

# Final Rule

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Tuesday  
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## Part VI

# Department of the Interior

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Fish and Wildlife Service

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50 CFR Part 17

Endangered and Threatened Wildlife and  
Plants; Determination of Threatened  
Status for the Northern Spotted Owl;  
Final Rule

## DEPARTMENT OF THE INTERIOR

## Fish and Wildlife Service

## 50 CFR Part 17

RIN 1018-AB32

## Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Northern Spotted Owl

AGENCY: U.S. Fish and Wildlife, Interior.

ACTION: Final rule.

**SUMMARY:** The U.S. Fish and Wildlife Service (Service) determines the northern spotted owl (*Strix occidentalis caurina*) to be a threatened species pursuant to the Endangered Species Act of 1973, as amended (Act). The present range of the subspecies is from southwestern British Columbia through western Washington, western Oregon, and the coast range area of northwestern California south to San Francisco Bay. The northern spotted owl is threatened throughout its range by the loss and adverse modification of suitable habitat as the result of timber harvesting and exacerbated by catastrophic events such as fire, volcanic eruption, and wind storms. Northern spotted owls primarily occur in old-growth and mature forest habitats, but may also be found in younger forests that possess the appropriate structural and vegetational attributes, with attendant prey populations. The rule extends the Act's protection to the northern spotted owl.

**EFFECTIVE DATE:** The effective date of this rule is July 23, 1990.

**ADDRESSES:** The complete file for this rule is available for inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement, 1002 NE Holladay Street, Portland, Oregon 97232.

**FOR FURTHER INFORMATION CONTACT:** Mr. Robert P. Smith, Assistant Regional Director for Fish and Wildlife Enhancement at the above address (503/231-6159 or FTS 429-6159).

**SUPPLEMENTARY INFORMATION:****Background**

The spotted owl (*Strix occidentalis*), consisting of three subspecies (northern, California, and Mexican), is a medium-sized owl with dark eyes, dark-to-chestnut brown coloring, with whitish spots on the head and neck and white mottling on the abdomen and breast. The adult female is slightly larger than the male. The first record of the spotted owl was made in 1858 in the western

portion of the Tehachapi Mountains in southern California (Xantus 1859) and it was first documented in the Pacific Northwest in 1892 (Bent 1938). Though observed only occasionally prior to the 1970s, the northern spotted owl since that time has been found to be more common in certain types of forested habitat throughout its range (USDA 1986).

Although a secretive and mostly nocturnal bird, the northern spotted owl is relatively unafraid of human beings (Bent 1938, Forsman *et al.* 1984, USDA 1986). The adult spotted owl maintains a territory year-round; however, individuals may shift their home ranges between the breeding and nonbreeding season. A "floater" population is comprised of subadults and adult owls who have not secured territories. Monogamous and long-lived, spotted owls tend to mate for life, although it is not known if pair-bonding or site fidelity is the determining factor.

Spotted owls are perch-and-dive predators and over 50 percent of their prey items are arboreal or semiarboreal species. Spotted owls subsist on a variety of mammals, birds, reptiles, and insects, with small mammals such as flying squirrels (*Glaucomys sabrinus*), red tree voles (*Arborimus longicaudus*) and dusky-footed woodrats (*Neotoma fuscipes*) making up the bulk of the food items throughout the range of the species (Solis and Gutierrez 1982, Forsman *et al.* 1984, Barrows 1985).

Three subspecies of the spotted owl currently are recognized by the American Ornithologists' Union (1957): the northern spotted owl (*Strix occidentalis caurina*), the California spotted owl (*S. o. occidentalis*), and the Mexican spotted owl (*S. o. lucida*). Northern spotted owls are distinguished from the other subspecies by their darker brown color and smaller white spots and markings (Merriam 1898, Nelson 1903, Bent 1938). Juvenile plumage is similar to adult plumage except for ragged white downy tips on the tail feathers of the juvenile which are retained until the bird is about 27 months old. Oberholser (1915) reported that there was considerable overlap in color of plumage between the northern and California spotted owl subspecies in California. Presumably the geographic separation between these two subspecies occurs within a 12-to-15 mile gap of forested habitat between southeastern Shasta and northwestern Lassen National Forests, where the Sierra Nevada contacts the Klamath physiographic province; the Pit River is generally accepted as the boundary between the two subspecies in California (USDA 1986; G. Gould,

California Dept. of Fish and Game, Sacramento, CA., pers. comm.). The width of the geographic separation between the northern and California subspecies is within the dispersal capabilities of the owl (E.C. Meslow, U.S. Fish and Wildlife Service Cooperative Wildlife Research Unit, Oregon State Univ., Corvallis, OR., pers. comm.).

Barrowclough (1985) examined available museum specimens of all three spotted owl subspecies to investigate geographic variation within and between these taxa. In his unpublished findings, he reported clinal variation over the range of the northern and California subspecies and questioned the validity of considering these two taxa as distinct subspecies. Recent electrophoretic work did not detect any variation between the northern and California spotted owl subspecies, at least for the blood proteins examined (Barrowclough and Gutierrez 1987). After reviewing these reports, however, the American Ornithologists' Union (AOU) informed the Service that it continues to recognize the northern spotted owl as a distinct subspecies (the AOU is the recognized authority for taxonomic issues pertaining to North American birds). In addressing the subspecific distinction between the California and northern spotted owls, the AOU notes, " \* \* \* the lack of genetic variation as determined by starch gel electrophoresis among the California and Oregon populations is not grounds for taxonomic merger of those populations." The present techniques for exposing genetic variation examine only a minute fraction of the genome and a lack of differentiation in this small fraction in the genome is without significance (N. Johnson, American Ornithologists' Union, letter dated December 12, 1989).

Specific spotted owl pairs usually do not nest every year nor are nesting pairs successful every year. Nesting behavior begins in February to March with nesting occurring from March to June; however, the timing of nesting and fledging varies with latitude and elevation (Forsman *et al.* 1984). The modal clutch size is 2 eggs, with a range of 1 to 4. Fledging occurs from mid-May to late June, with parental care continuing into September. Females are capable of breeding in their second year, but most probably do not breed until they are in their third year (Barrows 1985, Miller and Meslow 1985b, Franklin *et al.* 1986). A few males in juvenile plumage have been observed paired with adult females (Miller and Meslow 1985, Wagner and Meslow 1986). Males

do most of the foraging during incubation and assist with foraging during the fledging period.

Both the proportion of pairs occupying territories that attempt to breed and the proportion of pairs attempting to breed that are successful (i.e., fledge young) vary from year to year (Forsman *et al.* 1984, Gutierrez *et al.* 1984, Barrows 1985, Miller and Meslow 1985, Meslow *et al.* 1986, Allen *et al.* 1987, Franklin *et al.* 1987, Washington Department of Wildlife 1987, Thomas *et al.* 1990, Miller 1989).

However, in one study reproduction was relatively stable, at least for the years studied (Franklin *et al.* au). Average reproductive rates for Oregon and California (Marcot 1986) range from 0.49 to 0.87 juveniles per pair (Forsman *et al.* 1984, Gutierrez *et al.* 1985a, Barrowclough and Coats 1985, Franklin *et al.* 1987, Marcot and Holthausen 1987, Thomas *et al.* 1990). In some years most pairs may nest, whereas in other years very few pairs even attempt to breed. For example, Gutierrez *et al.* (1984) noted a broad failure in reproduction from northern California through Washington in 1982. It has been suggested that fluctuations in reproduction and numbers of pairs breeding may be related to fluctuations in prey availability (Forsman *et al.* 1984, Barrows 1985, Gutierrez 1985).

Mortality rates of juveniles are significantly higher than adult rates (Forsman *et al.* 1984, Gutierrez *et al.* 1985 a and b, Miller 1989). Recent studies of juvenile dispersal in Oregon and California indicate that few of the juvenile spotted owls survived to reproduce (Miller 1989, Gutierrez *et al.* 1985 a and b). These research studies all report very high mortality during pre-dispersal and the first months of dispersal. Using these data, Marcot and Holthausen (1987) estimated that about 60 percent of juveniles live until they disperse from their nesting areas, but only about 18 percent of those fledged survive for 1 year. In one study, only 7 out of 48 juveniles radio-tracked during a 3-year study (1982-1985), were known to be alive after 1 year (the fate of 4 was unknown because transmitter signals were lost) (Miller 1989). Survival of first year birds was estimated at 19 percent; predation by great horned owls and starvation were the two main causes of mortality (Miller 1989). Twelve of 23 juveniles in a 2-year study in California died during the dispersal period; the fate of the other 11 was unknown (Gutierrez *et al.* 1985b). It is not known whether the use of radio transmitters attached to juveniles for tracking purposes contribute to juvenile mortality (Irwin

1987; Dawson *et al.* 1986); researchers using this technique believe it should not measurably influence juvenile survival if done properly (Foster *et al.*, unpub. ms.).

The current range of the northern spotted owl is from southwestern British Columbia, through western Washington, western Oregon, and northern California south to San Francisco Bay. The southeastern boundary of its range, separating this subspecies from the California spotted owl, is the Pit River area of Shasta County, California. Populations are not evenly distributed throughout its present range. The majority of individuals is found in the Cascades of Oregon and the Klamath Mountains in southwestern Oregon and northwestern California (USDA 1988; Gould, pers. comm.; USDI 1989). Evidently, northern spotted owls reach their highest population densities and may have their best reproductive success in suitable habitat in this part of their range (USDI 1987, 1989; Franklin and Gutierrez 1988; Miller and Meslow 1988; Franklin *et al.* 1989; Robertson 1989). Habitat in southwestern Oregon south of Roseburg begins to change to a drier Douglas-fir/mixed conifer habitat with a corresponding change in prey base (from flying squirrels to woodrats (Meslow, pers. comm.). In addition, historical logging practices in the mixed conifer zone consisted of more selective timber harvesting than in other areas, leaving remnant patches of old growth or stands of varying ages with old-growth characteristics. This situation is also present along the east side of the Cascades in Washington.

The northern spotted owl is known from most of the major types of coniferous forests in the Pacific Northwest (Gould 1974, 1975, 1979; Forsman *et al.* 1977, 1984; Garcia 1979; Marcot and Gardetto 1980; Solis 1983; Sisco and Gutierrez 1984; Gutierrez *et al.* 1984, Forsman and Meslow 1985). The historical range of the northern spotted owl extended throughout the coniferous forest region from southwestern British Columbia south through western Washington, western Oregon, and the Coast Ranges of California to San Francisco Bay (USDA 1986). The current range and distribution of the northern subspecies is similar to the historical range where forested habitat still exists. The owl has been extirpated or is uncommon in certain areas (in intermingled private and State lands in southwestern Washington and intermingled Federal, State, and private lands in portions of Oregon and California) as the result of a decline or modification of old-growth and mature

forest habitat and, thus, its distribution is now discontinuous over its range (Dawson *et al.* 1986, Forsman 1986). Specific areas of concern are discussed in detail in the Status Review Supplement (USDI 1989, 3.6).

Population densities and numbers are lowest in northern Washington, southern British Columbia, and the eastern portion of its range in California. Few pairs have been located in British Columbia; all have been located near the United States border. Few owls (pairs or singles) are presently found in the Coast Ranges in southwestern Washington or in the northwestern Oregon Coast Ranges (north from the southern portion of the Siuslaw National Forest). The population also decreases in density toward its southern extreme along the Coast Range in Marin, Napa, and Sonoma Counties, California and the Mendocino National Forest.

In California, northern spotted owls most commonly use the Douglas-fir (*Pseudotsuga menziesii*) and mixed conifer forest types (Marcot and Gardetto 1980, Solis 1983, and Gutierrez 1985). Gould (1974) reported finding spotted owls in northwestern California in coast redwood, Douglas-fir and Bishop pine (*Pinus muricata*) forests, and also in stands dominated by ponderosa pine (*Pinus ponderosa*). In Washington's coastal forest, the spotted owl is found in forests dominated by Douglas-fir and western hemlock (*Tsuga heterophylla*). At higher elevations in western Washington, Pacific silver fir (*Abies amabilis*) is commonly used by owls whereas on the east side of the Cascades Douglas-fir and grand fir (*Abies grandis*) are used (Postovit 1977). Availability of forest types within a region may be responsible for the observed differences in use among types (Gutierrez 1985; Meslow *et al.* 1986). Gould (pers. comm.) observed that preferred habitat, particularly in California, is not continuous, but occurs naturally in a mosaic pattern, especially in the southern portions of range of the bird.

Spotted owls have been observed over a wide range of elevations, although they seem to avoid higher elevation, subalpine forests (USDA 1986). Garcia (1979) reports that spotted owl densities in Washington were greatest below 4,100 feet elevation. Postovit (1977) found owls on the Olympic Peninsula at elevations ranging from 70 to 3,200 feet and an elevation range of 1,600 to 4,200 feet in the Cascade Mountains of Washington. On the east side of Washington's Cascades, J. Casson (USDA Forest Service, Wenatchee National Forest, WA., pers.

comm.) found owls up to 5,000 feet elevation and almost always in association with Douglas-fir. Northern spotted owls have been observed occasionally at elevations up to 8,000 feet or more in California (Gould, pers. comm.).

The age of forests is not as important a factor in determining habitat suitability as are vegetational and structural components. Suitable owl habitat has moderate to high canopy closure (60 to 80 percent); a multi-layered, multi-species canopy dominated by large (> 30 inches in diameter at breast height (dbh)) overstory trees; a high incidence of large trees with various deformities (e.g., large cavities, broken tops, dwarf-mistletoe infections, and other evidence of decadence); numerous large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for owls to fly (Thomas *et al.* 1990). Usually the features characteristic of owl habitat are most commonly associated with old-growth forests (a widely used definition of old growth is provided in the "PNW-447 Old Growth Task Force Definition" (Franklin *et al.* 1986) or mixed stands of old-growth and mature trees, which do not assimilate these attributes until from 150 to 200 years of age (Thomas *et al.* 1990). The Interagency Scientific Committee (Thomas *et al.* 1990) reports that its members have seen sites used by owls throughout the range of the owl where the attributes of suitable owl habitat are present in relatively young forests (60+ years). Attributes of owl habitat are sometimes found in younger forests, especially those with significant remnants of earlier stands that were influenced by fire, wind storms, inefficient logging, or highgrading (removal of the most economically valuable trees). However, nests and major roost sites were located, in almost all instances, in the portions of the stand containing the oldest components (Thomas *et al.* 1990).

Recent field investigations in northern California documented the presence of northern spotted owls in 30-80 year-old forests that contain suitable structural characteristics (Diller 1989, Irwin *et al.* 1989d, Pious 1989, Kerns 1989 a and b). In some instances, nesting pairs of northern spotted owls were found in stands that developed 60-80 years after either selective cutting or clearcutting (Richards 1989; Irwin *et al.* 1989a; Pious 1989; Kerns 1988; G. Gould, pers. comm.). At several sites spotted owls nested in predominantly coastal redwood (*Sequoia sempervirens*) stands

that had acquired suitable habitat conditions in as little as 40-60 years (Pious 1989). Redwood-dominated forest stands within coastal northwestern California are believed to develop suitable habitat characteristics relatively more rapidly than other types because of unique conditions: a fast growing tree species, good soil conditions, high precipitation, coastal fog, long growing season, understorey composed of other conifers and hardwoods, and an abundant prey base (Thomas *et al.* 1990). The coastal redwood zone constitutes only 7 percent of the owl's overall range and caution is urged in assuming that these unique growing conditions will occur elsewhere (Thomas *et al.* 1990).

Northern spotted owl preferences for old-growth forests and forests with old-growth characteristics have been established using different types of information, including relative abundance, proportion of occupied sites containing old growth, and allocation of time by monitored owls. For the coniferous forest within the range of the northern spotted owl, young-growth forest is generally defined as less than 100 years of age, mature forest as stands from 100 to 200 years old, and old growth as forest more than 200 years old. However, habitat characteristics that are typical of suitable owl habitat may not neatly coincide with age classifications that are used primarily for timber purposes.

Forsman *et al.* (1977) computed an index to density of spotted owls based on response rates to simulated calls in Oregon, and estimated that spotted owl pairs were 5 to 12 times more abundant in old growth than in young-growth forests. Of 1,502 owl sites, Forsman *et al.* (1987) found that 1,282 were in old growth, 22 in mature forest, 131 in old-growth/mature forest, and 67 in stands less than 100 years age, demonstrating that the spotted owl is dramatically and disproportionately found in association with old growth (USDI 1989). Pairs were evident at 928 of these 1,502 sites. Other studies by Forsman *et al.* (1984, 1987) analyzed the habitat characteristics of spotted owl sites in Oregon and observed that more than 90 percent of sites occupied by owls contained a major component of old-growth forest. Similar studies conducted by Marcot and Gardetto (1980) in northern California found that 95 percent of spotted owl sites were in old-growth stands. Ninety-seven percent of the spotted owl population in Washington was found in old-growth/mature forest; there were no known reproductive pairs in managed second-growth forest (Allen

1988). The Interagency Scientific Committee (Thomas *et al.* 1990) reports that with the exception of recent work in the coastal redwood zone of California, all studies assessing habitat use suggest that throughout the range spotted owls concentrate their foraging and roosting activities during the entire year in old-growth or mixed-aged stands of mature and old-growth trees. Owls primarily nested either in remnant old-growth patches or in old-growth stands. Although there were exceptions, even these tended to support that owls nest in stands with old growth characteristics (Thomas *et al.* 1990).

There are a number of observations of nest sites in younger growth forests, including mixed-conifer forest in the Wenatchee and Okanogan National Forests in the eastern Cascades (Irwin *et al.* 1989a) and on private land in northern California (Irwin *et al.* 1989b, Pious 1989). Irwin *et al.* (1989c) found 13 of 29 nests in trees within what they describe as younger stands (78 to 120 years old). Marcot and Holthausen (1987) compared percent occurrence of occupancy to amount of area in old growth at each site. The results of their analysis showed probability of use is positively correlated with the percent of area containing old-growth forest types. In a recent study comparing densities of spotted owls in areas dominated by clearcuts and young forest (50-80 years of age) in northern California, Oregon, and Washington, to nearby areas with old growth, Bart and Forsman (unpub. ms.) found that forests regenerating from clearcuts of less than 80 years and containing little remnant older forest patches provided poor owl habitat. Young-growth forest supported a mean density of spotted owl pairs of 0.83 pairs/100 square miles, whereas mean density in old growth was 12.75 pairs/100 square miles. All old-growth areas contained owl pairs in comparison to only 2 of the 12 younger-growth study areas.

Even considering recent data indicating that owls can be found in 30-80 year-old stands in northern California, the vast majority of known successfully reproducing northern spotted owls are resident in old growth or in forested areas containing remnant patches of large trees or scattered individual large older trees. In instances where spotted owls have been found in stands other than old growth, in almost all cases the owls occur in situations that exhibit appropriate structural characteristics. Occurrences of owls in such habitats were known prior to the 1989 survey work conducted in northern California and, therefore, were not

unexpected (Thomas *et al.*, letter dated December 20, 1989).

Although the literature strongly supports the generalization that owls preferentially select old-growth forests over young growth (USDI 1989), there are records of owls using young-growth forests. These data on young-growth forests have led to questions on the importance of old-growth habitat to spotted owl populations (e.g., Irwin 1987). In addition to the studies noted earlier (Irwin *et al.* 1989a), Irwin *et al.* (1989c) examined the immediate vicinity surrounding and including 29 nest sites on the Wenatchee and Okanogan National Forests in the Washington Cascades. Each of these nests apparently had successfully fledged at least one young in 1987 and/or 1988. The authors noted that while characteristics of many of these sites did not completely coincide with the general description of old growth, most of the sites retained dense, multi-layered canopies; no estimates was made of the amount of old growth within the home ranges of the owls whose nest sites were included in the analysis. In the Irwin *et al.* (1989a) study, the average age of 52 nest trees was approximately 194 years and ranged from 67 to 700 years. Surveys in the northern third of the Oregon Coast Ranges (Forsman 1986) and in southwestern Washington (Irwin *et al.* 1989d), revealed a low density of spotted owls and a paucity of old-growth habitat, suggesting that this type of habitat (i.e., 40- to 120-year-old managed forest or predominantly young-growth forest) in this area is not preferred or suitable habitat for northern spotted owls. It is recognized that not all old growth is suitable northern spotted owl habitat because of either forest type, elevation, or stand size. Moreover, some suitable habitat is present in mature forest lacking some old growth characteristics, in young forests with remnant old growth components, and in younger forests where appropriate habitat characteristics were attained relatively early.

