces. Consequently, these three factors represented the greatest concern range-wide to the conservation of the northern spotted owl. Limited habitat was considered a severe or moderate threat in nine provinces, and low populations a severe or moderate concern in eight provinces, suggesting that these factors are a concern throughout the majority of the 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 northern 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 northern spotted owls (Courtney et al. 2004). However, great horned owls (*Bubo virginianus*), an effective predator on northern spotted owls, are closely associated with fragmented forests, openings, and clearcuts (Johnson 1992; Laidig and Dobkin 1995). As mature forests are harvested, great horned owls may colonize fragmented forests, thereby increasing northern spotted owl vulnerability to predation.

New Threats

Barred Owls

Since the listing of the northern spotted owl under the ESA, new information suggests that hybridization with the barred owl is less of a threat (Kelly and Forsman 2004) and competition with the barred owl is a greater threat than previously anticipated (Courtney et al. 2004). Since 1990, the barred owl has expanded its range south into Marin County, California, and the central Sierra Nevada Mountains, such that it is now roughly coincident with the range of the northern spotted owl (Courtney et al. 2004). Further, barred owl populations appear to be increasing throughout the Pacific Northwest, particularly in Washington and Oregon (Zabel et al. 1996; Dark et al. 1998; Wiedemeier and Horton 2000; Kelly et al. 2003; Pearson and Livezey 2003; Anthony et al. 2004), notwithstanding the likely bias in survey methods towards underestimating actual barred owl numbers (Courtney et al. 2004). Barred owl numbers now may exceed northern spotted owl numbers in the northern Washington Cascades (Kuntz and

Christopherson 1996) and in British Columbia (Dunbar et al. 1991) and appear to be approaching northern spotted owl numbers in several other areas (e.g., Redwood National and State Parks in California [Schmidt 2003]). Barred owl populations in the Pacific Northwest appear to be self-sustaining based on current density estimates and apparent distribution (Courtney et al. 2004).

Barred owls apparently compete with northern spotted owls through a variety of mechanisms: prey overlap (Hamer et al. 2001), habitat overlap (Hamer et al. 1989; Dunbar et al. 1991; Herter and Hicks 2000; Pearson and Livezey 2003), and agonistic encounters (Leskiw and Gutiérrez 1998; Pearson and Livezey 2003). New information on encounters between barred owls and northern spotted owls comes primarily from anecdotal reports which corroborate initial observations that barred owls react more aggressively towards northern spotted owls than the reverse (Courtney et al. 2004). There is also limited circumstantial evidence of barred owl predation on northern spotted owls (Leskiw and Gutiérrez 1998; Johnston 2002). Information collected to date indicates that encounters between these two species tend to be agonistic in nature, and that the outcome is unlikely to favor the northern spotted owl (Courtney et al. 2004).

Although barred owls were initially thought to be more closely associated with early successional forests than northern spotted owls from studies conducted on the west slope of the Cascade Mountains in Washington (Hamer 1988), recent studies conducted elsewhere in the Pacific Northwest indicate that barred owls utilize a broader range of habitat types than do northern spotted owls (Courtney et al. 2004). For example, a telemetry study conducted on barred owls in the fire prone forests of eastern Washington showed that barred owl home ranges were located on lower slopes or valley bottoms, in closed canopy, mature, Douglas-fir forest (Singleton et al. 2005). In contrast, northern spotted owl sites were characterized by closed canopy, mature, ponderosa pine or Douglas-fir forests, on southern or western exposure, mid-elevation areas (Singleton et al. 2005).

The only study comparing northern spotted owl and barred owl food habits in the Pacific Northwest indicated that barred owl diets overlapped strongly (greater than 75 percent) with northern spotted owl diets (Hamer et al. 2001). However, barred owl diets were also more diverse than northern spotted owl diets, including species associated with riparian and other moist habitats, and more terrestrial and diurnal species.

Evidence that barred owls are causing the displacement of northern spotted owls is largely indirect, based primarily on retrospective examination of long-term data collected on northern spotted owls. Correlations between local northern spotted owl declines and barred owl increases have been noted in the northern Washington Cascades (Kuntz and Christopherson 1996; Herter and Hicks 2000; Pearson and Livezey 2003), on the Olympic peninsula (Wiedemeier and Horton 2000; Gremel 2000, 2003), in the southern Oregon Cascade Mountains (e.g., Crater Lake National Park [Johnston 2002]), and in the coastal redwood zone in California (e.g., Redwood National and State Parks [Schmidt 2003]). Northern spotted owl occupancy was significantly lower in northern spotted owl territories where barred owls were detected within 0.5 miles (0.8 kilometers) of the northern spotted owl territory center than in northern spotted owl territories where no barred owls were detected (Kelly et al. 2003). Kelly et al. (2003) also found that in northern spotted owl territories where barred owls were detected, northern spotted owl occupancy was significantly lower ($P < 0.001$) after barred owls were detected within 0.5 miles (0.8 kilometers) of the territory center. Occupancy was "only marginally lower" ($P = 0.06$) if barred owls were located more than 0.5 miles (0.8 kilometers) from northern spotted owl territory centers. In a Roseburg, Oregon study area, 46 percent of northern spotted owls moved more than 0.5 miles (0.8 kilometers), and 39 percent of northern spotted owls were not relocated again in at least two years after barred owls were detected within

0.5 miles (0.8 kilometers) of the territory center. Observations provided by Gremel (2000) from the Olympic National Park are consistent with those of Kelly et al. (2003); he documented significant displacement of northern spotted owls following barred owl detections "coupled with elevational changes of northern spotted owl sites on the east side of the Park" (Courtney et al. 2004). Pearson and Livezey (2003) reported similar findings on the Gifford Pinchot National Forest where unoccupied northern spotted owl sites were characterized by significantly more barred owl sites within 0.5 miles (0.8 kilometers), 1 mile (1.6 kilometers), and 1.8 miles (2.9 kilometers) from the territory center than in occupied northern spotted owl sites. Because barred owl presence is increasing within the range of the northern spotted owls, Olson et al. (2005) suggest that further declines in the proportion of sites occupied by northern spotted owls are likely.

At two study areas in Washington, investigators found relatively high numbers of territories previously occupied by northern spotted owls that are now apparently not occupied by either northern spotted or barred owls (e.g., 49 of 107 territories in the Cascade Mountains [Herter and Hicks 2000]; 23 of 33 territories in the Olympic Experimental State Forest [Wiedemeier and Horton 2000]). Given that habitat was still present in these vacant territories, some factor(s) may be reducing habitat suitability or local abundance of both species. For example, weather conditions could cause prolonged declines in abundance of both species (Franklin et al. 2000). Because northern spotted owls have been anecdotally reported to give fewer vocalizations when barred owls are present, it is possible that these supposed vacant territories are still occupied by northern spotted owls that do not respond to surveys. Likewise, survey protocols for northern spotted owls are believed to under-detect barred owls (Courtney et al. 2004). Olson et al. (2005) showed that barred owl presence had a negative effect on northern spotted owl detection probabilities, and it had either a positive effect on local-extinction probabilities (at the territory scale) or a negative effect on colonization probabilities for three study areas in Oregon. Olson et al. (2005) concluded that future analyses of northern spotted owls must account for imperfect and variable detectability, and barred owl presence, to properly interpret results. Thus, some proportion of seemingly vacant territories may be an artifact of reduced detection probability of the survey protocol. Nonetheless, previously occupied territories apparently vacant of both northern spotted and barred owls suggest that factors other than barred owls alone are contributing to declines in northern spotted owl abundance and territorial occupancy (Courtney et al. 2004).

Two studies (Kelly 2001, Anthony et al. 2004) attempted to determine whether barred owls affected fecundity of northern spotted owls in the long-term demographic study areas. Neither study was able to clearly do so, although the Wenatchee and Olympic demographic study areas showed possible effects (Anthony et al. 2004). However, both studies described the shortfalls of their methods to adequately test for this effect. Iverson (2004) reported no effect of barred owl presence on northern spotted owl reproduction, but his results could have been influenced by small sample size (Livezey 2005). Barred owls had a negative effect on northern spotted owl survival on the Wenatchee and Olympic study areas and possibly an effect on the Cle Elum study area (Anthony et al. 2004). Olson et al. (2005) found a significant (but weak) negative effect of barred owl presence on northern spotted owl reproductive output but not on survival at a Roseburg, Oregon study area (Courtney et al. 2004).

Uncertainties associated with methods, analyses, and possible confounding factors such as effects of past habitat loss and weather warrant caution in interpretation of the patterns emerging from the data and information collected to date on interactions between barred and northern spotted owls (Courtney et al. 2004). Further, data are currently lacking that would allow accurate prediction of how barred owls will affect northern spotted owls in the southern, more xeric provinces in California and Oregon Klamath

regions. In spite of these uncertainties, the preponderance of the evidence gathered thus far is consistent with the hypothesis that barred owls are playing some role in northern spotted owl population decline, particularly in Washington, portions of Oregon, and the northern coast of California (Courtney et al. 2004).

Although the barred owl currently constitutes a significantly greater threat to the northern spotted owl than originally thought at the time of listing (Courtney et al. 2004), at present it is unclear whether forest management influences the outcome of interactions between barred and northern spotted owls (Courtney et al. 2004 as summarized by Lint 2005). Some of the most recent summaries compiled on the barred owl (Courtney et al. 2004; Lint 2005; U.S. Fish and Wildlife Service 2004d) do not provide recommendations about how to deal with this potential threat. However, Buchanan et al. (2005) offer research and management options to address inter-specific relationships between barred and northern spotted owls. Due to uncertainties surrounding barred owl interactions, the FWS's status review of the northern spotted owl (U.S. Fish and Wildlife Service 2004d) did not consider the risks sufficient to reclassify the northern spotted owl as endangered.

Wildfire

The short-term (i.e., a few years) affects of wildfires on northern spotted owl demography is an important consideration for resources managers. Bond et al. (2002) examined the demography of northern spotted owls post-wildfire, in which wildfire burned through northern spotted owl nest and roost sites in varying degrees of severity. Depending on the severity of the burn, wildfires may have relatively little short-term impact on northern spotted owl demography (i.e., survival, reproduction, and site fidelity). In a preliminary study conducted by Anthony and Andrews (2004) in the Klamath Province of Oregon, their sample of northern spotted owls appeared to be using a variety of habitat types within the Timbered Rock Fire, including areas which had experienced moderate burning. In 1994, the Hatchery Complex wildfires burned 43,498 acres (17,603 hectares) in the Wenatchee National Forest, eastern Cascades, Washington, affecting six northern spotted owl activity centers (Gaines et al. 1997). Northern spotted owl habitat within a 1.8 miles (2.9 kilometers) radius of the activity centers was reduced by 8 to 45 percent (mean equals 31 percent) due to direct effects of the fire and by 10 to 85 percent (mean equals 55 percent) due to delayed mortality of fire-damaged trees and insect caused tree mortality. Northern spotted owl habitat loss was greater on mid- to upper-slopes (especially south-facing) than within riparian areas or on topographical benches (Gaines et al. 1997). Direct mortality of northern spotted owls was assumed to have occurred at one site. Data were too sparse for reliable comparisons of site occupancy or reproductive output between sites affected by the fires and other sites on the Wenatchee National Forest. Two wildfires burned on the Yakama Indian Reservation, eastern Cascades, Washington, in 1994, affecting home ranges of two radio-tagged northern spotted owls (King et al. 1997). Although the amount of home ranges burned was not quantified, northern spotted owls were observed using areas that received low and medium intensity burning. No direct mortality of northern spotted owls was observed even though thick smoke covered several owl site centers for a week.

At the time of the northern spotted owl listing there was recognition that large-scale wildfire posed a threat to the northern spotted owl and its habitat (U.S. Fish and Wildlife Service 1990a). New information suggests that fire may be more of a threat than previously thought (U.S. Fish and Wildlife Service 2004d). 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). However, overall, the total amount of habitat affected by wildfires has been relatively small (Lint 2005). It may be possible to influence, through silvicultural management, how fire prone forests will burn and the extent of the fire

when it occurs. Silvicultural management of forest fuels are currently being implemented throughout the northern spotted owl's range, in an attempt to reduce the high levels of fuels that have accumulated during nearly 100 years of effective fire suppression. However, our ability to protect northern spotted owl habitat and viable populations of northern spotted owls from large fires through risk-reduction endeavors is uncertain (Courtney et al. 2004). The Northwest Forest Plan (USDA and USDI 1994a) recognized wildfire as an inherent part of managing northern spotted owl habitat in certain portions of the range. The distribution and size of reserve blocks as part of the Northwest Forest Plan design may help mitigate the risks associated with large-scale fire (Lint 2005).

West Nile Virus

West Nile Virus (WNV) has killed millions of wild birds in North America since it arrived in 1999 (McLean et al. 2001; Caffrey 2003; Marra et al. 2004). Mosquitoes are the primary carriers (vectors) of the virus that causes encephalitis in humans, horses, and birds. Mammalian prey may also play a role in spreading WNV among predators, like northern spotted owls. Owls and other predators of mice can contract the disease by eating infected prey (Garmendia et al. 2000; Komar et al. 2001). Recent tests of tree squirrels, including flying squirrels, from Los Angeles County, California, found over 70 percent were positive for WNV (R. Carney, Personal Communication, 2004, as cited in Courtney et al. 2004). One captive northern 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 northern spotted owl (Courtney et al. 2004), but it is unknown how WNV will ultimately affect owl populations. Susceptibility to infection and mortality rates of infected individuals vary among bird species, even within groups (Courtney et al. 2004). Owls appear to be quite susceptible. For example, breeding screech owls (*Megascops asio*) in Ohio experienced 100 percent mortality (T. Grubb, Personal Communication, as cited in Courtney et al. 2004). Barred owls, in contrast, showed lower susceptibility (B. Hunter, Personal Communication, as cited in Courtney et al. 2004). Some level of innate resistance may occur (Fitzgerald et al. 2003), which could explain observations in several species of markedly lower mortality in the second year of exposure to WNV (Caffrey and Peterson 2003). Wild birds also develop resistance to WNV through immune responses (Deubel et al. 2001). The effects of WNV on bird populations at a regional scale have not been large, even for susceptible species (Caffrey and Peterson 2003), perhaps due to the short-term (a few years) and patchy distribution of mortality (K. McGowan, pers. comm., cited in Courtney et al. 2004) or annual changes in vector abundance and distribution.

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

Habitat restoration for northern spotted owls will take decades to be realized. As such, it is too early to evaluate the long-term effectiveness of conservation efforts under the Northwest Forest Plan (U.S. Fish and Wildlife Service 2004d). Thus far, no mortality in wild, northern spotted owls has been recorded from west nile virus (Courtney et al. 2004). However, the potential threats to the northern spotted owl, like WNV, may not respond to or be affected by habitat management or improvement (U.S. Fish and Wildlife Service 2004d) including conservation efforts under the Northwest Forest Plan.

Sudden Oak Death

Sudden oak death was recently identified as a potential threat to the northern 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 in northern California. 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 186 miles (300 kilometers) of the central and northern California coast (Rizzo et al. 2002). It has also been found near Brookings, Oregon, killing tanoak and causing dieback of closely associated wild rhododendron (*Rhododendron* spp.) and evergreen huckleberry (*Vaccinium ovatum*) (Goheen et al. 2002). It has been found in several different forest types and at elevations from sea level to over 2625 feet (800 meters). Sudden oak death poses a threat of uncertain proportion because of its potential impact on forest dynamics and alteration of key prey and northern spotted owl habitat components (e.g., hardwood trees - canopy closure and nest tree mortality); especially in the southern portion of the northern spotted owl's range (Courtney et al. 2004). However, uncertainty about the likely scale of habitat effects and the potential for management to address the additive effects of sudden oak death on habitat availability mediated against placing too much weight on this factor in the FWS's Five-Year Review Evaluation of the northern spotted owl (U.S. Fish and Wildlife Service 2004d).

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 northern spotted owl at the time of listing. Recent studies show no indication of reduced genetic variation and past bottlenecks in Washington, Oregon, or California (Barrowclough et al. 1999; Haig et al. 2004; Henke et al. 2005). However, in Canada, the breeding population is estimated to be less than 33 pairs and annual population decline may be as high as 35 percent (Harestad et al. 2004). Canadian populations may be more adversely affected by issues related to small population size including inbreeding depression, genetic isolation, and reduced genetic diversity (Courtney et al. 2004). Low and persistently declining populations throughout the northern portion of the species range (see "Population Trends" below) may be at increased risk of losing genetic diversity.

Climate change

Climate change, a potential additional threat to northern spotted owl populations, is not explicitly addressed in the Northwest Forest Plan. Climate change could have direct and indirect impacts on northern spotted owls and their prey. However, the emphasis on maintenance of seral stage complexity and related biological diversity in Matrix Lands under the Northwest Forest Plan should contribute to the resiliency of the Federal forest landscape related to impacts of climate change (Courtney et al. 2004).

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

8.2.1.9 Conservation Needs of the Northern Spotted Owl

Based on the above assessment of threats, the northern spotted owl has the following habitat-specific and habitat-independent conservation (i.e., survival and recovery) needs (adapted from Courtney et al. 2004):

Habitat-specific Needs

1. Large blocks of suitable habitat to support clusters or local population centers of northern spotted owls (e.g., 15 to 20 breeding pairs) throughout the owl's range;
2. Suitable habitat conditions and spacing between local northern spotted owl populations throughout its range to 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 northern 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.

Habitat-independent Needs

1. A coordinated, research and adaptive management effort to better understand and manage competitive interactions between northern spotted and barred owls; and
2. Monitoring to better understand the risk that West Nile Virus and sudden oak death pose to northern spotted owls and, for West Nile Virus, research into methods that may reduce the likelihood or severity of outbreaks in northern spotted owl populations.

8.2.1.10 Conservation Strategy

Since 1990, various efforts have addressed the conservation needs of the northern spotted owl and attempted to formulate conservation strategies based upon these needs. The various efforts began with the Interagency Scientific Committee's Conservation Strategy (Thomas et al. 1990). The efforts continued with the designation of critical habitat (U.S. Fish and Wildlife Service 1992a); the Draft Recovery Plan (U.S. Fish and Wildlife Service 1992b); the Scientific Analysis Team report (Thomas et al. 1993); and the report of the Forest Ecosystem Management Assessment Team (Thomas and Raphael 1993). The efforts culminated with the Northwest Forest Plan (U.S. Department of Agriculture and U.S. Department of Interior 1994a). Each conservation strategy was based upon the reserve design principles first articulated in the Interagency Scientific Committee'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.

8.2.1.11 Conservation and Recovery Efforts on Federal Lands

The Northwest Forest Plan is the current conservation strategy for the northern spotted owl on Federal lands. It is designed around the conservation needs of the northern spotted owl and based upon the designation of a variety of land-use allocations whose objectives are either to provide for population clusters (i.e., demographic support) or to maintain connectivity between population clusters. Several land-use allocations are intended to contribute primarily to supporting population clusters: Late Successional Reserves, Managed Late-Successional Areas, Congressionally Reserved Areas, Managed Pair Areas, and Reserve Pair Areas. The remaining land-use allocations (Matrix, Adaptive Management Areas, Riparian Reserves, Connectivity Blocks, and Administratively Withdrawn Areas) provide connectivity between habitat blocks intended for demographic support.

The range-wide system of Late Successional Reserves set up under the Northwest Forest Plan captures the variety of ecological conditions within the 12 different provinces to which northern spotted owls are adapted. This design reduces the potential for extinction due to large catastrophic events in a single province. Multiple, large Late Successional Reserves in each province reduce the potential that northern spotted owls will be extirpated in any individual province and reduce the potential that large wildfires or other events will eliminate all habitat within a Late Successional Reserve. In addition, Late Successional Reserves are generally arranged and spaced so that northern spotted owls may disperse to two or more adjacent Late Successional Reserves. This network of reserves reduces the likelihood that catastrophic events will impact habitat connectivity and population dynamics within and between provinces.

FEMAT scientists predicted that northern spotted owl populations would decline in the Matrix over time, while populations were expected to stabilize and eventually increase within Late Successional Reserves, as habitat conditions improve over the next 50 to 100 years (Thomas and Raphael 1993; U.S. Department of Agriculture and U.S. Department of Interior 1994a and 1994b). Based on the results of the first decade of monitoring, the Northwest Forest Plan's authors cannot determine if the declining population trend will be reversed because not enough time has passed to provide the necessary measure of certainty (Lint 2005). 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 under the Northwest Forest Plan (Lint 2005). Other stressors that operate in intact suitable habitat, such as barred owls (already in action) and West Nile virus (yet to occur) may complicate the conservation of the northern spotted owl. Recent reports about the status of the northern spotted owl offer few management recommendations to deal with the emerging threats. The arrangement and distribution and resilience of the Northwest Forest Plan land use allocation system may prove to be the most appropriate strategy in responding to these unexpected challenges (Courtney et al. 2004).

Under the Northwest Forest Plan, the agencies involved (FWS, U.S. Forest Service, Bureau of Land Management, and the National Park Service) anticipated a decline of northern spotted owl populations during the first decade of implementation. Recent reports (Courtney et al. 2004; Anthony et al. 2004) identified greater than expected northern 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 northern spotted owls at the meta-population scale. However, at the territory scale, there is evidence of negative effects to northern spotted owl fitness due to reduced habitat quantity and quality. Also, there is no evidence to suggest that dispersal habitat is currently limiting (Courtney et al. 2004; Lint 2005). Even with the

population decline, Courtney et al. (2004) noted that there is little reason to doubt the effectiveness of the core principles underpinning the Northwest Forest Plan conservation strategy.

The current scientific information, including information showing northern spotted owl population declines, indicates that the northern spotted owl continues to meet the definition of a threatened species (U.S. Fish and Wildlife Service 2004d). That is, populations are still relatively numerous over most of the northern spotted owl's historic range, which suggests that the threat of extinction is not imminent.

8.2.1.12 Conservation Efforts on Non-Federal Lands

FEMAT noted that limited Federal ownership in some areas constrained the ability to form an extensive reserve network to meet conservation needs of the northern spotted owl. Thus, non-Federal lands were determined to be an important contribution to the range-wide goal of achieving conservation and recovery of the northern spotted owl. The FWS's main expectations for private lands are for their contributions to demographic support (pair or cluster protection) and/or connectivity with lands. In addition, timber harvest within each state is governed by rules that may provide protection of northern spotted owls and/or their habitat to varying degrees.

There are 16 current or completed Habitat Conservation Plans (HCPs) with incidental take permits issued for northern spotted owls, eight in Washington, four in Oregon, and four in California. They range in size from 40 acres to over 1.6 million acres, though not all acres are included in the mitigation for northern spotted owls. In total, the HCPs cover approximately 2.9 million of the 32 million acres of non-Federal forestlands in the range of the northern spotted owl. Most HCPs are fairly long in duration, though they range from only five years up to 100 years. While each HCP is unique, there are several general approaches to mitigation of incidental take of northern spotted owls, including: 1) reserves of various sizes, some associated with adjacent Federal reserves; 2) forest harvest that maintains or develops suitable habitat; 3) forest management that maintains or develops dispersal habitat; and 4) deferral of harvest near specific sites. Individual HCPs may employ one or more of these mitigation measures. Similarly the conservation objectives of individual HCPs vary from specified numbers of breeding northern spotted owls, with specified levels of reproductive success, to management objectives for nesting/roosting/foraging habitat or dispersal habitat (Courtney et al. 2004).