Nine studies assessing owl foraging habitat use in relation to forest habitat type and its availability within an individual home range were evaluated (USDI 1990). All nine studies quantitatively determined the amount of habitat and statistically analyzed use of the habitat by owls. Data were from the Oregon Coast, Oregon Cascades, Washington Cascades/Olympic Peninsula, and Klamath Province (E. Forsman, USDA, Forest Service, Pacific Northwest Experiment Station, Olympia, Washington, pers. comm.). Results of these studies clearly indicate that owls

use old forest more than expected for foraging (i.e., a "preferred" habitat). Sixty-eight of 81 (84 percent) owls having old forest within their home ranges used old forest more frequently than expected while 13 of 81 owls (16 percent) used old forest in relation to its availability (i.e., "neutral"). No individual owl monitored used old forest less than expected (i.e., "avoided"). The majority of owls (40 of 60; 67 percent) having mature forest in their home ranges were neutral towards mature forest; 9 of 60 (15 percent) avoided mature forest and 11 of 60 (18 percent) exhibited preference for mature forest in their home ranges. In contrast, owls having young forest within their home ranges tended to avoid (31 of 67; 46 percent) or were neutral (33 of 67; 49 percent) towards this habitat type. Owls having pole-sized forest types in their home ranges avoided (39 of 57; 68 percent) or were selectively neutral (18 of 57; 32 percent) with respect to their use of these forest types. Three (4 percent) exhibited preference for pole-sized forest. Note that none of the 57 owls with pole-sized forest and only 3 of 67 (4 percent) owls with young forest in their home ranges preferred these habitats. The clear conclusion is that owls having an array of habitat types within their home ranges select old forest, use mature forest in relation to its availability and tend to avoid or use young forest in relation to its availability (USDI 1990). The preponderance of data suggest that pole-sized forest is avoided (USDI 1990).

Three studies in the Oregon Coast (Thraillkill and Meslow 1989, Carey *et al.* 1990) and Oregon Cascades (Miller and Meslow 1989) were examined to determine the relationship of roost selection to habitat availability within home ranges (USDI 1990). These three studies are the only ones that examined attributes of roost characteristics and statistically compared roost attributes in relation to their availability in the home range. Although data are limited to studies in Oregon, they clearly indicate a strong association of roost sites with old forests. All 27 owls having old forest in the home range selected that forest type (i.e., "preferred") for roosting purposes. Mature stands were used in rough proportion to their availability, while only a few selected for or against mature stands for roosting. Owls having young and pole-sized forests in their home ranges used those habitats for roosting less than expected. These results provide no indication of what attributes associated with old forest owls find important in roost sites, but they do indicate that strong selection for

this forest type is occurring within an owl's home range (USDI 1990). Hypotheses such as the need for dense canopy for thermoregulatory balance (Barrows and Barrows 1978, Barrows 1981) will require additional study before they can be evaluated (USDI 1990).

Northern spotted owls have relatively large home ranges as demonstrated through studies using radiotelemetry techniques. In the 1990 Status Review (USDI 1990), home range size estimates are based on the 100 percent minimum polygon method (Southwood 1966) and are the union of annual home range estimates of paired male and female owls only. Because of small sample sizes of paired birds for which an annual home range has been calculated, and because of uncertainty regarding underlying assumptions, the median rather than mean home range size was calculated. Median annual pair home ranges were estimated to be 9,930 acres for the Olympic Peninsula (n=10), 6,308 acres for the Washington Cascades (n=13), 2,955 for the Oregon Cascades (n=11), 4,768 acres for the Oregon Coast Range (n=22), and 3,340 acres for the Klamath Province (n=36) (Thomas *et al.* 1990). Home range size varied from 1,035 acres in the Klamath Province to a high of 30,961 acres in the Washington Cascades (USDI 1990). Mean percent acres of old-growth and mature forest within a home range ranged from 25 percent in the Oregon Coast Range to 74 percent in the Klamath Province (USDI 1990). These data strongly suggest that paired northern spotted owls require large tracts of land containing significant acreage of old forest to meet their biological needs (e.g., foraging and breeding) (USDI 1990). In general, home range sizes are smallest during the spring and summer (reproductive period), largest during the fall and winter (non-reproductive period), increase from south to north, and increase with increasing elevation. Pairs of owls also may occupy overlapping home ranges (Solis 1983, Forsman *et al.* 1984).

Significantly, research indicates that spotted owls on the Olympic Peninsula and Oregon Coast Ranges consistently occupy larger home ranges than owls in the other provinces. These areas also have the fewest pairs of spotted owls and the least remaining old-growth forest (USDI 1989). The large home range sizes reported for owl pairs on the Olympic Peninsula, Oregon Coast Ranges, and on the west side of the Cascade Range in Washington (USDI 1989) may reflect: (1) The adverse influence of forest fragmentation

resulting from timber harvest; (2) difference in prey biomass availability; and (3) the fact that the Washington locations are near the periphery of the subspecies' range. Forests within these provinces are highly fragmented and have the least amount of old-growth forest remaining within the range of the owl. For example, on Bureau of Land Management (Bureau) property and on the Siuslaw National Forest, located within the Coast Ranges of Oregon, remaining old-growth timber occurs in widely separated and relatively small parcels (Harris 1984). In this area, the owls utilize the available old growth in a highly fragmented and patchy environment (Friesen and Meslow 1988). This pattern is probably true for the Olympic Peninsula as well. The above findings and those of Allen and Brewer (1985), Forsman *et al.* (1984), Carey (1985), and Dawson *et al.* (1986), suggest that home range size increases as quality and quantity per unit area of preferred habitat declines (USDI 1989).

There are no estimates of the historical population size and distribution of the northern spotted owl within preferred habitat, although spotted owls are believed to have inhabited most old-growth forests throughout the Pacific Northwest prior to modern settlement (mid-1800s), including northwestern California (USDI 1989). Spotted owls are still found within their historical range in most areas where preferred and suitable habitat exist, although most of the owls are restricted within this range to mature and old-growth forests managed by the Federal government. Approximately 90 percent of the roughly 2,000 known breeding pairs of spotted owls have been located on federally managed lands, 1.4 percent on State lands, and 6.2 percent on private lands; the percent of spotted owls on private lands in northern California would be slightly higher (Forsman *et al.* 1987; USDA 1988; USDI 1989; Thomas *et al.* 1990; Gould, pers. comm.).

#### Petition Process Background

On January 28, 1987, the Fish and Wildlife Service (Service) received a petition submitted by Greenworld requesting the listing of the northern spotted owl (*Strix occidentalis caurina*) as an endangered species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act). On July 23, 1987, the Service accepted the Greenworld petition as presenting substantial information indicating that listing might be warranted and initiated a status review.

On August 4, 1987, the Service received a second petition, submitted by

the Sierra Club Legal Defense Fund, Inc. on behalf of 29 conservation organizations, requesting that the populations of northern spotted owls on the Olympic Peninsula in Washington and the Coast Ranges of Oregon be listed as endangered pursuant to the Act, and that the subspecies be listed as threatened throughout the remainder of its range in Washington, Oregon, and northern California. The Sierra Club Legal Defense Fund, Inc. requested that its petition be consolidated with the petition by Greenworld. In accordance with its established policy, the Service treated this second petition as a public comment to be considered in evaluating the original listing petition. As a result, the time frames and schedules required by the first petition remained the same. Both petitions sought the designation of critical habitat.

Section 4(b)(3) of the Act requires the Secretary of the Interior to reach a final decision on any petition accepted for review within 12 months of its receipt. In conducting its review, the Service published a notice in the *Federal Register* (52 FR 34396) on September 11, 1987, requesting public comments and biological data on the status of the northern spotted owl. In addition, a status review team of three Service biologists was established. This team reviewed and evaluated all comments and information received in response to the September 11 notice as well as all other information in the Service's files or gathered in the effort to review the status of the subspecies. Two sequential drafts of the status review were prepared by the Service team and submitted for review by scientists, researchers, and others knowledgeable about the spotted owl in the Pacific Northwest.

On December 14, 1987, the Service team completed its status review on the northern spotted owl. On December 17, 1987, the Service's Regional Director for Region 1 made a finding, based on the review, that listing the northern spotted owl pursuant to Section 4(b)(3)(B)(i) of the Act was not warranted at that time. The Regional Director noted that because of the need for population trend information and other biological data, high priority would be given to this subspecies for continued monitoring and further research. Notice of this finding was published in the *Federal Register* on December 23, 1987 (52 FR 48552).

On May 5, 1988, the Sierra Club Legal Defense Fund, Inc. filed suit on behalf of 23 environmental organizations in the U.S. District Court for the Western District of Washington (*Northern Spotted Owl v. Hodel*, No. C88-573Z,

W.D., Wash. 1988) challenging the Service's finding on the listing petitions. In an order issued on November 17, 1988, the Court concluded that the Service's finding was arbitrary and capricious or contrary to law, and remanded the matter to the Service for further review. The Service was specifically ordered to: provide an analysis and explanation for its finding; explain the reasoning for not listing the owl as threatened; and to supplement its status review and petition finding.

On December 5, 1988, the Director of the Service established a new status review team, consisting of 12 Service biologists, to conduct an in-depth review and interpretation of all data and other information that had been made available to the Service in 1987 on the issue. After reviewing the 1987 administrative record, the Service concluded that there was considerable new information available that had not been present in the original record and that such information was needed to respond sufficiently to the Court's request and to meet the Act's requirement to evaluate the best available biological information. In an order issued on January 12, 1989, the Court granted the Service's request to reopen the administrative record for the status review and petition finding for a period not to extend beyond February 28, 1989. In a notice published in the *Federal Register* (54 FR 4049; January 27, 1989), the Service reopened the comment period for 30 days and solicited comments, data, and other information. In its order of January 12, 1989, to complete the additional status review, supplement the status review report, and submit to the court a new analysis and finding on the petition to list the northern spotted owl as endangered or threatened. On April 21, 1989, the team completed the review and submitted a supplemental status review report to the Regional Director, Region 1, Fish and Wildlife Service. On April 25, 1989, the Regional Director issued a revised petition finding indicating that listing the northern spotted owl as a threatened species throughout its entire range was warranted and that the Service would promptly pursue the listing process for the species.

The entire spotted owl species (*Strix occidentalis*) is listed on the Service's Notice of Review for vertebrate wildlife as a candidate species for listing, category 2. A category 2 species is one for which listing may be appropriate but for which additional information is needed. The information submitted and reviewed as part of the status review

process for the northern spotted owl contributed to the supplemental information needed on which to base a decision to propose this subspecies for listing. On June 23, 1989 [54 FR 26866], the Service published a proposal to list the northern spotted owl as a threatened species.

#### Summary of Comments and Recommendations

In the June 23, 1989, proposed rule (54 FR 26866) and associated notifications, all interested parties were requested to submit factual reports or information that might contribute to the development of a final rule. The comment period originally closed September 21, 1989. On September 15, 1989, the Service published in the *Federal Register* (54 FR 38256) a notice extending the comment period to December 20, 1989. Appropriate State agencies, county governments, Federal agencies, scientific organizations, and other interested parties were contacted and requested to comment. Numerous newspaper notices were published which invited general public comment. In the proposed rule, the Service published notice of four public hearings to obtain comments from interested parties on the proposal. Public hearings were conducted as follows: August 14, 1989, at the Columbia River Red Lion Inn, Portland, Oregon; August 17, 1989, at the Redding Convention Center, Redding, California; August 21, 1989, at the Washington Center for the Performing Arts, Olympia, Washington; and August 28, 1989, at the Lane County Convention Center Auditorium, Eugene, Oregon. Testimony was taken from 1:00-4:30 p.m. and from 6:00-8:00 p.m. or later depending on need. Notice of the proposal and public hearings was published in 66 daily and weekly newspapers in California, Oregon, and Washington. Between July 16 and 23, 1989, a notice of the proposal and public hearings was published in each of the following newspapers: (California) *Del Norte Triplicate* (Crescent City), *Times-Standard* (Eureka), *Redwood Record* (Garberville), *Siskiyou News* (Yreka), *Trinity Journal* (Weaverville), *Record-Searchlight* (Redding), *News* (Red Bluff), *Advocate-News* (Fort Bragg), *Journal* (Ukiah), *Lake County Record Bee* (Lakeport), *Press Democrat* (Santa Rosa), *Advocate* (Novato), *Register* (Napa), *Journal* (Willows), *Sun-Herald* (Colusa), *Modoc County Record* (Alturas), *Lassen County Times* (Susanville), *Bee* (Sacramento), *Union* (Sacramento), *Chronicle/Examiner* (San Francisco); (Oregon) *Astorian* (Astoria), *Headlight-Herald* (Tillamook), *News-Register* (McMinnville), *News-Times*

(Newport), *Register-Guard* (Eugene), *News-Review* (Roseburg), *World* (Coos Bay), *Coastal Pilot* (Brookings), *Courier* (Grants Pass), *Mail Tribune* (Medford), *Herald-News* (Klamath Falls), *Democrat Herald* (Albany), *Gazette Times* (Corvallis), *Polk Sun-Enterprise* (Monmouth), *Oregonian* (Portland), *Times* (Beaverton), *Enterprise-Courier* (Oregon City), *Statesman-Journal* (Salem), *Sentinel-Chronicle* (St. Helens), *News* (Hood River), *Chronicle* (The Dalles), *Pioneer* (Madras), *Bulletin* (Bend), *Sherman County Journal* (Moro); (Washington) *Peninsula Daily News* (Port Angeles), *Leader* (Port Townsend), *World* (Aberdeen), *Willapa Harbor Herald* (Raymond), *Wahkiakum County Eagle* (Cathlamet), *Chronicle* (Centralia), *News* (Longview), *Columbian* (Vancouver), *Skamania County Pioneer* (Stevenson), *Sentinel* (Goldendale), *News Tribune* (Tacoma), *Olympian* (Olympia), *Mason County Journal* (Shelton), *Sun* (Bremerton), *Herald-Republic* (Yakima), *North Kittitas County Tribune* (Cle Elum), *Times* (Seattle), *Herald* (Everett), *World* (Wenatchee), *Argus* (Mount Vernon), and *Herald* (Bellingham). On March 29, 1990, the Service published a notice (55 FR 11825) reopening the comment period for 14 days to solicit additional biological information on the status of the spotted owl. In an additional notice, the Service extended the comment period to April 18, 1990 (55 FR 13578).

To review the available biological data on the owl, including the information and data provided during the comment periods, the Service established a Northern Spotted Owl Listing Review Team. This team consisted of the Spotted Owl Listing Coordinator and five Service research scientists. These individuals prepared the 1990 Status Review (USDI 1990) and prepared the final decision document which included responding to the issues raised during the comment periods.

During the comment period, totaling about 6.5 months, 23,255 comments on the proposal were received. Of these, 3,674 (15.8 percent) supported the proposal, 18,718 (80.5 percent) were opposed, and 863 (3.7 percent) stated no opinion. Of the commenters who supported the proposal, 2,301 (9.9 percent) recommended that the northern spotted owl be listed as endangered, rather than threatened. Of the supporting comments, 2,064 (56.2 percent) were form letters. Of the 18,718 letters against the listing, 18,239 (86.8 percent) were form letters. In addition to individual letters and form letters, 5,351 individuals signed petitions urging the Service to list the spotted owl as either

an endangered or threatened species. Petitions opposing the listing were signed by 3,953 people. Various companies and organizations, that are directly or indirectly related to the timber industry were opposed, as were local governments in timber-dependent communities and numerous private citizens who rely on a timber-supported economy. The Oregon Department of Fish and Wildlife commented that Federal listing of the northern spotted owl as a threatened species is warranted. Although the Washington Department of Wildlife and California Department of Fish and Game submitted extensive comments and reports outlining their concerns for the continued viability of northern spotted owls, neither stated its position on the proposed Federal listing. Of the main Federal agencies involved, the U.S. Forest Service opposed the listing, the Bureau of Land Management stated no position, and the National Park Service supported protecting the northern spotted owl on the Olympic Peninsula.

Written comments and oral statements obtained during the public hearings and comment periods are combined in the following discussion. Opposing comments and other comments questioning the rule can be placed in a number of general groups, organized around specific issues. These categories of comment, and the Service's response to each are listed below.

#### Issue 1. Public Hearings/Public Comment Process

##### Hearings

*Comment:* A commenter stated that public hearings were inadequate to obtain public input on the proposal and should have been held in towns that are directly affected by the proposal. Another said that public hearings should have been held in "middle ground," where the community represented a more neutral atmosphere. According to one commenter, the purpose of the public hearings seemed to be to allow the timber industry to create a media circus over economic considerations. Several commenters maintained that the hearings were not run fairly because the first speakers were all anti-owl. Other commenters said that the hearings were biased in favor of individuals being paid to present testimony and that other people could not afford to take time off from work to appear or had to wait too long before they were called to speak. Several commenters recommended that the decision-makers in the Service should have been present to hear the testimony given at the hearings.

*Service response:* Under provisions of the Endangered Species Act, the Service is obligated to hold one public hearing on a listing proposal if requested to do so within 45 days of publication of the proposal (16 U.S.C. 1533(b)(5)(E)). In the case of the northern spotted owl the Service gave notice in the proposal that four public hearings would be conducted in Portland, Oregon; Redding, California; Olympia, Washington, and Eugene, Oregon. One hearing, however, would have met the legally mandated requirement. The locations of meetings were selected because they provided an opportunity for a large number of interested parties to attend. The Service acknowledges that the hearing locations may not be regarded as "middle ground" by some people. However, with a proposal that has generated the level of interest that this one has, it may not have been possible to find four neutral locations within the range of the northern spotted owl in which to hold the hearings. The Service notes that at several of the hearings, individuals with a given viewpoint were present in high numbers. Anyone who felt too uncomfortable to present testimony at the public hearings was free to submit written comments. Such written comments receive the same consideration as oral testimony. The purpose of the public hearings was to obtain pertinent public input on this proposal. While an individual has the latitude to present whatever testimony he/she chooses during the public hearing, the Service is limited to considering only relevant biological information and data in its deliberations. Hence, the Service cannot take the numerous economic comments into account and has repeatedly stated this.

During each public hearing, after elected officials and representatives of Federal, State, and local agencies provided testimony, the next speakers were taken in order according to when they signed up to speak. The Service held the hearings in the afternoons and evenings to accommodate the schedules of most working individuals. Also, the Service limited the amount of time each individual was given to present testimony to minimize the waiting time of subsequent speakers. However, the public hearings were well attended and because of the large number of people desiring to speak, it was not possible for the hearing officer to proceed as quickly as some individuals would have liked. For those not wishing to wait, the address where written comments could be submitted to supplement or substitute for oral testimony was prominently

posted and was announced by the hearing officer. Further, during all four public hearings, a court recorder was present who transcribed the proceedings to create a public hearing transcript. These transcripts are part of the official administrative record associated with this proposal and are considered along with written comments by decisionmakers. Each pertinent issue raised during the oral testimony and in the written comments is responded to in this Federal Register document.

#### Comment Procedure

*Comment:* One respondent said it was unfair that people outside of the impact area have an opportunity to comment and stated that those who are affected should make the decision. Others maintained that there was insufficient notification to the public of the proposal. Another commenter claimed that the Service's Status Review Team drafted the Status Review Supplement and largely reached its conclusions in January 1989 before the Service reopened the public comment period prior to revising the original petition finding. A commenter stated that the Service should have obtained input from industry on the use of second growth by spotted owls even before convening the public hearings.

*Service response:* The Service does not agree that the opportunity to provide public comments should be limited to only those individuals that believe they may be affected by the proposal. Endangered and threatened species issues are of interest to Americans throughout the Nation. In the Service's view it would be unfair to deny all interested parties an opportunity to comment simply because they do not reside in the Pacific Northwest.

The Service's notification process is extensive and is summarized at the beginning of this section. The Service is required to publish a notice in local newspapers soliciting comments on the proposal and stating the particulars of any public hearing(s) (if any are scheduled), to give notice of the proposal to appropriate scientific organizations, and to hold a public hearing (if requested to do so within 45 days of publication of the proposed rule). The Service has met all requirements pertaining to the notification process as indicated at the beginning of this section.

The Service's Status Review Team developed the initial draft of the 1989 Status Review Supplement in January 1989, after which several revisions were prepared. However, the recommendation of the team was not developed until April when the "finding"

was prepared. Prior to developing the finding, the public comment period was opened on January 27, 1989 (54 FR 4049) for 30 days to obtain additional input on the status review supplement and petition finding. Service personnel had the benefit of reviewing all additional information submitted during this comment period prior to reaching a recommended determination. When evaluating a species for listing, the Service must rely upon the best available scientific and commercial data. Had industry conducted its studies earlier and made those results available, the Service would have considered such data in its proposal. Input from industry on the use of younger growth by spotted owls was submitted subsequent to publication of the proposal and is considered in this final decision document.

#### Issue 2. Evidentiary Hearing

*Comment:* A number of parties requested that an evidentiary hearing be held on this proposal. One commenter provided an extensive comment outlining the specifics of the requested action including provision for cross-examination of witnesses. This comment included a request to extend the comment period for six months, hold an additional public hearing, and prepare a revised status review supplement concluding that listing is not warranted. The commenter viewed the evidentiary hearing as not being burdensome or unduly time-consuming and believed the hearing could be completed with the six-month extension period for the decision (the Act provides for a six-month extension of the one-year due date to solicit additional data for purposes of resolving a substantial disagreement regarding the sufficiency or accuracy of the available data relevant to the determination (16 U.S.C. 1533(b)(8)(B)(i)).

*Service Response:* Congress deliberately made listings under the Endangered Species Act subject to the informal rulemaking procedures of Section 553 of the Administrative Procedure Act and provided for one public hearing to be held if requested within 45 days of a proposal. If Congress had intended a more formal process for proposed listings, it would have used different language. Four public hearings have already been held, more than meeting the hearing requirements of the Endangered Species Act and Administrative Procedure Act. There is no legal requirement that any further hearings or any different type of hearing be conducted. In addition, the Service has conducted three status reviews and

has received over 23,000 written and oral comments, making it unlikely that additional information bearing on the listing will be brought to light through a further hearing procedure. The Service already has convened a pre-proposal evaluation team and a second team to examine the record and recommend final action on the proposal. The second team consists of a group of Service scientists with established research credentials. In addition, the Service participated in the Interagency Scientific Committee (ISC), a group of highly qualified agency biologists responsible for preparing a conservation plan for the northern spotted owl throughout its range. Further, the Service has considered the ISC's comments on the proposal. The Service is not persuaded that another scientific panel convened to assist in the evidentiary hearing, as recommended by the commenter, would improve the decision-making process.

#### *Issue 3. National Environmental Policy Act*

*Comment:* Several commenters suggested that the Service should prepare an Environmental Impact Statement (EIS) on the proposal to list the northern spotted owl. According to a comment, listing violates the National Environmental Policy Act (NEPA), which requires that any effects on the human environment be identified before a decision is made.

*Service response:* For the reasons set out in the NEPA section of this document, the Service takes the position that rules issued pursuant to Section 4(a) of the Endangered Species Act do not require the preparation of an EIS. The decision in *Pacific Legal Foundation v. Andrus*, 657 F.2d 829 (6th Circuit 1981) held that as a matter of law an EIS is not required for listings under the Act. The decision noted that preparing EIS's on listing actions does not further the goals of NEPA or the Endangered Species Act.

#### *Issue 4. General Issues*

*Comment:* A commenter stated that listing has not helped other species until they have been almost eliminated by research studies. Another individual maintained that single-species management is wrong and other species will suffer if the spotted owl's needs are made a priority for management. Another comment indicated that old-growth forest ecosystems should be listed, rather than concentrating on single-species management. Others said that the owl already has sufficient protection. Several individuals expressed the viewpoint that if the owl does not adapt, it should become extinct

and speculated whether owls were good for anything. Numerous commenters recommended that the fate of the owl should rest with a divine power, rather than with mortals.

*Service response:* The Service disagrees with the implication that research studies have contributed significantly to the need to list species. Research has been instrumental in aiding the recovery and conservation of many endangered and threatened species. It is the Service's position that actions taken to conserve the northern spotted owl would benefit a number of species inhabiting the same ecosystems. However, the possibility does exist that an action beneficial to the management of the spotted owl may be deleterious to non-listed sympatric species. Although a purpose of the Act is to conserve ecosystems upon which endangered and threatened species rely, the Act does not specifically authorize listing an ecosystem. Under Factor D, "Inadequacy of Existing Regulatory Mechanisms," the Service outlines its rationale for concluding that existing mechanisms are insufficient to protect the owl. A species may not be able to adapt to modifications in its habitat precipitated by human-related activities. Adaptation is an evolutionary mechanism, that requires considerable time. The view expressed by the commenters that the owl should either adapt to the effects of logging or become extinct is directly contrary to the intent of Congress as stated in the purposes of the Act. Nor does the Service view the remark that a divine power should dictate whether or not the owl survives as having merit, particularly when it is really the power of people, harvesting timber, that is the primary cause for the bird's decline.

*Comment:* One party wrote that the owl will become another snail darter because the Service is being duped by preservationist groups into listing. The spotted owl issue was viewed by some commenters as a mechanism to reduce public access to public land for recreation. Another stated that the Act was being used to create more parks where Congress has not appropriated funds to acquire land. Others accused the Service of using the owl as an excuse to support its own environmental agenda. Another said the Service is making a biological decision based on a court injunction which was in turn based on a mathematical computer model that is highly questionable. Several commenters maintained that listing the owl is being used to block industry and is an abuse of the Act. Numerous commenters stated that the

owl was being used as a political tool. Another suggested that the President should request that Congress exempt the owl from the Act as it did the snail darter.

*Service response:* By assessing all available information and data, the Service reached a decision on the biological status of the northern spotted owl. The Service does not believe that it was unduly influenced in this decision by any particular group. There also is no evidence to support the contention that listing the northern spotted owl will reduce access to public land for recreational purposes or is being used to create additional parks.

Under provisions of the Act, the Service is required to review the status of species and list those it believes qualify for listing. After the supplemental status review of the northern spotted owl, the Service concluded that the owl should be proposed for listing. No mathematical viability model influenced the Service during the status review, proposal development, or final decision process. The decision on the listing is based on the best available scientific and commercial data and is not determined or influenced by the court injunctions against timber sales. As mentioned, the Service has certain legal obligations under the Act and to fulfill those obligations is not an abuse of the Act. Further, the Service did not propose to list the owl to inhibit the timber industry but rather to provide for the conservation of a threatened species. Whether or not the owl is being used as a "political tool" to further the personal views of certain individuals has no bearing on the Service's decision on this listing proposal. When the Service receives a petition requesting that a species be listed, the information must be objectively evaluated on the basis of biology regardless of the petitioner's motivation for submitting the petition. Whether Congress would be amenable to a proposal to exempt the northern spotted owl from the protection provided by the Act is unknown.

*Comment:* In one commenter's view, listing would further diminish the rights of private landowners and restrict the use of private property without compensation when the prerequisites of the Act are not met. Another commenter stated it was appropriate to protect wildlife on State and Federal lands but questioned such protection on private lands. A commenter challenged the Service's jurisdiction over the spotted owl, stating that the Federal Constitution gives the Federal Government no power over any place

that it does not own. Another commenter stated that on private land in California, no suitable owl habitat could be harvested without an approved habitat conservation plan (HCP). Further, the commenter wrote that 1.5 to 2 years may be needed to obtain the permit based on the HCP and that during the interim, the California Department of Forestry would not approve any timber harvest plans. Simpson Timber Company stated that if the northern spotted owl is listed, it will be unable to experiment with new approaches to forest management to determine if suitable spotted owl habitat can be retained or created at the same time that harvesting occurs in managed forests. Further, Sierra Pacific stated that listing the owl will cause them to cancel assessments of the impacts of harvesting operations on nesting pairs because a HCP must be in place prior to any such work to ensure that these activities do not result in violating Section 9 of the Act by "taking" a listed species.

*Service response:* Under Section 9 of the Act the prohibition against "take" of listed species is not based on land ownership. Under Section 10(a) of the Act, a private landowner may develop a conservation plan and apply for a Section 10(a) permit to allow take of a listed species that is incidental during the course of otherwise lawful activities. Such a permit constitutes an exception to the prohibition against taking. Details of the procedures involved in applying for a Section 10(a) permit may be found in 50 CFR 17.32(b). In California, resource agencies and the private sector have established a Habitat Conservation Plan Committee to cooperatively develop a conservation plan for the northern spotted owl. This plan may provide the basis for an incidental take permit under Section 10(a) of the Act. One subcommittee is responsible for preparing draft interim guidelines to clarify situations where logging may occur while the plan is under preparation. These guidelines will be submitted to the California State Board of Forestry, who could accept them and issue emergency regulations implementing the guidelines as early as July 1990. This being the case, the Service does not concur with the commenter's view that all logging in suitable owl habitat on private land in California will cease until a HCP is approved. The Service does not view the listing as a taking of private property without compensation.

Both Sierra Pacific and Simpson have been conducting research on the northern spotted owl on their properties

in northern California. Permits for scientific research involving listed species are available for qualified applicants (See 50 CFR 17.32 and Section 10(a)(1)(A) of the Act).

*Comment:* If the owl is listed, one commenter was concerned that its company's efforts of adaptive management would be constrained by protracted litigation. Sierra Pacific Industries commented that a positive listing decision would cause them to terminate all research on the owl (e.g., fledgling success, etc.), and channel those resources into simply canvassing its extensive ownership for owls. According to another commenter, the Service is required to conduct a takings implications assessment under Executive Order 12630 prior to making a major decision that may involve a taking of private land. In the commenter's opinion, although the Department of the Interior has issued a categorical exemption for certain listing decisions under the Endangered Species Act, the spotted owl proposal does not fall within the exclusion because the involved private land owners have not consented to the proposed listing.

*Service response:* The Service will prepare a takings implications assessment under Executive Order 12630.

*Comment:* Another position was that the spotted owl should not be listed until there is a consensus reached by noted authorities from government, business, and the private sector.

*Service response:* Under the Act, the Service has the responsibility to review the status of species to determine if listing is warranted. While "noted authorities from government, business, and the private sector" may provide information and data through the public comment period during the petition and proposal phases of the process, the decision to list rests with the Service and must be based solely on biological factors.

*Comment:* Several respondents expressed the opinion that the Service should prove beyond a shadow of a doubt that the northern spotted owl qualifies for listing. Another stated that it was unclear what level of burden of proof was needed for the Service to list. According to another party, the individuals requesting listing, not the taxpayers, should provide the proof. Someone requested that the Service state what criteria were used to propose the owl as a threatened species.

*Service response:* The Act requires a listing determination to be made on the basis of the five biological factors set forth in Section 4(a)(1). In making the

determination, the Service must conduct a status review and use the best scientific and commercial data available. A listing determination will be upheld by the courts unless it is arbitrary and capricious.

*Comment:* In one person's opinion, once the owl is listed there will be no further research to find solutions for a compromise to accommodate the owl and timber harvesting. Another stated that an unnecessary listing will never be corrected. Another said there should be a mechanism to delist if further research indicates it was listed in error or the need for threatened status no longer exists.

*Service response:* When a species is listed, the Service is required to prepare a recovery plan, which is intended to conserve the species so that it eventually will qualify for delisting. Research activities are frequently included as necessary tasks in recovery plans. Further, both the Forest Service and the Bureau of Land Management have ongoing research and inventory and/or survey programs for spotted owls, and these are anticipated to continue. The conservation plan developed by the Interagency Spotted Owl Scientific Committee recognizes the need to explore various silvicultural strategies to conserve the spotted owl and its habitat and yet allow for a certain degree of commercial timber harvesting. If a listed species is found to have been listed in error or if the species recovers so that it no longer requires the protection afforded by the Act, it can be delisted. The delisting process requires formal proposal for delisting in the **Federal Register**, soliciting of public comments, analysis of the comments and all available data, other formal notifications, and publication of a final decision.

*Comment:* Several respondents maintained that the decision to make the proposal final rests with 14 people (the 12 Service biologists on the Status Review Team, Regional Director, and Director).

*Service response:* A decision to list a species rests with the Secretary of the Interior who has delegated this responsibility to the Assistant Secretary for Fish and Wildlife and Parks. The Service established a listing review team for the northern spotted owl composed of Service scientists who reviewed pertinent data and made a recommendation to the Regional Director, who weighed this information, making a further recommendation to the Director and Assistant Secretary. The 12 Service biologists referred to in the

comment were involved in preparing the 1989 Status Review Supplement.

*Comment:* One person expressed the opinion that if the Forest Service has spent considerable money researching the northern spotted owl and concluded that listing is unnecessary, then the Service should abide by that recommendation. Another stated that the Forest Service, not the Fish and Wildlife Service, should handle the listing issue.

*Service response:* While the Service appreciates the efforts of the Forest Service to undertake research on the northern spotted owl, the Act charges the Secretary of the Interior with listing decisions. Decision-making authority within the Department has been delegated to the Assistant Secretary for Fish and Wildlife and Parks, with the Fish and Wildlife Service assuming the role of reviewing and evaluating scientific evidence. Responsibility for reviewing and assessing the available biological data on this proposal rests with the Fish and Wildlife Service and cannot be delegated to another agency.

*Comment:* One commenter suggested that listing of the northern spotted owl should be precluded because listings of other species are of greater priority.

*Service response:* Although the Act provides for a petition finding of "warranted but precluded" by work on higher priority species, such a provision does not apply once a species has been proposed for listing. After a proposal has been published, Section 4(b)(6)(A) of the Act permits the Service one year from the date the proposal appeared in the *Federal Register* to publish a final decision. This one year period may be extended for six months if the Secretary finds that there is substantial disagreement regarding the sufficiency or accuracy of the relevant available data.

#### *Issue 5. Modify Listing Decision*

*Comment:* Numerous commenters requested that the northern spotted owl be designated as an endangered, rather than a threatened, species throughout its range. One commenter stated that endangered status is appropriate because the species already has declined to a few thousand individuals and has specialized habitat needs. Others asked that the owl be listed as endangered in portions of its range (e.g., Coast Ranges, Olympic Peninsula) and as threatened elsewhere. Several others requested that the northern spotted owl be upgraded to endangered if Section 318 of the 1990 House Interior Appropriations Bill (P.L. 101-121), passes (note: Section 318 did pass). Another commenter stated that the

Service proposed threatened status rather than endangered because critical habitat is not presently determinable.

*Service response:* When a species is proposed for threatened status, the final decision can be either to list or not list as threatened within all or a portion of its range. The Service cannot generally make a final determination that is more restrictive than the original proposal. If the Service concludes that a proposal for threatened status is in error and that endangered status would more accurately reflect the status of the species, the Service may re-propose the species as endangered. Section 318 is applicable only through fiscal year 1990 (ending September 30, 1990). It is the Service's belief that passage of this amendment is not justification to propose the northern spotted owl as endangered. To list the northern spotted owl as endangered would require that the Service publish a new proposal. Whether or not critical habitat is being proposed has no bearing on whether a species is proposed for endangered versus threatened status.

*Comment:* One commenter stated that the proposal was in error because the available data do not demonstrate a "gradual, range-wide decline in the species," but rather a rapid decline throughout the entire range. Further, it noted that the red-cockaded woodpecker (*Picoides borealis*) and the northern spotted owl, while having different life histories, are similar in a number of respects. For example, red-cockaded woodpeckers require large stands of mature coniferous forest for nesting and foraging and the loss of old growth is the most serious threat to their long-term viability. The population of red-cockaded woodpeckers exceeds 3,000 breeding pairs and it is listed as endangered. According to this comment, the northern spotted owl likewise should be classified as an endangered species.

*Service response:* The Service does not agree that the owl would properly be listed as endangered. Endangered status is warranted in situations where the species is in immediate danger of extinction throughout all or a significant portion of its range. As stated in the proposal and restated in this document at the end of the "Summary of Factors Affecting the Species" section, the Service recognizes that the situation with regard to the owl is most severe in certain portions of the range. However, it is the Service's conclusion that when the status of the entire subspecies is analyzed rangewide, the likelihood of extinction of the subpopulations of owls in these areas is not so immediate as to justify a classification of endangered at

this time. This was also the rationale for not proposing endangered status even though the number of known breeding pairs of northern spotted owls is lower than that of some other listed species such as the endangered red-cockaded woodpecker.

*Comment:* The Service was requested to expand the listing to include the California spotted owl, while others asked that all three subspecies of spotted owl be listed in the final decision. Still others requested that the northern spotted owl not be listed in California even if the Service were to decide to proceed with listing the birds in Oregon and Washington. Someone else requested that the great horned owl be listed.

*Service response:* Only the northern spotted owl was the subject of the proposed rulemaking and only this subspecies can be considered in the final decision, thus the Service is precluded from expanding the final decision to include the other two subspecies. The Service has received a petition to list the Mexican spotted owl (*Strix occidentalis lucida*) and is now reviewing the status of that subspecies. After reviewing the entire status of the northern spotted owl, it is the Service's decision to promulgate a final decision that includes the entire range of this subspecies. Although there are portions of the range where the status of the northern spotted owl is more perilous than in others, the Service concludes that considered rangewide, threatened status is warranted. For the reasons presented under Factors A and D in the "Summary of Factors Affecting the Species" section, the Service concludes that habitat loss and adverse modification of spotted owl habitat on both Federal and private lands throughout the range is anticipated to continue into the foreseeable future and, if continued as currently planned, will adversely affect the long-term viability of the northern spotted owl. The great horned owl is not considered a candidate for listing by the Service.

#### *Issue 6. Do Not Proceed or Delay the Decision Because More Information Is Needed*

*Comment:* One commenter believed that the northern spotted owl already was listed, and said until more data are available the northern spotted owl should be taken off the Endangered Species List. Others maintained that because the data do not suggest that extinction is an imminent possibility, the owl should not be listed. According to a commenter, it is premature to designate acreage of prime timber growing lands

to be set aside because there is no conclusive proof that the owl needs this vast amount of old growth timber. Another commenter stated that no subspecies of spotted owl should be listed until more data are available on the use by owls of second growth.

*Service response:* The commenter was incorrect in that prior to today's decision the northern spotted owl was not listed under the Act. According to the Act, an endangered species is one that is in danger of extinction throughout all or a significant portion of its range (16 U.S.C. 1532(6)). A threatened species is any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (16 U.S.C. 1532(20)). In its proposal, the Service stated that while it did not believe the evidence justified an immediate threat of extinction, the owl was likely to become endangered in the foreseeable future if suitable protective measures were not successfully undertaken. The proposal did not set aside any specific lands to conserve the owl. From the available data, the Service concludes that spotted owls do have large home ranges and are associated with old-growth timber or stands with old-growth characteristics (USDI 1989, 1990; Thomas *et al.* 1990). This decision only addresses the northern spotted owl, one of three subspecies of spotted owl. The Service believes that sufficient data on the northern spotted owl's use of younger growth are available to reach a decision on the proposal. The Service can postpone a decision on a proposed listing pursuant to Section 4(b)(6)(B)(i) of the Act, but only for six months and only after a finding that there is substantial disagreement regarding the sufficiency or accuracy of the available data relevant to the listing determination.