Washington

In 1996, the Washington Forest Practices Board adopted rules (Washington Forest Practices Board 1996) that would "contribute to conserving the northern spotted owl and its habitat on non-Federal lands" based on recommendations from a Science Advisory Group which identified important non-Federal lands and recommended roles for those lands in northern spotted owl conservation (Hanson et al. 1993; Buchanan et al. 1994). The 1996 rules designated 10 northern spotted owl special emphasis areas (SOSEAs) in Washington that comprise over 1.5 million acres of State and private lands where owl protections on non-Federal lands would be emphasized. At all sites within SOSEAs, any proposed harvest of suitable spotted owl habitat within a territorial owl circle is considered a "Class-IV special" and would trigger State Environmental Policy Act (SEPA) review. Within SOSEAs, all suitable habitat within 0.7 miles of northern spotted owl activity centers, and 40 percent of suitable habitat within the provincial median home range circle surrounding an occupied activity center is generally protected from timber harvest. Proposed harvest that would reduce habitat amounts below these levels are considered to have a significant probable adverse affect on the environment with respect to SEPA. If a determination of significance is made, preparation of a SEPA Environmental Impact Statement is required prior to

proceeding. If a determination of non-significance or mitigated determination of non-significance is reached, the action can proceed without further environmental assessment. Until recently, these habitat protections could be lifted if a northern spotted owl activity center was determined to be unoccupied (Buchanan and Swedeen 2005). In 2005, the Forest Practices Board adopted emergency rules to further protect suitable habitat in northern spotted owl circles within SOSEAs (Washington Forest Practices Board 2005). Under the 1996 Washington Forest Practices Rules, suitable northern spotted owl habitat located on non-Federal lands outside of owl management circles or located outside of a SOSEA boundary was not protected from timber harvest, unless the habitat was protected by an approved HCP. Northern spotted owl-related HCPs in Washington cover over 1.92 million acres and generally provide both demographic and connectivity support as recommended in the draft northern spotted owl recovery plan (U.S. Fish and Wildlife Service 1992b). (A more detailed discussion of the Washington Forest Practices Rules is provided in the northern spotted owl environmental baseline).

Oregon

The Oregon Forest Practices Act provides for protection of 70-acre core areas around known northern spotted owl nest sites, but does not provide for protection of northern spotted owl habitat beyond these areas (Oregon Department of Forestry 2006). In general, no large-scale northern spotted owl habitat protection strategy or mechanism currently exists for non-Federal lands in Oregon. The four northern spotted owl-related HCPs currently in effect in Oregon cover over 300,000 acres of non-Federal lands. These HCP's have provided, and will continue to provide, some nesting habitat and connectivity over the next few decades.

California

In 1990, the California Forest Practice Rules, which govern timber harvest on private lands, were amended to require surveys for northern spotted owls in suitable habitat and to provide protection around activity centers (California Department of Forestry 2005). Under the California Forest Practices Rules, no timber harvest plan can be approved if it is likely to result in incidental take of federally listed species, unless authorized by a Federal HCP. The California Department of Fish and Game initially reviewed all timber harvest plans to ensure that take was not likely to occur; the FWS took over that review function in 2000. Several large industrial owners operate under Spotted Owl Management Plans that have been reviewed by the FWS; the plans specify basic measures for northern spotted owl protection. Four HCPs authorizing take of northern spotted owls have been approved covering over 669,000 acres of non-Federal lands. Implementation of these HCPs has provided, and will continue to provide, for northern spotted owl demographic and connectivity support to Northwest Forest Plan lands.

8.2.1.13 Current Condition of the Northern Spotted Owl

The current condition of a species incorporates the effects of all past human and natural activities or events that have led to the present-day status of the species and its habitat (U.S. Fish and Wildlife Service and NMFS 1998).

Range-wide Habitat Trends

Habitat Trends

The FWS has used information provided by the U.S. Forest Service, Bureau of Land Management, and National Park Service to update the habitat baseline conditions on Federal lands for northern spotted owls

on several occasions since the northern spotted owl was listed in 1990. The estimate of 7.4 million acres used for the Northwest Forest Plan in 1994 (U.S. Department of Agriculture and U.S. Department of Interior 1994a) was determined to be representative of the general amount of northern spotted owl habitat on these lands. This baseline was used to track relative changes over time in subsequent analyses. In 2005, a new map depicting suitable northern spotted owl habitat throughout their range was produced as a result of the Northwest Forest Plan's effectiveness monitoring program (Lint 2005). However, the spatial resolution of this new habitat map currently makes it unsuitable for tracking habitat effects at the scale of individual projects. The FWS is evaluating the map for future use in tracking habitat trends. Additionally, there are no reliable estimates of northern spotted owl habitat on other land ownerships; consequently, acres that have undergone ESA section 7 consultation can be tracked, but not evaluated in the context of change with respect to a reference condition on non-Federal lands. The production of the Northwest Forest Plan monitoring program habitat map does, however, provide an opportunity for future evaluations of trends in non-Federal habitat. The following analyses indicate changes to the baseline condition established in 1994.

Range-wide Analysis 1994 – 2001

In 2001, the FWS conducted an assessment of habitat baseline conditions, the first since implementation of the Northwest Forest Plan (U.S. Fish and Wildlife Service 2001a). This range-wide evaluation of habitat, compared to the Final Supplemental Environmental Impact Statement, was necessary to determine if the rate of potential change to northern spotted owl habitat was consistent with the change anticipated in the Northwest Forest Plan. In particular, the FWS considered habitat effects that were documented through the ESA section 7 consultation process since 1994. In general, the analytical framework of these consultations focused on the reserve and connectivity goals established by the Northwest Forest Plan land-use allocations (U.S. Department of Agriculture and U.S. Department of Interior 1994a), with effects expressed in terms of changes in suitable northern spotted owl habitat within those land-use allocations. The FWS determined that actions and effects were consistent with the expectations for implementation of the Northwest Forest Plan from 1994 to June, 2001 (U.S. Fish and Wildlife Service 2001a).

During the 2001 assessment, the FWS developed an intranet database for compiling and tracking habitat losses anticipated through ESA section 7 consultations and other habitat effects (e.g., wildfire effects, though this data is incomplete). Information in the database is updated with each new consultation across the range of the species. The total acres of habitat loss changes over time as additional consultations are completed. As projects are implemented, Federal agencies report the actual acres implemented, and in some cases, the implemented acres are substantially less than the acres that were analyzed in the consultation. The FWS uses these reports to update the database and add or subtract habitat acres. For each ESA section 7 consultation, the FWS uses the current information in the consultation database to track the effects across the range of the northern spotted owl and update the information on the status of the northern spotted owl. As a result, the acres from ESA section consultation reported in this Opinion may vary from previous consultations due to updated information in the consultation database. Copies of the summary tables from the database used for this Opinion are filed in the administrative record for this Opinion.

Range-wide Analysis 1994 – 2004 (first decade of the Northwest Forest Plan)

This section updates the information considered in U.S. Fish and Wildlife Service (2001a), relying particularly on information in documents the FWS produced pursuant to ESA section 7 and information

provided by Northwest Forest Plan agencies on habitat loss resulting from natural events (e.g., fires, windthrow, insects, and disease).

In 1994, about 7.4 million acres of suitable northern spotted owl habitat were estimated to exist on Federal lands (U.S. Department of Agriculture and U.S. Department of Interior 1994a). As of April, 2004, the FWS had consulted (under ESA section 7) on the proposed removal of 571,263 acres of northern spotted owl habitat range-wide, including 165,748 acres on Federal lands managed under the Northwest Forest Plan (Table 8-3). Federal lands were expected to experience an approximate 2.6 percent decline in suitable northern spotted owl habitat due to all management activities (not just timber harvest) over the past decade, with approximately 2.3 percent being removed by timber harvest. The consulted-on effects for the Northwest Forest Plan area indicated a decadal loss of approximately 2.2 percent. These anticipated changes in suitable northern spotted owl habitat were consistent with the expectations for implementation of the Northwest Forest Plan.

There was little available information regarding northern spotted owl habitat trends on non-Federal lands. Yet, we do know that internal FWS consultations conducted since 1994 have documented the eventual loss of 411,200 acres of habitat on non-Federal lands (Table 8-4). Most of these losses have yet to be realized because they are part of large-scale, long-term HCPs.

In 2005, the WDFW 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 northern 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 reported. In the 3.2-million acre study area, Pierce and others (2005) estimated there were 816,000 acres of suitable northern spotted owl habitat in 2004, or about 25 percent of their study area. Most of the suitable northern spotted owl habitat in the Pierce et al. (2005) study area in 2004 (56 percent) occurred on Federal lands, and lesser amounts were present on State-local lands (21 percent), private lands (22 percent) and tribal lands (1 percent). 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 northern spotted owl habitat. This represented a loss of about 6 percent of the northern spotted 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 northern spotted owl habitat levels in 450 owl management circles (based on the provincial annual median owl home range). Across their study area, they found that northern spotted 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 eastern Cascade Mountains, indicating that many northern spotted owl territories in Washington are significantly below the 40 percent suitable habitat threshold used by the State and FWS as a viability indicator for northern spotted owl territories (Pierce et al. 2005).

The FWS estimated an increase of approximately 600,000 acres of late-successional forest across the range of the northern spotted owl since 1994 (U.S. Fish and Wildlife Service 2004e). This estimate was based on a projection of forest age and size class over time. Because stand age and size class do not necessarily account for the complex forest structure often associated with northern spotted owl habitat, Courtney et al. (2004) believed the FWS's in-growth estimate likely overestimates actual habitat development. Also, without more detailed spatial information, the availability of these additional acres of late-successional forest to northern spotted owls and their significance to northern spotted owl conservation remains unknown.

Table 8-4. Changes to NRF[1] habitat acres from activities subject to ESA section 7 consultations and other causes range-wide from May 1994 to present (February 23, 2006).

Northwest Forest Plan Group/Ownership		ESA Section 7 Consultation Habitat Changes[2]		Other Habitat Changes[3]	
		Removed/ Downgraded	Degraded	Removed/ Downgraded	Degraded
Federal Northwest Forest Plan	Bureau of Land Management	82,474	16,637	760	0
	Forest Service	100,282	450,007	12,897	5,481
	National Park Service	2,642	3,300	3	0
	Multi-agency[4]	15,175	23,314	0	0
	NWFP Subtotal	200,573	493,258	13,660	5,481
Other Management and Conservation Plans (OMCP)	Bureau of Indian Affairs and Tribes	104,494	27,890	0	0
	Habitat Conservation Plans	295,889	14,430	0	0
	OMCP Subtotal	400,383	42,320	0	0
Other Federal Agencies & Lands[5]		241	466	28	70
Other Public & Private Lands[6]		10,576	880	30,240	20,949
TOTAL Changes		**611,773**	**536,924**	**43,928**	**26,500**

Source: Table A from the FWS Northern Spotted Owl Consultation Effects Tracker (web application and database) Feb. 23, 2006.

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

[2] Includes both effects reported by U.S. Fish and Wildlife Service (2001a) and subsequent effects compiled in the Northern Spotted Owl Consultation Effects Tracker (web application and database).

[3] Includes effects to NRF habitat (as documented through technical assistance) resulting from wildfires (not from suppression efforts), insect and disease outbreaks, and other natural causes, private timber harvest, and land exchanges not associated with consultation. Information from all fires occurring since 1994 is not yet available for entry into the database and thus is not included here but is compiled in Table 8-6.

[4] The 'Multi-agency' grouping is used to lump a variety of Northwest Forest Plan mixed agency or admin unit consultations that were reported together prior to June 26, 2001, and cannot be separated out.

[5] Includes lands that are owned or managed by other Federal agencies not included in the Northwest Forest Plan.

[6] Includes lands not covered by Habitat Conservation Plans that are owned or managed by states, counties, municipalities, and private entities. Effects that occurred on private lands from right-of-way permits across U.S. Forest Service and Bureau of Land Management lands are included.

Range-wide Analysis from 1994 to the Present

As stated previously, in 1994 about 7.4 million acres of suitable habitat were estimated to exist on Federal lands. As of February 2006, the FWS has consulted on the removal of 611,773 acres of northern spotted owl habitat range-wide, of which 200,573 acres occurred on Federal lands managed under the Northwest Forest Plan (Table 8-4). From April, 2004, to the present, the FWS has consulted on the removal or degradation of 34,825 acres of northern spotted owl habitat range-wide on Federal lands managed under the Northwest Forest Plan (Table 8-4).

Habitat loss from Federal lands has varied by province with most losses concentrated in the Oregon physiographic provinces. Habitat removed from the Oregon Klamath Mountains province and the two Oregon Cascades provinces made up 79 percent of the habitat loss on Northwest Forest Plan lands range-wide since 1994 (Table 8-5).

Table 8-5. Aggregate results of all adjusted, suitable habitat (NRF[1]) acres affected by ESA section 7 consultation for the northern spotted owl; baseline and summary of effects by state, physiographic province, and land use function from 1994 to present (February 23, 2006).

Physiographic Province[4]		Evaluation Baseline[2]			Habitat Removed/Downgraded[3]			% Provincial Baseline Affected	% Range-wide Affected
		Reserves[5]	Non-Reserves[6]	Total	Reserves[5]	Non-Reserves[6]	Total		
WA	Olympic Peninsula	548,483	11,734	560,217	867	24	891	-0.12	0.47
	Eastern Cascades	506,340	200,509	706,849	1,749	4,242	5,991	-0.85	3.17
	Western Cascades	864,683	247,797	1,112,480	1,180	11,001	12,181	-1.09	6.44
	Western Lowlands	0	0	0	0	0	0	0	0
OR	Coast Range	422,387	94,190	516,577	399	4,145	4,544	-0.88	2.40
	Klamath Mountains	448,509	337,789	786,298	2,434	80,301	82,735	-10.52	43.76
	Cascades East	247,624	196,035	443,659	1,243	9,352	10,595	-2.39	5.60
	Cascades West	1,012,426	1,033,337	2,045,763	2,926	53,542	56,468	-2.76	29.87
	Willamette Valley	593	5,065	5,658	0	0	0	0	0
CA	Coast	47,566	3,928	51,494	181	69	250	-0.49	0.13
	Cascades	61,852	26,385	88,237	0	4,808	4,808	-5.45	2.54
	Klamath	734,103	345,763	1,079,866	1,470	9,143	10,613	-0.98	5.61
Total		**4,894,566**	**2,502,532**	**7,397,098**	**12,449**	**176,627**	**189,076**	**-2.56**	**100.00**

Source: Table B from the FWS Northern Spotted Owl Consultation Effects Tracker (web application and database) Feb. 23, 2006.

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

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

[3] Includes both effects reported by USFWS (2001a) and subsequent effects compiled in the Northern Spotted Owl Consultation Effects Tracking System (web application and database).

[4] Defined by the Northwest Forest Plan as the twelve physiographic provinces, as presented in Figure 3 and 4-1 on page 3 and 4-16 of the Final Supplemental Environmental Impact Statement.

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

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

In summary, habitat loss in Washington accounted for 10.06 percent of the range-wide loss, but it only resulted in a loss of 0.80 percent of available habitat on Federal lands in Washington (Table 8-5). In Oregon, habitat loss accounted for 81.63 percent of the range-wide losses, but only 4.06 percent of available habitat on Federal lands in Oregon (Table 8-5). Loss of habitat on Federal lands in California accounted for 8.28 percent of the losses range-wide, but only 1.28 percent of habitat on Federal lands in California (Table 8-5).

The FWS has limited information on the impacts of recent wildfires. From 1994 to 2004, the FWS estimated that approximately 168,300 acres was lost due to natural events. About two-thirds of this loss was attributed to the Biscuit Fire that burned over 500,000 acres in southwest Oregon (Rogue River basin) and northern California in 2002. This fire resulted in a loss of approximately 113,000 acres of northern spotted owl habitat, including habitat within five Late Successional Reserves.

Northern Spotted Owl Numbers, Distribution, and Reproduction Trends

There are no estimates of the historical population size and distribution of northern 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 (U.S. Fish and Wildlife Service 1989). According to the final rule listing the northern spotted owl as threatened (U.S. Fish and Wildlife Service 1990a), approximately 90 percent of the roughly 2,000 known northern spotted owl breeding pairs were located on federally managed lands, 1.4 percent on State lands, and 6.2 percent on private lands; the percent of northern spotted owls on private lands in northern California was slightly higher (Forsman et al. 1984; U.S. Fish and Wildlife Service 1989; Thomas et al. 1990).Using data from 1986-1992, Gutiérrez (1994) tallied 3,753 known pairs and 980 singles throughout the range of the northern spotted owl. At the time the Northwest Forest Plan was initiated (July 1, 1994), there were 5,431 known locations of, or site centers of northern spotted owl pairs or resident singles: 851 sites (16 percent) in Washington, 2,893 (53 percent) in Oregon, and 1,687 (31 percent) in California (U.S. Fish and Wildlife Service 1995). The actual population of northern spotted owls across the range was believed to be larger than either of these counts because some areas were, and remain, unsurveyed (U.S. Fish and Wildlife Service 1992a; Thomas et al. 1993).

Because existing survey coverage and effort are insufficient to produce reliable population-size estimates, researchers use other indices, such as demographic data, to evaluate trends in northern spotted owl populations. Analysis of demographic data can provide an estimate of the rate and direction of population growth [i.e., lambda (λ)]. A λ of 1.0 indicates a stationary population (i.e., neither increasing nor decreasing), a λ less than 1.0 indicates a declining population, and a λ greater than 1.0 indicates a growing population. Demographic data are analyzed during workshops that occur at 5-year intervals.

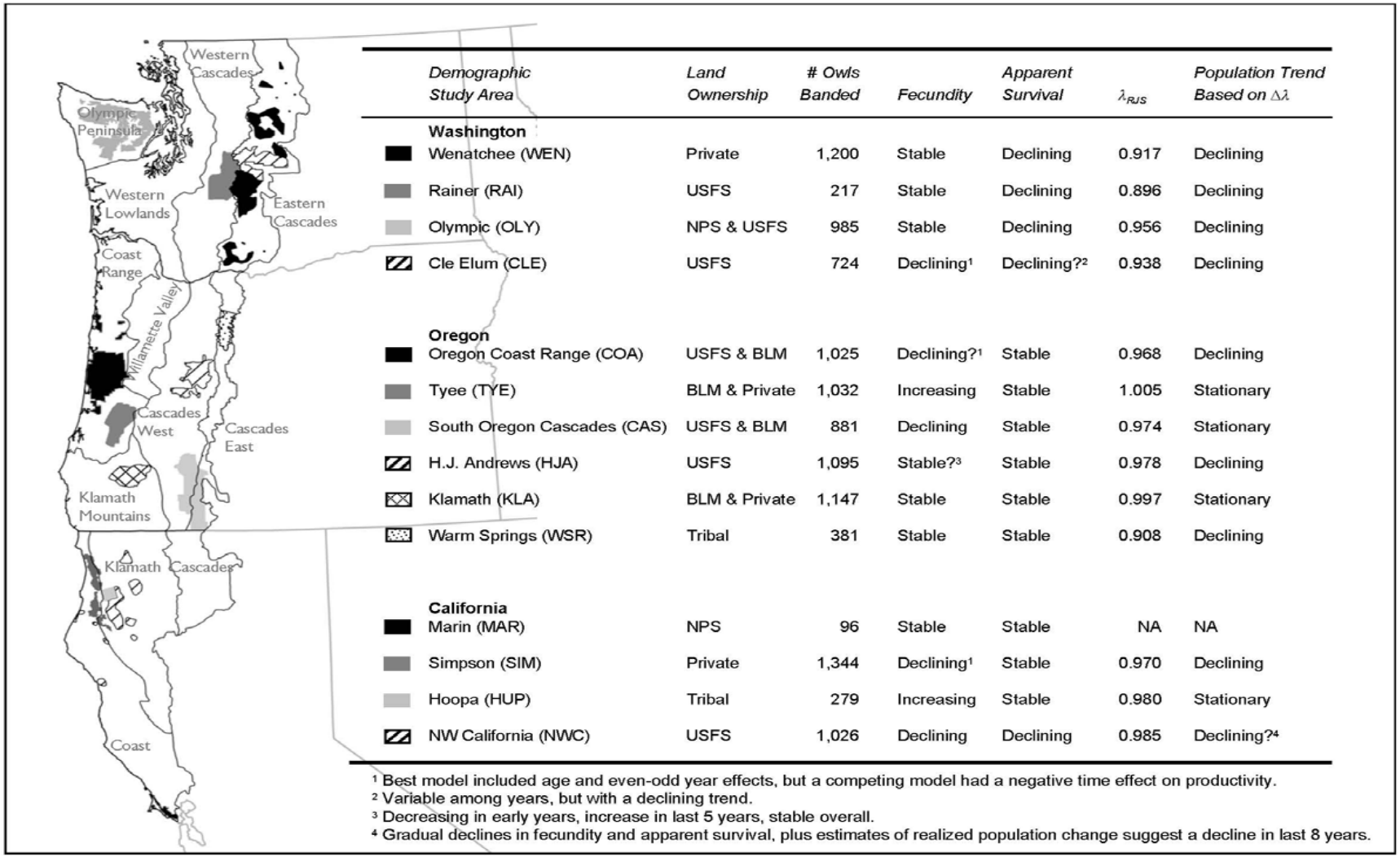
In January 2004, at a meta-analysis workshop northern spotted owl demographic studies, two meta-analyses were conducted on the rate of population change using the re-parameterized Jolly-Seber method (λRJS); 1 meta-analysis for all 13 study areas and 1 meta-analysis for the 8 study areas that are part of the Effectiveness Monitoring Program of the Northwest Forest Plan (Anthony et al. 2004). Data were analyzed separately for individual study areas, as well as simultaneously across all study areas (true meta-analysis). Estimates of λRJS ranged from 0.896-1.005 for the 13 study areas, and all but 1 (Tyee) of the estimates were <1.0 suggesting population declines for most areas (Anthony et al. 2004) (Figure 8-1). There was strong evidence that populations on the Wenatchee, Cle Elum, Warm Springs, and Simpson study areas declined during the study, and there also was evidence that populations on the Rainer, Olympic, Oregon Coast Range, and HJ Andrews study areas were decreasing (see Figure 8-1). Precision

of the λRJS estimates for the Rainier and Olympic study areas were poor and not sufficient to detect a difference from 1.00. However, the estimate of λRJS for Rainier study area (0.896) was the lowest of all of the areas. Populations on the Tyee, Klamath, South Oregon Cascades, Northwest California, and the Hoopa study areas appeared to be stationary during the study, but there was some evidence that the South Oregon Cascades, Northwest California, and Hoopa study areas were declining (λRJS <1.00). The weighted mean λRJS for all of the study areas was 0.963 (SE = 0.009, 95 percent confidence Interval = 0.945-0.981), suggesting that populations over all of the study areas were declining by about 3.7 percent per year from 1985-2003. The mean λRJS for the 8 demographic monitoring areas on Federal lands was 0.976 (SE = 0.007, 95 percent confidence interval = 0.962-0.990) and 0.942 (SE = 0.016, 95 percent confidence interval = 0.910-0.974) for non-Federal lands, an average of 2.4 versus 5.8 percent decline, respectively, per year. This suggests that northern spotted owl populations on Federal lands had better demographic rates than elsewhere, but interspersion of land ownership on the study areas confounds this analysis.

The number of populations that have declined and the rate at which they have declined are noteworthy, particularly the precipitous declines on the four Washington study areas (Wenatchee, Cle Elum, Rainier, Olympic) (estimated at 30 to 50 percent population decline over 10 years) and the Warm Springs study area in Oregon (Anthony et al. 2004). Declines in adult survival rates may be an important factor contributing to declining population trends. Survival rates declined over time on five of the 14 study areas: four study areas in Washington, which showed the sharpest declines, and one study area in the Klamath province of northwest California (Anthony et al. 2004). In Oregon, there were no time trends in apparent survival for four of six study areas, and remaining areas had weak non-linear trends. In California, two study areas showed no trend, one showed a slight decline, and one showed a significant linear decline (Anthony et al. 2004). Like the trends in annual rate of population change, trends in adult survival rate showed clear declines in some areas, but not in others. Anthony et al. (2004) provide the only range-wide estimate of northern spotted owl demographic rates.

Loehle et al. (2005) sampled a small portion of the range of the northern spotted owl and questioned the accuracy of lambda estimates computed in Anthony et al. (2004), suggesting that the estimates were biased low by 3 to 4 percentage points. Loehle et al. (2005) contends the lambda estimates in Anthony et al. (2004) do not accurately account for northern spotted owl emigration. Therefore, more of the northern spotted owl demography study areas would have a lambda closer to 1.0, a stationary population. The Loehle et al. (2005) statement could be accurate if Anthony et al. (2004) used Leslie matrix models to compute survival and lambda. Instead, Anthony et al. (2004) used the Pradel reparameterized Jolly-Seber method to compute survival and lambda to avoid the biases associated with the Leslie matrix method.

British Columbia has a small population of northern spotted owls. This population is relatively isolated, apparently declining sharply, and absent from large areas of apparently-suitable habitat (Courtney et al. 2004). Breeding populations have been estimated at fewer than 33 pairs and may be declining as much as 35 percent per year (Harestad et al. 2004). The amount of interaction between northern spotted owls in Canada and the U.S. is unknown (Courtney et al. 2004). The Canadian population has reached the point where it is now vulnerable to stochastic demographic events that could cause further declines and perhaps extirpation (Courtney et al. 2004, pgs. 3-26 to 3-27).



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 8-1. Physiographic provinces, northern spotted owl demographic study areas, and demographic trends (Anthony et al. 2004).

8.2.2 STATUS OF NORTHERN SPOTTED OWL CRITICAL HABITAT

8.2.2.1 Legal Status

On January 15, 1992, the FWS designated critical habitat for the northern spotted owl within 190 Critical Habitat Units which encompass nearly 6.9 million acres across Washington (2.2 million acres), Oregon (3.3 million acres), and California (1.4 million acres) (U.S. Fish and Wildlife Service 1992b). These individual units are coded by the state they occur in and then they are individually numbered (e.g., WA-1…, OR-1…, CA-1…). Only Federal lands were designated as critical habitat in the final rule (FR 57:10:1796-1838). The northern spotted owl critical habitat final rule states: "Section 7 analysis of activities affecting owl critical habitat should consider provinces, subprovinces, and individual Critical Habitat Units, as well as the entire range of the subspecies (page 1823)." The rule goes on to assert the basis for an adverse modification opinion should be evaluated at the provincial scale (page 1823).

Primary Constituent Elements

Primary constituent elements (PCEs) are the physical and biological features of critical habitat essential to a species' conservation. PCEs identified in the northern spotted owl critical habitat final rule include those physical and biological features that support nesting, roosting, foraging, and dispersal (U.S. Fish and Wildlife Service 1992b). Features that support nesting and roosting habitat typically include a moderate to high canopy (60 to 90 percent); a multi-layered, multi-species canopy with large [greater than 30 inches diameter at breast height] overstory trees; a high incidence of large trees with various deformities (e.g., 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 northern spotted owls to fly (Thomas et al. 1990). Foraging habitat generally consists of attributes similar to those in nesting and roosting habitat, but may not always support successful nesting pairs (U.S. Fish and Wildlife Service 1992b). Dispersal habitat, at minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities; there may be variations over the northern spotted owl's range (e.g., drier sites in the east Cascades or northern California) (U.S. Fish and Wildlife Service 1992b).

Conservation Role of Critical Habitat

Northern spotted owl critical habitat was designated based on the identification of large blocks of suitable habitat that are well distributed across the range of the northern spotted owl. Critical habitat units were intended to identify a network of habitats that provided the functions considered important to maintaining stable, self-sustaining, and interconnected populations over the range of the northern spotted owl, with each Critical Habitat Unit having a local, provincial, and a range-wide role in northern spotted owl conservation. Most Critical Habitat Units were expected to provide suitable habitat for population support, some were designated primarily for connectivity, and others were designated to provide for both population support and connectivity.

The Northwest Forest Plan was developed using conservation principles similar to those used to designate critical habitat and is considered the Federal contribution to the conservation of northern spotted owls and its habitat in the United States. Specifically, Late Successional Reserves were created under the Northwest Forest Plan to provide large blocks of suitable habitat capable of supporting multiple pairs of northern spotted owls. Standards and Guidelines under the Northwest Forest Plan establish that Late Successional Reserves will be managed to protect and enhance late-successional and old-growth forests

ecosystems. Riparian Reserves and other Northwest Forest Plan land use allocations provide for connectivity between reserves. Approximately 70 percent of suitable habitat in Critical Habitat Units overlaps with Northwest Forest Plan Late Successional Reserves on a range-wide basis and will therefore be managed to protect and enhance habitat characteristics.

8.2.2.2 Current Condition of Critical Habitat

Range-wide

In 1994, the Final Supplemental Environmental Impact Statement for the Northwest Forest Plan established that 3,141,987 acres of nesting, roosting, and foraging habitat existed within northern spotted owl Critical Habitat Units on federally administered public lands. To assess changes to the baseline condition since implementation of the Northwest Forest Plan, the FWS relies on information in ESA section 7 consultations and available information on natural events. Hereafter, effects to critical habitat refer to nesting, roosting, and foraging habitat habitat within northern spotted owl critical habitat.

Across the range of the northern spotted owl between 1994 and February 2006, the FWS has consulted on the removal or degradation of 46,705 acres (1.49 percent) of critical habitat due to management-related activities (Table 8-6). The majority of these effects (32,915 acres) have been concentrated in the Oregon Cascades West and Oregon Klamath Mountains Provinces. In addition, natural events (including fire and insect outbreaks) have resulted in the removal or downgrading of approximately 42,679 acres (1.39 percent) of critical habitat extant in 1994 (Table 8-7). In general, fires have had more of an impact to northern spotted owl critical habitat in the interior provinces of Washington and California and the southern and interior provinces of Oregon than the coastal provinces. Over 50 percent of northern spotted owl critical habitat removed or downgraded by fire can be attributed to the 1999 Megram Fire that burned in north-central California and the 2002 Biscuit Fire that burned in southwestern Oregon and northern California.

Although most provinces within the range of the northern spotted owl have experienced some degree of habitat loss since 1994, total effects have been disproportionately distributed. The majority of effects to critical habitat (approximately 98 percent) have been concentrated in just six physiographic provinces (Washington East Cascades, Washington West Cascades, Oregon Klamath Mountains, Oregon Cascades East, Oregon Cascades West, and California Klamath) (Tables 8-6 and 8-7). Of the remaining six provinces, one (Oregon Willamette Valley) had no designated critical habitat, one (Washington Western Lowlands) had no suitable habitat within critical habitat, and four provinces (Olympic Peninnsula, Oregon Coast Range, California Coast Range, California Cascades) had less than one percent of their critical habitat removed or downgraded since 1994.

Provinces

Washington East Cascades

This province, which contains 18 Critical Habitat Units, is located east of the Cascade Crest and provides the easterly extension of the northern spotted owl in Washington.

Table 8-6. Aggregate results of all adjusted, suitable critical habitat acres affected by ESA section 7 consultation for the northern spotted owl; baseline and summary of effects by state, physiographic province, and land use function from 1994 to present (February 23, 2006).

Physiographic Province[3]		Evaluation Baseline[1]			Habitat Removed/Downgraded[2]			% Provincial Baseline Affected	% Range-wide Affected
		Reserves[4]	Non-Reserves[5]	Total	Reserves[4]	Non-Reserves[5]	Total		
WA	**Olympic Peninsula**	193,081	3,928	197,009	-12	-59	-71	-0.04	0.15
	Eastern Cascades	225,855	100,737	326,592	-87	-4,549	-4,636	-1.42	9.93
	Western Cascades	424,273	90,305	514,578	-3	-5,040	-5,043	-0.98	10.80
	Western Lowlands	0	0	0	0	0	0	0	0
OR	**Coast Range**	332,562	16,155	348,717	-50	-1,200	-1,250	-0.36	2.68
	Klamath Mountains	228,112	85,157	313,269	-4	-12,830	-12,834	-4.10	27.48
	Cascades East	86,882	51,802	138,684	-138	-1,372	-1,510	-1.09	3.23
	Cascades West	532,571	361,563	894,134	-122	-19,959	-20,081	-2.25	43.00
	Willamette Valley	0	0	0	0	0	0	0	0
CA	**Coast**	2,589	27	2,616	0	0	0	0	0
	Cascades	47,947	2,740	50,687	0	-472	-472	-0.93	1.01
	Klamath	322,372	33,329	355,701	0	-808	-808	-0.23	1.73
Total		2,396,244	745,743	3,141,987	-416	-46,289	-46,705	-1.49	100.00

Source: Table D from the FWS Northern Spotted Owl Consultation Effects Tracker (web application and database) Feb. 23, 2006.

[1] 1994 FSEIS baseline (USDA and USDI 1994).

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

[3] Defined by the Northwest Forest Plan as the twelve physiographic provinces, as presented in Figure 3 and 4-1 on page 3 and 4-16 of the Final Supplemental Environmental Impact Statement.

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

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

Table 8-7. Change in northern spotted owl suitable critical habitat from 1994 to December 10, 2004, resulting from Federal management actions and natural events by physiographic province.

Physiographic Province	1994 Final Supplemental Environmental Impact Statement Provincial Critical Habitat Baseline1994-2004	Critical Habitat (acres) Removed/Downgraded,				% of 1994 Final Supplemental Environmental Impact Statement Provincial Critical Habitat Baseline	% of all Rangewide Habitat Effects
		Management	Fire	Insect/Disease	Total		
WA:							
Olympic Peninsula	197,009	71	0	0	71	0.04	0.08
East Cascades	326,592	1,035	6,925[1,2]	532	8,492	2.60	9.67
West Cascades	514,578	4,994	0	0	4,994	0.97	5.69
Western Lowlands	0	0	0	0	0	0.00	0.00
OR:							
Coast Range	348,717	1,224	0	0	1,224	0.35	1.39
Klamath Mountains	313,269	13,912	17,453	0	31,365	10.01	35.72
Cascades East	138,684	1,706	6,878[2]	0	8,584	6.18	9.78
Cascades West	894,134	21,003	1,216	0	22,219	2.48	25.31
Willamette Valley	0	0	0	0	0	0.00	0.00
CA:							
Coast Range	2,616	0	0	0	0	0.00	0.00
Cascades	50,687	365	0	0	365	0.72	0.41
Klamath	355,701	808	9,675	0	10,483	2.95	11.95
Total	**3,141,987**	**45,118**	**42,147**	**532**	**87,797**	**2.79**	**100.00**

Note: Fire effects were compiled by the FWS northern spotted owl coordination group from unpublished agency reports. Management effects portrayed in this table may vary from values reported elsewhere due to updates in information since December 2004.

[1] Habitat effects from some 1994 fires were included in the 2001 update, and thus, appear as consulted-on effects in the Northern Spotted Owl Consultation Effects Tracking Database. For the purpose of this critical habitat update, habitat effects associated with those fires are included in the fire effects column.

[2] Includes fires in 2003.

Between 1994 and December 2004, approximately 8,492 acres of critical habitat, or 2.6 percent of its provincial baseline, have been removed or downgraded (Table 8-7). The majority of the effects has been concentrated in the northern half of the province and have resulted primarily from the Tyee, Needles, North 25 Mile, and Maple Fires. The largest of these fires, the Tyee, removed or downgraded approximately 3,600 acres of suitable habitat from WA-06, WA-09, and WA-11. The Maple Fire removed or downgraded an additional 300 acres of suitable habitat from to WA-06. The Needles and North 25 Mile Fires removed or downgraded approximately 2,500 acres (23 percent) and 474 acres (28 percent) of suitable habitat from WA-02 and WA-04, respectively. Collectively, the units impacted by these fires are important for the range-wide distribution of the northern spotted owl as they occur on the eastern and northeastern edge of their range (Tehan 1991). Additionally, these Critical Habitat Units provide habitat for intra-provincial connectivity (Tehan 1991).

Since December 2004, efforts have continued to refine estimates of additional critical habitat lost due to wildfires during recent seasons. Preliminary estimates indicate that as much as 3,600 acres of nesting, roosting, and foraging habitat may have been removed or downgraded from critical habitat units in this province. At present, this estimate has not been finalized and entered in the range-wide database for tracking effects on critical habitat.

Washington West Cascades

This province, which contains 23 Critical Habitat Units and the most critical habitat of the Washington provinces, is located west of the Cascade Crest. It is characterized by significant differences in topography and distribution of habitat between its northern and southern portions.

Since 1994, the FWS has consulted on the removal or downgrading of approximately 5,043 acres of critical habitat within six Critical Habitat Units, representing about 1.42 percent of the provincial baseline (Table 8-6). Although impacts to five of these units have been relatively minor (less than 2.5 percent of their baseline), WA-39 has had 1,776 acres of suitable habitat (46 percent) consulted-on for removal or downgrading. WA-39 is expected to provide connectivity between the Western Cascades and Western Lowlands Provinces and improve the distribution of northern spotted owls and habitat in the portion of the province impacted by the 1980, Mount St. Helens eruption (Tehan 1991). Fire has not resulted in measurable impacts to northern spotted owl critical habitat in this province.

Oregon Klamath Mountains

The Oregon Klamath Mountains Province contains 16 Critical Habitat Units and provides the link between the Oregon Cascades West and Oregon Coast Ranges Province south into California.

Since 1994, the FWS has consulted on the removal or downgrading of 12,834 acres of critical habitat, representing about 4.1 percent of the provincial baseline. Wildlfire events have resulted in the additional loss of at least 17,453 acres (Table 8-7). Although effects noted determined from ESA section 7 consultations were distributed across 11 Critical Habitat Units, approximately 36 percent of effects have occurred in two adjacent units (OR-74 and OR-75). Together, these units provide an east-west linkage in the southern portion of the Klamath Mountains Province and provide nesting, roosting, and foraging habitat, and dispersal habitat in a highly fragmented area (Tweten 1992). The majority of fire effects in this province can be attributed to the Biscuit Fire. This fire removed or downgraded approximately 23, 46, and 37 percent of the suitable habitat within OR-68, OR-69, and OR-70, respectively.

These units were identified for their important contributions to inter- and intra-provincial connectivity and to provide nesting, roosting, and foraging habitat, and dispersal habitat, in areas where habitat is lacking (Tweten 1992).

Oregon Cascades West

This province is located in the geographic center of the northern spotted owl's range and contains more critical habitat (over 894,000 acres) than any other province. It provides links with the Washington Cascades, Oregon Coast Range, and Klamath Mountains Provinces.

Since 1994, the FWS has consulted on the removal or downgrading of approximately 20,081 acres or 2.25 percent of the provincial baseline (Table 8-6). Fire effects have resulted in the the additional loss of at least 1,216 acres (Table 8-7). Effects determined from ESA section 7 consultations have been widely dispersed within 26 of the 29 Critical Habitat Units in this province. In general, this has resulted in relatively small impacts to individual units. However, two adjacent units, OR-23 and OR-24, have experienced relatively concentrated effects, with 215 acres (14.3 percent) and 946 acres (48.8 percent) removed or downgraded, respectively. Together these units were identified as being important inter-provincial links between the Coast Ranges and the Oregon Cascades West Provinces (Tweten 1992). Fire has had limited effects to northern spotted owl critical habitat in this province: 1,216 acres or less than 0.5 percent of the provincial baseline have been removed or downgraded by fire.

Since December 2004, the Oregon Cascades West Province critical habitat baseline, for activities that have undergone ESA section 7 consultation that will remove or downgrade suitable habitat, has been adjusted by -922 acres (i.e., 922 acres of suitable habitat have been added back to the environmental baseline). As stated above, this is usually due to modifications in proposed activities. Once projects are completed, and monitoring reports submitted, acres that are not affected are amended and the consultation is closed.

Oregon Cascades East

The Oregon Cascades East Province provides the easterly extension of the northern spotted owl's range in Oregon and contains all or portions of 10 Critical Habitat Units.

Since 1994, the FWS has consulted on the removal or downgrading of approximately 1,510 acres or 1.09 percent of the provincial baseline (Table 8-6). Fire effects have resulted in the additional loss of at least 6,878 acres (Table 8-7). The impacts of these fires were concentrated in the central portion of this province where approximately 20 percent of the extant suitable habitat in OR-3 and OR-4 and over 36 percent of the suitable habitat in OR-7 were removed or downgraded. OR-3 and OR-4 were designated to maintain suitable habitat and support dispersal along the eastern slope of the Oregon Cascades (Tweten 1992). OR-7 provides a north-south link within the province and an inter-provincial link with the Oregon Cascades West Province. Effects determined from ESA section 7 consultations have been evenly distributed, occurring in 8 of 10 Critical Habitat Units, and have resulted in less than a 5 percent reduction (through removal or downgrading) of suitable habitat within any individual Critical Habitat Unit.

California Klamath

The California Klamath Province contains all or portions of 36 Critical Habitat Units and over 85 percent of northern spotted owl critical habitat in California.

Since 1994, the FWS has consulted on the removal or downgrading of approximately 808 acres or 0.23 percent of the provincial baseline (Table 8-6). Fire effects have resulted in the additional loss of at least 9,675 acres (Table 8-7). The majority of effects to these acres can be attributed to the Megram Fire. This fire removed or downgraded 9,390 acres (22 percent) of the suitable habitat within CA-30; this Critical Habitat Unit is located in the west/central portion of this province and links the interior sub-provinces with the coastal provinces and is expected to provide for up to 24 northern spotted owl pairs overtime (Spangle 1992). Two other small Critical Habitat Units, CA-10 (9,637 acres) and CA-35 (12,470 acres), have had approximately 20 percent of their suitable habitat removed or degraded from activities that have undergone ESA section 7 consultation. The primary function of these Critical Habitat Units is to provide intra-provincial connectivity in the eastern and south-central portion of this province, respectively (Spangle 1992).

8.2.3 ENVIRONMENTAL BASELINE – Northern Spotted Owl and Northern Spotted Owl Critical Habitat

Regulations implementing the ESA (50 CFR § 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the expected impacts of all proposed Federal projects in the action area that have undergone ESA section 7 consultation, and the impacts of State and private actions that are contemporaneous with the consultation in progress. Such actions include, but are not limited to, previous timber harvests and other land-management activities.

8.2.3.1 Northern Spotted Owls in Washington

The range of the northern spotted owl in Washington includes four physiographic provinces covering an area of over 21 million acres. The four provinces are the Olympic Peninsula, the western Washington lowlands, the western Washington Cascades, and the eastern Washington Cascades. Northern spotted owls now occur primarily on the eastern and western slopes of the Cascades and on the Olympic Peninsula. Historically, northern spotted owls were likely distributed throughout much of the western Washington lowlands, but now are considered rare in that portion of their range. Northern spotted owls occur at elevations ranging from sea level up to 3,500 - 5,000 feet depending on the region, and as in other parts of their range, northern spotted owls in Washington primarily use mature and old forest habitats for nesting, roosting, and foraging.

There are no current estimates of the total number of northern spotted owls. However, past assessments have indicated that approximately 15 to 20 percent of the rangewide population occurs in Washington (U.S. Fish and Wildlife Service 1995; 2004d). The most recent demographic-monitoring information indicates that the northern spotted owl population in Washington is declining at an annual average rate of 7.3 percent, compared to an average rate of 2.6 percent per year in the remainder of the range (Anthony et al. 2004). The realized population change estimates (i.e., the proportion of the population remaining each year, given the rates of decline) indicate that currently only about 40 to 60 percent of the initial 1990 northern spotted owl population in Washington remains (Anthony et al. 2004; Lint 2005). Anthony and others (2004) suggest that the combined influences of high densities of barred owls; lag effects associated with rapid habitat loss prior to the Federal listing of the northern spotted owl in 1990; continued habitat loss from wildfire, timber harvest and defoliation; and poor weather conditions are the likely causes for these declines.

Recent habitat assessments indicate that about 25 to 30 percent of the rangewide northern spotted owl habitat occurs in Washington (Davis and Lint 2005). Due primarily to historical timber harvest, approximately 84 percent of the known northern spotted owl site centers (Buchanan and Swedeen 2005) and about 60 to 70 percent of extant northern spotted owl habitat in Washington is located on Federal lands managed under the Northwest Forest Plan (Davis and Lint 2005). Since the Federal listing in 1990, the FWS has consulted on the removal or downgrading of about 240,000 acres of suitable northern spotted owl habitat in Washington under ESA section 7. Most (89 percent) of this consulted-on habitat loss is associated with approved Habitat Conservation Plans (≈ 143,000 acres) or tribal forest management plans (≈ 70,000 acres).

8.2.3.2 Assessments of Northern Spotted Owl Habitat in Washington

Two recent assessments of northern spotted owl habitat in Washington have been completed. The first study is a range-wide analysis of northern spotted owl habitat completed for monitoring the Northwest Forest Plan (Davis and Lint 2005). This study is a provincial-scale analysis of northern spotted owl habitat derived from vegetation maps, and includes map data of northern spotted owl habitat in Washington for the period of 1992 to 1996. The map data are derived from satellite imagery. Northern spotted owl habitat was modeled from vegetation maps using the Biomapper ecological niche-factor analysis model developed by Hirzel and others (2002). The northern spotted owl habitat suitability maps are based on the physical and vegetative attributes adjacent to known northern spotted owl pair locations for each province. The resulting raster maps are a grid of 269 square feet (25 square meters) cells (0.15 acres per pixel). Each cell in the raster is assigned a value of 0-100. Values closer to 100 represent areas that match the northern spotted owl nesting locations; values closer to 0 are likely unsuitable for nesting (Davis and Lint 2005). These habitat maps do not provide absolute habitat estimates, but rather a range of habitat suitability values, which can be interpreted in different ways. Davis and Lints' (2005) report was developed to evaluate the Northwest Forest Plan and does not provide summary information concerning northern spotted owl habitat on non-Federal lands. However, the map data developed for their study includes state and private lands, and we used these data to estimate northern spotted owl habitat in the FPHCP action area due to the comprehensive coverage of this map data.

One of the difficulties of working with the Biomapper habitat data is that there are no absolute values, and it is difficult to interpret which values represent "suitable" northern spotted owl habitat. We chose the mean habitat suitability values reported by Davis and Lint (2005) that accounted for 90 percent of northern spotted owl pair locations to represent suitable habitat. Based on the information provided by Davis and Lint, we believe the 90 percent values provide a reasonable estimate of "potential" northern spotted owl habitat in Washington. We use the term "potential" habitat to emphasize the idea that the habitat suitability index values that we selected from the Biomapper results represent forest cover that has the general attributes of northern spotted owl habitat (i.e., mid-seral or late-seral conifer forests with high canopy cover), whether or not northern spotted owls are actually using the habitat.

It is important to note that all suitable habitat estimates that we generated from Davis and Lints' (2005) data are general estimates based on the FWS's interpretation of data. The values reported here are coarse estimates used for the purposes of this analysis, and are not intended to represent absolute values. The habitat acres depicted by Davis and Lint's (2005) data are not expected to accurately depict all areas that would meet the regulatory definitions of "suitable" habitat defined at WAC 222-16-085.