*Comment:* Another commenter stated that the Service had not done a comprehensive study to determine whether listing is warranted. A commenter stated that a 20-40 year study is needed on the northern spotted owl before it is listed because the proposal has too many assumptions and presumptions that are unsupported by facts.

*Service response:* The Service has conducted three status reviews for this taxon and believes the results, including the public comment input, are sufficient to reach a determination on listing the northern spotted owl. In the Service's view there is no justification for a 20-40 year study before a decision is made. If future research and management actions

provide for conserving and recovering the spotted owl, it can be considered by the Service for delisting.

*Comment:* Many commenters requested that the Service take more time, collect more data, or wait and consider data being collected in the summer of 1989 and spring/summer 1990, especially in California, before reaching a decision. The Service received many requests to extend the public comment period, some asking for a 90-day to as much as a three-year extension. Another commenter opposed extending the comment period to December 20, 1989, because it may delay listing. The Service was requested by one commenter to delay the decision until the Meyer *et al.* report on the effects of forest fragmentation on owl habitat is available in the Fall of 1990. Other commenters asked for additional time beyond the last comment period which extended from March 28, 1990 to April 18, 1990.

*Service response:* The Service granted the request to extend the closing date of the initial public comment periods so that the results of research being conducted on the northern spotted owl during the summer of 1989 could be submitted to the Service. Neither the extension of the comment period to December 20, 1989, nor the reopening of the comment period from March 28-April 18, 1990, prevented the Service from making a timely final decision. In the Service's view, the available biological data are accurate and sufficient upon which to base a decision on this proposal. In the Service's opinion, no such scientific dispute exists. Hence, it is not appropriate to delay the decision to receive additional biological data or information.

#### Issue 7. Economic Considerations

*Comment:* Numerous people expressed economic concerns in their comments. Some maintained that a decision of this magnitude should consider the economic impact on the affected communities and individuals. Numerous commenters stated that old growth needs to be harvested to support jobs and the economy. Another commenter asked of what use is public input if economics cannot be considered? Several commenters stated that if the owl is listed, landowners would experience severe hardships. Another commenter said listing is a scam to drive the price of wood up. One commenter stated that bids for Bureau of Land Management and Forest Service timber have at least doubled and they could cut one-half as much and still generate the same amount of money for the counties and Federal treasury.

According to another, the preservation of trees for tourism and recreation outweighs the economic value of cutting them.

*Service response:* Under Section 4(b)(1)(A) of the Act, a listing determination must be based solely on the best scientific and commercial data available. The legislative history of this provision states clearly the intent of Congress to "ensure" that listing decisions are "based solely on biological criteria and to prevent non-biological considerations from affecting such decisions". H.R. Rep. No. 97-835, 97th Cong. 2d Sess. 19 (1982). As further stated in the legislative history, "economic considerations have no relevance to determinations regarding the status of species . . ." *Id.* at 20. Because the Service is specifically precluded from considering economic impacts in a final decision on a proposed listing, the Service cannot respond to comments concerning possible economic consequences of the listing.

#### Issue 8. Critical Habitat

*Comment:* One individual recommended that the Service should designate critical habitat for the northern spotted owl. Another commenter specifically requested that the entire known range of the northern spotted owl be determined to be critical habitat. Another commenter stated that according to Service regulations, the Service should have had a discussion of critical habitat at the time the owl was proposed for listing. Several commenters stated that without taking economic information into consideration, it is not possible to evaluate the economic impacts on surrounding communities of such a designation. The commenter indicated a desire to have a followup public hearing if critical habitat is proposed.

*Service response:* Under Section 4(a)(3)(A) of the Act, the Secretary must designate critical habitat to the maximum extent prudent and determinable at the time a species is determined to be endangered or threatened. In the proposed rule, the Service detailed its rationale for not proposing critical habitat concurrently with the proposal to list the owl. In the "Critical Habitat" section of this document, the Service states its rationale for not designating critical habitat for the northern spotted owl at this time. The Service concluded that designation of critical habitat is not presently determinable as defined under implementing regulations at 50 CFR 424.12(a)(2). When a finding is made that

critical habitat is not determinable at the time of listing, the regulations (50 CFR 424.17(b)(2)) provide that the designation of critical habitat be completed to the maximum extent prudent within two years from the date of publication of the proposed rule to list the species. Any proposal to designate critical habitat will be published in the **Federal Register** including maps and legal descriptions of all areas included in the proposal and solicitation of public comments, including oral testimony at one or more public hearings. The potential economic impacts of the critical habitat designation will be evaluated during preparation of the required economic analysis.

*Comment:* The Service was asked if it could define the difference between preferred and critical habitat and allow peer review by world scientists to be certain of methodology and results. One commenter requested that land within the Quinalt Ranger District on the Olympic Peninsula not be designated as critical habitat. Another person said the Service should not list until the true critical habitat needs of the owl are known.

*Service response:* Critical habitat is a legal term defined in the Act (Section 3(5)(A)) as "(i) the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed in accordance with provisions of section 4 of the Act, upon a determination by the Secretary that such areas are essential for the conservation of the species." Under Section 7 of the Act, Federal agencies must ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of an endangered or threatened species or destroy or adversely modify its critical habitat, if any has been designated.

Preferred habitat can have a variety of definitions. For example, it may be defined as the habitat in which an individual bird spends proportionately more of its time than predicted on the basis of availability of that habitat in its home range. In comparison critical habitat is an area demarcated by a legal boundary description that utilizes either permanent structural features such as roads, bridges, rivers, etc., or survey descriptions (township, range, section),

etc. Hence, it is not uncommon for critical habitat to include within its boundaries some acreage that is not used by the species in question and may even contain, for example, substantial agricultural, urban, or commercial facilities, which could not be construed as preferred habitat. Should the Service decide to propose critical habitat for the northern spotted owl, public comments would be solicited as they were for the proposal to list. At that time anyone, including scientists, wishing to comment would be free to do so. Further, prior to any proposal for critical habitat, the Service would assess potential areas to be included. At that time a decision on including the Quinalt Ranger District on the Olympic Peninsula would be made. As previously stated, the Service believes critical habitat for the northern spotted owl is presently not determinable. However, the Act provides for listing a species, under certain circumstances, without concurrently designating critical habitat.

#### *Issue 9. Mitigation, Section 7 Procedures, Timber Sales*

*Comment:* One commenter maintained that before the owl is listed the Service should notify involved parties of what mitigation will be required for specific projects not related to timber harvesting operations.

*Service response:* Pursuant to Section 7(a)(2) of the Act, Federal agencies are required to consult formally with the Service if they propose to authorize, fund, or carry out any activity that may affect a listed species. If the Service finds that the action is not likely to jeopardize the spotted owl, then project modifications may not be required by Section 7(a)(2). However, if it is determined that the action is likely to jeopardize the continued existence of the owl, then reasonable and prudent alternatives to the proposal should be considered. Such alternatives, which satisfy the requirements of Section 7(a)(2), may involve significant project modifications if they are economically and technologically feasible and can be implemented in a manner consistent with the intended purpose of the action and the scope of the Federal agency's legal authority and jurisdiction. Section 7 consultations are conducted only with Federal agencies and would involve not just proposed timber harvest on Federal land, but any other projects or activities that a Federal agency authorizes, funds, or carries out which may affect a listed species. Private landowners or other non-Federal entities may choose to prepare conservation plans under Section 10(a) of the Act. The Service will assess these plans during pre-

application consultation to determine if the provisions of Section 10(a) have been met so that the Service can consider issuing a Section 10(a) incidental take permit. As part of a conservation plan, a permit applicant must specify, among other things, how the plan will be funded and implemented to minimize and mitigate. To the maximum extent practicable, the impacts of the incidental taking sought to be authorized. Regulations governing incidental take permits were published September 30, 1985, in the **Federal Register** (50 FR 39681) and are codified at 50 CFR 17.22(b)(1) for endangered species and 50 CFR 17.32(b)(1) for threatened species).

*Comment:* One commenter questioned how the spotted owl can be threatened if it is found in almost every timber sale and maintained that these sales were being closed down or taken off the market to protect owls within the sale boundary. Another commenter stated that if conferencing pursuant to Section 7 of the Act was taking place, why were timber sales being halted. Another stated he did not agree with the Forest Service testimony at the Redding public hearing to the effect that Section 7 conferencing in California was going well. Someone criticized the Service's Section 7 conferencing guidelines pertaining to the Olympic National Forest because, according to the commenter, the guidelines do not take into consideration that owls live in smaller, fragmented old-growth stands in that area.

*Service response:* As noted by the commenter, many timber sales on Federal land in the Pacific Northwest contain suitable owl habitat. The juxtaposition of owl habitat and proposed timber sales was one of the major reasons for proposing threatened status for the northern spotted owl. Logging has substantially reduced the quantity, availability, and distribution of spotted owl habitat. Informal conferencing reports have been completed for all timber sales in Oregon for all six spotted owl Bureau of Land Management districts in the state and for most of the timber sales for the Forest Service in northern California. The conferencing process addressed the overall impacts of the agencies' timber sale program and the specific impacts of individual sales. These reports recommend measures intended to minimize impacts to nesting, foraging, and dispersal habitat. The Service issued an informal conference report to the Forest Service for its timber sale program in fiscal years 1989 and 1990 for Oregon and Washington that addressed

the overall impacts of that program on spotted owls. Specific impacts of individual sales were not reviewed by the Service. In California, the Service conferred with the Forest Service on 165 timber projects and recommended no modification for 130, some modification for 24, reduction in volume for 9, and deferral on 2.

The Service's interim guidelines to assist in the review of timber sales do recognize that habitat within the Olympic Province is quite fragmented. In the Olympic Peninsula, the Section 7 review includes an evaluation of timber harvesting activities occurring within 2.5 miles of the activity center of a pair of owls, if data regarding use of the habitat by owls are available, otherwise impacts within 2.1 miles are assessed. Reviews are concentrated on timber harvesting activities located between 0.5 miles to 2.5 miles of a nest site or pair activity center unless more than 7,500 acres of suitable spotted owl habitat would remain after harvest.

*Comment:* Another commenter stated that logging should continue until something is worked out and the Forest Service and Bureau of Land Management should be allowed to do their jobs. According to one commenter, the Service should develop an interim program of owl management designed to allow the Forest Service to maintain its targeted levels of timber production until a final listing for the northern spotted owl is developed. Another commenter suggested that forest management plans be developed to manage the owl as well as the economic aspects of timber production.

*Service response:* Logging has not been discontinued as the result of the Section 7 conferencing process. Both the Forest Service and Bureau of Land Management are continuing to review and process timber sales. In a sense, the Section 7 conferencing provided an interim program for owl management in the face of timber harvest while the owl was a proposed species.

#### *Issue 10. Adaptability of the Northern Spotted Owl*

*Comment:* Many commenters maintained that spotted owls are adaptable and will relocate to other non-old-growth areas if the old growth they are inhabiting is harvested. Several commenters expressed the opinion that spotted owls can adapt to many environments and are found in residential areas, light industrial areas, new growth, oak timber, abandoned cars, mailboxes, and orchards. A commenter stated that when given the opportunity, northern spotted owls select barn lofts rather than old growth.

Another individual stated that wildlife does much better and is more abundant in close proximity to human beings. Another commenter questioned protecting the spotted owl and maintained that it can survive in any habitat from barren desert, to wheat fields, to tropical rain forest. Someone stated that spotted owls also nest in holes in banks and hillsides. Another commenter wrote that the spotted owl is not native to Oregon and Washington which proves it is adaptable to change. Several noted that the oldest trees are only around 1,000 years old and wondered where the owls were when today's old growth was second growth.

*Service response:* There is no evidence available to prove that northern spotted owls are flexible in their habitat requirements, nor have they been verified to occur in residential areas, mailboxes, junk cars, barn lofts, etc. However, even if a northern spotted owl were to be documented nesting in one of the referenced locations, it would constitute an aberrant nesting situation and not the normal nest site selection. Further, no data were presented to substantiate the claim that wildlife does much better in close proximity to human beings. Although for a limited number of species, such as rats (*Rattus spp.*), house mice (*Mus musculus*), starlings (*Sturnus vulgaris*), and house sparrows (*Passer domesticus*), this may be true, there are no data to conclude that this is the case for the northern spotted owl. The distribution of the northern spotted owl does not include barren desert, wheat fields, tropical rain forests, etc. Nesting preferences of the owl are not known to include holes in banks and hillsides. Contrary to the commenter's statement, the northern spotted owl is native to Oregon and Washington. Historically, the landscape consisted of a mosaic of habitat types at any one time. Some areas contained old growth, while others were young, regenerating forest stands resulting from fires, windstorms, disease, etc. Hence, the northern spotted owl evolved in a habitat that consistently had a proportion of the landscape in old-growth forest. Moreover, historically the entire area was not comprised of even-aged forest stands as suggested by the commenter.

#### *Issue 11. No New Data Were Presented, Initial Decision Was Correct, Need for Peer-Review*

*Comment:* A commenter stated he believed the Service did a five-year survey and found that spotted owls were not threatened. What happened to this report?

*Service response:* The Service has not undertaken a five-year survey of the

northern spotted owl. However, as noted in the Petition Process Background section, the Service completed its initial status review on December 17, 1987, and published its finding that the northern spotted owl did not warrant listing under Section 4(b)(3)(B)(i) at that time. In a subsequent legal challenge by the Sierra Club Legal Defense Fund, Inc., the court found that the Service's 1987 decision was arbitrary and capricious or contrary to law, and remanded the matter to the Service for further review.

*Comment:* Other commenters expressed the belief that the Service's 1987 decision that the listing of the northern spotted owl was not warranted was correct and that the Service had reversed the earlier decision only because of either pressure from the Court or other political pressure. Several commenters expressed the view that the proposal changed the Service's original position without using new data. One commenter reported that the U.S. District Court for the Western District of Washington found that the Service's original petition finding of not warranted was "arbitrary and capricious" and required an explanation between the known facts and the decision, but that the court did not mandate that the northern spotted owl be listed (*Northern Spotted Owl v. Hodel*, 716 F. Supp. 481 (W.D. Wash. 1988)). Several commenters stated that although the proposed rule claims that new information supports the conclusion to list, most of the data cited in the proposed rule were available prior to the original finding of not warranted. These commenters maintained that much of the "new" data consists of brief cumulative reports derived from old data on population trends and owl biology. The commenters further stated that about 67 percent of the studies evaluated by the Service (94 of 140 studies) predate the 1987 Status Review; roughly two-thirds of the information dated after December 1987 was oral communication and fails to meet the same standards of data quality. Several individuals said the proposal relies heavily on personal communications and unverified information rather than sound scientific studies. Others noted that many of the reports cited in the Status Review Supplement and proposal were unpublished and maintained, therefore, they had not been subjected to adequate peer-review. Someone requested that all research projects be peer-reviewed. Another commenter stated that the Status Review Supplement dismissed Barrowclough's (unpublished draft 1987) manuscript on

the taxonomic status of the spotted owl because it had not been peer-reviewed and published. The commenter maintained that this dismissal is inconsistent with the Review Team's reliance on other non-peer-reviewed documents in the Status Review Supplement to support listing.

*Service response:* The Service revised the earlier "not warranted" petition finding after reviewing additional information that became available subsequent to the 1987 petition decision. Of the 140 sources listed in the references section, 46 (about 33 percent) were dated 1988 or later. The commenter is correct in stating that the court did not direct the Service to alter its "not warranted" finding. However, after a review of all the best available data the Service did not adhere to its earlier decision. According to the listing regulations given in 50 CFR 424.13, "Data reviewed by the Secretary may include, but are not limited to scientific or commercial publications, administrative reports, maps or other graphic materials, information received from experts on the subject, and comments from interested parties." Cumulative reports dealing with data on population trends and owl biology were certainly of interest to the Service in its review because they represented confirming analyses of biological data pertaining to its status. The Service disagrees that "roughly two-thirds of the information dated after December 1987 was oral communication." Of the 46 references cited above, several were oral communications and several were letters. Personal communications can provide valuable data that may not have been published. As such the Service is obligated to consider this information and sees no rationale to diminish the input from such data sources. Nor does the Service agree that it relied heavily on personal communications or unverified information rather than sound scientific studies. The commenter presented no additional data to indicate that the information obtained from personal communications was incorrect and no examples were presented to support the contention that the Service used data from studies that were not scientifically sound. A number of the reports the Service examined were drafts or had been submitted to scientific journals for consideration of publication. Other agency reports update or summarize results of research studies. Agencies generally have an in-house review process whereby scientists critique each other's study proposals and work prior to initiation of projects and preparation of final reports.

Although these reports may not have been peer-reviewed at a level required by a scientific journal, authors routinely obtain input from other researchers prior to submitting their reports. Some of these reports present interim data associated with a long-term research effort whose results would normally not be expected to be submitted to a scientific journal until the entire project was completed. The Service does not believe that these reports should be dismissed because they were not peer-reviewed or published. In addition, the scientific community has neither criticized nor objected to the reports or the information they contain.

When considering taxonomic questions, the Service generally accepts the latest published work on the taxon. However, the Service is under no obligation to do so and may conduct its own evaluation to clarify taxonomic status if necessary. In this case the Service accepted the nomenclature as provided by the "American Ornithologists' Union Check-list of North American Birds" and restated in a letter to the Service from the AOU (Dr. Ned Johnson, letter dated December 12, 1989) rather than Barrowclough's unpublished report. The 1957 edition of the AOU Check-list includes subspecies and recognizes the northern spotted owl. Additional information on the taxonomic questions regarding the owl is given in a later issue entitled, "Taxonomy."

*Comment:* One commenter asked why the Service did not assume the responsibility to fully analyze and interpret the considerable amount of data that is available on the northern spotted owl prior to formally proposing it for threatened status (ref: Status Review of 1989, p. 7.5. "In addition, except for the various attempts at viability analyses, little effort has been made by any involved parties to fully analyze or interpret the considerable amount of data that is available on this species.") Another commenter wondered what the value of public comments was if the Service knows of data from researchers such as Dr. Larry Irwin (NCASI) refuting the proposal and knows that the population viability model of Dr. Russell Lande "has been discredited." Some data relating to radio-telemetry studies on the owl (Washington Department of Wildlife) are not available to the public and have not been peer-reviewed according to another commenter.

*Service response:* The Service believes that the individual who asked why the Service did not analyze the available data, misunderstood the

sentence that was quoted from page 7.5 of the Status Review Supplement. In fact the Service did analyze the available data to prepare the 1989 Status Review Supplement and to formulate the final decision on this proposal. All biological information provided to the Service, including the information submitted during the public comment period, has been reviewed and considered in this decision. This includes the reports and data from Dr. Irwin. As mentioned previously, the Service did not rely on any population viability model to reach its decision on the proposal.

#### *Issue 12. Data Needs, Gaps, Best Available Data, and Bias*

*Comment:* Several commenters maintained that the information gaps identified in the original finding are not filled by the new information: for example, no new information was forthcoming on habitat needs, how many acres of suitable habitat exist, biological requirements, or population declines of the owl. A number of commenters stated that other information regarding such issues as lack of knowledge on forest characteristics utilized as habitat; whether the northern spotted owl, California spotted owl, and Mexican spotted owl are the same subspecies; the extent of juvenile mortality; current number and location of spotted owls; and whether spotted owl populations are declining. A commenter maintained that the Service's decision must be based on the same information used to justify not listing and is therefore, arbitrary and capricious under the Administrative Procedure Act (5 U.S.C. 701). The commenter further stated that without this information, spotted owl habitat cannot be defined and it cannot be concluded that habitat is being lost.