Although dated, these data represent the best provincial-scale maps of northern spotted owl habitat currently available, and we used these maps in our assessment of northern spotted owl habitat on FPHCP

covered lands. Using the mean habitat suitability scores, Davis and Lints data indicates there were approximately 3.68 million acres of suitable northern spotted owl habitat in Washington (all ownerships) in 2003. (For more information on the FWS's GIS analysis to derive these estimates, refer to the northern spotted owl GIS memo in the administrative record for this Opinion).

The second study of northern spotted owl habitat is an assessment of completed by the Washington Department of Fish and Wildlife (WDFW) (Pierce et al. 2005). This study estimates the amount of northern spotted owl habitat in 2004 on lands affected by State and private forest practices. The study area is a subset of the total State and private forestlands, 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 and others (2005) estimated there were 816,000 acres of suitable northern spotted owl habitat in 2004, or about 25 percent of their study area. Based on their results, and the results of Davis and Lints (2005) analysis of Federal lands, Pierce and others (2005) estimated there were less than 2.8 million acres of northern spotted owl habitat in Washington in 2004. This differs substantially from the 3.68 million acres that we derived from Davis and Lints' (2005) habitat data, but is not unexpected because the values from Davis and Lints' map data can vary widely depending on which habitat suitability values are selected. Additionally, there are approximately 378,000 acres potential spotted owl habitat on non-Federal lands in the western Washington lowlands province that were not included in Davis and Lint's (2005) published report.

The study completed by Pierce and others (2005) did not produce a comprehensive GIS map for all State and private lands. These data represent the best estimates for suitable habitat and timber harvest rates on State and private lands within their study area, but because these data do not cover the entire FPHCP covered lands area, we chose not to use this information to evaluate conditions on the FPHCP covered lands. However, data provided in this study were used as a cross-reference for the results derived from the Davis and Lint (2005) data, and so information from both studies is presented in this Opinion. Both Davis and Lint (2005) and Pierce et al. (2005) relied on the work of Healy et al. (2003) to evaluate the impacts of the stand-replacing fires and harvests on northern spotted owl habitat that occurred between 1994 and 2002, although the Pierce et al. (2005) study included harvest data up to 2004, and includes estimates of partial harvest acres in the East Cascade Mountains.

8.2.3.3 Northern Spotted Owl Habitat on Forest Practices Habitat Conservation Plan Lands

Of the 9.3 million acres of FPHCP covered lands in Washington, over 6.9 million acres (74 percent) of the covered lands are within the range of the northern spotted owl. Suitable northern spotted owl habitat (i.e., nesting, roosting, and foraging habitat) currently exists on approximately 3.68 million acres in Washington. About 18 percent of suitable northern spotted owl habitat is located on FPHCP covered lands (Table 8-8). However, much of the suitable habitat on FPHCP covered lands exists as small isolated patches which are too small to support northern spotted owls. The 18 percent figure likely over estimates that actual suitable northern spotted owl habitat on FPHCP covered lands. Pierce and others (2005) estimated that 7 to 13 percent of suitable northern spotted owl habitat was located on private lands in their study area.

Table 8-8. FPHCP covered lands within the range of the northern spotted owl in Washington.

Province	FPHCP Covered Lands (acres)	Total Northern Spotted Owl Habitat (acres - all ownerships)	Northern Spotted Owl Habitat on FPHCP Covered Lands (acres)	% of Northern Spotted Owl Habitat in Province on FPHCP Covered Lands
Olympic Peninsula	715,300	717,000	40,700	6%
Western WA Lowlands	3,941,200	378,600	235,100	62%
Western WA Cascades	1,430,900	1,616,300	178,200	11%
Eastern WA Cascades	860,600	972,500	205,800	21%
Totals:	**6,948,000**	**3,684,400**	**659,800**	**18%**

Note: All figures are approximate values derived from GIS data. Northern spotted owl habitat estimates represent approximate conditions in 2003, as depicted by Davis and Lints' (2005) map data, and accounting for stand-replacing timber harvest and fire losses that occurred from 1992 to 2002 (Healey et al. 2003).

8.2.3.4 Northern Spotted Owls on FPHCP Covered Lands

As of October 2004, there were 1,044 territorial sites (status 1, 2, or 3) documented in the WDFW database (Buchanan and Swedeen 2005). Status 1-3 sites represent known northern spotted owl pair locations, pairs of unknown breeding status, or resident singles. This figure likely over estimates the actual number of active northern spotted owl territories in Washington because once a site is documented, the status of the site at the time of the last survey remains in the database until new information is available to revise the status (Buchanan and Swedeen 2005).

Given the annual declines in the northern spotted owl population in Washington, it is likely that some northern spotted owl sites classified as status 1, 2, or 3 are no longer occupied, but are still considered active in the database (Buchanan and Swedeen 2005).

Most (84 percent) of the northern spotted owl sites in Washington are located on Federal lands (n = 878) (Buchanan and Swedeen 2005). Of the 166 northern spotted owl territories that occur on non-Federal (or tribal) lands in Washington, 62 sites (37 percent) are centered on FPHCP covered lands (Table 8-9). Northern spotted owls in Washington use large annual homerange areas that vary from less than 3,000 to more than 30,000 acres (Hansen et al. 1993). Because the actual configuration of a home range is rarely known, a circle centered on an owl activity center is used to identify the area approximating the provincial median annual home range. For example, median northern spotted owl circles used in Washington range from a 1.8-mile radius circle in the Cascades to a 2.7-mile radius circle on the Olympic Peninsula (WAC 222-10-041(4)(b)(i)(ii)). Because northern spotted owls use large areas, owl site centers that are located on Federal lands or other ownerships may have circles that overlap the FPHCP covered lands.

We analyzed northern spotted owl circles in Washington and found that about half (n = 531) have at least 5 acres of FPHCP covered lands within the circle, and about 25 percent (n = 263) have at least 10 percent or more FPHCP covered lands within the circle (Table 8-9). We used 5 acres of FPHCP covered lands within an owl circle as a "may affect" indicator in this Opinion. We expect that all northern spotted owl circles with 5 acres or more of FPHCP covered lands within the circle have the potential for measurable effects from forest practices activities. We expect that northern spotted owl circles with less than 5 acres of FPHCP covered lands are not likely to be adversely affected by forest practices activities on the

FPHCP covered lands, because 5 acres represents less than 0.1 percent of the area within an owl circle. We used 10 percent in FPHCP covered lands within an owl circle as a threshold to identify circles with significant FPHCP ownership (i.e.,greater than 10 percent).

Table 8-9. Northern spotted owl sites on FPHCP Covered Lands by province in Washington.

Province	Total number of northern spotted owl sites (all ownerships)	No. of northern spotted owl site centers located on FPHCP covered lands	No. of northern spotted owl circles with ≥5 acres located on FPHCP covered lands	% of northern spotted owl circles with ≥5 acres located on FPHCP covered lands	No. of northern spotted owl circles with ≥10 percent located on FPHCP covered lands	% of northern spotted owl circles with ≥10 percent located on FPHCP covered lands
Olympic Peninsula	244	3	124	51%	54	22%
Western Washington Lowlands	21	12	21	100%	21	100%
Western Washington Cascades	456	11	189	41%	89	20%
Eastern Washington Cascades	323	36	197	61%	99	31%
Washington Totals	**1,044**	**62**	**531**	**51%**	**263**	**25%**

Notes: Includes only status 1,2,3, sites documented in the WDFW northern spotted owl database. Status 1 = known pair location; status 2 = two owls (male and female) located, but pair status unknown; status 3 = resident single.

Using Davis and Lints' (2005) habitat maps, we estimated the amount of habitat associated with northern spotted owl circles that overlap FPHCP covered lands (Table 8-10). The map data provide general estimates, but lack sufficient detail to be applied for site-specific analysis with confidence (Davis and Lint 2005). In general, these data indicate that over 60 percent of the owl circles that overlap the FPHCP covered lands have less than 40 percent suitable habitat within the circle. About 14 percent of the owl circles had less than 20 percent suitable habitat in the circle. A landscape assessment by Bart and Forsman (1990) showed that both the rate of occurrence of northern spotted owls and reproductive output were higher in landscapes that had at least 40 percent suitable habitat. The FWS uses the 40 percent habitat threshold as a general guideline for analytical purposes. We recognize that there are many examples of northern spotted owl sites that have persisted with habitat below 40 percent, that home ranges are not circular, and that the 40 percent threshold is not an absolute indicator of site-viability (U.S. Fish and Wildlife Service 1990c; U.S. Fish and Wildlife Service 1995). This 40 percent value has also been used by the Washington Forest Practices Board as a guideline for maintaining suitable habitat in northern spotted owl circles to maintain the viability of the northern spotted owl territories (WAC 222-10-041).

The relatively low amount of suitable habitat inside the northern spotted owl circles as indicated by Davis and Lints' (2005) data is not unexpected. Northern spotted owl habitat is highly fragmented from a

legacy of clearcut timber harvest throughout the owl's range in Washington prior to the owl's listing as a threatened species in 1990. Pierce and others (2005) evaluated suitable habitat levels in 450 owl circles in their study area and found a similar pattern of low suitable habitat within the circles. Across their study area, they found that owl circles averaged about 26 percent suitable habitat in the circle across all landscapes. Values in this study ranged from an average 7 percent in southwest Washington to an average of 31 percent in the east Cascades (Pierce et al. 2005, p. 53).

Table 8-10. Number of northern spotted owl circles by amount of suitable habitat (percent area) that overlap FPHCP covered lands.

	Amount of Suitable Habitat (percent (%) area) in Northern Spotted Owl Circles				
Province	**0-19%**	**20-39%**	**40-59%**	**60-79%**	**Total Circles**
Olympic Peninsula	22	53	44	5	124
Western Washington Lowlands	16	5	-	-	21
Western Washington Cascades	9	94	77	9	189
Eastern Washington Cascades	25	103	60	9	197
Washington Totals	**72**	**255**	**181**	**23**	**531**
Percent	**14 %**	**48%**	**34%**	**4%**	**100 %**

Notes: Suitable habitat acres were calculated on all ownerships within the circles and estimates represent approximate conditions in 1996, as depicted by Davis and Lints' (2005) map data. Data includes only status 1,2,3, sites documented in the WDFW northern spotted owl database.

8.2.3.5 Conservation Role of the FPHCP Covered Lands for Northern Spotted Owls

The draft recovery plan for the northern spotted owl identified specific conservation roles that non-Federal lands provide for the conservation and recovery of northern spotted owls. These roles include: 1) providing habitat (suitable or dispersal) to support the conservation of northern spotted owls in Federal reserves in areas where non-Federal lands are mixed with Federal lands; 2) providing for clusters of breeding pairs on non-Federal lands in locations where Federal lands are not adequate to provide for recovery; 3) provide habitat for existing northern spotted owl pairs to avoid take of those owls as defined by the ESA; and 4) providing dispersal habitat for connectivity between Federal reserves (U.S. Fish and Wildlife Service 1992b, p.106).

Currently about 18 percent of the extant suitable habitat acres in Washington is located on the FPHCP covered lands. In areas with few Federal acres (e.g., southwest Washington), the conservation of northern spotted owls is entirely dependent upon conservation efforts on State or private lands. The FPHCP covered lands provide important nesting, roosting, foraging, and dispersal habitat for at least 25 percent of the existing territorial northern spotted owls in Washington, due to the substantial overlap of the territorial circles with FPHCP covered lands. In southwest Washington, FPHCP covered lands comprise the majority of that landscape, and over 60 percent of the suitable habitat acres in this province are located on the FPHCP covered lands. Although there are only a few territorial northern spotted owls sites in the Western Lowlands province, the FWS considers these sites to be increasingly important for the conservation of northern spotted owls in Washington, due to their location between clusters of northern spotted owls on the Olympic Peninsula, the western Cascades, and northwest Oregon. The relative importance of these areas for northern spotted owl recovery will be evaluated in a revised northern

spotted owl recovery plan, currently scheduled to be completed in 2007. Much of the northern spotted owl habitat that occurs on the FPHCP covered lands is widely scattered in small patches across large landscapes, and that much of this habitat does not exist in sufficient quantities to support territorial northern spotted owls. However, these small patches of habitat are potentially important for northern spotted owl connectivity, and provide important dispersal and foraging habitat functions for northern spotted owls dispersing across private lands between areas with large blocks of habitat on adjacent State and Federal lands.

8.2.3.6 Northern Spotted Owl Habitat in the FPHCP Riparian Management Zones

Due to the high density of rivers and streams in Washington, riparian areas occupy a substantial portion of the landscape. In western Washington, the RMZs comprise about 13 percent of the total FPHCP covered land acres. About 10 percent of all suitable northern spotted owl habitat on the westside FPHCP covered lands is located in RMZs (Table 8-11). The amount of owl habitat within different RMZ types varies by province. On the Olympic Peninsula, only about 4 percent of the RMZ acres contain owl habitat. This is presumably due to a low percentage of conifer cover in Olympic Peninsula RMZs, and a high percentage of RMZ areas with second-growth forest.

In the east Cascades province, the FPHCP RMZs occupy a much smaller part of the landscape (7 percent) and only about 5 percent of the suitable northern spotted owl habitat is located in the eastside RMZs. However, FPHCP RMZs in the East Cascades province contains the highest percentage of owl habitat within RMZs (18 percent) of any of the provinces (Table 8-11).

Table 8-11. Northern spotted owl habitat (nesting, roosting, and foraging (NRF)) in riparian management zones (RMZs) on the FPHCP covered lands (acres).

Province		Acres in Type S RMZs	Acres in Type F RMZs	Acres in Type Np RMZs	Total Acres in RMZs	Total Acres of FPHCP Covered Lands	% of Acres on FPHCP Covered Lands in RMZs
Olympic Peninsula	Total Acres	29,400	66,700	16,900	113,000	715,300	16%
	NRF Habitat	900	2,300	1,000	4,200	40,700	10%
	Percent of acres with NRF habitat	3%	3%	6%	4%	6%	na
Western Washington Lowlands	Total Acres	133,500	303,300	70,400	507,200	3,941,200	13%
	NRF Habitat	4,700	12,300	6,200	23,200	235,100	10%
	Percent of RMZ acres with NRF habitat	4%	4%	9%	5%	6%	na
Western Washington Cascades	Total Acres	60,300	77,300	56,200	193,800	1,430,900	14%
	NRF Habitat	4,700	7,500	7,900	20,100	178,200	11%
	Percent of RMZ acres	8%	10%	14%	10%	12%	na

Table 8-11. Northern spotted owl habitat (nesting, roosting, and foraging (NRF)) in riparian management zones (RMZs) on the FPHCP covered lands (acres). (continued)

Province		Acres in Type S RMZs	Acres in Type F RMZs	Acres in Type Np RMZs	Total Acres in RMZs	Total Acres of FPHCP Covered Lands	% of Acres on FPHCP Covered Lands in RMZs
	with NRF habitat						
Eastern Washington Cascades	Total Acres	17,800	22,200	19,600	59,600	860,600	7%
	NRF Habitat	2,200	4,700	4,100	11,000	205,800	5%
	Percent of RMZ acres with NRF habitat	12%	21%	21%	18%	24%	na
Washington Totals	Total Acres	241,000	469,500	163,100	873,600	6,948,000	13%
	NRF Habitat	12,500	26,800	19,200	58,500	659,800	9%
	Percent of RMZ acres with NRF habitat	5%	6%	12%	7%	9%	na

Notes: na= not applicable. All figures are approximate values derived from GIS data. Northern spotted owl habitat estimates represent approximate conditions in 2003, as depicted by Davis and Lints' (2005) map data, and accounting for stand-replacing timber harvest and fire losses that occurred from 1992 to 2002 (Healey et al. 2003). Riparian areas include average RMZ widths along Type S, F, and Np stream types based on the average 100-year site-potential tree height for site index 2 and 3.

8.2.3.7 FPHCP Riparian Management Zones in Territorial Northern Spotted Owl Circles

We analyzed provincial owl circles that had at least 50 percent (n = 71) or more of the circle located on FPHCP covered lands to estimate the average proportion of the northern spotted owl circles that are located within RMZs (Table 8-12). Fifty percent was used because: (1) there are few owl circles with 100 percent of the circle located on FPHCP covered lands, and (2) using something much less than 50 percent would have skewed the average proportion of circles within RMZs to a very low average percentage since RMZs make up a relatively small part of any given owl circle. The analysis indicates that in western Washington, the FPHCP RMZs comprise a substantial portion of the owl circles on FPHCP covered lands, averaging from 8 to 12 percent of the total circle area. However, only about 3 to 8 percent of the current suitable habitat within the circles is located in the RMZs, and owl circles that have the majority of ownership on FPHCP covered lands tend to have low amounts of suitable habitat within the circles (i.e., less than 40 percent).

In the east Cascades, the FPHCP RMZs occupy a much smaller portion of northern spotted owl circles, averaging about 3 percent, and the amount of suitable habitat in circles located in the FPHCP RMZs also equals about 3 percent. About a third of the east Cascades northern spotted owl circles are centered on WDNR eastside HCP lands or Federal lands. The overall average percent of suitable habitat in the eastside owl circles is substantially higher (38 percent) than in the westside provinces (i.e., 14 to 23 percent). Although the FPHCP RMZs on the eastside occupy less area, they are likely important source

areas for northern spotted owl prey (Peffer 2001), and are therefore important for northern spotted owl recovery over the long-term.

Table 8-12. FPHCP Riparian Management Zones (RMZ) in provincial owl circles. Average values for total acres in RMZs are presented. Owl circles analyzed included only those circles that had greater than or equal to 50 percent of the circle located on FPHCP covered lands.

Province	No. of sites with ≥50% of owl circle area on FPHCP Lands	Average acres of FPHCP Lands within provincial owl circle	Average percent of owl circle located on FPHCP Lands	Average total NRF[1] acres within provincial owl circle (all owner-ships)	Average % of owl circle with NRF habitat	Average acres of FPHCP-RMZs within owl circles	Average % of acres of FPHCP-RMZs within owl circles	Average acres of NRF habitat in RMZs on FPHCP Lands	Average % of NRF habitat in owl-circle located in RMZs on FPHCP Lands
Olympic Peninsula	5	8,330	57%	2,040	14%	1,340	9%	70	3%
Western Washington Lowlands	14	11,790	80%	1,910	13%	1,810	12%	150	8%
Western Washington Cascades	16	4,580	70%	1,500	23%	530	8%	70	5%
Eastern Washington Cascades	36	5,270	81%	2,450	38%	220	3%	80	3%

Note: All figures are approximate values derived from GIS data. Northern spotted owl habitat estimates represent approximate conditions in 1996, as depicted by Davis and Lint's (2005) map data. The provincial owl circle used for the Olympic Peninsula and the Western Washington lowlands = 14,658 acres (2.7-mile radius). The provincial northern spotted owl circle area used for the Western and Eastern Cascades = 6,514 acres (1.8-mile radius).

[1] NRF means nesting, roosting, and foraging habitat.

8.2.3.8 Northern Spotted Owl Habitat Management under the Washington Forest Practices Rules

Northern spotted owls in Washington are protected under both State and Federal regulations. The Washington Fish and Wildlife Commission listed the northern spotted owl as a State endangered species in 1988, and the northern spotted owl was listed as a federally threatened species in 1990. The Washington Forest Practices Rules require that both State and federally listed species be considered for designation of "critical habitat state" – a designation that serves as a trigger for State Environmental Policy Act (SEPA) review (WAC 222-16-050(1)(b)). In addition, ESA section 9 prohibits "take" of listed species. Together, the State and Federal regulations provide a framework for northern spotted owl management guidelines in Washington.

Important Definitions Pertaining to Northern Spotted Owls

The Washington Forest Practices Rules contain several specific definitions that pertain to the identification and management of northern spotted owl habitat (WAC 222-16-085):

1. **Suitable northern spotted owl habitat** means forest stands which meet the description of old forest habitat, sub-mature habitat or young forest marginal habitat found in (a) and (b) of this

subsection. Old forest habitat is the highest quality, followed in descending order by submature habitat and young forest marginal habitat.

a. **Old forest habitat** means habitat that provides for all the characteristics needed by northern spotted owls for nesting, roosting, foraging, and dispersal, described as stands with:

    i. A canopy closure of 60 percent or more and a layered, multispecies canopy where 50 percent or more of the canopy closure is provided by large overstory trees (typically, there should be at least 75 trees greater than 20 inches diameter at breast height per acre, or at least 35 trees 30 inches diameter at breast height or larger per acre); and

    ii. Three or more snags or trees 20 inches diameter at breast height or larger and 16 feet or more in height per acre with various deformities such as large cavities, broken tops, dwarf mistletoe infections, and other indications of decadence; and

    iii. More than two fallen trees 20 inches diameter at breast height or greater per acre and other woody debris on the ground.

b. **Sub-mature habitat and young forest marginal habitat.** Sub-mature habitat provides all of the characteristics needed by northern spotted owls for roosting, foraging, and dispersal. Young forest marginal habitat provides some of the characteristics needed by northern spotted owls for roosting, foraging, and dispersal. Sub-mature habitat and young forest marginal habitat stands can be characterized based on the forest community, canopy closure, tree density and height, vertical diversity, snags and cavity trees, dead and down wood, and shrubs or mistletoe infection. They are described in Tables 8-13 and 8-14.

Northern spotted owl dispersal habitat means habitat stands that provide the characteristics needed by northern spotted owls for dispersal. Such habitat provides protection from the weather and predation, roosting opportunities, and clear space below the forest canopy for flying. Timber stands that provide for northern spotted owl dispersal have the following characteristics:

a) **For western Washington,** timber stands 5 acres in size or larger with:

    i. 70 percent or more canopy cover; and

    ii. 70 percent or more of the stand in conifer species greater than 6 inches diameter at breast height; and

    iii. A minimum of 130 trees per acre with a diameter at breast height of at least 10 inches or a basal area of 100 square feet of 10 inch diameter at breast height or larger trees; and

    iv. A total tree density of 300 trees per acre or less; and

    v. A minimum of 20 feet between the top of the understory vegetation and the bottom of the live canopy, with the lower boles relatively clear of dead limbs.

Table 8-13. Western Washington Northern Spotted Owl Sub-Mature and Young Forest Marginal Habitat Characteristics from the Washington Forest Practices Rules (WAC 222-16-085).

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

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

b) **For eastern Washington,** timber stands 5 acres in size or larger with:

   i. 50 percent or more canopy closure; and

   ii. A minimum of 50 conifer trees per acre, with a diameter at breast height of 6 inches or more in even-aged stands or 4 inches or more in uneven-aged stands, and an average tree height of 65 feet or more; and

   iii. Total tree density of 200 trees per acre or less; and

   iv. A minimum of 20 feet between the top of the understory vegetation and the bottom of the live canopy, with the lower boles relatively clear of dead limbs; or

   v. Conifer stands with a quadratic mean diameter of 9 inches or more and a relative density of 33 or more or a canopy closure of 55 percent or more.

c) Suitable northern spotted owl habitat provides all of the required characteristics needed by northern spotted owls for dispersal.

Table 8-14. Eastern Washington Northern Spotted Owl Sub-Mature and Young Forest Marginal Habitat Characteristics from the Washington Forest Practices Rules (WAC 222-16-085).

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

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

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

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

Northern Spotted Owl Special Emphasis Areas

Timber harvest on the FPHCP covered lands is subject to the provisions of the Washington Forest Practices Rules for northern spotted owls that were adopted by the Forest Practices Board in 1996 (WAC 222-10-041). The 1996 rules identified 10 landscapes or Northern Spotted Owl Special Emphasis Areas (SOSEAs) where northern spotted owl protections would be emphasized. The 10 SOSEAs in Washington comprise over 2 million acres, including about 1.5 million acres of non-Federal lands (Washington Forest Practices Board 1996). The SOSEAs were identified and adopted by the Forest Practices Board because they represent landscape areas where the protection of northern spotted owls on non-Federal lands would contribute to the overall conservation of northern spotted owls in Washington, and are generally located to complement conservation goals on adjacent Federal lands managed under the Northwest Forest Plan. Pierce and others (2005) estimated that there were 426,272 acres of suitable northern spotted owl habitat inside the SOSEAs in 2004, which represents about 21 percent of the SOSEA acres.

Each of the SOSEAs has one or more conservation functions assigned to them. These conservation functions are associated with specific areas within the SOSEA or in some cases with an entire SOSEA. The conservation functions are demographic support, dispersal support, and a combination of dispersal

and demographic support (Washington Forest Practices Board 1996). The SOSEA designations were identified to guide management decisions in the development of Landowner Option Plans under the State rules, or to inform the development of Habitat Conservation Plans (HCP). In the absence of a Landowner Option Plan or an HCP, there are default rules to protect northern spotted owl habitat in SOSEAs that is located within status 1-3 owl circles under the "critical habitat" State rules (WAC 222-16-080).

Northern Spotted Owl Habitat Management Within SOSEAs

Within SOSEAs, any proposed harvest of suitable northern spotted owl habitat (as defined by WAC 222-16-085) within a known territorial owl circle (status 1-3) is considered a "Class-IV-Special" activity that requires a SEPA review. For individual northern spotted owl site centers (status 1-3) within a SOSEA, the Washington Forest Practices Rules generally prohibit timber harvest within 0.7 miles of a site center, and require that a minimum of 40 percent of the suitable habitat within the territorial circle be maintained to protect the viability of the territory. At all sites within SOSEAs, any proposed harvest of suitable spotted owl habitat within a territorial owl circle is considered a "Class-IV special" and would trigger State Environmental Policy Act (SEPA) review. Proposed harvest that would reduce habitat amounts below the 40 percent threshold is considered to have a significant probable adverse impact on the environment with respect to SEPA. If a determination of significance is made, preparation of a SEPA Environmental Impact Statement is required prior to proceeding. If a determination of non-significance or mitigated determination of non-significance is reached, the action can proceed without further environmental assessment. Exemptions to this rule include areas that are managed under a completed HCP for northern spotted owls approved by the FWS, or a State Landowner Option Plan that has gone through SEPA review. In addition, any landowner with an ownership of less than 500 acres in a SOSEA is exempt from the Class IV-Special rules as long the proposed harvest occurs >0.7 miles from a status 1-3 northern spotted owl activity center (WAC 22-16-080 (1)(h)(iv)).

Until recently, suitable habitat within a northern spotted owl circle that was harvested under an approved HCP, ESA section 7 consultation, or a 500-acre exemption could still be counted as suitable habitat acres contributing towards the minimum 40 percent by other landowners within the same circle. Additionally, the prohibition against harvesting habitat that would bring an owl circle below the 40 percent suitable habitat threshold, or harvesting within 0.7 miles of the site center, could be lifted if surveys indicated the site was abandoned for a period of 3 years or more. These exemptions were changed on November 30, 2005, through an emergency rule making by the Forest Practices Board. The emergency rule will protect suitable habitat in northern spotted owl circles within SOSEAs under status 1-3 site rules, regardless of current status. Further, acres harvested under an approved HCP or other conservation agreement cannot be counted by other landowners as "suitable" habitat (Washington Forest Practices Board 2005).

We analyzed the FPHCP covered lands on SOSEAs and found that only about 11 percent (779,800 acres) of the FPHCP covered lands within the range of the northern spotted owl are located in SOSEAs, and that about 29 percent of the northern spotted owl habitat in SOSEAs was located on FPHCP covered lands (Table 8-15). Pierce and others (2005) estimated that there was a total of 426,200 acres of suitable habitat located within SOSEAs in 2004, and that about 59 percent of the habitat (249,600 acres) in SOSEAs is located inside northern spotted owl circles, and about 35 percent (149,000 acres) is located within approved HCPs. Of the 1,044 northern spotted owl sites in Washington, 91 sites (9 percent) are located in SOSEAs.

Table 8-15. FPHCP covered lands and northern spotted owl habitat in SOSEAs.

Province	Total SOSEA Acres in Province	FPHCP Covered Lands in SOSEAs (acres)	Percent of SOSEA Acres on FPHCP Covered Lands	Total NRF Acres in SOSEA	Total NRF Acres on FPHCP Covered Lands in SOSEA	Percent of NRF Acres in SOSEA on FPHCP Covered Lands	Total NRF Acres on all FPHCP Covered Lands in Province (1996)	NRF acres on FPHCP Covered Lands in SOSEA Owl Circles	Percent of NRF acres on FPHCP Covered Lands in SOSEA Owl Circles
Olympic Peninsula	396,800	128,600	32%	47,500	4,600	10%	40,700	2,900	7%
Western Washington Lowlands	1,000	nc	nc	nc	nc	nc	235,100	0	0
Western Washington Cascades	884,900	368,000	42%	157,000	35,600	23%	178,200	18,000	10%
Eastern Washington Cascades	775,300	283,200	37%	198,300	79,600	40%	205,800	56,600	27%
Washington Totals	**2,058,000**	**779,800**	**38%**	**402,800**	**119,800**	**29%**	**659,800**	**77,400**	**12%**

Note: nc = not calculated. All figures are approximate values derived from GIS data. Northern spotted owl habitat estimates represent approximate conditions in 2003, as depicted by Davis and Lints' (2005) map data, and accounting for stand-replacing timber harvest and fire losses that occurred from 1992 to 2002 (Healey et al. 2003).

Northern Spotted Owl Habitat Management Outside SOSEAs

Outside of SOSEAs, there are no timber harvest restrictions within northern spotted owl territories except during the nesting season (March 1 through August 31) under the Washington Forest Practices Rules. During the nesting season any harvest, road construction, or aerial application of pesticides within the best 70 acres of suitable habitat surrounding a northern spotted owl site is prohibited to prevent direct mortality of owls associated with the harvest of an active nest site during the nesting season. Outside the nesting season, there are no restrictions, and habitat surrounding a northern spotted owl site may be harvested, including the 70-acre nest grove. At the time that the Forest Practices Board was developing the SOSEA conservation strategy, the FWS had proposed a draft 4(d) rule to modify the Section 9 take prohibition for northern spotted owl sites outside SOSEAs (U.S. Fish and Wildlife Service 1995). The provisions of the proposed 4(d) rule were fundamental to the development of the Washington Forest Practices Rules adopted in 1996 (Buchanan and Swedeen 2005). However, the proposed 4(d) rule was not finalized, creating a situation where a landowner could be in full compliance with the Washington Forest Practices Rules and potentially be in violation of ESA Section 9 if their harvest activities resulted in unauthorized take. Of the 1,044 northern spotted owl sites in Washington, 62 sites (6 percent) are located on non-Federal lands outside SOSEAs (Buchanan and Swedeen 2005).

We evaluated suitable northern spotted owl habitat on the FPHCP covered lands and found that about 25 percent (188,969 acres) of the 1996 owl habitat acres were located in known owl circles (both inside and outside of SOSEAs), but that only 12 percent of the FPHCP owl habitat was located in owl circles located in SOSEAs (Table 8-16). Most of this habitat occurred in the eastern Washington Cascades province.

Overall, 89 percent of the suitable northern spotted owl habitat on the FPHCP covered lands is not associated with owl circles or is not located in SOSEAs.

Table 8-16. Suitable northern spotted owl habitat on FPHCP covered lands in known owl circles.

Province	Total FPHCP Acres in Province	Total NRF Acres on FPHCP Covered Lands (2003)	NRF Acres on FPHCP Covered Lands associated with known owl circles	Percent Total NRF Acres on FPHCP Covered Lands associated with known owl circles	NRF Acres on FPHCP Covered Lands associated with known owl circles in SOSEAs	Percent Total NRF Acres on FPHCP Covered Lands associated with known owl circles in SOSEAs
Olympic Peninsula	715,300	40,700	14,900	37%	2,900	7%
Western Washington Lowlands	3,941,200	235,100	18,400	8%	0	0%
Western Washington Cascades	1,430,900	178,200	28,900	16%	18,000	10%
Eastern Washington Cascades	860,600	205,800	99,500	48%	56,600	27%
Washington Totals	**6,948,000**	**659,800**	**161,700**	**24%**	**77,500**	**12%**

Note: All figures are approximate values derived from GIS data. Northern spotted owl habitat estimates represent approximate conditions in 2003, as depicted by Davis and Lints' (2005) map data, and accounting for stand-replacing timber harvest and fire losses that occurred from 1992 to 2002 (Healey et al. 2003).

The FWS recognizes that not all suitable northern spotted owl habitat is currently occupied by territorial northern spotted owls. Suitable habitat that occurs outside of the known northern spotted owl circles is also important for supporting territorial northern spotted owls because territories are not circular but vary in size and configuration (Forsman et al. 1984). Many territorial circles have low amounts of suitable habitat suggesting that habitat located outside the circles may also be important for supporting territorial northern spotted owls (Buchanan and Swedeen 2005). Suitable habitat that occurs outside of known circles is also important for the successful dispersal of northern spotted owls across landscapes, and is ultimately important for species recovery because dispersing northern spotted owls are more likely to successfully colonize suitable habitat adjacent to occupied territories than random locations on the landscape (Lahaye et al. 2001).

Timber Harvest on FPHCP Covered Lands

We estimated the annual rates of timber harvest on the FPHCP covered lands for the period of 1992 – 2002 using the data compiled by Healey et al. (2003). These mapped data depict stand-replacing disturbance associated with timber harvest and wildfire, but do not portray changes associated with partial harvests such as commercial thinning. Within the range of the northern spotted owl in Washington, we

found that stand-replacing timber harvest (without fires) occurred at a rate of 1.1 to 1.3 percent per year on the FPHCP covered lands (Table 8-17). For the 10 year period of 1992-2002, there were over 800,000 acres harvested or burned. About 90 percent of these acres were identified as timber harvest. Although there were large wildfires in the eastern Washington Cascade Mountains during this period, most of the stand-replacing fires occurred on Federal lands, and a relatively small portion of the FPHCP covered lands were burned (Table 8-17).

Table 8-17. Acres of timber harvest and stand-replacing wildfire on FPHCP covered lands 1992-2002.

Province	Total Acres of FPHCP Covered Lands in Province	Timber Harvest Acres - 2000 - 2002	Timber Harvest Acres - 1996 - 2000	Timber Harvest Acres - 1992 - 1996	Total Timber Harvest Acres - 1992 - 2002	10-year average annual harvest acres	Average Percent of FPHCP Acres Harvested Annually	Total Wildfire Acres Burned - 1992 - 2002
Olympic Peninsula	715,300	19,300	40,800	33,300	93,400	9,340	1.3%	0
Western Lowlands	3,941,200	80,500	173,600	201,800	455,900	45,500	1.2%	0
Western Washington Cascades	1,430,900	31,700	64,000	87,100	182,800	18,200	1.3%	430
Eastern Washington Cascades	860,600	17,800	31,900	11,700	61,400	6,140	0.7%	7,930
Washington Totals	**6,948,000**	**149,300**	**310,300**	**333,900**	**793,500**	**79,350**	**1.1%**	**8,360**

Note: All figures are approximate values derived from GIS data depicting stand-replacing timber harvest and fire losses that occurred from 1992 to 2002 (Healey et al. 2003). Partial disturbances, such as commercial thinning or partially burned areas, are not accounted for in this data.

We estimated the acres of northern spotted owl habitat removed by overlaying the Healey et al. (2003) disturbance data with Davis and Lints' (2005) northern spotted owl habitat suitability maps. The information derived from this analysis provides a general estimate of the rate of habitat loss in Washington, but does not represent absolute values. We found that over 202,000 acres of northern spotted owl habitat was harvested between 1992 - 2002 on all lands in Washington, representing a decadal loss of about 5 percent (Table 8-18). Timber harvest on the FPHCP covered lands accounted for about 68 percent of the total habitat removed (136,900 acres). Harvest on Federal, tribal, or other HCP-covered lands accounted for the remaining 32 percent of habitat loss. Timber harvest on the FPHCP covered lands removed about 17 percent of the northern spotted owl habitat that was present in 1992-1996. Most of habitat loss occurred in the Western Washington Lowlands (44 percent) where there are few northern spotted owls, but all provinces had substantial habitat loss (Table 8-18).

Table 8-18. Estimated acres of suitable northern spotted owl habitat harvested on FPHCP covered lands 1992-2002.

Province	Total NRF Acres in Province (1994-1996)	Total NRF Acres on FPHCP Covered Lands (1994-1996)	Total NRF Acres Harvested in Province (2002)	Percent of NRF Acres in Province Harvested (1992-2002)	Total NRF Acres Harvested on FPHCP Covered Lands (1992-2002)	Percent of NRF Acres on FPHCP Covered Lands Harvested (1992-2002)
Olympic Peninsula	736,900	54,800	19,800	3%	14,100	26%
Western Washington Lowlands	449,700	295,400	71,100	16%	60,300	20%
Western Washington Cascades	1,672,400	217,000	56,100	3%	38,800	18%
Eastern Washington Cascades	1,027,700	229,600	55,200	5%	23,700	10%
Washington Totals	**3,886,700**	**796,800**	**202,200**	**5%**	**136,900**	**17%**

Note: All figures are approximate values derived from GIS data. Northern spotted owl habitat estimates represent approximate conditions in 2003, as depicted by Davis and Lints' (2005) map data, and accounting for stand-replacing timber harvest and fire losses that occurred from 1992 to 2002 (Healey et al. 2003).

Pierce and others (2005) also completed an evaluation of habitat loss from timber harvest in their study area for the period of 1996 to 2004. They also used the disturbance maps developed by Healey et al. (2003), but their study also included estimates of habitat loss associated with partial harvests. Pierce and others (2005) mapped a total of 172,000 acres of timber harvest in their 3.2 million-acre study area, including harvest of 56,400 acres of suitable northern spotted owl habitat. This represented a loss of about 6 percent of the northern spotted owl habitat in their study area distributed across all ownerships. Approximately 77 percent of the harvested habitat occurred on private lands and about 15 percent occurred on State lands (Pierce et al. 2005).

The emergency rule changes adopted by the Forest Practices Board were partly in response to data presented by Pierce et al. (2005). The Board summarized the need for the rule changes: "Since the Forest Practices Board adopted rules to protect the habitat of the northern spotted owl in 1996, the amount of suitable habitat in Northern Spotted Owl Special Emphasis Areas, outside areas being managed under a habitat conservation plan has declined by an average of 16 percent. Furthermore, fewer plans to conserve northern spotted owl habitat at a landscape level have been developed than was anticipated when the Northern Spotted Owl rules were adopted. With few landscape-level plans, the forest practices rules continue to rely heavily upon the regulation of timber harvest at individual northern spotted owl sites to provide habitat conservation."

Federally Designated Northern Spotted Owl Critical Habitat

Federally designated northern spotted owl critical habitat in Washington covers approximately 2.3 million acres distributed across 53 units. Only Federal lands were designated in the final rule (FR 57:10:1796-

1838) so the Critical Habitat Units in Washington actually comprise about 2.15 million acres of Federal lands and encompass approximately 1.02 million acres of suitable northern spotted owl habitat. Although no Federal critical habitat occurs on FPHCP covered lands, the FWS anticipates that activities that occur on FPHCP covered lands may affect northern spotted owl critical habitat where the FPHCP covered lands occur adjacent to Critical Habitat Units. Edge effects from FPHCP covered activities associated with windthrow are reasonably certain to occur in adjacent Critical Habitat Unit stands. We used GIS to estimate the Critical Habitat Unit areas that border FPHCP covered lands, and estimated that about 64,000 acres of critical habitat occurs adjacent (within 400 feet) to FPHCP covered lands (2.8 percent). This figure represents a gross estimate and includes some non-Federal acres that are embedded within the Critical Habitat Unit boundaries. We did not calculate the suitable habitat acres associated with these Critical Habitat Unit "edge" acres, but an estimate of approximately 40 percent suitable habitat would not be unreasonable given the total ratio of suitable habitat to designated critical habitat acres (Table 8-6).

8.2.4 EFFECTS OF THE ACTION – Northern Spotted Owl and Northern Spotted Owl Critical Habitat

8.2.4.1 Context of the Effects Analysis

The analysis for the northern spotted owl and its designated critical habitat include only those effects that would be expected to occur as effects of permit issuance, such as the effects of timber harvest activities in the Riparian Zone of influence and road-related activities. The framework for analysis section of this Opinion described the primary activities that are considered effects of the permit issuance for the FPHCP. Future timber harvest activities in upland areas would be essentially unchanged by the permit issuance for the FPHCP, and therefore these activities are not analyzed in this section, but will be addressed in the analysis of cumulative effects.

Our analysis in this Opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. U.S. Fish and Wildlife Service (No. 03-35279) to complete the following analysis with respect to critical habitat.

Effect Determinations For the Northern Spotted Owl and Northern Spotted Owl Critical Habitat

The FWS has determined that the forest practices activities covered under the FPHCP "may affect, and is likely to adversely affect" the northern spotted owl and federally designated northern spotted owl critical habitat. The effect determination for northern spotted owls is based on our assessment that the effects of activities under the Permit are likely to result in the degradation and loss of northern spotted owl habitat on the FPHCP covered lands. The effect determination for critical habitat is based on our assessment that the forest practices activities are likely to result in the degradation and loss (i.e., due to windthrow) of suitable northern spotted owl critical habitat. Therefore, in accordance with ESA section 7(a)(2), the FWS has prepared the following effects analysis of the proposed Federal action (i.e., issuance of the FPHCP incidental take permit for aquatic species) for the northern spotted owl and its designated critical habitat.

Assumptions Regarding "Incidental Take" of Northern Spotted Owls

The northern spotted owl is not a covered species under the FPHCP; therefore, the FWS does not anticipate or authorize any incidental take of northern spotted owls associated with the implementation of the FPHCP. Any "take" would violate the prohibitions in Section 9 of the ESA, and would therefore invalidate the FPHCP Permit with respect to all listed covered species for that forest practices application that resulted in unauthorized "take." ESA section 3(19) defines the term "take" to include "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct". The terms "harm" and "harass" have been further defined by regulations at 50 CFR §17.3 as follows:

Harass means an intentional or negligent act of omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns that include, but are not limited to, breeding, feeding, or sheltering.

Harm means an act that actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

Northern spotted owls are likely to be taken as a result of activities that: (1) kill or injure birds; (2) impair essential behaviors by adversely affecting occupied or unsurveyed suitable breeding habitat; or (3) cause significant disturbance of breeding birds, leading to reduced reproductive success. Timber harvesting can result in the direct loss of suitable habitat important for northern spotted owl nesting, roosting or foraging. As a result, northern spotted owls may abandon a territory and seek out habitat elsewhere that may be marginal or occupied by other northern spotted owls that compete for the same resources. Timber harvest can adversely affect northern spotted owls by reducing the total amount of suitable habitat within a northern spotted owl's home range. The result may be that the northern spotted owls continue to persist at the territory, but marginal habitat conditions in the territory compromise the northern spotted owls' ability to survive and successfully reproduce. The FWS uses 40 percent as a minimum threshold for suitable habitat within a northern spotted owl median home range circle (U.S. Fish and Wildlife Service 1995) to avoid incidental take of that owl circle. We use the 40 percent habitat threshold as a general guideline for analytical purposes. We recognize that there are many examples of northern spotted owl sites that have persisted with habitat below 40 percent, that home ranges are not circular, and that the 40 percent threshold is not an absolute indicator of viability. However, we continue to use the 40 percent threshold for our section 7 consultation analyses because it is supported by numerous studies that indicate that northern spotted owls commonly have between 30 to 50 percent suitable habitat within a home range (e.g., Thomas et al. 1990; Hanson et al. 1993; Bart 1995; Dugger et al. 2005). The 40 percent threshold is a general guideline that is also used by WDNR to manage northern spotted owl sites in SOSEAs.

In the absence of a federally approved HCP or a State-approved Landowner Option Plan, suitable northern spotted owl habitat on non-Federal lands is only protected by the Washington State Forest Practices rules where protocol surveys have documented a status 1-3 northern spotted owl site within a SOSEA boundary. Under the Washington Forest Practices Rules, a landowner in Washington could be in full compliance with the Washington Forest Practices Rules and have some risk of causing "take" if their forest practices activities resulted in the loss of occupied northern spotted owl habitat (i.e., take). These situations include:

1. Outside of SOSEA boundaries, there are no restrictions on the harvest of suitable northern spotted owl habitat. Therefore, a landowner could harvest timber (habitat) without a pre-harvest survey, potentially resulting in the loss of a northern spotted owl site center or essential habitat within a

median home range circle (For the purpose of this discussion, "essential" habitat is defined as all suitable habitat within 0.7 miles of a site center, and all habitat required to meet a minimum of 40 percent of the suitable habitat within a territorial circle to protect the viability of the territory). If a known owl territory is present, timber harvest is restricted only during the nesting season (March 1 through August 31). Outside the nesting season, there are no restrictions, and the habitat surrounding a northern spotted owl nest site may be harvested, including the 70-acre nest grove. When a nest grove is harvested, or essential habitat surrounding the nest grove is removed, northern spotted owls are likely to be permanently displaced from their territory, potentially resulting in take.

2. Within SOSEA boundaries, there are no timber harvest restrictions to protect habitat within median home range circles where the site center occurs outside of the SOSEA boundary on non-Federal lands. (This exemption only applies to site centers located on non-Federal lands. Owl sites centered on adjacent Federal lands are protected, except in the Entiat SOSEA, where only owl site centers located within areas indicated for demographic support are protected). Habitat that occurs within SOSEA boundaries may be important for northern spotted owls nesting on adjacent lands. The removal of suitable habitat below 40 percent of the area within a median home range circle is one of the FWS's indicators of the potential for incidental take for this species. Loss of essential habitat due to timber harvest within a SOSEA boundary could result in take of northern spotted owls nesting outside the SOSEA boundary.

3. Timber harvesting in suitable northern spotted owl habitat that occurs where a landowner owns less than 500 acres and the land is not located within 0.7 miles of a northern spotted owl site center (WAC 222-16-080(h)(iv). Landowners with less than 500 acres are not required by the Washington Forest Practices Rules to protect northern spotted owl habitat on their lands where the habitat is located farther than 0.7 miles from a northern spotted owl activity center. Loss of habitat due to small landowner timber harvest could result in take of northern spotted owls if the harvest resulted in effects that rise to the level of harass or harm.

4. Timber harvesting along Federal boundary areas with suitable northern spotted owl habitat. Outside of SOSEA boundaries, there are no restrictions on the harvest of suitable northern spotted owl habitat. Therefore, a landowner could harvest timber (habitat) up to a Federal boundary, potentially resulting in a significant disruption of northern spotted owl breeding if the harvest occurs during the nesting season (harassment), and loss of habitat essential for survival and reproduction if the harvest occurs within an occupied median home range circle (harm). Northern spotted owl surveys have not been conducted on most Federal land areas for the past 10 years, so the locations of northern spotted owls on Federal lands are largely unknown. Some Federal boundary areas may be identified and protected under the SEPA review process, but it is not clear to the FWS that WDNR will identify suitable northern spotted owl habitat on Federal boundary areas as likely to be occupied habitat.

The above situations represent the greatest risk for landowners to have a potential violation of section 9 of the ESA (i.e., unauthorized incidental take). Other situations that have the potential to result in take of northern spotted owls include harvesting of suitable northern spotted owl habitat that is located outside of median home range circles; disturbance harassment associated with forest practices, or, harvesting occupied northern spotted owl habitat that has been surveyed to protocol, but the surveys failed to detect northern spotted owls (i.e., survey error). Even though each of these situations has the potential to result

in the loss of occupied northern spotted owl habitat, the risk of incidental take in these situations is relatively low.