*Service response:* USDI (1990) presented new information on habitat needs, acres of suitable habitat, biological requirements of owls and estimates of the rate of population decline. Owl use in various stand classifications was provided in USDI (1990) and the subspecies classification by the American Ornithologists' Union was reviewed and documented. In addition, estimates of juvenile mortality, number and location (e.g., by State) of owls, and the rate of population decline were provided. The Service's decision was based on the best and most current information available. The Service believes that there is more than sufficient information available on the northern spotted owl to warrant making a determination on its status. These additional data became available during

development of the Service's 1989 Status Review Supplement (USDI 1989) and 1990 Status Review (USDI 1990) which included a review of the information submitted during the public comment periods. The Service concluded that substantial amounts of habitat have been and will continue to be lost or modified due to timber harvest.

*Comment:* According to one commenter, the Service must do independent research to fill any significant information gaps. As stated by the commenter, at a minimum, the Service must resolve the gaps in its logic before proceeding with listing and should at least have the benefit of the data the private industry groups and others will produce in 1990. Several commenters stated that poor or incomplete data, even if it is the best available, will not support a listing, and that gaps in the information require the Service to withdraw the proposal and conduct additional research.

*Service response:* The Service has completed independent research, and the results were presented in USDI (1990). The Endangered Species Act sets certain deadlines in the Listing process. Under the Act, a final decision on a listing proposal must be made within 12 months after publication of the proposed rule, unless the Secretary finds that there is substantial disagreement regarding the sufficiency or accuracy of available relevant data.

The Service is not required to conduct independent research to fill data gaps pertaining to the status of a species under consideration for listing. However, the Service has conducted and completed independent research on the northern spotted owl and the results were presented in the 1990 Status Review (USDI 1990) as well as being summarized in this *Federal Register* document. The Service's analysis included reviewing recent research findings provided by the timber industry for private forest lands. From March 29 to April 11, and from April 12 to 18, 1990, the public comment period on this proposal was reopened to accommodate anyone wishing to submit biological information obtained prior to that time but subsequent to the close of the previous comment period (December 20, 1989). Although the Service acknowledges that ongoing and future research efforts are likely to provide additional insight into the biology of spotted owl, it is the Service's conclusion that the information currently available is more than sufficient to reach a determination on the proposed listing. To withdraw the proposal and conduct additional

research would not improve the status of the owl and would not be in keeping with the mandates of the Endangered Species Act.

*Comment:* Numerous individuals stated that surveys are needed in wilderness, parks, set-asides, and other areas where harvesting presumably will never occur. One party questioned whether with 4.2 million acres of unsurveyed wilderness, the Service can say the owl is threatened. A commenter stated that the Service should analyze the 300 California state parks and recreation areas, comprising 1.1 million acres, because many are in timber regions and will provide permanent old growth. According to one commenter, many other acres are protected by conservancy easements instituted by private, non-profit organizations and these should be evaluated to determine if habitat diversity is adequate for the owl. Numerous commenters suggested that all second growth less than 100 years old should be surveyed.

*Service response:* Results of surveys in wilderness, parks and other areas have been summarized in Thomas *et al.* (1990) and USDI (1990). Although not all wilderness and other set-aside areas have been surveyed, estimates have been made of the number of owls that may occur in some of these areas based upon an assessment of the amount of suitable habitat (Thomas *et al.* 1990). Indications are that for the most part reserved areas do not represent optimal habitat conditions for the owl. Data for owls suggest that the density of reproductive pairs and their reproductive success is significantly less in reserved areas than non-reserved. An accurate count of the number of remaining individuals is not required in order to make a determination regarding the species' status, nor is it necessary to have complete population surveys throughout the entire range to reach that determination. The Service considers convincing evidence that suitable habitat is being lost at a substantial rate, that the habitat is highly fragmented, and that the population of owls is declining, to provide an adequate basis for reaching a conclusion on the owl's status. Estimates of habitat quantity and owl numbers in state parks and other such areas are presented in Thomas *et al.* (1990). New data now exists for stands less than 100 years old, especially in northern California and these results are summarized in Thomas *et al.* (1990).

*Comment:* According to several commenters, the proposal is vague and replete with assumptions. Several commenters maintain that because the

Forest Service was only interested in surveying areas scheduled for timber harvesting, no inventories have been done in wilderness or other set-aside areas. Another commenter stated that to be scientifically valid, studies must include a random sample of all areas, not just old growth that is planned to be logged.

*Service response:* Considerable new data exist on owl numbers in wilderness and other set-aside areas and these are summarized in Thomas *et al.* (1990). Results of surveys employing a random sample of habitats (Random Sample Areas, RSAs) have been summarized and analyzed in the ISC report. These data have been reviewed by the Service and incorporated into the Summary of Factors Affecting the Species. USDI (1990) provides an analysis of the quality of protected lands, avoids using terms employed in the proposal that could be considered vague, and clearly identifies the assumptions used. The Forest Service had to concentrate owl surveys on areas that were being considered for sales to assess the potential impacts of such sales on the owl. Thus, the survey information in reserved areas was not as complete as that in areas planned for logging. However, the Service considered and reviewed all information available on the distribution and numbers of owls in preparing its proposal.

The proposal contained assumptions, but they were clearly stated as such and not represented as established facts. Many surveys have now been conducted in all types of forest habitat, not just those that were considered for logging. The Service considered all the results of these surveys.

*Comment:* Several commenters believed there is a need to determine what kinds of silvicultural techniques and harvesting methods can be used to manage for high quality timber and still assure long-term viability of the northern spotted owl.

*Service response:* The Service agrees that information is needed on silvicultural methods to manage for high quality timber harvest and still assure long-term viability of the owl. Selective cutting may provide a partial solution; however, clearcutting is the method being used on almost all public (>95 percent) and on many private lands.

*Comment:* According to one commenter, the data on the northern spotted owl are not the best available. Several statements referenced comments that Service biologists made on draft versions of the Status Review Supplement while it was under internal review. For example, one commenter

said that several Service biologists strongly criticized the following statement in the Status Review Supplement. "In our opinion, although there is always a need for more information, more is known about the northern spotted owl than many other wildlife species, and certainly more than for most species considered for listing under the Endangered Species Act." The commenter also wrote that a Service biologist noted in the margin of the February 1989 draft of the Status Review Supplement that he did not agree that sufficient data existed to do a good assessment of the northern spotted owl's status, and stated the Service could not "predict extinction probability for any time frame \* \* \* with any confidence at all". The commenter wrote that the revised finding ignores these and other significant data gaps noted by Service reviewers (who also were members of the Status Review Team). Hence, the commenter maintained that the Service failed to meet its obligation to rely solely on the best available data.

*Service response:* The Service used the best data available to prepare the proposed rule. A tremendous amount of data have been collected recently by government agencies, private timber groups, and environmental organizations. New demographic data are available since April 1989 on large study areas in northwest California and southwest Oregon. Large scale monitoring data collected by the Bureau of Land Management and U.S. Forest Service during the summer of 1989 are also now available. The Timber Association of California provided extensive survey data on private timber lands for 1989. The current situation is updated and summarized in both Thomas *et al.* (1990) and USDI (1990). Moreover, the Service is not obligated to have data on all aspects of a species' biology prior to reaching a determination on listing. Comments on the draft of the Status Review Supplement by members of the 1989 status review team were considered in preparing the Status Review Supplement, even if all comments were not accepted or incorporated. The Service has reviewed and assessed the new available data pertaining to the status of the owl and incorporated this information into the final decision on the proposal.

*Comment:* Several commenters were concerned that data furnished from logging interests on owl usage of second growth forest may not be accurate and suggested that such data should be examined carefully as industry may be tempted to falsify or misinterpret data to

its advantage. Other persons said studies done under the auspices of the timber industry are biased and that data have been falsified. According to other commenters, data presented by the Wilderness Society on spotted owl habitat distribution and trends are biased and should not be relied on to provide viable scientific input. Another commenter said the Service data are false and demanded the resignation of all those involved in developing the proposal because the proposal was synonymous with the long-term goals of certain environmental groups.

*Service response:* The Service studied industry data, techniques, and results with industry biologists to understand and assess the data that were collected. In like manner, Service biologists also coordinated with environmental groups to understand and review the data and other information that these groups submitted. The Service found no evidence to support the claim of falsification or misinterpretation of data by any of these parties. The Service's biologists responsible for preparing the proposal followed standard Service guidelines and procedures and, in the Service's opinion, did nothing improper.

*Comment:* One individual said studies on the spotted owl are inaccurate because owls are only counted at night and not all of them can be seen. Numerous persons stated that owl survey data are biased because surveys were concentrated along roads. Also, according to a commenter, radio tracking near clearcuts was excluded from research findings, thus biasing the results against use by owls of clearcuts. Someone expressed the opinion that research supported by the Timber Association of California is deficient and does not meet the requirements of Forest Service standard scientific protocols.

*Service response:* The Service agrees that nighttime surveys do not count all owls present. In addition, some bias may occur because many owl surveys are conducted along roads. However, night surveys provide only an index to abundance, thus the bias is not thought to be a major limitation in the use of these data. Radio tracking data collected near clearcuts were not excluded from research findings; rather, research tends to indicate that owls generally avoid clearcut areas. Surveys conducted by the Timber Association of California were an excellent attempt to further understand the situation in California. The first year of its surveys (1989) started late in the season and other "startup" problems were encountered. The Association made

every effort to conduct its surveys according to the U.S. Forest Service protocol and the Service considered its findings in the 1990 Status Review (USDI 1990).

*Comment:* An individual said that he had heard that Bureau of Land Management biologists felt they were finding too many owls and, hence, stopped reporting them. Another person said a Forest Service biologist falsified owl record data to get a particular drainage taken out of a timber sale.

*Service response:* The Service found no evidence to support the contention that Bureau of Land Management or Forest Service biologists falsified data or failed to report owl locations. The commenter failed to provide any specific evidence that the Service could use to inquire further into these claims.

*Comment:* One commenter wrote that there was a conflict among the data regarding the survey results on Simpson Timber Company lands in northern California and the Status Review Supplement. Further, the commenter stated that the Service must await completion of or institute comprehensive studies of the entire range in order to explain the direct contradiction between the Service's data and industry's findings and that listing should be deferred until the 1990 studies are completed.

*Service response:* The Service did not find a substantial "conflict" between the Status Review Supplement and the data collected on Simpson Timber Company lands. Previous to the owl survey work initiated by industry groups, including Simpson Timber Company, little data were available on private industry lands in northern California. These new data and the current situation are summarized in the 1990 Status Review (USDI 1990) and in this document. Unless there is a finding of substantial disagreement regarding the sufficiency or accuracy of available data, the Service is required under Section 4(b)(6) of the Act to reach a decision on a proposal within one year of publication of the proposed rule. Hence, the Service cannot postpone the decision solely to await the results from the 1990 field season. Whereas the proposal suggested that spotted owls may have been eliminated from private commercial forest lands because of lumbering activities, these recent studies document the occurrence of owls on some private land that had been harvested in the early 1990s and on lands that had several entries for selective cut. Lands in the redwood zone represent a small portion (probably less than 7 percent,

Thomas *et al.* 1990) of the overall range of the owl.

#### Issue 13. Taxonomy

*Comment:* Several commenters are of the opinion that Oberholser (1915) should be considered the most recently published, peer-reviewed analysis dealing with the taxonomic status of the spotted owl and conclude that the northern and California spotted owls are a single subspecies. One commenter wrote that the northern spotted owl differed from the California spotted owl in means of size and color, but not enough to be distinguishable by a 95 percent rule, and that they barely make a 75 percent rule. This commenter also said that the two subspecies had highly significant differences in plumage pattern, size (several body measurements such as culmen, gonyes, tail, middle claw), and color. One commenter stated that Barrowclough (unpublished 1987) concluded that the northern and California spotted owls cannot be distinguished by generally accepted taxonomic standards and that the taxonomic variation is clinal in nature between the birds in British Columbia and those in southern California. The commenter further stated that recent electrophoretic data show that the California and northern spotted owls are not different.

According to one commenter, to arbitrarily delineate a geographic boundary among subspecies is improper; hence, the best available data should incorporate the data available for the California spotted owl. Because the Status Review Supplement does not include the California spotted owl, a commenter maintained that it is incomplete and must be reversed to meet the criteria under the Act. Several commenters suggested that the presence of a serious scientific dispute exists regarding the taxonomic validity of the northern spotted owl and that it requires that the Service withdraw the proposal until the dispute is resolved.

*Service response:* The taxonomic status of birds in North America is under the purview of the American Ornithologists' Union (AOU). The present classification follows the 1957 AOU check-list and formally recognizes the northern spotted owl (*Strix occidentalis caurina*). The taxonomic status of this species was reviewed by the AOU Committee on Classification and Nomenclature in August 1989. The Committee concluded a recent report by Barrowclough and Gutierrez (1989) provided insufficient grounds for a taxonomic merger of the populations because present techniques for exposing genetic variation examine only a tiny

fraction of the genome. The formal decision by AOU was to retain the northern spotted owl as a distinct subspecies (Dr. Ned Johnson, AOU, letter dated December 12, 1989). The Service accepts this taxonomic disposition. The report by Oberholser (1915) was not peer-reviewed. The Service does not accept the opinion that Oberholser provides the most recent paper on this issue. The Service has not proposed the California spotted owl for listing, thus information on this subspecies was not incorporated. It is the Service's opinion that there is no dispute regarding the taxonomic status of the northern spotted owl and the suggestion to withdraw the proposal or delay the decision has been considered and rejected.

*Comment:* One person stated that the Service should define the status of the different subspecies of "northern spotted owls" and the owl habitat area types (area and quality) necessary for each subspecies.

*Service response:* The American Ornithologists' Union (AOU) gives the range of the three subspecies. Only the northern spotted owl was the subject of the proposal and this final rule. Hence, habitat characteristics of the other two subspecies of spotted owls will not be addressed.

#### Issue 14. Population Trends and Size New Information

New information on aspects of the biology of northern spotted owls was provided during the extended comment period and has been incorporated into the Status Review (USDI 1990). Additional information on owl distribution and numbers was provided through research funded by Federal and State agencies, the Timber Association of California (an umbrella organization for industry groups in California), other private companies, and various interested parties. The recent survey work in northern California documented numerous northern spotted owls on private lands; however, surveys of private lands in Oregon and Washington and public lands in California have noted low numbers of northern spotted owls. The significance of northern spotted owls on private lands in California is addressed in greater detail later in this section and also under Factor A in the Summary of Factors Affecting the Species section. Several reports on the California spotted owl were submitted; these are not summarized below because they did not deal with the subspecies that was the subject of the proposed rulemaking.

*Comment:* One commenter maintained that the Status Review Supplement fails to note that there was no survey work on private lands except Kerns (1988) to support its conclusion of extirpation of spotted owls. The Timber Association of California, however, detected approximately 284 spotted owls including 63 pairs on private forested lands in northern California. However, another commenter stated that according to all available data, spotted owl habitat no longer exists on private forest lands and is rapidly being depleted on public lands. The commenter indicated that Forest Service figures show only 48,000 acres of old growth out of a total of 6.9 million acres on private forest lands in Oregon.

*Service response:* The Status Review Supplement, in reaching its conclusion that the listing proposal was warranted, stated that the northern spotted owl " \* \* \* may have been nearly extirpated on private land \* \* \* due to the reduction of old-growth habitat." (USDI 1989). The Status Review Supplement incorporated all available information at that time, including data from public and private lands (e.g., Postovit 1977, Irwin *et al.* 1988, 1989b). The present document reflects recent data on the distribution and numbers of northern spotted owls on private lands estimated from studies conducted by the Timber Association of California (1989b) and other private groups (e.g., Kerns 1989a,b; Pious 1989). A total of 332 responses, defined as 1 auditory or visual location of at least 1 northern spotted owl during the period 31 May 1989 to 31 August 1989, was recorded. One hundred eighty-two of these 332 vocal responses were determined to represent sites occupied by at least one northern spotted owl. The number of adult owls was estimated at 247. Sixty-three of 83 sites sampled to determine pair status contained pairs (76 percent). Reproductive success was assessed at 55 of the sites and 28 (51 percent) were recorded as having been successful.

The Service acknowledges that the amount of old growth remaining on private forest land in Oregon is quite small, but does not know the exact amount.

*Comment:* One commenter cited his research on spotted owls to indicate that night-based estimates during the first year of a study over-estimated the population size by 72 percent, when using a direct count which he believes is within 90 percent of the true estimate based on the amount of habitat present and considering the intensity of conducted searches (Ward *et al.*, 1989).

He urged caution in reviewing data based on night surveys alone.

*Service response:* The Service accepts the comment.

*Comment:* In 1989, inventory and monitoring by the Bureau of Land Management indicated the presence of 946 spotted owls (801 adults, 145 young) on Bureau of Land Management land in Oregon. Seventy percent of the sites (461 of 661) visited were occupied and of these, 74 percent (340 of 461 occupied sites) contained pairs. Of the 293 pairs checked for reproduction, 128 displayed evidence of nesting. Of the 128 pairs studied, 100 produced offspring (78 percent reproductive success rate) and fledged 145 young (1.45 young/successful nest).

*Service response:* The Service accepts the comment provided by the Bureau of Land Management.

*Comment:* The Bureau of Land Management commented that the increasing numbers of occupied sites reported during the last five years does not imply an increase in population trend, but rather represents expanded surveys on all Bureau of Land Management districts and active banding program. The Bureau of Land Management reported that the level of spotted owl habitat surveys of its lands varies by district office and between resource areas ranging from 50-90 percent. In the past, the Bureau of Land Management had said that 80-90 percent of its habitat had been examined; however, some of these earlier surveys did not use standardized survey protocol and often made only one visit.

*Service response:* The Service agrees that increases in numbers of northern spotted owls may be a consequence of increased sampling effort rather than increased population numbers.

*Comment:* During 1989, the Forest Service inventory, monitoring, and survey program in Regions 5 and 6 detected 771 pairs, of which 314 were known to be reproductive. The total number of adults and subadults on Forest Service land in California, Oregon, and Washington was estimated at 2,400 birds. The Forest Service commented that different personnel participated in the inventory, monitoring, and survey efforts, so detection of a single owl in the inventory and monitoring segments also could have been made during a survey. Although every attempt was made to determine if birds had been double-counted, the true overlap is unknown and there is the potential for significant overlap for single birds. The Forest Service stated the numbers for single birds probably are high but has

confidence in the estimate for the number of pairs.

*Service response:* The Service considered the comments provided by the U.S. Forest Service and Thomas *et al.* (1990).

*Comment:* The Washington Department of Wildlife (WDW) updated the number of owls in Washington with a cumulative total of 326 pairs (144 reproductive) and an additional 173 singles for a total of 825 birds (the data for the Cascade Range for 1989 were not updated). Nineteen new sites, primarily in previously unsurveyed areas, were found on the Olympic Peninsula. This value includes 65 pairs on the Olympic National Forest and 22 pairs on the Olympic National Park.

*Service response:* The Service accepts the comment provided by the Washington Department of Wildlife but notes that the number of pairs in Olympic National Park has been estimated at 14-20 (Thomas *et al.* 1990).

*Comment:* WDW divided the State into cells and surveyed a random sample of these cells for spotted owls. The survey included 47 transects, with nine on the Olympic Peninsula, six in southwestern Washington, 18 in the western Cascades, and 14 in the eastern Cascades. The results indicated that the two regions with the highest percent of old growth (Olympic Peninsula and western Cascades) had the highest response rate (0.05 response/mile), 10 times as great as southwestern Washington (0.005 response/mile), where there was no old growth along surveyed transects. Although the results indicate spotted owls may inhabit younger forest, they were found at much lower densities there than in older forests. According to the WDW, the vegetation analyses obtained from data collected within the one-quarter-mile radius circles surrounding the calling stations may have underestimated the percent composition of older forests and overestimated the percentage composition of younger growth. Therefore, it was possible to underestimate the amount of old growth within an area in which spotted owls could be heard.