Northern spotted owls in Washington use large annual home range areas that vary from less than 3,000 to more than 30,000 acres (Hansen et al. 1993). Because the actual configuration of a home range is rarely known, a circle centered on a northern spotted owl activity center is used to identify the area approximating the provincial median annual home range. Because northern spotted owl territories are variable, the median home range circle may or may not identify all essential habitats within an owls' territory. Without radio telemetry data for individual northern spotted owls, it is difficult to know which stands are used by northern spotted owls. Therefore, the FWS and WDNR both use the median home range circle to assess the potential impacts of forest practices activities. We recognize that the home range circle is an imperfect management tool, and that habitat essential to a northern spotted owl territory could occur outside a median home range circle. However, we expect that the majority of habitat that is essential to a northern spotted owl territory will occur within the median home range circle.

We expect that some sound and activity- related disturbances to nesting northern spotted owls could potentially occur on the FPHCP covered lands and adjacent ownerships, but the risk for potential injury to northern spotted owls is relatively low due to the 0.25 mile disturbance restrictions required by the Washington Forest Practices Rules during the nesting season (March 1 to August 31). The Washington Forest Practices Rules minimize the potential for adverse effects from disturbance to nesting northern spotted owls, but they do not ensure that all northern spotted owls will be protected from disturbance under all circumstances. Blasting within a mile of an occupied northern spotted owl site, or, timber harvesting or other forest practice activities adjacent to unsurveyed suitable habitat on Federal lands could result in harassment of nesting northern spotted owls.

Both the FWS and the State management agencies (i.e., WDNR and WDFW) are currently relying on the FWS northern spotted owl survey protocol to determine if potential habitat is occupied by nesting northern spotted owls (U.S. Fish and Wildlife Service 1992c). This protocol is not error-free, and some researchers have expressed concern regarding the efficacy of the protocol in landscapes occupied by barred owls (Courtney et al. 2004). Despite these uncertainties, the protocol represents the best available method for determining the northern spotted owl occupancy in potential habitat. Therefore, we expect that take of northern spotted owl is not likely in suitable habitat that has been surveyed to protocol with no occupancy detected (even though incidental take may occur due to the potential for survey error).

8.2.4.2 Effects of Timber Harvest to Northern Spotted Owl Habitat in FPHCP Riparian Management Zones

Assumptions Regarding Effects to Northern Spotted Owl Habitat in RMZs

For this analysis, we use the terms "suitable" habitat or "NRF" (nesting, roosting, foraging) to refer to areas with forest cover that have the general attributes of northern spotted owl habitat (i.e., mid-seral or late-seral conifer forests with high canopy cover) as depicted by the habitat maps developed by Davis and Lint (2005). "Essential" habitat is defined as all suitable habitat within 0.7 miles of a northern spotted owl site center, and all habitat required to meet a minimum of 40 percent suitable habitat within a territorial circle to maintain the viability of the territory. In the following analysis, we also refer to "dispersal" habitat. We use the term "dispersal habitat" to refer to areas with some forest cover (i.e., a riparian buffer adjacent to a clearcut area) that a transient northern spotted owl could potentially use when moving between areas of suitable habitat.

The environmental baseline analysis indicates that about 9 percent of the suitable northern spotted owl habitat on the FPHCP covered lands is located in RMZs (≈ 71,400 acres). Therefore, suitable habitat in RMZs that is not identified as essential habitat within northern spotted owl median home range circles is likely to be removed by stand replacing timber harvest in the Outer Zones of RMZs, or adversely affected by thinning from below treatments in the Inner Zones of RMZs. The environmental baseline indicates that approximately 24 percent of the suitable northern spotted owl habitat on FPHCP covered lands is located in median home range circles. Due to the low levels of suitable habitat in most median home range circles (i.e., less than 40 percent), we expect that few acres will be available for RMZ harvest in owl circles. However, there are approximately 54,000 acres of suitable northern spotted owl habitat in RMZs that are not associated with known circles, and are therefore likely to be affected by timber harvest in RMZs.

Because suitable northern spotted owl habitat consists of both intermediate and old-forest habitats, we are assuming that Option 1 (thinning from below) or Option 2 (leaving trees closest to the water) are both options that could be used to manage RMZs with suitable northern spotted owl habitat. Therefore, we estimated the potential effects associated with both options and present the results as a range of potential effects to suitable northern spotted owl habitat in RMZs.

Estimates of RMZs managed per decade and effects to northern spotted owl habitat were calculated by applying simple ratios. For example, in the West Cascades, RMZs comprise about 14 percent of the FPHCP covered lands (Table 8-11). Timber harvest on the FPHCP covered lands in the West Cascades affects about 182,800 acres per decade (Table 8-17). We assumed this rate of harvest would continue into the future. Since RMZs occupy about 14 percent of the landscape, we assume that about 14 percent of 182,800 acres (≈ 25,600 acres) would include managed RMZs. RMZs were further analyzed by Type. For example, Type F RMZs comprise 40 percent of the total RMZ acres in the West Cascades. Therefore out of 25,600 acres of RMZs managed per decade, we assume that 40 percent (≈ 10,200 acres) would be in Type F RMZs. The environmental baseline analysis for the West Cascades RMZs indicated that about 10 percent of the area in Type F RMZs contains suitable northern spotted owl habitat (Table 8-11). Therefore, we assumed that about 10 percent of the Type F RMZs managed per decade (≈ 1,000 acres) would include northern spotted owl habitat affected by timber harvest in the West Cascades. We applied similar calculations to Type S and Type Np RMZs for each province. This analysis provides rough estimates of the amount of northern spotted owl habitat that could be affected by timber harvest in RMZs. The values presented in the following effects analysis are estimates only, and are not intended to be interpreted as absolute values. (Detailed information regarding our methods to estimate effects associated with RMZs is available in a northern spotted owl GIS memo in the administrative record for this Opinion).

Westside Option 1 (Thinning From Below) and Eastside Mixed Conifer/Ponderosa Pine Zones

Westside Option1 (thinning from below) and eastside mixed conifer zone and ponderosa pine zone riparian rules all have similar harvest guidelines for Type S or Type F RMZs. The rules protect Core Zones and allow limited entry thinning in the Inner Zones. Outer Zones can be managed with a light retention harvest prescription (i.e., clearcut with leave trees). Overall, the FWS estimates that 30 to 60 percent of the trees within the 100-year site index tree height (75 – 200 feet) of Type S or Type F waters will be retained in managed RMZs.

Effects to Northern Spotted Owl Habitat in Core Zones

In western Washington, the Core Zone includes the channel migration zone (CMZ) and a 50- foot no-harvest buffer measured from the outer edge of the CMZ or the bankful width of fish-bearing waters. In eastern Washington, the Core Zone is a minimum of 30 feet wide and also includes additional protected areas for CMZs. No timber harvest is allowed in Core Zones except for road crossings and yarding corridors. Patches of northern spotted owl habitat in Core Zones would be adversely affected by timber harvest in the adjacent Inner and Outer Zones due to indirect effects associated with habitat fragmentation and reduced patch size. Habitat patches retained in Core Zones will vary in width from 30 to 50 feet wide along either side of a stream or river, plus any additional area associated with protected CMZs. Affected Core Zones will become narrow strips of trees, with increased solar radiation (which stimulates understory growth), and an increased risk of windthrow.

Northern spotted owl habitat protected in Core Zones will be of marginal value for northern spotted owl nesting, roosting, or foraging, due to the small patch size of the protected area. The Core Areas will likely continue to provide some cover for northern spotted owl dispersal, particularly in areas that border adjacent patches of suitable habitat. Trees retained in the adjacent Inner Zones will provide some additional forest cover and act as a "managed buffer" to reduce edge effects normally associated with a clearcut boundary (e.g., increased risk of windthrow). The adverse effects associated with small patch sizes in Core Zones will gradually diminish and transition into a closed-forest habitat as adjacent Inner Zone and Outer Zone stands regenerate over a period of 40 to 50 years. In the long-term (50+ years), the northern spotted owl habitat retained Core Zones will provide important legacy features (large trees and snags) adjacent to upland young forest patches. These legacy features will likely provide habitat for prey species, and may support nesting, roosting, and foraging opportunities in areas that are largely forested with "young-forest marginal" or dispersal habitats (WAC 222-16-085). The FWS estimates that an average of 39 percent of the suitable northern spotted owl habitat associated with managed Type S or Type F RMZs will be retained in Core Zones (Table 8-19).

Effects to Northern Spotted Owl Habitat in Inner Zones

Inner Zones can be managed with a "thinning from below" timber harvest treatment, but dominant trees and some overstory canopy cover would be retained. At minimum, at least 57 trees per acre must be retained within the Inner Zones under the westside Option 1 rules. In the eastside mixed-conifer and ponderosa pine zones, trees can be thinned to a minimum density of 100 trees per acre in stands with low basal area, and a minimum density of 50 trees per acre in stands with high basal area (defined as greater than 110 square feet per acre for trees greater than 6 inches diameter at breast height). Inner Zones vary in width from 45 to 70 feet wide on the eastside, and from 10 feet to 100 feet wide on the westside, depending upon site class. Most westside Inner Zones will vary from 43 to 78 feet wide (site classes II and III).

Thinning treatments in the Inner Zones will adversely affect northern spotted owl habitat by reducing total stem density (trees per acre), and reducing overstory canopy cover, reducing the number of standing snags, and potentially reducing decayed down logs on the forest floor. Suitable northern spotted owl habitat in western Washington (as defined at 222-16-085) consists of conifer stands with a stem density of 115 to 280 trees per acre and an overstory canopy cover greater than or equal to 70 percent. In eastern Washington, suitable northern spotted owl habitat has a minimum density of 100 trees per acre and an overstory canopy cover of greater than or equal to 50 percent (WAC 222-16-085).

Table 8-19. Summary of the estimated effects (per decade) to northern spotted owl habitat (NRF) in RMZs managed under Westside Option 1 (Thinning from Below) or Eastside Mixed Conifer/Ponderosa Pine Zone Rules

Province	Estimated Acres in Type S and Type F RMZs Managed Per Decade	Estimated NRF Habitat Acres in Managed RMZs	Estimated NRF Acres Protected in Core Zones	Estimated NRF Acres Adversely Affected by Thinning in Inner Zones	Estimated NRF Acres Removed in Outer Zones
Olympic Peninsula	12,550	420	160	150	110
Western WA Lowlands	50,540	1,960	770	690	500
West Cascades	17,570	1,560	620	550	390
Western WA Subtotals	80,660	3,940	1,550	1,390	1,000
		100%	40%	35%	25%
East Cascades Subtotals	4,750	820	290	400	130
		100%	35%	49%	16%
Totals	85,410	4,760	1,840	1,790	1,130
		100%	39%	37%	24%

Notes: Values in this table are estimates derived from a GIS analysis of northern spotted owl habitat in RMZs and have been rounded to the nearest 10. We used past timber harvest rates and the percent area within RMZs to estimate acres of RMZs managed per decade. The values listed here are estimates only, and do not represent absolute values.

NRF = Nesting, roosting, foraging habitat.

Inner Zones harvested with a maximum thinning treatment (i.e., thinned to 50 or 57 trees per acre) would be rendered unsuitable for northern spotted owl nesting, roosting, foraging or dispersal habitat, because stem density and overstory canopy cover would be reduced to such an extent that northern spotted owls would likely avoid these areas (Hansen et al. 1993; Meiman et al. 2003). An exception would be that some eastside stands thinned to 50 trees per acre may meet minimum requirements for dispersal habitat if the treated stands have at least 50 percent canopy cover (WAC 222-16-085). Thinning can also have short-term (i.e., less than 10 years) adverse affects for northern spotted owl prey species through the destruction of understory plants and fungi, and the loss of forest canopy connectivity important for northern flying squirrels (Carey 2004). There are relatively few studies that have examined the effects of thinning to northern flying squirrels (Gomez et al. 2005). Gomez et al. (2005) found that flying squirrel densities in managed forests in coastal Oregon were highly variable and were positively correlated with the biomass and frequency of fungal sporocarps, suggesting that flying squirrels were limited by the availability of food resources rather than forest structure. Gomez et al. (2005) found that commercial thinning had no measurable short-term effects (within 3 years) on the density, survival, or body mass of flying squirrels. In the Puget Sound area, northern flying squirrels were observed in thinned stands, but at much lower densities than those found in unmanaged second-growth stands (Wilson and Carey 2000). Other prey species such as deer mice respond positively to thinning treatments and are more abundant in thinned stands than in unmanaged second-growth stands (Wilson and Carey 2000).

Not all Inner Zones are likely to be harvested to the maximum extent allowed under the Option 1 rules. Some thinned areas may retain sufficient trees and overstory canopy to provide dispersal habitat functions for northern spotted owls, but we have no reliable way of estimating how much area would be affected by such treatments. Regardless of the intensity of thinning treatments in Inner Zones, all northern spotted

owl habitat in managed Inner Zones would be adversely affected by clearcut harvest in Outer Zones due to reduced patch size and habitat fragmentation effects. For this analysis, we expect that suitable habitat acres subjected to thinning in managed Inner Zones will be unsuitable for northern spotted owls. The FWS estimates that about 35 percent of the northern spotted owl habitat in managed Type S or Type F RMZs would be adversely affected by thinning treatments in Inner Zones and clearcut harvest in Outer Zones (Table 8-19).

Although there are short-term (i.e., less than 10 years) negative effects associated with thinning, treated stands that are relatively young (i.e., 40-60 years old) tend to recover quickly with increased tree growth (U.S. Forest Service 2002). Positive long-term effects of thinning can include increased growth of trees, increased crown differentiation, increased development of understory vegetation, and increased flowering and fruiting of understory plants that provide important foods for northern spotted owl prey species (Carey 2004). In eastern Washington, thinning can be beneficial for forest health by reducing competition between trees and reducing risks associated with fire hazard, insects, and disease (Quigley et al. 2001).

The time required for treated stands to recover from the short-term (i.e., less than 10 years) negative effects of thinning and regenerate an overstory canopy cover suitable for northern spotted owl habitat will vary depending upon the intensity of the thinning treatments. Recovery of habitat functions could occur in less than 10 years in locations harvested with light understory thinning treatments (Carey 2001), or could require much longer (30-40 years) in heavily thinned stands. However, due to the narrow width and small patch sizes associated with managed RMZs, habitat retained in the Core Zone and managed Inner Zone areas will be of marginal value to northern spotted owls. As noted for Core Zone areas, the adverse effects associated with small patch sizes in Inner Zones will gradually diminish and transition into a closed-forest habitat as adjacent Outer Zone stands regenerate over a period of 40 to 50 years. In the long-term (50+ years), the northern spotted owl habitat retained in Inner Zones will provide important legacy features (large trees and snags) adjacent to upland young forest patches. These areas will likely provide habitat for northern spotted owl prey species, and may support nesting, roosting, and foraging opportunities in areas that are largely forested with "young-forest marginal" or dispersal habitats (WAC 222-16-085). The FWS estimates that an average of 39 percent of the suitable northern spotted owl habitat associated with managed Type S or Type F RMZs will be retained in Core Zones (Table 8-19).

Effects to Northern Spotted Owl Habitat in Outer Zones

Outer Zone timber harvest will adversely affect northern spotted owl habitat by removing most of the overstory trees and rendering the harvested area unsuitable for northern spotted owl nesting, roosting, foraging, or dispersal. Timber harvest in the Outer Zones will result in clearcut areas with a few scattered leave trees retained in dispersed or clumped groups to meet the average 20 trees per acre retention requirement. In eastern Washington, we assume that 60 percent of Outer Zones will be clearcut, and 40 percent will be harvested with partial harvest methods. Clearcut areas will remain unsuitable as northern spotted owl habitat for a minimum of 40 to 50 years until forest regeneration produces trees large enough to support dispersal habitat functions. The FWS estimates that about 24 percent of the suitable northern spotted owl habitat associated with managed Type S or Type F RMZs will be harvested in Outer Zones (Table 8-19).

Summary of Effects under Western Washington Option 1/Eastern Washington Mixed Conifer/Ponderosa Pine Zones

Within the range of the northern spotted owl in Washington, there are approximately 710,500 acres associated with Type S or Type F RMZs, encompassing approximately 39,300 acres of northern spotted owl habitat (5.5 percent) (Table 8-11). Based on past harvest trends, we estimate that 85,410 acres of Type S or Type F RMZs would be affected by timber harvest per decade, encompassing a total of 4,760 acres of northern spotted owl habitat (Table 8-19). Approximately 39 percent of the northern spotted owl habitat acres would be protected in Core Zones (1,840 acres) and approximately 37 percent of suitable habitat would be managed by thinning in Inner Zones (1,790 acres). All habitat retained in Core Zones or Inner Zones would be of marginal quality for northern spotted owl foraging or dispersal due to the small patch size and linear nature of managed RMZs. The remaining 24 percent of northern spotted owl habitat would be removed by timber harvest in Outer Zones, resulting in a loss of 1,130 acres of northern spotted owl habitat per decade (Table 8-19).

Effects of Western Washington Option 2 – Leaving Trees Closest to the Water

Under Option 2 (leaving trees closest to the water), landowners may forego the thinning from below guidelines and harvest trees within the Inner and Outer Zones if the Desired Future Condition objectives for the RMZ can be met. In Option 2, trees located 80 to 100 feet from the outer edge of the CMZ along Type S or Type F streams (depending on stream size) will be remain intact (no timber harvest except at road crossings and yarding corridors), while trees from 80 to 100 feet out to 140 to 200 feet (Inner and Outer Zones) may be harvested down to a minimum of 20 trees per acre. This option is not applicable in eastern Washington due to the narrower riparian zone widths.

Effects to Northern Spotted Owl Habitat in Core/Inner Zones

Under Option 2, patches of suitable northern spotted owl habitat in Core/Inner Zones would be adversely affected by timber harvest in the adjacent Inner/Outer Zones due to indirect effects associated with habitat fragmentation and reduced patch size. Habitat patches retained in Core/Inner Zones will vary in width from 80 to 100 feet wide along either side of a stream or river, plus any additional area associated with protected CMZs.

Northern spotted owl habitat protected in Core/Inner Zones will be of marginal value for northern spotted owl nesting, roosting, or foraging, due to the small patch size of the protected area. The Core/Inner Zone areas will likely continue to provide some cover for northern spotted owl dispersal, particularly in areas that border adjacent patches of suitable habitat. Habitat for northern spotted owls prey species such as northern flying squirrels would be present (i.e., canopy connectivity) but reduced patch sizes could result in the abandonment of some areas by flying squirrels. Rosenberg and Raphael (1986) demonstrated that there is a decreasing frequency of flying squirrel occupancy with decreasing patch size. Small habitat patches in managed Core/Inner Zones will gradually transition to a closed-forest condition as adjacent Inner Zone and Outer Zone stands regenerate over a period of 40 to 50 years. The FWS estimates that about 61 percent of the suitable northern spotted owl habitat associated with Type S or Type F RMZs will be protected in Core/Inner Zones (Table 8-20).

Table 8-20. Summary of the estimated effects (per decade) to northern spotted owl habitat (NRF) in RMZs managed under Westside Option 2 (leaving trees closest to the water).

Province	Estimated Acres in Type S and Type F RMZs Managed Per Decade	Estimated NRF Habitat Acres in Managed RMZs	Estimated NRF Acres Protected in Core/Inner Zones	Estimated NRF Acres Removed in Inner/Outer Zones
Olympic Peninsula	12,550	420	250	170
Western WA Lowlands	50,540	1,960	1,200	760
West Cascades	17,570	1,560	940	620
Western WA Totals	80,660	3,940	2,390	1,550
		100%	61%	39%

Notes: Values in this table are estimates derived from a GIS analysis of northern spotted owl habitat in RMZs. We used past timber harvest rates and the percent area within RMZs to estimate acres of RMZs managed per decade. The values listed here are estimates only, and do not represent absolute values.

NRF = Nesting, roosting, foraging habitat.

Effects to Northern Spotted Owl Habitat in Inner/Outer Zones

Timber harvest in the Inner/Outer Zones will adversely affect northern spotted owl habitat by removing most of the overstory trees and rendering the harvested area unsuitable for northern spotted owl nesting, roosting, foraging, or dispersal. Inner/Outer Zone harvest will result in clearcut areas with a few scattered leave trees retained in dispersed or clumped groups to meet the average 20 trees per acre retention requirement. Clearcut areas will remain unsuitable as northern spotted owl habitat for a minimum of 40 to 50 years until forest regeneration will produce trees large enough to support dispersal habitat functions. The FWS estimates that about 39 percent of the suitable northern spotted owl habitat associated with Type S or Type F RMZs in Western Washington will be harvested in Outer Zones (Table 8-20).

Summary of Western Washington Option 2 Effects

In Western Washington, there are approximately 670,500 acres associated with Type S or Type F RMZs, encompassing approximately 32,400 acres of northern spotted owl habitat (5 percent) (Table 8-11). Based on past harvest trends, we estimate that 80,660 acres of Type S or Type F RMZs would be affected by timber harvest per decade, encompassing a total of 3,940 acres of northern spotted owl habitat (Table 8-20). Approximately 61 percent of the northern spotted owl habitat acres would be protected in the no-harvest Core/Inner Zones (2,390 acres) but this habitat would be of marginal quality for northern spotted owls due to the small size and linear nature of Core/Inner Zones. Approximately 39 percent of northern spotted owl habitat would be removed by timber harvest in the Inner/Outer Zones, resulting in a loss of 1,550 acres of habitat per decade (Table 8-20).

Sensitive Sites and RMZs along Type Np and Type Ns Waters

In western Washington, a minimum 50-foot no-harvest buffer must be retained along the lower 500 feet of Type Np waters upstream from the confluence with Type S or F waters. Beyond 500 feet from such confluences, a 50-foot no-harvest buffer is required along approximately 50 percent of the remaining Type Np stream lengths. Sensitive sites associated with headwall seeps, sidewall seeps, and perennial flow initiation points are also protected with 50- to 56-foot radius no-harvest buffers. Type Ns streams

are not protected with no-harvest buffers, except in the vicinity of sensitive sites, unstable slopes, and/or buffers associated with Type S or Type F confluences. In eastern Washington, management along Type Np and Type Ns waters, as well as sensitive sites are similar to the westside rules. However, eastside landowners have the option to thin trees down to a density of 50 trees per acre adjacent to Type Np waters, and clearcut areas adjacent to Type Np streams are limited to 300 foot segments along the stream.

To evaluate the effects of management along Type Np streams, we used GIS to map buffers representing an average 100-year site index tree height along both sites of Type Np waters. This area represents the Riparian Zone of influence, rather than the Type Np RMZ defined in the Washington Forest Practices Rules (the 50-foot buffer). The 50-foot no-harvest buffers along portions of Type Np waters retains about 15 to 20 percent of the existing trees within the 100-year site index tree height of the stream. Outside the 50-foot no-harvest zones, all trees within the 100-year site index tree height (from 50 out to 200 feet, depending on the site) are likely to be clearcut or heavily thinned, resulting in the loss of suitable northern spotted owl habitat in these locations.

Patches of suitable northern spotted owl habitat protected in Type Np RMZs would be adversely affected by the adjacent timber harvest due to indirect effects associated with habitat fragmentation and reduced patch size. Habitat patches retained in Type Np RMZs or around sensitive sites will vary in width from 50 to 60 feet along either side of a stream or a sensitive site, but these areas may be further fragmented by clearcut areas between the protected patches. Isolated patches less than 5 acres in size would be unsuitable as northern spotted owl foraging or dispersal habitat, and would likely be too small to support northern flying squirrels. Other prey species such as deer mice would continue to persist in these small patches. Patches larger than 5 acres may provide some provide some cover for northern spotted owl dispersal, particularly in areas that border adjacent patches of suitable habitat. Small habitat patches in managed Type Np RMZs will gradually transition to a closed-forest condition as adjacent upland stands regenerate over a period of 40 to 50 years. The FWS estimates that about 17 percent of northern spotted owl habitat along Type Np streams will be protected in buffers, and 83 percent will be removed by timber harvest (Table 8-21).

Table 8-21. Summary of the estimated effects (per decade) to northern spotted owl habitat (NRF) in Type Np RMZs.

Province	Estimated Acres in Type Np RMZs Managed Per Decade	Estimated NRF Habitat Acres in Managed RMZs	Estimated NRF Acres Protected in Type Np RMZs	Estimated NRF Acres Removed within a site-potential tree height adjacent to Type Np streams.
Olympic Peninsula	2,210	130	20	110
Western WA Lowlands	8,140	720	120	600
West Cascades	7,180	1,010	170	840
East Cascades	2,330	490	80	410
Western WA Totals	19,860	2,350	390	1,960
			17%	83%

Notes Values in this table are estimates derived from a GIS analysis of northern spotted owl habitat in RMZs. We used past timber harvest rates and the percent area within RMZs to estimate acres of RMZs managed per decade. The values listed here are estimates only, and do not represent absolute values.

NRF = Nesting, roosting, foraging habitat.

Summary of Effects from Type Np Buffers

Within the range of the northern spotted owl in Washington, there are approximately 163,100 acres associated with Type Np RMZs, encompassing approximately 19,200 acres of northern spotted owl habitat (12 percent) (Table 8-11). Based on past harvest trends, we estimate that 19,860 acres of Type Np RMZs would be affected by timber harvest per decade, encompassing a total of 2,350 acres of northern spotted owl habitat (Table 8-21). Approximately 17 percent of the northern spotted owl habitat acres would be protected in the no-harvest buffer zones (390 acres) but this habitat would be of marginal value for northern spotted owl dispersal due to the small patch sizes and linear nature of protected areas. Approximately 83 percent of northern spotted owl habitat located within a 100-year site index tree height of Type Np waters would be removed by timber harvest, resulting in a loss of 1,960 acres of habitat per decade (Table 8-21). Regeneration stands in harvested areas will require a minimum of 40 to 50 years to produce stands with sufficient tree height and canopy cover to provide habitat functions for northern spotted owls.

Windthrow Effects to Northern Spotted Owl Habitat in RMZs

Northern spotted owl habitat retained in protected Core/Inner Zones will likely be degraded by the effects of windthrow. Grizzel and Wolff (1998) studied riparian buffer strips on small streams in northwestern Washington and reported that about 33 percent of buffer trees were affected by windthrow. In a study by Rollerson and McGourlick (2001), riparian windthrow averaged about 21 percent of the standing timber along stream edges. They note there were a large number of plots with only a minor amount of windthrow and conversely only a limited number of areas with substantial amounts of windthrow. The average distance of penetration into standing timber was about 40 feet. They also noted that buffers exposed on both sides were more vulnerable and that "feathered edges" had lower amounts of windthrow.

The potential effects of windthrow in RMZs are highly variable and dependant on many site-specific factors. There are no reliable methods to estimate or quantify the effects that windthrow may have on northern spotted owl habitat at the scale of the FPHCP. However, it is likely that northern spotted owl habitat retained in the protected portions of RMZs will be degraded by the loss of trees resulting in reduced canopy cover in the affected areas. In catastrophic wind events, all trees left in an RMZ could be lost to windthrow, but this will likely be uncommon.

Summary and Comparison of the Effects of the FPHCP Riparian Management Options

Within the range of the northern spotted owl in Washington, there are approximately 873,600 acres of RMZs encompassing a total of 58,500 acres of northern spotted owl habitat (Table 8-11). Northern spotted owl habitat acres represent about 7 percent of the total area in RMZs. The percentage of northern spotted owl habitat in RMZs varies by province, from 4 percent on the Olympic Peninsula, to 18 percent in the East Cascades. Based on the average timber harvest rate of approximately 12 percent per decade for the FPHCP covered lands, we estimated that 12 percent of the RMZs would be managed per decade, affecting a total of approximately 7,110 acres of northern spotted owl habitat in RMZs (Table 8-22). All northern spotted owl habitat acres in managed RMZs would be adversely affected. Some acres will be directly affected by timber harvest (thinning or clearcut), and other areas will be indirectly affected by adjacent timber harvesting in the Outer Zones, resulting in narrow, linear patches of habitat retained in Core/Inner Zone areas.

Table 8-22. Comparison and summary of the estimated effects (per decade) associated with riparian management in all RMZ Types.

	RMZ Acres		Westside Option 1 and Type Np			Westside Option 2 and Type Np	
Province	Estimated Acres in RMZs Managed Per Decade	Estimated NRF Habitat Affected Acres in Managed RMZs	Estimated NRF Acres Protected in Core Zones	Estimated NRF Acres Adversely Affected by Thinning in Inner Zones	Estimated NRF Acres Removed in Outer Zones	Estimated NRF Acres Protected in Core/ Inner Zones	Estimated NRF Acres Removed in Inner/ Outer Zones
Olympic Peninsula	14,760	550	180	150	220	270	280
Western WA Lowlands	58,680	2,680	890	690	1,100	1,320	1,360
West Cascades	24,750	2,570	790	550	1,230	1,110	1,460
Westside Subtotals	98,190	5,800	1,860	1,390	2,550	2,700	3,100
		100%	32%	24%	44%	47%	53%
East Cascades Zones and Type Np Subtotals	7,080	1,310	370	400	540	370	940
		100%	28%	30%	42%	28%	72%
	105,270	7,110	2,230	1,790	3,090	3,070	4,040
WA Totals per Decade		100%	32%	25%	43%	49%	51%
50-Year Totals	526,350	35,550	11,150	8,950	15,450	15,350	20,200

Notes: For this comparison, we assumed the same effects for the East Cascades to derive totals under Option 1 and Option 2. Values in this table are estimates derived from a GIS analysis of northern spotted owl habitat in RMZs. We used past timber harvest rates and the percent area within RMZs to estimate acres of RMZs managed per decade. The values listed here are estimates only, and do not represent absolute values.

NRF = Nesting, roosting, foraging habitat.

For the westside Type S or Type F RMZs, the habitat acres retained in Core/Inner Zones and associated CMZs will vary from 40 to 60 percent depending upon the management option selected, and the habitat acres directly removed by clear-cut timber harvest in Outer Zones will vary from 25 to 40 percent per decade. In the east Cascades province, fewer habitat acres are protected in Type S or Type F RMZ Core Zones (35 percent), but only 16 percent of habitat acres would be removed by harvest in Outer Zones. To date, most landowners have implemented Option 2 (leaving trees closest to the water), but this trend may change over time. Habitat impacts associated with Type Np RMZs are similar across all provinces. Approximately 83 percent of the habitat acres located within a 100-year site index tree height of Type Np waters will be removed by clearcut harvest or heavy thinning.

At the scale of the FPHCP covered lands, the FWS estimates that 4,000 to 5,000 acres of northern spotted owl habitat will be directly affected by timber harvest (thinning and clearcut) in RMZs per decade, and approximately 2,200 acres to 3,100 acres will be retained in protected Core Zone or Inner Zone areas. Over the 50 year life of the FPHCP, approximately 61 percent of the northern spotted owl habitat (35,550 acres) that is currently associated with RMZs will be adversely affected by timber harvest (Table 8-22). These effects would be distributed across 873,600 acres of RMZs (Table 8-11) from the Olympic

Peninsula to the East Cascades, which in turn are distributed across 6.9 million acres of FPHCP covered lands within the range of the northern spotted owl.

Summary of Scientific Research Regarding the Effects of Timber Harvest to Northern Spotted Owls

Habitat loss is a well-known factor influencing northern spotted owl populations throughout the species range, and is the primary reason the species was listed as a federally threatened species in 1990 (55 FR 26114-26194). Northern spotted owls have large home ranges encompassing thousands of acres of forest. Northern spotted owls prefer to use mature and old forest habitats, presumably because they are most effective at capturing their preferred prey in these habitats. Northern spotted owls move across their home ranges over the course of the year searching for prey (Forsman et al.1984). Loss of suitable habitat reduces the amount of foraging area available and likely reduces the overall population and availability of prey, and thus reduces the capability of the landscape to support northern spotted owls. Landscapes below a certain threshold of habitat amount will not support northern spotted owls. Bart and Forsman (1992) found that northern spotted owls in some landscapes were capable of reproducing in areas with 20 to 40 percent suitable habitat. However, approximately 50 times more young northern spotted owls were fledged in areas with greater than 60 percent suitable habitat than in areas with less than or equal to 20 percent suitable habitat.

Timber harvest practices have the potential to reduce availability of northern spotted owl nest and roost sites. As reported earlier, northern spotted owls do not construct their own nests, but depend upon existing structures such as cavities and broken tree tops, characteristics associated with stands in later seral stages of development (Forsman *et al.* 1984; Buchanan *et al.* 1995; LaHaye and Gutiérrez 1999). Silvicultural prescriptions that specifically target the oldest, most-decadent trees in the stand for economic purposes, or require removal of hazard trees and snags to address human safety concerns, are likely to result in loss of nesting opportunities for northern spotted owls by removing the trees that contain those structures.

Removal or downgrading of habitat within home ranges, and especially close to the nest site, can reasonably be expected to have negative effects on northern spotted owls. Bart (1995) reported a linear reduction in northern spotted owl productivity and survivorship as the amount of nesting, roosting, and foraging habitat within a northern spotted owl home range declined. Timber harvest resulting in relatively open stands or patch clear-cuts can fragment forest stands, creating more forest edge, and reducing the area of interior old forest habitat (Lehmkuhl and Ruggiero 1991). Extensive habitat fragmentation has the potential to isolate individual owls or populations of owls by increasing distances between suitable habitat patches and reducing habitat connectivity. Such isolation decreases the likelihood of successful dispersal of juvenile northern spotted owls (Miller 1989).

Although there are recognized benefits to northern spotted owls from thinning, the effects of commercial thinning on northern spotted owls are unclear and not well documented in the published literature. In a recent scientific review of the status of the northern spotted owl, Courtney et al. (2004) identified northern spotted owl responses to various silvicultural treatments as an important research need. Hansen and others (1993) suggest that commercially-thinned stands would be functionally non-suitable during project implementation because northern spotted owls are likely to avoid these areas during the commercial-thinning operation due to the presence of logging equipment and the activities associated with timber harvest. Meiman and others (2003) tracked the response of a single male northern spotted owl following commercial thinning in young Douglas-fir stands in the Oregon Coast Range. The data collected in this

study indicated that commercial thinning resulted in significantly reduced use of the thinned area during and after harvest, and a shift in use away from the thinned stand. Hicks and others (1999) documented northern spotted owls using partially harvested stands for roosting six months after treatment, suggesting that use of thinned stands by northern spotted owls may occur rapidly following treatment in some areas.

In extreme cases, timber-harvest activities can result in direct mortality of adults, eggs, or young. Such cases are rare, but direct mortality due to timber felling has been documented (Forsman et al. 2002). The potential risk for northern spotted owls to be struck and killed or injured by falling trees during timber harvest is highest in the area relatively close to the nest tree. During timber harvest, non-breeding adult northern spotted owls can reasonably be expected to move away from the area and avoid injury. However, nesting northern spotted owls tending to reproductive activities such as incubation or brooding may be reluctant to leave the area (Delaney *et al.* 1999), and therefore, may be vulnerable to such injury. Fledglings, whether in or out of the nest, may also be at risk of direct mortality due to the effects of tree falling, or might disperse prematurely in response to the disturbance and thus be subject to predation or starvation outside of the nest grove. Potential effects to eggs range from parental abandonment to destruction during tree falling. These kinds of effects are only likely during the breeding season and then only if breeding activities are underway.

Habitat loss from timber harvest has the potential to increase the competitive interactions between barred owls and northern spotted owls in the remaining habitat patches that are left. Because northern spotted owls and barred owls are competitive with each other and utilize the same habitats, the loss of suitable habitat could result in increased competitive interactions between northern spotted owls and barred owls in the remaining patches of suitable habitat (Courtney et al. 2004). It is important to note that the recent scientific review of the status of northern spotted owls completed by Courtney et al. (2004) concluded that there is no direct scientific evidence that has clearly demonstrated that forest management has an effect on the outcome of interactions between barred owls and northern spotted owls (Courtney et al. 2004).

8.2.4.3 Effects to Northern Spotted Owls Associated with the FPHCP Riparian Management Zones

Loss of suitable habitat in RMZs would adversely affect northern spotted owls by reducing the total amount of habitat on the landscape that is available for nesting, roosting, foraging, and dispersal. Northern spotted owls move across the landscape over the course of the year searching for prey (Forsman et al. 1984). Loss of suitable habitat reducing the total amount of foraging area available and likely reduces the overall population and availability of prey species, and thus reduces the capability of the landscape to support northern spotted owls. Most of the forest habitat on the FPHCP covered lands is not suitable for northern spotted owls, or consists of dispersal habitat that has minimal foraging opportunities. Therefore, the small patches of suitable northern spotted owl habitat that do occur on these lands are important for both resident territorial owls and for non-territorial owls dispersing across the landscape and searching for vacant territories to occupy.

Approximately 9 percent of the northern spotted owl habitat on the FPHCP covered lands is located in RMZs. Timber harvest in the RMZs will result in adverse affects to an estimated 7,100 acres of northern spotted owl habitat per decade, including the direct loss of 4,000 – 5,000 acres due to clear-cut harvest or thinning. Habitat patches protected in Core Zones will be reduced to small, fragmented patches that will be marginal or unsuitable for northern spotted owl nesting, roosting, or foraging for 40 to 50 years following harvest of the Outer Zones. In the long-term (50+ years), the northern spotted owl habitat

retained Core Zones will provide important legacy features (large trees and snags) adjacent to upland young forest patches. These legacy features will likely provide habitat for prey species, and may support nesting, roosting, and foraging opportunities in areas that are largely forested with "young-forest marginal" or dispersal habitats (WAC 222-16-085).

Relatively few acres of RMZs are associated with known northern spotted owl circles. There are currently 62 northern spotted owl site centers documented on the FPHCP covered lands, but only 2 of these sites are located in mapped RMZs (3 percent). In areas where FPHCP covered lands occupy 50 percent or more of a northern spotted owl circle, habitat conditions in these circles are generally at or below the assumed thresholds for territory viability (Table 8-12). The adverse effects associated with habitat loss in RMZs does not include direct adverse effects to nesting northern spotted owls, but rather a reduction in the overall suitable habitat that is available for northern spotted owl foraging and dispersal on the FPHCP covered lands.

As the RMZs on the FPHCP covered lands are managed to develop into mature forests over time, the amount of mature conifer habitat in the RMZs could increase from the current levels of approximately 7 percent to perhaps 50 percent in the Core and Inner Zone areas. This is a rough estimate based on the average amount of mature conifer habitat in unmanaged riparian areas (Diaz and Mellen 1996). Because riparian areas often support a diversity of species and age classes, the total area occupied by mature conifer habitat is usually less than 60 percent (Diaz and Mellen 1996). However, Glenn and others (2004) observed that northern spotted owls used both hardwood and mixed hardwood – conifer riparian stands for roosting and foraging in coastal Oregon second-growth forests, suggesting that mature riparian stands of any type can be important for northern spotted owls.

Northern spotted owls likely select riparian areas for roosting and foraging because of the association of some of their prey with riparian areas. Doyle (1990) reported that small mammal communities in the Oregon Cascades were more abundant and had a greater diversity of species in riparian areas compared to upland areas, and that riparian areas may act as source habitats for several small mammal species including northern flying squirrels. The availability of water and a greater availability of diverse forage such as fruits, herbs, deciduous shrubs, and mast make riparian areas important habitat for small mammals (Doyle 1990). Carey (1991) reported that bushy-tailed wood rats are more abundant in riparian forests, and that dense understory brush cover often associated with riparian areas is a key habitat feature for woodrats. In the eastern Cascades of Washington, Peffer (2001) found that the abundance of small mammals was greater in riparian habitats than in upland areas, suggesting that even though eastside riparian areas occupy a relatively small portion of the landscape, they are likely important source areas for northern spotted owl prey species.

Because northern spotted owls require large landscapes forested with mature and old-forest habitat to survive, the RMZs play a relatively minor role in the overall conservation needs for northern spotted owls. However, the RMZs do comprise a substantial portion of the FPHCP covered lands, and these areas are clearly important for northern spotted owl prey species. The management of the RMZs will ultimately complement and improve the existing conservation efforts for northern spotted owls on the FPHCP covered lands by improving habitat conditions in the RMZs and protecting high-hazard slope areas.

Approximately 27 percent (241,000 acres) of the RMZs within the range of the northern spotted owl in Washington occur along major rivers (Type S RMZs). Riparian zones along major valley-bottom rivers and streams may be of marginal value to northern spotted owls due to the preferred use of these habitats

by barred owls, which may preclude northern spotted owls from establishing territories in these areas. There is uncertainty around this, but studies in Washington have shown that barred owls tend to colonize valley bottom habitats first, and then expand into adjacent upland areas (Herter and Hicks 2000; Pearson and Livezey 2003; Buchanan et al. 2004). This is not to say that there is no benefit to northern spotted owls by increased habitat in valley bottom riparian zones. These areas would likely be important for northern spotted owl foraging and dispersal functions, but barred owls are more likely to colonize these areas for nesting than are northern spotted owls. No research studies have definitively shown that northern spotted owls are excluded from areas occupied by barred owls (Courtney et al. 2004), but anecdotal observations documented by researchers indicate barred owls are strongly territorial and that they aggressively defend their territories from incursions by other barred owls or northern spotted owls (Courtney et al. 2004).

Effects of Disturbance to Nesting Northern Spotted Owls Associated with Forest Practices Activities

Road building, maintenance, and repair; timber harvesting; and timber hauling require the use of heavy equipment, chainsaws, and large vehicles, all of which introduce an increased level of sound into the environment. The Washington Forest Practices Board recognized that noise disturbance might disrupt northern spotted owl breeding behavior; therefore, the Board adopted rules to protect northern spotted owls from disturbance by imposing an operating restriction during the northern spotted owl nesting season (March 1 through August 31) (Washington Forest Practices Board 1996). Restricted activities include road construction, operation of heavy equipment, blasting, timber felling, yarding, helicopter operations, and slash disposal or prescribed burning. These activities are prohibited within 0.25 miles of northern spotted owl site centers located within SOSEA boundaries (WACs 222-24-030 and 222-30-050, -060, -065, -070, -100).

We previously completed an analysis of the potential for injury associated with disturbance (visual and sound) to northern spotted owls (U.S. Fish and Wildlife Service 2003). In this analysis, we concluded that behaviors indicating potential injury to northern spotted owls are: flushing from the nest and aborted feedings. These determinations and the associated injury threshold distances are based on research by Delaney and others (1999) who documented that Mexican spotted owls (*Strix occidentalis lucida*) flushed from their roosts when chainsaws were operated within a distance of 197 feet (60 meters). Based on these data, we determined the injury threshold distance for chainsaws falling trees is 65 yards, and the threshold distance for heavy equipment (e.g., excavators) is 35 yards. We note that scientific data related to injury threshold distances associated with sound and visual disturbance is limited, and we continue to collect pertinent data related to the issue. Therefore, these injury threshold distances may be adjusted in the future based on best available science.

Because the 0.25-mile buffer restriction for occupied northern spotted owl sites is substantially larger than the distances where the FWS anticipates northern spotted owls are at risk to potential injury from disturbance, we expect that the existing Washington Forest Practices Rules will protect most nesting northern spotted owls associated with known sites within SOSEAs. One exception is blasting. We consider blasting within 1 mile of a northern spotted owl nest site during the early nesting season (March 1 to July 15) to be an activity that may result in potential injury to northern spotted owls. However, we do not have decibel data for blasting on which to determine potential injury threshold distances for these activities. For blasting with charges of 2 pounds or larger, we continue to use the conventional 1-mile potential injury threshold distances due to lack of decibel information to more accurately address these distances (U.S. Fish and Wildlife Service 2003).

Other situations that could lead to disturbance to northern spotted owls include harvesting suitable habitat within a median home range circle, or timber harvesting adjacent to unsurveyed habitat on Federal lands. Although timber harvesting is restricted within 0.25 miles of a site center, there is the potential that suitable habitat outside the 0.25 mile buffer zone could be harvested during the nesting season. The result could be that northern spotted owl foraging behavior would be disrupted in the harvest areas, precluding northern spotted owl use of important foraging habitat during the nesting season.

Forest practices activities that occur adjacent to suitable northern spotted owl habitat on Federal lands may also result in disturbances to nesting northern spotted owls. Most of the suitable northern spotted owl habitat that occurs on Federal lands has not been surveyed to determine northern spotted owl occupancy. The Washington Forest Practices Rules that minimize disturbance to northern spotted owls only apply in locations where surveys have documented a northern spotted owl site center. For example timber harvesting in second-growth (non-habitat) that borders suitable northern spotted owl habitat on Federal lands would not be restricted unless the Federal land habitat was located within 0.25 miles of a known site center. Because most suitable habitat on Federal lands has not been surveyed for northern spotted owls, the Washington Forest Practices Rules that apply to northern spotted owl sites do not apply to unsurveyed habitat on Federal lands. Non-Federal landowners are not required to survey adjacent ownerships for northern spotted owls, therefore it is likely that forest practices activities that occur along Federal land boundaries could result in potential injury disturbance to northern spotted owls.

Based on the information presented above, we expect that some sound and activity- related disturbances to nesting northern spotted owls may occur on the FPHCP covered lands, but the risk for potential injury to northern spotted owls is low due to the 0.25 mile disturbance buffers within SOSEA boundaries. The Washington Forest Practices Rules minimize the potential for adverse effects from disturbance associated with forest practices to nesting northern spotted owls, but they do not ensure that all northern spotted owls will be protected from disturbance under all circumstances. Blasting within a mile of an occupied northern spotted owl site, unrestricted activities outside of SOSEA boundaries, and forest practices adjacent to unsurveyed suitable nesting habitat on Federal lands during the nesting season are all situations which may result in northern spotted owls flushing from a nest or aborted feedings.

Risk of Injury or Mortality

Under the Washington Forest Practices Rules, timber harvest within a 0.7 mile radius of a northern spotted owl site center is prohibited within SOSEAs, therefore there is little risk of direct mortality to northern spotted owls within SOSEAs. Outside of SOSEAs, there are no timber harvest restrictions within northern spotted owl territories except during the nesting season (March 1 through August 31). During the nesting season any harvest, road construction, or aerial application of pesticides within the best 70 acres of suitable habitat surrounding a northern spotted owl site is prohibited to prevent direct mortality of northern spotted owls associated with the harvest of an active nest site during the nesting season.

Effects of Forest Road Management to Northern Spotted Owls

Under the FPHCP, forest roads will be managed over time to reduce road-related impacts to the aquatic environment and to improve fish passage at road-stream crossings. In western Washington, there are over 45,000 miles of roads on the FPHCP covered lands, and over 14,000 crossings on Type F streams. Many of these roads will be decommissioned over time, and other roads may be constructed to avoid riparian areas or high-hazard soils areas. Many existing stream crossings on fish-bearing streams will be replaced

and upgraded to provide fish passage for all life stages of fish. We did not analyze how many roads or stream crossings occur in northern spotted owl suitable habitat. However, about 9 percent of the FPHCP covered lands within the range of the northern spotted owl contain suitable owl habitat, so it is reasonable to expect that about 9 percent of roads and stream crossings on FPHCP covered lands could occur in northern spotted owl habitat.