*Service response:* The Service accepts the comment.

*Comment:* The Washington Department of Natural Resources (WDNR) manages 180,000 acres of the Hoh-Clearwater block of state trust lands on the western Olympic Peninsula. Roughly 70 percent of this area has been logged within the last 30 years. About 53,000 acres of mature/old growth forest remains. During a survey of the area in 1988-89 by WDNR, owls were detected at 18 sites (11 pairs, 7

singles). Three of these pairs produced five young. All owl sites were in mature forest, which while not equivalent to classical old growth, is very old (>1000 years of age in some instances) and has never been harvested. Although mature forest in this area looks different (i.e., shorter in height than classical old forest), it is the functional equivalent (Eric Cummins, Washington Department of Wildlife, pers. comm., 1990).

*Service response:* The Service accepts the comment.

*Comment:* There were three main studies conducted by the timber industry in northern California pertaining to the status of the spotted owl. The Timber Association of California reported on a survey of spotted owls that it oversaw encompassing nine ownerships in northern California during the summer of 1989 (see Irwin *et al.* 1989b). A number of individual companies that participated in the Timber Association of California survey also submitted separate comments; these will not be reported on in detail here as their findings are incorporated within the Timber Association of California submittal. In the second investigation, the Pacific Lumber Company funded a study (see Kerns 1989 a, b) of its property. In the third study, timberland owned by Louisiana Pacific and Georgia Pacific were inventoried in a joint survey (see Pious 1989). In all, more than 360,000 ha (912,000 acres) of managed young growth forests (30-80 years old) were examined in northern California. During the course of the three studies, a combined total of 284 spotted owl sites were located. Of 136 sites that were checked, 100 were found to be occupied by pairs (74 percent occupancy rate). These industry studies estimated that 453 owls were detected, including fledglings (Timber Association of California 284 owls, Pacific Lumber Company 36, Louisiana Pacific/Georgia Pacific 138).

*Service response:* The Service accepts, with the minor exception noted, the comments provided by the Timber Association of California. A total of 136 (totals from the Timber Association of California 1989b), not 138, sites were checked by the Timber Association of California, Pacific Lumber Company and Louisiana Pacific/Georgia Pacific. The Service considers the difference in reporting values minor since they represent a <2 percent error.

*Comment:* Timber Association of California efforts surveyed 40 tracts in coastal and interior northern California covering approximately 182,000 ha (456,000 acres). The Timber Association

of California did not include old growth tracts in its survey. According to the Timber Association of California most of the tracts do not qualify as mature stands under the Status Review Supplement definition because they are less than 100 years old. During the surveys, 332 vocal responses were heard at 182 sites on 36 of the 40 tracts and estimated to represent 247 adults and 37 fledglings (a site is defined as an area occupied by at least one owl). Of these 182 sites, 83 were checked during the daytime and determined to contain 63 pairs (76 percent occupancy rate). Rate of response/km was calculated as 0.20 response/km of transect (0.32/mile). A crude density estimate of adults and subadults was 0.14 owl/sq km (0.35 owl/sq mi). Of 55 pairs that were sampled in more detail, 28 produced 37 fledglings in 1989 (0.67 fledgling/pair; 1.32 fledglings/successful pair).

*Service response:* The Service accepts the comments provided by the Timber Association of California with one exception. The Service contends that definitions of forest type based strictly on age are inappropriate across broad geographical ranges. For example, redwood forest 60 years of age has many of the characteristics of older forests, including standing snags, dead and down material and a multilayered canopy. Kerns (1988) reported that 78 percent of the redwood vegetative complexes containing owls had characteristics similar to old growth, but none could be considered "old growth" based strictly on age. Application of an age definition based on coniferous forest to redwood forest is incorrect. The Service contends that structure rather than age is more important in defining habitat characteristics that are important to owls.

*Comment:* Simpson Timber Company owns about 100,000 acres of timberlands that were included in the Timber Association of California study. The company wrote that its property in northwestern California consists of some fragmented old growth, redwood, and Douglas-fir forests and that the timber stands are primarily recently cut to 80-year-old-second-growth. These lands are managed under a 60-year rotation. In the Simpson Timber Company funded study, Diller (1989) located 124 owls of which 29 were believed to be pairs that produced 29 fledglings. Further, he calculated a tentative density estimate of 1 pair/950-1300 acres and stated that these densities are more closely aligned with those reported for old growth than for second growth. Diller (1989) calculated a fledgling success rate of approximately

1.2 owlets/pair in comparison to a crude estimate of all reported studies of about 0.5 owl/pair (including non-reproductive pairs) (USDA (1988)). He concluded that spotted owls can nest successfully in young growth. Of the nest sites he located; one was found in a residual older redwood, whereas only 6 of the 14 others had older residual trees in the area. Simpson Timber Company submitted initial findings for the beginning of the 1990 field season. During April 1-16, 1990, they rechecked 60 sites that were occupied last year by owls and found that 53 sites were occupied (41 pairs, 19 nests). The company stated that owl densities in coastal redwood sites appear comparable to more xeric inland conditions dominated by Douglas-fir. The age of the 19 nest trees varied from 30 to 150 years. Nest trees generally were relatively large in relation to the average tree in the stand; however, in two instances they were smaller.

*Service response:* Comparisons of the acreage per pair on land owned by Simpson Timber Company are tentative because in at least one area (Mad River tract) Forest Service protocols were not followed (Diller 1989:4). Thus, the lower limit of the range, 1 pair per 950 acres, may not be a correct estimate. While the Service does not dispute findings of successful reproduction in younger-aged forests, it is important to note that redwood stands exhibit many of the structural characteristics of old-growth forest at younger ages (Kerns 1988). In addition, comparisons of different tree types in markedly different ecosystems (e.g., Douglas-fir in the Cascades versus redwoods in coastal California) may not be valid. The Service accepts the data from the studies, with the one exception noted, but cautions that estimates from coastal redwoods cannot be strictly compared against estimates from Douglas-fir forests. Also, only about 7 percent of the northern spotted owl's range is within the coastal redwood forest (USDI 1990).

The Service accepts the comments provided by the Simpson Timber Company for the beginning of the 1990 field season.

*Comment:* A consultant for Sierra Pacific Industries stated that four tracts in coastal California were surveyed with a general mosaic of second-growth Douglas-fir or redwood forest with hardwood vegetation and scattered residual old growth and clearcut areas. In these areas, spotted owls were found within a variety of habitats, near or in drainages with some old growth or dense vegetation. Two fledglings were found in a mixed-hardwood habitat.

Another consultant for the same company surveyed about 140,000 acres in three interior counties in California. All spotted owls were found in fragmented habitat with only small pockets of old growth. He stated that selective harvesting was practiced over much of northern California and produces a forest that is younger and more open than old growth, but still quite structurally diverse. Most stands with spotted owls had two, sometimes three vertical strata in the overstory because of the way the trees had been removed in the past. Dominant trees were not as large as old growth. It appeared that the number of layers was more important than the size of the layers. Suppression of fire, especially combined with a selective cut, leads to development of a shrub and understory and accumulation of dead and down woody material. Both conditions may be associated with high rodent densities. This consultant did not believe that his findings contradicted or refuted any work that has been done elsewhere in the owl's range. He did not know where owls were nesting.

*Service response:* Patterns reported in these two studies are consistent with those reported elsewhere on private lands in California (e.g., Kerns 1988, Pious 1989). Northern spotted owls are associated with structurally diverse habitat that contains one or more layers, some older forest providing an overstory and dead and down material. However, the habitats described were created by repeated harvest entries and do not occur under a clearcut harvest regime. Continued use of clearcut prescriptions on public and private land and any additional shift towards an increased use of clearcuts will make it difficult to maintain the structurally diverse conditions used by owls.

The Service accepts the comment that two active nests were located in stands containing residual trees, and that several birds noted as singles in 1989 are paired in early 1990. The Service also considers as reasonable the hypothesis that retaining some amount of older forest in managed younger growth stands provides some of the habitat characteristics needed by northern spotted owls. Data from other studies in California (e.g., Timber Association of California 1989b, Pious 1989) also provide support for the hypothesis. However, under current harvest methods, remnant trees are seldom left after harvest, and the stands will be harvested again before reaching the size at which they would provide suitable habitat for northern spotted owls.

*Comment:* Sierra Pacific Industries submitted comments on its initial field work for 1990. It noted that two active nests were found in the interior of northern California (non-redwood tracts) and stated this suggests the hypothesis that retention of small amounts of remnant, decadent trees with managed second growth provides all the habitat requirements needed by spotted owls. Several birds noted as singles in 1989 were documented as pairs in 1990.

*Service response:* The Service has considered the information provided in this comment.

*Comment:* Tracts for the Timber Association of California study were selected on the basis of continuous private land with a minimum of several thousand hectares. The primary composition was 30- to 80-year-old stands, on average, with less than 10 percent residual forest conditions. In general, these areas had been completely clearcut in the early 1900s, and subsequently burned repeatedly for up to two to three decades in a futile attempt to convert the land to grassland for domestic livestock grazing. The type conversion effort was abandoned in the 1920s and 1930s, after which the areas reforested naturally resulting in the 60- to 80-year-old stands that Timber Association of California surveyed. There was some variation in the above historical management perspective. For example, Simpson Timber Company's Mad River tract, in coastal northern California, is a redwood forest that was clearcut about 1900 and burned. Since 1900 parts have been harvested a second time and the area is being regenerated with a mixture of Douglas-fir and redwood. The Hilt tract, owned by Fruit Growers, is a white fir/ponderosa pine site located along the California-Oregon border. During a railroad logging operation, most of this area was clearcut. Reforestation occurred naturally and subsequent management has been primarily of a selective nature. Sierra Pacific's Wells Mountain tract, 50 km west of Redding, California, also has a history different from the other tracts. It is a mixed forest type with interspersions of prairie grasslands and hardwood stands. It was entered in the early 1960s after a major fire.

*Service response:* The Service has considered this information.

*Comment:* Fruit Growers Supply Company submitted additional data on its initial field work for 1990. Of the 11 confirmed sites with pairs in 1989, 10 were observed with owls by mid-April 1990. Two additional sites also have owls. Of these sites, one contains a

nesting pair, one a suspected pair, two contain other pairs, and eight have single birds. Also, the company noted the presence of owls in basins that were logged last year. According to the commenter, in one sale area, the birds relocated and re-nested outside the sale area about 0.66 miles away. The commenter noted that the birds are not banded. Fruit Growers Supply Company stated it believes that not all nest sites in the interior of northern California were in remnant old-growth patches.

*Service response:* The Service has considered the information in the comments.

*Comment:* A study funded by the Pacific Lumber Company, the second major private study in northern California, indicated that radio-tagged spotted owls used all available habitat roughly in proportion to its availability (except thinned young growth) during the June-September 1989 study period (Kerns 1989 a, b). Approximately 40 individual owls were detected. Of 12 pairs, five were determined to have reproduced in 1989. Birds used thinned young growth 31 percent of the time which was higher than the predicted use based on availability of 25 percent ( $n=8$ ). Approximately 35,000-45,000 acres of Pacific Lumber Company land were surveyed, during which 40 birds were identified. Only two of eight radio-tagged birds had old growth in their home ranges. Therefore, Kerns (1989 a, b) concluded that the owls are not dependent on old growth. Birds foraged in closed canopy timber types with 75-100 percent canopy closure, and roosted in vegetative types with canopy closures of 25-100 percent.

*Service response:* The Service believes that the conclusions of this study are premature and, therefore, unwarranted. Unlike other studies evaluating use versus availability and reviewed in the Status Review (USDI 1990), sample sizes (i.e., locations of owls) in this study were not large enough to estimate the annual home range of any of the radio-marked owls (Kerns 1989b:2). Without proper delineation of the home range boundary it is impossible to estimate what is "available" for use by the individual owl. Modification of the home range size as additional location points are added will change the definition of "available" and hence the assessment of "use." As described in the Status Review (USDI 1990), demonstration of selection is a consequence of how "available" is defined. The Service also disagrees with the contention that owls are not dependent on "old growth" or stands containing "old growth" structural characteristics, and argues that the data

from this study are not sufficient at this time to either reject or support the hypothesis that northern spotted owls in coastal California redwoods use habitat in relation to its availability.

In addition to inadequate data for determining a home range size, the Service also believes that the definition of "old growth" in this study as only uncut timber (Kerns 1989b: figure 9) is unnecessarily restrictive and one that ignores the importance of structure when defining forest type. For example, a YY2 stand in this study was defined as "young" growth having trees with a dbh >40 inches and 50 percent to 75 percent crown coverage. A Y1 stand consisted of "young" growth with a dbh "up to 28 [inches]" and a crown coverage of 75 percent to 100 percent. Although direct comparisons of dbh of different tree species are questionable, note that the YY2 and Y1 definitions could be reassessed, based on the structural definitions for Douglas-fir (*Pseudotsuga menziesii*) presented in the Status Review (USDI 1990), into old and mature forest, respectively. In the absence of more specific descriptions of the characteristics of each stand type, the Service is reluctant to redefine each stand type and reanalyze Kerns' data, but does caution against interpretation based strictly on the "young" and "old" labels attached to each forest type.

The Service believes that statements regarding selection for or against available habitat types must be statistically sound. In reviewing studies claiming to address use versus availability, the Service excluded from consideration those that concluded selection for or against habitat types but provided no rigorous statistical analysis (USDI 1990). The method employed by Kerns, that of simply subtracting the proportion of observations in each habitat type from the proportion of that habitat type in the owl's "Observed Area of Use" (Kerns 1989a,b), has no statistical basis. He gives no way of statistically ascertaining whether a difference of 1, 5 or 10 percent in any direction represents no selection, or selection for or against habitat types until sample sizes increase. Thus, the Service considers the conclusions of this study of limited use.

*Comment:* Louisiana Pacific (Pious 1989) reported that 1,382 km of transects of managed second growth coastal redwood timber lands in northern California, Mendocino County, were surveyed and owls were detected at 90 sites, 51 of which contained pairs. Breeding was verified at 31 of the 51 sites and fledged young were produced by 32 percent of the 25 pairs checked

(0.44 young fledged per female and 1.38 young/productive female). Relative abundance was 0.1 owl/km. Most sample plots were dominated by small-sized (29–52 cm dbh) and medium-sized (53–90 cm dbh) trees. Various structural classes or seral stages exist within potential foraging habitat. Within the roosting sites, canopy closure exceeded 85 percent and ground cover consisted of shrubs, logs, coarse woody debris, and litter. Seven nests were found in sites with a total canopy closure of 86 percent. Vegetation structure at nest sites was characterized as a stratified canopy with an overstory dominated by conifers (trees > 40 cm dbh), and an understory dominated by hardwoods (trees 13–40 cm dbh). In general, habitats used by spotted owls were vigorous, young, even-aged to uneven-aged stands with sparsely distributed older conifer trees.

*Service response:* The Service accepts in general the comments by Louisiana Pacific and notes again that presence of owls is strongly associated with structurally diverse habitats. Most of the stands surveyed by Louisiana Pacific had vertical structuring that could be attributed to repeated harvest entries; clearcuts, when mentioned in stand history descriptions, occurred in the late 1300s and early 1900s. Use of the term "young" in describing the stands to which owls were associated may be misleading, and it would be incorrect to conclude that because owls are found in "young" redwood they could be found in "young" Douglas-fir. Twenty-five of the 29 sites described in Pious (1989: appendix H) were dominated by redwoods, a tree species that attains characteristics similar to "old growth" at a relatively young age (see Kerns 1983).

*Comment:* One representative of Harbor Against Land Take (HALT) used aerial photographs of the Olympic Peninsula to estimate the amount of habitat for spotted owls in 12 major drainages. He speculated that there are 210 potential spotted owl sites.

*Service response:* The Service does not consider use of 1 pair of owls per 2 to 3 miles of river drainage multiplied by the miles of river drainage to be an accurate estimator of the number of potential owl sites in a given area. Not all habitat on both sides of the drainage can be considered suitable owl habitat. Instead, the amount of suitable habitat divided by the median home range provides a maximum estimate of the number of paired owls if all available habitat was occupied by owls. Under these guidelines the Service estimates up to 30 pairs of owls are present in

Olympic National Park at any one time. A total of 12 to 20 pairs have been documented in the park (USDI 1990: table 4.6). Even if the low end of home range size in the Olympic Peninsula rather than the median (data from Thomas *et al.* 1990) was used to estimate the potential number of sites, only a total of 61 potential sites are estimated, well below the suggested value of 210. The Service therefore rejects the estimate of 210 potential spotted owl sites.

*Comment:* Results were reported for the Willow Creek Study Area on the Six Rivers National Forest (Franklin *et al.*, in press). Surveys during 1985–89 indicated that the population was either stable or slightly increasing in this area. In 1989 there were 138 owls, 66.5 percent of the pairs nested and 41.4 percent fledged young (0.67 young/pair). Annual survival figures were 0.16, 0.83, 0.96, and 0.87 for juveniles, subadults, males, and females, respectively. The increase in population density was attributed to processes such as immigration, rather than internal increases in the sample areas. The population increased either from immigration from other areas rendered unsuitable by logging or to have reflected changes in the composition of the "floating" population. Franklin *et al.* (in press) state, "Based on our population estimates, current management plans for spotted owls proposed a 60.0–82.5 percent reduction in current populations, assuming that habitat around SOFIAs becomes unsuitable for occupancy under planned timber management programs over the next 50 years. Proposed reductions in spotted owl populations will coincide with reduction and fragmentation of suitable habitat: a situation incompatible with density-dependent mechanisms."

*Service response:* The Service has considered the information provided in this comment.

*Comment:* Frank Wagner (Oregon Cooperative Wildlife Research Unit [OCWRU], Oregon State University) commented that his research indicates that spotted owls use highly fragmented habitat in southwestern Oregon, and that he found relatively high densities in the Elk Creek watershed (0.117 pairs/sq km in 1988, and 0.128 pairs/sq km in 1989). He noted that although his study area has been referred to by others as dominated by young and partially cut forest with limited fragmentation, this is not the case. His study area consisted of three distinct general landscapes: (1) Relatively large blocks of unentered old-growth and mature forest; (2) stands of moderately fragmented old-growth and

mature forest; and (3) a highly fragmented area with limited old growth, but with a matrix of diverse young and partial cuts (part of this last area comprises the Miller Mountain Telemetry Study Area). In 1989, he found that home ranges of 23 pairs of owls averaged 205 acres (range 26–445 acres) of unentered old growth within a 0.5 mile radius of the center of activity and that this contrasts to 70 acres (range 0–225 acres) within a 0.5 mile radius from random points. He stated that in southwestern Oregon owls occupying areas with a low availability of older forest but a high degree of young stands and previously partially cut stands, appear to be operating as a population sink.

*Service response:* The Service accepts all of the comments except for the specific assertion that the areas mentioned appear to be operating as a population sink. Data from the study are insufficient to adequately determine whether the area is acting as a population sink.

#### Present Population Estimates

*Comment:* One commenter stated that the Service admits that estimates of present population estimates are flawed ("few data on numbers and distribution on private, State, and tribal lands \* \* \* are available.") A number of commenters asked if all preserved/reserved and non-reserved lands had been surveyed or whether the generalizations of owl non-occurrences on non-Federal lands such as private, Indian, and State, were based more on speculation than actual inventories. A commenter asked what proportion of owls occur on private lands. Several people stated that because the Forest Service was only interested in surveying areas scheduled for timber harvesting, no inventories have been done in wilderness or other set-aside areas. Someone questioned the finding that northern spotted owls are found primarily below 3,500 feet in elevation. Another stated that wilderness areas in California are not primarily high elevation lands above tree line.