The effects of roads to northern spotted owls include the long-term loss of habitat that would have otherwise been available for northern spotted owl nesting, roosting, and foraging, and the potential for noise disturbance to nesting individuals associated with logging trucks, vehicle traffic, or other heavy equipment. Minor habitat losses associated with hazard tree removal and/or culvert/bridge replacement projects may also occur. When culverts are replaced, it is sometimes necessary to clear trees adjacent to the stream crossing, thus creating a larger gap in the forest canopy. These types of habitat effects are generally minor due to the northern spotted owl's use of large landscapes, and the low risk that northern spotted owls would be nesting in these areas. The greatest risk to northern spotted owls associated with road management is the potential for noise disturbance to nesting northern spotted owls.

We used GIS to estimate the number of northern spotted owl sites located within 0.25 miles of roads on FPHCP lands. Of the 531 northern spotted owl territories that overlap FPHCP covered lands, there are 96 northern spotted owl sites (18 percent) that are located within 0.25 miles of a forest road. There was a total of 37 miles of roads on FPHCP covered lands associated with the 0.25 mile buffers. We have no reliable way of quantifying the amount of potential disturbance to northern spotted owls associated with road-related activities on the FPHCP covered lands. The GIS analysis indicated that at least 18 percent of the known northern spotted owl sites adjacent to FPHCP covered lands could be affected by road management activities. We expect that the existing Washington Forest Practices Rules which restrict forest practices activities within 0.25 miles of occupied northern spotted owl sites will minimize potential disturbance effects associated with roads to nesting northern spotted owls.

8.2.4.4 Summary of the Effects of the Action

Within the range of the northern spotted owl in Washington, we estimate that approximately 105,000 acres of RMZs would be managed per decade, resulting in adverse effects to 7,100 acres of northern spotted owl habitat, including the direct loss of 4,000 to 5,000 acres of habitat from thinning or clearcut harvest in the Inner and Outer Zones. Over a period of 50 years, we estimate the proposed action would result in adverse affects to approximately 35,550 acres of northern spotted owl habitat in RMZs, including the direct loss of 15,000 to 20,000 acres of habitat. We expect these effects would be distributed across 873,600 acres of RMZs from the Olympic Peninsula to the East Cascades, which in turn are distributed across 6.9 million acres of FPHCP covered lands. This equates to an average rate habitat loss of 400 to 500 acres per year. At the scale of the physiographic provinces in Washington, this level of habitat loss is practically immeasurable.

Northern spotted owl habitat protected in Core Zone areas would be marginal for northern spotted owls, providing dispersal habitat functions for approximately 40 to 50 years. As harvested stands regenerate over time, the small habitat patches protected in Core Zones will provide important legacy habitat features and will serve as refugia for northern spotted owl prey species in landscapes dominated by young forest habitats. As the RMZs that are currently in early- or mid-seral condition are managed to meet the Desired Future Condition of mature, fully stocked riparian stands over time, the amount of northern spotted owl habitat (i.e., young forest marginal habitat, as defined at WAC 222-16-085) in the RMZs will increase from the current levels of 7 percent to perhaps 50 percent over a period of 50+ years. Because northern

spotted owls require large landscapes forested with mature and old-forest habitat to survive, the RMZs play a relatively minor role in the overall conservation needs for northern spotted owls. The management of the RMZs that are currently in early or mid-seral stages will ultimately complement and improve the existing conservation efforts for northern spotted owls on the FPHCP covered lands by improving dispersal habitat conditions on the private lands. Therefore, the conservation role of the FPHCP covered lands (i.e., to maintain habitat in owl circles and to provide dispersal habitat) would be maintained.

Road management activities will result in minor habitat losses associated with hazard tree removal as would culvert/bridge replacement projects. These types of habitat effects are generally minor due to the northern spotted owl's use of large landscapes, and the low risk that northern spotted owls would be nesting in these areas. Approximately 18 percent of the known northern spotted owl sites adjacent to FPHCP covered lands (96 sites) could be affected by road management activities. We expect that the existing Washington Forest Practices Rules which restrict forest practices activities within 0.25 miles of occupied northern spotted owl sites will minimize potential disturbance effects associated with roads management to nesting northern spotted owls.

We expect that some sound and activity- related disturbances to nesting northern spotted owls may occur on the FPHCP covered lands, but the risk for potential injury to northern spotted owls is low due to the 0.25 mile disturbance buffers.

8.2.4.5 Effects to Federally Designated Northern Spotted Owl Critical Habitat

The effects analysis for the northern spotted owl critical habitat includes only those effects that would be expected to occur as effects of permit issuance, such as effects of timber harvest activities in the Riparian Zone of influence and road-related activities. We do not anticipate any direct effects associated with the loss of suitable northern spotted owl habitat due to timber harvesting in RMZs or road construction in designated northern spotted owl critical habitat. We anticipate that some habitat loss associated with edge effects to designated critical habitat on Federal lands are likely to occur. These effects are associated with timber harvest practices in upland areas. Therefore, these activities and their effects to northern spotted owl critical habitat are not analyzed in this section, but will be addressed in the analysis of cumulative effects.

8.2.5 CUMULATIVE EFFECTS – Northern Spotted Owl and Northern Spotted Owl Critical Habitat

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

8.2.5.1 Cumulative Effects to Northern Spotted Owls

The cumulative effects analysis for the northern spotted owl and its designated critical habitat include the effects of activities that are not directly associated with permit issuance, such as the effects of future timber harvest activities in upland areas. These activities are essentially unchanged by the issuance of the FPHCP permit, and will occur regardless of permit issuance.

In the range of the northern spotted owl, there are over 6.9 million acres of FPHCP covered lands. Only about 13 percent of theses lands are located in the RMZs. The other 6 million acres of FPHCP covered

lands are upland areas that are expected to be managed on a 40-year to 80-year harvest rotation. Active management in RMZs is not likely to occur without some harvest activities occurring in the adjacent uplands.

As summarized in the environmental baseline section, northern spotted owl habitat on State and private lands is managed under differing standards, depending on whether or not the habitat occurs within or outside of a SOSEA, and whether or not the habitat is associated with a known owl circle. In the absence of a federally approved HCP or a State-approved Landowner Option Plan, northern spotted owl habitat in SOSEAs is only protected within known northern spotted owl circles. Outside the SOSEAs, northern spotted owl habitat is not protected on the private lands under the Washington Forest Practices Rules. However, the prohibitions of ESA section 9 still apply.

The environmental baseline analysis indicates that stand-replacing timber harvest occurred at an average rate of 0.7 to 1.3 percent per year on the FPHCP covered lands from 1992 to 2002 (Table 8-17). Over 793,000 acres of timber were harvested (clearcut) during that period, resulting in the loss of 136,900 acres of northern spotted owl habitat (Table 8-18). This represents a loss of 17 percent of the northern spotted owl habitat that existed on the FPHCP covered lands in 1992. This information indicates that northern spotted owl habitat on the FPHCP covered lands was harvested at a rate of about 13,000 to 14,000 acres per year, or 1.5 percent to 2 percent, annually. Future rates of habitat loss due to timber harvest on the FPHCP covered lands may not be as high as rates documented for the period 1992-2002. The first 3 years of that period (1992-1995) preceded implementation of the northern spotted owl habitat rules under the 1996 Washington Forest Practices Rules. Following rule implementation (July 1, 1996), landowners proceeded to harvest finite amounts of older habitat as permitted by the rules. Opportunities for harvesting northern spotted owl habitat have steadily diminished as more and more of the habitat available for harvest under the 1996 rules has been depleted. Opportunities were further diminished in 2001, when new restrictions were placed on timber harvest on unstable slopes, groundwater recharge areas of glacial deep-seated landslides, channel migration zones, and other areas. At some future point, opportunities to harvest in excess of habitat replenishment may be exhausted, and rates of habitat harvest would be expected to equilibrate with rates of habitat development, i.e., there would be no net loss of northern spotted owl habitat on the FPHCP covered lands.

We were not able to account for growth of northern spotted owl habitat on the FPHCP covered lands from the habitat maps developed by Davis and Lint (2005). However, Davis and Lint (2005) did estimate that over 600,000 acres of forests on Federal lands in the Northwest Forest Plan area have transitioned into late-successional forest during the past decade (1994-2003), resulting in a decadal increase of approximately 5 percent of potential habitat on Federal lands. Over time, habitat acres within Federal reserves are expected to continue to increase (Davis and Lint 2005). Whether or not growth of northern spotted owl habitat on private lands is increasing at a similar rate is unknown.

We evaluated northern spotted owl habitat on the private lands and found that about 24 percent were located in known owl circles, but that only 12 percent of the habitat acres were located in known owl circles located in SOSEAs (Table 8-16). Overall, 88 percent of the northern spotted owl habitat on the private lands is not associated with known owl circles in SOSEAs, indicating that nearly 582,000 acres of northern spotted owl habitat in Washington, dispersed across each of the four provinces, is at risk of harvest (Table 8-16). This is approximately 15.8 percent of the total northern spotted owl habitat in Washington. Not all of this habitat will be subject to harvest, as some areas will be protected for marbled murrelet sites or high-hazard soils areas. For example, there are approximately 26,000 acres of habitat associated with occupied marbled murrelet sites in coastal Washington. Other habitat areas located

outside SOSEAs may also be protected in known northern spotted owl circles. We did not calculate how much habitat would be protected for other conservation needs, but we suspect these areas represent a small percentage of the total acres that are at risk. If all habitat associated with known northern spotted owl circles was protected (161,700 acres), the remaining habitat acres at risk would be 498,000 acres, representing approximately 13.5 percent of the northern spotted owl habitat in Washington.

Suitable habitat that occurs outside of the known northern spotted owl circles is important for supporting territorial owls because owl territories are not circular but vary in size and configuration (Forsman et al. 1984). Many territorial circles have low amounts of suitable habitat suggesting that habitat located outside the circles may also be important for supporting territorial owls (Buchanan and Swedeen 2005). Habitat outside of the known northern spotted owl circles is also important for the conservation and recovery of northern spotted owls, because these areas provide important connectivity (i.e., foraging and dispersal) for non-territorial northern spotted owls dispersing across the landscape searching for vacant territories. Unoccupied habitat adjacent to occupied territories is ultimately important for species recovery because dispersing northern spotted owls are more likely to successfully colonize suitable habitat adjacent to occupied territories than random locations on the landscape (Lahaye et al. 2001).

Northern spotted owl habitat on private lands in the western Washington lowlands, the northern Olympic Peninsula, and the southeast Cascades provinces are of concern, because these areas contain substantial habitat acres that are not protected by SOSEAs or existing HCPs. It is important to note that much of the suitable northern spotted owl habitat that occurs on the private lands is widely scattered in small patches across large landscapes, and that much of this habitat does not exist in sufficient quantities to support territorial northern spotted owls. For example, the western Washington lowlands province has an estimated 378,000 acres of northern spotted owl habitat distributed across over 4.5 million acres. There are only 21 documented northern spotted owl sites in this province, and all of these circles are currently below minimum habitat thresholds. However, these small patches of habitat are potentially important for northern spotted owl connectivity, and may provide important dispersal and foraging habitat functions for northern spotted owls dispersing across private lands.

The northern spotted owl populations in Washington are currently experiencing substantial annual declines, and the current range of the species is essentially contracted to landscapes with large State or Federal ownership. Although habitat loss on Federal lands has slowed in the past decade, habitat loss on State and private lands continues to occur at a rate of 1-2 percent per year. The current Washington Forest Practices Rules have resulted in circle-by-circle management within SOSEAs. Buchanan and Swedeen (2005) summarized the current northern spotted owl circle management: "The predominant management strategy utilized under the Forest Practice Rules is to manage based on individual circles that are the size of the average northern spotted owl home range, regulating harvest inside circles, and allowing all proposed harvest outside the circles…The circle approach provides a certain amount of protection but it is not likely adequate in many cases and especially at the level of sub-populations. Telemetry data from Washington indicate that northern spotted owl home ranges are irregularly shaped and are often not contiguous patches of forest…Consequently, an owl's actual home range typically extends beyond the bounds of "management circles" used in Washington Forest Practice Rules. Most if not all of the owl circles in the SOSEAs were below the SEPA threshold when the current rules were adopted, and many of these circles use – and – likely require other areas of habitat outside of the management circles. In some landscapes, habitat outside of circles is not available, thus owls with lesser amounts of habitat available to them will likely be unable to persist…Circle management, particularly

when site abandonment provisions are exercised, is clearly incompatible with landscape-level population management" (Buchanan and Swedeen 2005).

Of the 1,044 northern spotted owl sites documented in Washington, approximately 25 percent (263 sites) are likely to have measurable cumulative effects due to the presence of greater than or equal to 10 percent of the area of these owl circles being located on FPHCP covered lands. Northern spotted owl site centers on FPHCP covered lands in southwest Washington are particularly at risk, because none of these sites are protected by SOSEAs. The most-recent demographic-monitoring information indicates that the northern spotted owl population in Washington is declining at an annual average rate of 7.3 percent, compared to an average rate of 2.6 percent per year in the remainder of the range (Anthony et al. 2004). The realized population change estimates (i.e., the proportion of the population remaining each year, given the rates of decline) indicate that currently only about 40 to 60 percent of the initial 1990 northern spotted owl population in Washington remains (Anthony et al. 2004; Lint 2005). The environmental baseline analysis indicated that over 60 percent of the northern spotted owl circles that overlap the FPHCP covered lands are currently at or below recognized viability thresholds for habitat, suggesting that the documented declines in northern spotted owl numbers in these circles is likely to continue into the near future, regardless of whether or not there are further losses of habitat.

Recent habitat assessments indicate that about 25 to 30 percent of the rangewide northern spotted owl habitat occurs in Washington (Davis and Lint 2005). Due primarily to historical timber harvest, approximately 84 percent of the known northern spotted owl site centers (Buchanan and Swedeen 2005) and about 60 to 70 percent of extant northern spotted owl habitat in Washington are located on Federal lands managed under the Northwest Forest Plan (Davis and Lint 2005). Since the Federal listing in 1990, the FWS has consulted on the removal or downgrading of about 240,000 acres of suitable northern spotted owl habitat in Washington under ESA section 7. Most (89 percent) of this consulted-on habitat loss is associated with approved Habitat Conservation Plans (≈ 143,000 acres) or tribal forest management plans (≈ 70,000 acres). The additional 500,000+ acres of habitat (i.e., all suitable habitat outside known northern spotted owl circles) that are at risk on the FPHCP covered lands represent a potentially substantial reduction in habitat on non-Federal lands in Washington.

Given the persistent and rapid declines of northern spotted owls in Washington, and the apparently increasing population of barred owls, the FWS considers all northern spotted owl sites that are currently occupied as increasingly important to protect and maintain for species recovery. If barred owl densities continue to increase in Washington the competition for available habitat between the two species is very likely to result in further declines to northern spotted owls in Washington, including northern spotted owl populations in protected landscapes such as National Parks. As habitat loss continues on the non-Federal lands, an increasing proportion of northern spotted owls will remain within the habitat blocks on Federal lands, where they are also subjected to the negative interactions with barred owls.

8.2.5.2 Cumulative Effects to Federally Designated Northern Spotted Owl Critical Habitat

The FWS anticipates that activities that occur on private lands may affect northern spotted owl critical habitat where the private lands occur adjacent to Critical Habitat Units. Edge effects associated with clearcut timber harvest in the uplands could result in an increased risk of windthrow, resulting in adverse effects to critical habitat on adjacent Federal lands. The FWS anticipates that windthrow could occur for distances up to 400 feet into adjacent Critical Habitat Unit stands.

Windthrow Effects

Windthrow is a natural phenomenon affecting forests throughout the Pacific Northwest. Every year hundreds of acres of trees are blown over in natural stands and along clearcut boundaries and road corridors (Strathers et al. 1994). The factors that influence windthrow include individual tree characteristics, stand characteristics, root zone soil characteristics, topographic exposure characteristics, and meteorological conditions (Strathers et al. 1994; Harris 1999). Windthrow usually occurs in the first few years after harvesting, particularly where more susceptible trees are exposed to stronger winds as a result of harvesting. Trees can become more windfirm after a few years of exposure as they develop reaction wood in response to swaying (Strathers et al. 1994). Timber harvesting can increase the windthrow hazard by increasing the wind speed and turbulence along the downwind edge of clearcut boundaries. Winthrow damage can extend into adjacent stands for hundreds of feet, although most damage is usually concentrated within the first 30 to 60 feet of the cutting boundary edge (Strathers et al.1994).

Effects to Northern Spotted Owl Critical Habitat

We used GIS to estimate the Critical Habitat Unit areas that border private lands, and estimated that about 64,000 acres of critical habitat occurs adjacent (within 400 feet) to private lands (2.8 percent). This figure represents a gross estimate and includes many non-Federal acres that are embedded within the Critical Habitat Unit boundaries. We did not calculate the suitable habitat acres associated with these Critical Habitat Unit "edge" acres, but an estimate of approximately 40 percent suitable habitat would not be unreasonable given the total ratio of suitable habitat to designated critical habitat acres (Table 8-6).

Assuming an annual harvest rate of about 12 percent per decade on the private lands, we estimate that approximately 7,700 acres of designated critical habitat may be affected by clearcut edges on adjacent private lands per decade (i.e., 12 percent of 64,000 acres of Critical Habitat Unit edge areas ≈ 7,700 acres), for a total of up to 38,500 acres affected over 50 years. The amount of potential nesting habitat exposed will be substantially less than this figure, probably on the order of 3,000 acres per decade (i.e., 40 percent of the affected area). Over a 50-year period, approximately 15,000 acres of suitable northern spotted owl habitat located along the edges of designated Critical Habitat Units would be exposed to an increased risk of windthrow.

The potential effects of windthrow are highly variable and dependent on many site-specific factors. There are no reliable methods to estimate or quantify the effects that windthrow may have on northern spotted owl habitat at the scale of the FPHCP covered lands. However, it is likely that northern spotted owl habitat in Critical Habitat Units will be adversely affected by the loss of individual trees that provide cover and structure for nesting, roosting, and foraging habitat functions. For the purposes of this analysis, we are assuming that 15 percent of the suitable habitat along affected Critical Habitat Unit boundaries will be adversely affected by windthrow. This assumption is based on the review by Strathers et al. (1994) who found that most windthrow damage occurs within 30 to 60 feet of a clearcut boundary (i.e., 60 feet represents 15 percent of the 400-foot area of potential edge effects). Based on this assumption, we estimate that up to 2,250 acres of suitable northern spotted owl habitat could be lost along Critical Habitat Unit boundaries due to windthow effects over a 50-year period.

Summary of Cumulative Effects to Northern Spotted Owl Critical Habitat

Forest practices on the FPHCP covered lands that share boundaries with Critical Habitat Units could result in edge effects to 15,000 acres of suitable northern spotted owl habitat, including the loss of up to

2,250 acres of habitat due to windthrow damage. These effects will be distributed across 53 Critical Habitat Units which encompass over 2.3 million acres and contain over 1,028,000 acres suitable northern spotted owl habitat. We recognize that the loss of habitat from a catastrophic windthrow event could be substantial at an individual site scale. However, we have no way of predicting the location or extent of such events.

Individual Critical Habitat Units in Washington vary in size from 5,000 acres to over 170,000 acres in size, and average 40,000 acres. Edge effects will be confined to the boundary areas of the Critical Habitat Units, potentially affecting less than 1 percent of the habitat in an individual unit.

The loss of potential nesting habitat could be an adverse effect to critical habitat at an individual site scale. At the scale of individual Critical Habitat Units, there could be a loss of 1 percent of potential habitat. At the scale of Critical Habitat Units in Washington, the estimated loss of potential habitat would be 0.2 percent, over a 50-year period. The cumulative effects associated with FPHCP forest practices will be confined to the boundary areas of individual Critical Habitat Units and therefore should have only minor adverse effects to the overall function of the critical habitat. Each Critical Habitat Unit was designated to include large blocks of suitable habitat to support the successful nesting, roosting, foraging, and dispersal of northern spotted owls. Overall, the loss of up to 2,250 acres of suitable habitat due to windthrow over a 50-year period is not expected to have a substantial adverse effect on the function or conservation role of the critical habitat units in Washington.

8.2.6 CONCLUSION – Northern Spotted Owl and Northern Spotted Owl Critical Habitat

8.2.6.1 Conclusion for Northern Spotted Owls

After reviewing the current status of the northern spotted owl, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the FWS's biological opinion that implementation of the proposed action discussed herein is not likely to jeopardize the continued existence of the northern spotted owl.

The northern spotted owl is not a covered species under the FPHCP; therefore, the FWS does not anticipate or authorize any incidental take of northern spotted owls associated with the implementation of the FPHCP. Any unauthorized "take" would violate the prohibitions in Section 9 of the ESA, and would therefore invalidate the FPHCP Permit with respect to all listed covered species for that forest practices application that resulted in unauthorized "take."

Based on our analysis, we estimate that the proposed action would result in adverse affects to approximately 35,500 acres of northern spotted owl habitat in RMZs, including the direct loss of 15,000 to 20,000 acres of suitable habitat. These effects would be distributed across 873,600 acres of RMZs from the Olympic Peninsula to the East Cascades, which in turn are distributed across 6.9 million acres of FPHCP covered lands within the range of the northern spotted owl, over a period of 50 years. This equates to an average rate habitat loss of 400 to 500 acres per year. At the scale of the physiographic provinces in Washington, this level of habitat loss is practically immeasurable. We conclude that these activities pose a low risk to northern spotted owl reproduction and nesting success.

The draft recovery plan for the northern spotted owl identified specific conservation roles that non-Federal lands provide for the conservation and recovery of northern spotted owls. These roles include: 1) providing habitat (suitable or dispersal) to support the conservation of northern spotted owls in Federal

reserves in areas where non-Federal lands are mixed with Federal lands; 2) providing for clusters of breeding pairs on non-Federal lands in locations where Federal lands are not adequate to provide for recovery; 3) provide habitat for existing northern spotted owl pairs to avoid take of those owls as defined by the ESA; and 4) providing dispersal habitat for connectivity between Federal reserves (U.S. Fish and Wildlife Service 1992b). Due to the widely distributed effects associated with harvest in RMZs, we conclude that the issuance of a Permit for the FPHCP for covered aquatic species would not be expected to appreciably affect the overall reproduction, numbers, and distribution of northern spotted owls.

8.2.6.2 Conclusion for Northern Spotted Owl Critical Habitat

After reviewing the current status of northern spotted owl critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the FWS's biological opinion that the proposed action is not likely to destroy or adversely modify designated critical habitat for the northern spotted owl.

The effects associated with private forest practices will be confined to the boundary areas of individual Critical Habitat Units and therefore should have only minor adverse effects to the overall function of the critical habitat. At the scale of individual subunits, there could be a loss of up to 1 percent of potential habitat. At the scale of Critical Habitat Units in Washington, the estimated loss of potential habitat would be 0.2 percent, over a 50 year period. Each Critical Habitat Unit was designated to include large blocks of suitable habitat to support successful nesting, roosting, foraging, and dispersal of northern spotted owls. Overall, the loss of up to 2,250 acres of habitat due to windthrow over a 50 year period is not expected to have a substantial adverse effect on the function or conservation role of the Critical Habitat Units in Washington.