*Service response:* The Service realizes that not all lands in the range of the northern spotted owl have been surveyed. However, in the past three years, many new surveys have been conducted on private, State and tribal lands. These results are summarized in detail in Thomas *et al.* (1990) and in general in USDI (1990). Approximately 6 percent of known owls occur on private land. It is incorrect to state that no surveys have been conducted in younger stands (details are summarized in USDI

1990 and Thomas *et al.* 1990). Thomas *et al.* (1990) reported that approximately 6 percent of the owls occur on private lands. There have been inventories on Wilderness Areas and other set-aside areas. In fact, most owls are found at elevations below 3,500 feet. Forested Wilderness Areas in California have only 13–18 percent suitable habitat, some of which is at higher elevations. Details are provided in USDI (1990) and Thomas *et al.* (1990).

*Comment:* A party commented that earlier estimates of a population decline are fraught with methodological, analytical, and factual errors. A commenter maintained that the Status Review Supplement relies on survey work by Forsman to support the assumption of a population decline, yet his survey method suffers from several methodological deficiencies and, therefore, his data are unreliable. The commenter continued that Gould (1974) used a similar monitoring program and recently stated that those estimates are subject to uncertainties. According to this individual, the methodology employed by Forsman and Gould is not adequate because it assumes that an owl that moved slightly or left the study area was dead.

*Service response:* Past efforts to estimate the rate of population decline have been criticized because of methodological issues and the fact that the rate of decline was not statistically significant. USDI (1990) corrects these issues and presents firm evidence that resident populations are declining at a statistically significant rate (e.g., 5 percent and 14 percent per year). The ISC (Thomas *et al.*, letter dated December 20, 1989) stated to the Service that the population was declining in response to timber harvest of available habitat. Count data on the Willow Creek Study Area do not show a population decline because of significant immigration each year. The Service agrees with the commenter that reproduction and mortality rates were nearly constant over the course of the study (1984–89). The Jolly-Seber model (Pollock *et al.* 1990) for open populations employed in the Status Review (USDI 1990) allows estimates of the entry of “new” owls into the adult population. This total was partitioned into the two components: recruitment of young into the adult population and the immigration of owls from surrounding areas. The Service found that the resident population of adult females was declining 5 percent per year (21.6 percent over the 5 years of study). However, the immigration into the study

area kept the population size nearly constant (the “rescue effect”).

Thus, in a trivial way, the population has not declined at the Willow Creek Study Area. However, the simple count data from standard surveys do not properly portray the sharply declining population of resident, territorial owls. The Service has strong evidence of significant population declines (USDI 1990). The Service agrees that emigration is a source of bias in the estimates of juvenile survival.

The Service did not follow Franklin's alleged convention of assuming “the owl is dead if he fails to return to the territory in two seasons.” USDI (1990) used contemporary analysis theory for capture-recapture surveys to avoid the criticisms noted (i.e., 100 percent site fidelity, owls immediately responding in a single follow-up visit in succeeding years, and movement within the same general territory). Early surveys by Gould were similar to those by Franklin and Forsman. Jolly-Seber type models for the analysis of capture-recapture/resight data incorporate a capture/sighting probability to avoid the criticisms noted by the commenter. In fact, the capture/resight probability can vary by age, sex, and year to properly allow for non-detection of owls, given they are present. Details of these procedures are cited in USDI (1990).

*Comment:* According to one commenter, a thorough survey of the entire range of the northern spotted owl is needed to determine nesting and foraging habitat. Another asked if the owl is still found in most of its range, why is it thought to be threatened. Several commenters stated that in the proposal, assumptions not yet clearly established are used as evidence that owl numbers are declining.

*Service response:* It would be ideal if intensive surveys could be conducted over the entire range of the owl. This is not possible or practical. A species can be widespread, but could be “threatened” if the population was thought likely to become in danger of extinction in the foreseeable future due to, for example, drastic loss of habitat. The amount of suitable habitat for the northern spotted owl has decreased substantially over the past 40–100 years. It now seems clear that the population of the northern spotted owl is declining throughout its range.

Has the Owl Population Increased in Size?

*Comment:* Numerous commenters expressed opinions regarding owl population estimates indicating that owl numbers have increased with an increase in survey efforts and that the

number of owls has increased from several hundred 10 years ago to about 5,000 today. Several individuals questioned how the spotted owl can warrant listing if the count in 1989 is higher than in 1985 and is still increasing. Someone stated that studies show there are more owls now than 50 years ago when little or no old growth had been harvested; however, he did not provide or cite references for these studies. Another said that owl numbers on Bureau of Land Management lands have reportedly doubled in three years and that if this rate is typical, there will be serious problems associated with owl over-population in the next few years. Another maintained that owl populations are large and stable.

*Service response:* The number of owls detected during surveys has increased with survey effort. The Service is not aware of any estimate that there were only a few hundred owls ten years ago. The population is now believed to be decreasing throughout much or all of its range, although counts of owls have increased due to expanded survey efforts. The Service is unable to confirm the abundance of owls 50 years ago. It is very likely that owl population size was larger when larger amounts of old growth existed. The Service cannot confirm that the population of owls on Bureau of Land Management land has doubled or tripled in the past three years. The commenter failed to give a reference for this statement. However, the Service acknowledges that the Bureau of Land Management has increased its efforts to survey for owls and, therefore, the increase in the number of owls encountered is not unexpected.

*Comment:* One commenter understood that private parties were undertaking their own surveys and had located over 6,000 pairs. One commenter said the data from private land surveys in northern California produced 62 pairs, almost double the previous population estimate for private lands in the State, and show the Status Review Supplement underestimated the number of spotted owls on private land in northern California by almost 100 percent.

*Service response:* The Service is not aware of studies by private parties that have located over 6,000 pairs of owls. It is true that the Service had underestimated the number of owls on private land in California. New information provided, for example, by the Timber Association of California, however, has been considered in USDI (1990) and in this document.

*Comment:* Someone else stated that there are over 3,000 known pairs in

eastern Oregon where they were not supposed to be. Another wrote that there are thousands, maybe millions of spotted owls. In one person's view, the spotted owl population is healthy throughout at least five of seven western states. Someone commented that because the spotted owl ranges into Arizona, New Mexico, and southern U.S.A., it is difficult to believe that with this large a range the spotted owl is not able to adjust to environmental changes.

*Service response:* The Service is not aware of any estimate of 3,000 pairs of owls in eastern Oregon. According to the ISC (Thomas *et al.* 1990), there are approximately 2,000 known pairs rangewide of northern spotted owls although they estimate that 3,000–4,000 pairs actually may be present. There is no evidence to support the statement that there may be millions of spotted owls. The northern spotted owl occurs in 3 states and one Canadian Province, not in at least 5 of 7 western states. It is the Mexican spotted owl that occurs in Arizona and New Mexico, not the northern spotted owl. Long-lived birds such as the spotted owl are not considered likely to adjust rapidly to drastic environmental change. Such adaptations ordinarily take place only on an evolutionary time scale of thousands of years.

*Comment:* A commenter referenced work by Franklin *et al.* (1986, 1987, 1989) that indicates a stable and even increasing population in the Willow Creek study area. Someone stated that the Status Review Supplement erroneously quotes Franklin as stating the northern spotted owl population is declining in northwestern California. Another reported that the Service ignored research data from Franklin in which he found there were 830 owls in the Six Rivers National Forest. Franklin *et al.* (in press) extrapolated the population of the Six Rivers National Forest at 833–912 owls, which was twice the Forest Service estimate of 400 based on suitable owl habitat. However, only about 50 percent of the Six Rivers National Forest has been adequately surveyed. The higher estimate did not account for any effects of habitat fragmentation. In discussing the estimate of 833–912 owls, Mr. Franklin stated in his comments, "I do not know whether our extrapolated estimates of numbers are correct. You need to bear in mind that we extrapolated to an area that was 13.3 times larger than the sampled area. Any errors in our estimates would be magnified by that factor. However, the point in the extrapolation was not to strictly estimate population size for the SRNF

but to examine the relationship between potential and managed populations. Intuitively, I believe the Forest Service estimate of 400 may be more accurate than our extrapolations."

*Service response:* Population change on the Willow Creek Study Area (WCSA) is treated in detail in USDI (1990), including updated estimates of vital rates. Confusion arises over the fact that the resident (territorial) population has experienced a significant decline over the past 6 year study interval, but the population has been maintained by immigration into the area of floaters (non-territorial birds) and territorial birds displaced by timber harvest in surrounding lands. The Service shares the commenter's concern that the extrapolated estimates made by Franklin are likely to be inaccurate.

*Comment:* According to one party, the Status Review Supplement failed to adequately estimate the effects on the overall population estimate of the spotted owls in reserved areas. This individual maintained that populations living in extensive reserved areas may be expected to be stable and those living in managed forests older than about 50–60 years may even be increasing as habitat grows back (Irwin 1989b).

*Service response:* Information on owl abundance in reserved areas was treated in the Status Review Supplement and is treated in more detail in Thomas *et al.* (1990) and USDI (1990). The available evidence suggests that the populations in reserved areas may have low viability and may not be replacing themselves. This poor viability is likely due to higher elevation, poorer site quality, and more open canopies typically found on many reserved areas (USDI 1990). Thus, suspected low viability is not due to declining amount of habitat in reserved areas.

The Service believes that the proposal accurately portrayed the loss of habitat. Owls in managed forests are unlikely to be viable. Before a managed forest reaches an age that is fully suitable for owls, it is likely to be cut again. In general, the forest rotation age and the stand age at which owls begin to utilize the stand for foraging, nesting, and roosting are similar.

*Comments:* One commenter stated that the Forest Service confirmed 640 new owl sites of which 321 have pairs and 141 of these pairs (43.9 percent) successfully reproduced (USDA 1989). One commenter said the Status Review Supplement estimated the owl population on Forest Service lands would vary from 58–81 percent of estimated habitat capability. Further, he

believed that in Region 6 of the Forest Service, the habitat capability is estimated at 1,289 pairs. Since confirmed pairs on Forest Service land now total 1,287 pairs, or almost 100 percent of habitat capability, the commenter maintained that this assumption was obviously incorrect. One commenter stated that in only one season, survey work confirmed 537 new pairs (35 percent increase) on Bureau of Land Management, Forest Service, and private lands, and that this number excludes the results from Forest Service lands in Region 5 and from National Parks.

*Service response:* Table C-1 in the ISC (Thomas *et al.* 1990) report presents the most recent comprehensive compilation of spotted owl habitat and owl pairs located in the last 5 years. On Forest Service lands within the range of the northern spotted owl 1,387 pairs of owls have been confirmed (609 pairs with evidence of reproduction) since 1985. Not all spotted owl sites are occupied by pairs each year. Monitoring of SOHAs by the Forest Service indicated that for 1989 58 percent of the SOHAs had pairs while for 1988 and 1989 combined 78 percent had pairs present in at least one year: 55 percent of the SOHAs had documented reproduction in one of the 2 years (USDA 1989). The habitat capability estimate for Region 6 Forest Service is 1,283 reproductive pairs of spotted owls (USDA 1988, USDA 1989). As of the end of the 1989 field season 525 pairs of owls (sites) have had documented reproduction within the past 10 years (USDA 1989). The greatly increased inventory efforts of federal timber managing agencies in 1989 resulted in the location of many "new" owls. Caution must be exercised in interpreting these new owl locations. For instance, because few of the owls on Forest Service lands were banded it is difficult to assess what proportion are new and which may represent double counting of known owls at adjacent locations. There is no question, however, that the increased survey effort in 1989 disclosed many additional owls.

*Comment:* One commenter stated that additional population surveys had detected new birds as follows: 537 pairs, 549 singles, and 334 juveniles, for a total of 1,957 new owls, and that these data increase the previous count to about 2,200 pairs and more than 6,000 individuals. The commenter stated that the Forest Service in Oregon and Washington had completed surveys on less than 2 million of its 13.7 million acres of forest.

*Service response:* The compilation of spotted owl pairs presented in table C-1 of Thomas *et al.* (1990) report represents the most recent comprehensive enumeration of known northern spotted owl pairs. The figure of 2,022 pairs of owls located between 1985 and 1989 does not include any estimate of single birds. The ISC report further offers (Appendix C, p. 67) an estimate of between 3,000 and 4,000 pairs rangewide on all land ownerships. No agency has completed owl surveys on all land holdings; Bureau of Land Management has surveyed a greater proportion of its holdings in Oregon than has the Forest Service. Most survey effort has been in older forests—where owls are most abundant and where timber sales are planned; less effort has been expended in young forests—where owls are absent or at low density. Wilderness Areas, which are mostly at high elevations and have reduced densities of spotted owls, have not been surveyed intensively for owls. Because of the above, densities on unsurveyed lands are not likely to be proportional to densities on already surveyed lands.

*Comment:* Another individual estimated that lands in California had the capability of supporting about 775 pairs of spotted owls. He emphasized that this is an estimate of pairs, not of pairs that would constitute the breeding core of the population. He noted that in the Willow Creek study area, only about 45 percent of the pairs were found to be consistent breeders over the 5-year period of the study.

*Service response:* The Service had considered this information. The Timber Association of California surveys found 63 pairs. The Service cannot verify the comment that California lands have the capability of supporting "about 775 pairs of spotted owls." USDI (1990) tabulated 533 observed owls on surveyed lands in northern California during 1985-89. However, these are only the number observed at least once during this 5 year period. Other areas have not yet been surveyed. In addition, the Service notes that many pairs breed only in alternate years or irregularly.

*Comment:* A biologist stated it is not necessarily true that owl numbers have increased because Forest Service estimates have not dropped out those owls that cease to exist as the result of logging or natural mortality. Another biologist commented that many "new" owls have been known for more than 10 years, but the Forest Service has simply just verified them by the new standard of seeing a male and female in daylight less than 200 yards apart. A minority of

the new pairs are actually newly discovered.

*Service response:* The Service has considered this information.

*Comment:* Several commenters suggested that there is no empirical information to support the Status Review Supplements' spotted owl population estimate. Another commenter stated that the 1,500-pair estimate is based on the summary in the Status Review Supplement of inventoried sites and projections of estimated habitat capacity, and that no data show that the overall population is decreasing. One commenter referenced the pers. comm. by E.C. Meslow cited in the Status Review Supplement to the effect that the population had declined in many portions of Oregon, and said this statement was not verified with data or citations.

*Service response:* A complete census of the owl throughout its range would be extremely difficult. However, based upon the latest survey results, there are approximately 2,000 known pairs of northern spotted owls (Thomas *et al.* 1990). The Service presents evidence that the population is decreasing (USDI 1990) and provides estimates of the average annual rate of decline (i.e., 5-14 percent). Field biologists believed the population had declined based on occupancy rates for established territories and based on the drastic declines in suitable habitat. USDI (1990) provides the statistical evidence of sharply declining populations of resident, territorial owls (5 percent per year in northwest California and 14 percent per year in southwest Oregon).

*Comment:* Another speculated that the spotted owl population may be at carrying capacity and, therefore, the young have a high mortality and the adults a low reproductive rate.

*Service response:* The Service agrees with this comment and suggests that the current population may in fact be above the current carrying capacity.

*Comment:* One commenter noted that in 1986, the Audubon Society wrote that a stable population of northern spotted owls would consist of 2,000 pairs and that a minimum of 1,500 pairs were needed to maintain the population. The commenter stated that if the Service says there are 1,500 known pairs, this is quite a difference in population since 2,000 were readily found in California). A commenter asked if 1,500 known breeding pairs are not sufficient to preclude the need to list.

*Service response:* The Service agrees that the Audubon Report (Dawson *et al.* 1986) suggested a minimum of 1,500 pairs of owls. However, this figure

included the California subspecies, and the authors stated that they were " \* \* \* marginally comfortable with this number." Dawson *et al.* (1986) present no mathematical formulation or analysis of demographic data to support their figure. This issue is discussed in detail in Thomas *et al.* (1990:30-31). The Service has no evidence that 2,000 pairs of northern spotted owls have been verified in California. The number of verified pairs in northern California is 533, not 2,000. In fact, the 533 relates to only pairs on sites observed at least once during the 1985-89 period and is, thus, somewhat of an optimistic count for the areas surveyed. The numerical size of the population of owls is not necessarily critical to the species' survival; rather, the critical issue is related to the population dynamics. The Service believes that (1) the population is above carrying capacity due to drastic reductions in habitat and an increase in forest fragmentation, (2) the owl population is declining rapidly, and (3) the population will decline much further, even if all harvest of suitable habitat is halted. Changes in the amount and quality of suitable habitat remaining from past management practices and changes anticipated in the future are more important considerations than total population size alone. The Service's evaluation of the status of the northern spotted owl is presented in the "Summary of Factors Affecting the Species" section of this document. The Service notes that the present population size is not included as one of the factors.

*Comment:* A number of commenters questioned how is it possible to conclude that loss of habitat represents a significant loss to the owl if there is no reliable estimate of remaining suitable habitat in the Northwest. Further, if there are no estimates of historical owl population numbers, how one can make reasonable assumptions regarding the impacts of timber harvesting on the status of the owl. Numerous commenters stated that before any action on endangered or threatened status can be taken, the total number of owls must be known. One commenter maintained that the Service has withdrawn proposed rules when it has been demonstrated that population numbers are actually greater than had been previously believed. Since survey data show the spotted owl to be more abundant on Federal and private lands than was previously believed, the commenter recommended that the proposal should be withdrawn.

*Service response:* Good estimates of the amount of remaining suitable habitat

are available (USDI 1990, Thomas *et al.* 1990). However, estimates for Oregon and Washington made by the Forest Service are nearly double those made by The Wilderness Society. By either measure, the amount of suitable habitat remaining is limited and is anticipated to decline further if expected losses from planned timber harvesting and natural perturbations continue. A strong relationship exists between the amount of suitable habitat and the abundance of owls (USDI 1990). The continued cutting of suitable habitat and resulting high fragmentation rates are both detrimental to owls. Although the total number of owls is not known, this is of little importance as the Service has solid evidence of a drastic population decline in owl numbers as a consequence of sharp declines in suitable habitat and increasing habitat fragmentation. The Service believes that the dynamic changes in the population are more important than the size of the population in assessing long-term viability. Although not all estimates of the amount of historical suitable owl habitat agree, it is clear that the net amount has declined dramatically over what was available historically.

#### Distribution of Owls

*Comment:* One commenter stated that the assumption that 90 percent of owls are on Federal land must be re-evaluated. The commenter noted that it was assumed that few spotted owls occurred on National Parks and Wilderness Areas, yet surveys during 1988 in Yosemite, Sequoia, and Kings Canyon National Parks for the California spotted owl found relatively high densities (Roberts *et al.* 1988, Roberts 1988). In this commenter's opinion, survey efforts for national forests in Regions 5 and 6 of the Forest Service are woefully behind, and no National Forest in Oregon or Washington has surveyed 100 percent of its suitable owl habitat.

*Service response:* According to the latest summary of survey results, approximately 90 percent of the known spotted owl pairs occur on Federal land (Thomas *et al.* 1990); the proposal relied on a similar estimate. The National Park Service estimates that fewer than 100 owls exist in its parks within the range of the northern spotted owl. Roberts *et al.* (1988) dealt only with the California spotted owl, not the northern subspecies, and his study is therefore not directly applicable to the Service's decision on this proposal. The Service acknowledges that no National Forest has surveyed 100 percent of its suitable owl habitat. However, complete survey data are not required for the Service to

reach a determination on the status of the northern spotted owl.

*Comment:* One commenter suggested that the California studies reveal that the owl is apparently expanding its range.

*Service response:* Owls had been assumed to inhabit private lands, however surveys had not been conducted previously. The recent studies in California were within the known range of the species and confirm the presence of owls on private lands. There is no evidence to suggest that the owl is expanding its range.

#### Correlation of Decline in Old Growth and Spotted Owl Population

*Comment:* Several parties noted that the Status Review Supplement assumes that the projected decrease in old-growth forests will result in a corresponding reduction in the owl population and that historical numbers were much higher; they considered this to be an incorrect and unproven assumption. Further, if there were 41.2 million acres of suitable owl habitat historically, at the turn of the century there would have been about 8,950 pairs. This population estimate does not add up with the historical estimate presented in Figure 6 of the Status Review Supplement, according to one commenter. As stated by this commenter, the spotted owl population has not been shown to be declining because historical population estimates relied on the incorrect assumption that the number of spotted owls could be directly correlated with the number of acres of old growth. One commenter maintains that the estimates of northern spotted owl historical population numbers are not credible. One person referenced a comment made by a reviewer of a draft of the Status Review Supplement who noted that without historical population numbers, the current population size is meaningless. The commenter stated that the review team realized this and fabricated a linear relationship to obtain an historical population figure. According to one commenter, the Status Review Supplement fabricated historical old-growth estimates to enable the Review Team to claim massive spotted owl population declines without considering that forests are dynamic systems and that they will regenerate once cut. Further, the commenter questioned the assumed linear relation between old growth and spotted owl populations because it does not consider that owls use young-growth forest. Also, the commenter stated that it has been shown that suitable habitat can be maintained through existing timber

harvesting methods (Irwin 1989b, Smith 1989, Gould deposition).

*Service response:* The Service acknowledges the difficulty of estimating how many northern spotted owls existed in historical times, and did not base its determination of the status of the northern spotted owl on estimates on historical numbers. Further, the Status Review Supplement estimated there were 14–19 million acres of old-growth historically in Washington and Oregon, not 41.5 million acres as the commenter suggests. However, ample evidence indicates that the northern spotted owl prefers forest habitat with old-growth characteristics. As there has been a net loss of suitable habitat, the Service believes it is reasonable to conclude that overall owl population numbers have declined. The Service did not fabricate historical old-growth estimates to substantiate a significant decline in the owl population. The Service acknowledges that forests can regenerate after harvesting but notes that rotation ages are such that throughout most of the range of the owl, stands are re-cut before sufficient time has elapsed for them to obtain the structural characteristics of suitable owl habitat.

*Comment:* Another commenter said that the conclusion that the owl population will continue to decline because of timber harvesting is speculative as the Service has not defined "biologically effective" owl habitat.

*Service response:* From the substantial data relating habitat use to availability, it is apparent that suitable (or effective) spotted owl habitat contains structural characteristics commonly associated with old-growth forest. These attributes are described in the Background section of this document. The Service has shown that northern spotted owls are rare or absent in regions where stands less than 80 years old cover more than 80 percent of the area, and it has shown that such areas will increase due to timber harvest activities, if current land use trends continue (see Discussion under Factor A).

*Comment:* A commenter was concerned that the owls seen today reflect the habitat conditions of 5–15 years ago and may say nothing about what will happen to the next generation because there is a time lag between loss of habitat and reduction in owl population size. Hence, the future may be even more bleak according to this commenter than the presence of 1,500 known pairs indicates.

*Service response:* The Service shares the concern expressed in this comment.

*Comment:* One commenter noted that because the Status Review Supplement found that many suitable habitats are not occupied every year, he believes that this contradicts the assumption that owl numbers are correlated with the amount of old-growth acreage.

According to this commenter, most population experts disagree that the number of spotted owls can be calculated based on the number of old-growth acres.

*Service response:* The Service believes that convincing evidence exists showing that the abundance of northern spotted owls is correlated with the amount of old growth present in an area (see discussion under Factor A). There is no reason to expect that northern spotted owls will occur in every tract of suitable habitat every year because many patches are now small and isolated. Furthermore, some surveys are not sufficiently intensive to detect every owl present, so some reported cases of suitable habitat being vacant may be due to not detecting birds. The Service agrees that the actual number of northern spotted owls present in an area cannot be calculated from the amount of old growth present, and the listing decision does not rely on any such calculations.

#### Issue 15. Habitat Use

##### Habitat Preferences

*Comment:* A number of commenters indicated that the owl's preference for old growth in northern California has not been demonstrated. One comment reported that studies by industry organizations found northern spotted owls using 40 different vegetative types, 70 percent of which were not old growth. Several commenters said that old-growth Douglas-fir forests have only been present for 200 years because prior to that time, Indians burned the forests on the valleys and mountains. These commenters questioned where the owl had resided. A commenter noted that preservationists did not object in one instance to logging within 60-70 acres around a pair nesting in a second growth area and asked how owls can be considered endangered in old growth and surplus in second growth. Several commenters suggested that the owl's assumed preference for old growth in Northern California also is not shown. A number of individuals questioned why the spotted owl should be entitled to preferred habitat instead of just what it needs.

*Service response:* After reviewing all available data, the Service has

concluded that northern spotted owls are closely associated with old-growth forest or forest with old-growth structural and vegetational characteristics (for details, refer to background section and Factor A). Northern spotted owls in northern California are found in areas having remnant old growth or in situations where site conditions and tree species composition were such that stands attained the characteristics usually associated with old growth at relatively young tree ages (Pious 1989, Kerns 1988, Blakesley *et al.* 1990b).

No evidence was presented to substantiate the claim that old growth was not present prior to 200 years ago. The Service is of the opinion that it would be unreasonable and illogical to conclude that Indians burned all forests approaching or more than 200 years of age.

Whether or not preservationists failed to object to logging activities associated with a particular timber sale has no bearing on the Service's decision on the proposal.

Studies by Sisco and Gutierrez (1984) and Solis (1983) demonstrated selection for old-growth forest by radio-marked northern spotted owls. Results from an additional study (Kerns 1989a,b) examining habitat use of radio-marked owls in coastal redwoods are inconclusive due to small sample sizes at this time. Kerns (1988) noted that 78 percent of the vegetative components in which owls were located in northern California, while not 200+ years of age, had many of the habitat characteristics of old growth. Work by Pious (1989) in coastal redwoods also demonstrated the association of owl roost sites with a multi-layered canopy, a characteristic of old growth forests. The Service maintains that the association of northern spotted owls with forest having old growth characteristics, including multi-layered canopy, large trees of varying species and size, and down logs and snags, is clearly demonstrated in northern California, and that these structural characteristics are similar to those associated with old growth.

It is the Service's opinion that although owls were documented in sites in northern California that did not meet the definition of old growth given in the proposal as to age (generally >200 years), the site did contain the structural characteristics identified in the proposal as constituting suitable habitat. As discussed in the Background section, the Service believes that spotted owl habitat is more appropriately defined by structural and vegetational attributes than by age. Given the preponderance of data indicating that northern spotted

owls, when given the opportunity to select from a variety of habitat types within their home range (USDI 1990), spend a disproportionate amount of time in older forests, the Service contends that attributes of old-growth forest are critical to owls. Hence, the Service believes that the northern spotted owl's long-term viability is related to the availability of suitable habitat. Further, the Service maintains that a strong association or preference demonstrates biological needs, particularly in the absence of significant numbers of owls in young forests throughout the range of the owl. In the Service's opinion, preferred habitat is more likely to provide for maintaining owls on a long-term basis because of higher reproductive and survival rates than would lower quality habitat.

*Comment:* Several commenters objected to the Status Review Supplements' use of data from Oregon and Washington to support conclusions in California, arguing that the climate and prey base are different. One commenter noted that California forests are more complex with respect to plant species composition and tend to have uneven size classes in even-age forests in contrast to Oregon and Washington. Commenters also pointed out that non-Federal clearcuts in California are usually 80 acres, cannot legally exceed 120 acres, and must be separated from adjacent clearcuts by a minimum of 300 feet of forest area. The commenter continued that in Oregon and Washington, clearcuts of hundreds of acres are not uncommon. Several commenters wrote that in California, watercourses and lakeside protection zones, ranging from 50-200 feet, must retain 50 percent of overstory canopy and, therefore, provide corridors through many clearcuts.

*Service response:* The Service agrees that data from different physiographic provinces in Oregon or Washington, particularly with respect to the use of age only as an indicator of forest stand characteristics, may not be directly applicable to California; the same may be true between Oregon and Washington. The Service likewise agrees that data from California are not entirely applicable to Oregon and Washington. The Service maintains that although there exist differences both in tree species composition and growing conditions across the range of the northern spotted owl, there nonetheless exists strong evidence that owls are associated with structurally diverse habitats with old-growth characteristics.

While the Service recognizes there exist regulatory mechanisms specific to

timber harvest on private and State lands in California (as well as in Oregon and Washington), such as provisions for streamside corridors and restrictions on sizes of clearcuts, these afford only incidental protection to northern spotted owls on private lands. The Forest Practice Act of California [4513(b)] does state that the "goal of maximum sustained production of high-quality timber products is [to be] achieved while giving consideration to values relating to \* \* \* wildlife \* \* \*," but as noted by K. Delfino, California Division of Forestry, "The Department does not have any specific direction for spotted owl management" (letter of December 14, 1989, to Jack Ward Thomas, Chairman, Interagency Spotted Owl Scientific Committee). Although the Service recognizes that watercourse protection zones are an integral part of any habitat protection scheme for northern spotted owls, the protection they afford by themselves is minimal.

Both the Forest Service and Bureau of Land Management have policies regarding the maximum size of clearcuts and the circumstances under which areas adjacent to clearcuts can be harvested. Larger clearcuts are permitted in instances of salvage operations arising from blowdown, fire, or insect infestation. Also, Federal policies provide for streamside protection zones for streams meeting certain criteria. Both Federal agencies maintain that their harvesting policies are at least as stringent as those of the respective states. State and Federal regulations and policies are discussed in greater detail under Factor D in the Summary of Factors Affecting the Species section.

*Comment:* Comments pertaining to northern spotted owl habitat preferences and usage included statements that owls do not require old-growth forest to survive and that information is inadequate to establish the actual habitat needs of the owl. According to a number of commenters, there are no data showing that owls occur in old growth more frequently than in other forest types. Several commenters stated that reports on use of macro-habitat were employed to support the preference of owls for old growth are incomplete and did not compare owl use in a statistically valid manner. One commenter maintained that the Status Review Supplement asserts that only large patches of old growth are biologically effective habitats and relied on only four reports for this conclusion. Further, the commenter stated that the Service should not have relied on these reports because Allen (1988), Forsman

(1986), Forsman *et al.* (1984), and Irwin *et al.* (1989d), do not provide appropriate bases for this conclusion. Another commenter stated that the Status Review Supplement failed to mention the work of Gutierrez and Call (1988) and Gutierrez and Bias (1988) on the California spotted owl and habitat use. A commenter noted that Garcia (1979) found 2, 2, 3, 3 and 21 pairs in 60-80, 81-100, 101-120, 121-200, and 200+ year-old forests, respectively, and that data on preferences for old growth have been taken out of context.

*Service response:* The Service disagrees with the contention that owls do not use old growth more frequently than other forest types and that the studies used by the Service to conclude owls select old growth are not statistically valid. Data from use versus availability studies clearly demonstrate strong selection by owls for old-growth forest in the Oregon Coast Range, Olympic Cascades, Washington Cascades/Olympic Peninsula and Klamath Provinces (USDI 1990). Further, only studies that evaluated use versus availability in a statistically rigorous fashion were considered by the Service. The studies evaluated all used widely accepted statistical tests (USDI 1990). Excluded were studies that provided no statistical basis for concluding selection for or against habitat types. While providing a rich collection of anecdotes and incidental observations, these latter studies did not evaluate the relation between northern spotted owls and forest types in a statistically rigorous fashion.

The Service agrees that demonstration of true dependency requires a well-designed experiment, but maintains that the evidence overwhelmingly demonstrates strong association between owls and old-growth forest. If owls did not select so strongly for old-growth forest, more evidence indicating non-random use of other forest types might have been evident. Use of large patches of habitat is a consequence of the large home ranges used by owls, which range from a median size of 1,411 acres in the Klamath Province to 9,930 acres in the Olympic Peninsula (Thomas *et al.* 1990).

Work by Gutierrez and Call (1988) was referenced in the Status Review Supplement (USDI 1989). That study, and another by Gutierrez and Bias (1988), were on the California spotted owl, a different subspecies not the subject of the proposed rulemaking.

Data often are amenable to a variety of analyses, including an  $X^2$  test. Under the hypothesis of independence, pairs of northern spotted owls should be

randomly distributed among the 5 age categories of trees. Thus, if owls were randomly distributed across the landscape, and exhibited no selection for a particular forest type, the expected number of pairs in each age category would be 30 (the total) divided by 5 (the number of age categories) = 6. Using the data provided, an  $X^2$  statistic of 47.0 having 4 degrees of freedom can be completed. Comparison to an  $X^2$  distribution table indicates this value is very unlikely ( $P < 0.001$ ) and the hypothesis of independence is rejected. Given that 21 of 30 pairs were found in forest > 200 years of age, and that this one category contributed most to the  $X^2$  statistic, a reasonable conclusion would be that the paired owls in this study were associated with forest > 200 years of age.

However, such an analysis is not strictly correct because it assumes that the 5 age categories themselves are equally distributed across the landscape (i.e., each age category comprises one fifth of the total forest). When the proportional makeup of the forest types is not equal, pairs of owls cannot be equally distributed across the landscape. Under the hypothesis of independence they would be distributed in proportion to each of the forest types. Consequently, the expected values used to estimate the  $X^2$  statistic must be weighted by the proportional makeup of the habitat types across the landscape. Because Garcia (1979) did not present the proportional makeup of the landscape on which he conducted his study, it is impossible to weight the expected values in the appropriate fashion. Even though the  $X^2$  value indicates that the owls were not using the age categories in a random fashion, the Service would maintain that the study indicates selection but does not evaluate it in a statistically rigorous fashion. Incomplete knowledge regarding the availability of each of the age categories precludes a complete evaluation of the relationship between the owls and the forest types. When evaluating studies pertaining to habitat use by northern spotted owls, the Service relied principally on those that assessed data in a statistically rigorous manner.

*Comment:* Another commenter stated that there is some evidence indicating that a handful of spotted owls "preferred" forests in the pole/medium timber category (Sisco and Gutierrez 1984), 61-80 year old stands (Forsman *et al.* 1984), and 50-100 year old class (Carey *et al.*, in press).

*Service response:* Data summarized by the Service and presented in the

Status Review (USDI 1990) indicate that only 3 of 81 owls (4 percent) having young forest in their home range exhibited selection for that forest type. Forty-five of the same 81 birds selected against young forest. The Service considers the numbers exhibiting selection for young forest small and not indicative of the habitat needs of northern spotted owls.

*Comment:* One commenter stated that the second highest density of spotted owls in 1989 was found on the Miller Mountain study area, near Medford, Oregon; an area with little old growth. The commenter also indicated that no habitat preferences have been demonstrated for forest stands more than 50 years old. Moreover, he stated that earlier studies only compared stands less than 50 years of age to those more than 200 years old; but that new studies document that use of stands 50-200 years old is equal or higher than expected based on availability. Further, according to this opinion, no study documents that spotted owls prefer old growth to these intermediate successional stage forests.

*Service response:* The Service accepts the density estimate of owls on the Miller Mountain study area in 1989, but notes that Wagner (letter of 18 April 1990) disagreed that the Miller Mountain Study Area can be characterized as an area with little old growth. Wagner estimates that approximately 29 percent of the study area can be considered older forest, a value he considers relatively high for unreserved commercial forest land in that area.

The Service maintains that selection has been demonstrated for stands > 50 years of age. Sixty-eight of 81 owls having old-growth forest > 200 years of age in their home range selected for that forest type (USDI 1990). Only 3 of 81 owls having forest < 70 years of age in their home range selected for that forest type. While data indicate that 41 of 81 owls used mature forest 70 to 200 years of age in proportion to its availability, only 11 of the 81 owls selected from mature forest. This value is offset somewhat by 9 owls that selected against use of mature forest. These studies clearly demonstrate that owls select forest > 50 years of age.

*Comment:* Frank Wagner (OCWRU, Oregon State University) submitted additional data on his research on spotted owls in the Elk Creek watershed near Medford, Oregon. Wagner offers that habitat use data from the Miller Mountain Study Area portion of his study indicates that spotted owls select old growth in excess of availability, avoid regenerating forest, and have various responses to intermediate age

forest. He suggests that initial entries of three-stage partial cuts or heavier entries (greater than or equal to about 30 percent basal area removal) diminishes habitat suitability significantly for at least several decades. In contrast, light partial cut entry (less than 20 percent basal area removed around 25 years ago) was used both in excess and in proportion to its availability.

*Service response:* The Service also believes that conclusions from Wagner (letter of 18 April 1990) suggesting that in his study area northern spotted owls select for old-growth forest, select against regenerating forest and use intermediate-aged forest in a variable fashion are premature and unwarranted. Thus far habitat types within individual owl home ranges in his study area have not been classified, making it impossible to determine availability and hence evaluate use.

Data were not presented supporting the contention that three-stage partial cuts or heavier entries diminished habitat suitability for several decades, and the Service thus is unable to verify its accuracy.

*Comment:* One commenter indicated that the Bureau of Land Management found 10 pairs of spotted owls in a drainage that is a highly fragmented stand of timber of all age classes with most of the remaining timber second growth Douglas-fir, 80-150 years old. Of these 10 pairs, four successfully reproduced in 1989. One commenter stated that since there are no 2,000-acre tracts of old growth to support the birds, how can they survive in this area?

*Service response:* The estimate of 2,000 acres per pair of northern spotted owls was used to establish the Spotted Owl Habitat Area network on Forest Service Lands. The intent was not to state that precisely 2,000 acres of old growth was needed before owls could be expected to survive and reproduce. Clearly, there exists variability in the requirements of individual owls, as well as of owls in different physiographic provinces. For example, median home range size varies from 1,411 acres in the Klamath Province to 9,930 acres in the Olympic Peninsula (Thomas *et al.* 1990). While the Service accepts that 4 to 10 pairs successfully bred in areas containing some young growth Douglas-fir, it cautions against the inference that without a 2,000 acre block of old growth owls are not expected to be present. Clearly some owls can live successfully in areas containing < 2,000 acres of old-growth forest while others require more than 2,000 acres. Moreover, although highly fragmented, the stand referred to in the commenter's letter contained timber of all age classes, with most of it

being young-growth Douglas-fir 80 to 150 years old. It is anticipated that Douglas-fir of that age class would have developed structural characteristics commonly associated with northern spotted owl habitat. Hence, the use of such an area by owls would not be unexpected.

*Comment:* The Forest Service commented that no reproductive pairs in Region 6 were found in what was considered unsuitable spotted owl habitat; however, seven owls were located in what was deemed unsuitable habitat in seven random sample areas. In six of these cases, the responses were single birds, one of which eventually paired with a bird in suitable habitat. The seventh response was a pair located above what was believed to be the elevational limit for the spotted owl in that area.

*Service response:* Observation of individual birds in habitat considered "unsuitable" is not unexpected in territorial birds. Such birds are likely "floaters" searching for mates and/or territories.

*Comment:* One commenter included results of a study by Miller, Speich, and Irwin (1989) on the status of the owl in a managed forest mosaic in the McKenzie Resource Area, Eugene Bureau of Land Management District. These researchers did not observe that the birds foraged more in old growth, but did note that use of 120-139 year old stands was greater than expected on the basis of availability. In this study, trees 80-99, 60-79, and 40-59 years old were used in proportion to their availability, whereas trees 0-19 and 20-39 years old were used less than expected. The study was too brief to provide detailed data on owl reproductive success, although the author noted that little reproduction has been observed during the last three years in this area.

*Service response:* The Service accepts the comments.

*Comment:* A radio telemetry study of spotted owls was conducted between 1982 and 1987 on the Olympic, Okanogan, Gifford Pinchot, and Mt. Baker-Snoqualmie National Forests (Hays *et al.*, 1989b). Researchers found that old growth, large saw timber (dominant trees 20-34 in dbh, fewer canopy layers and less dead woody material), and small saw timber (dominant trees 13-20 in dbh, little or no dead woody material) were the only cover types used more than expected by availability by any of the 10 owls studied. Use of small saw timber was variable. There was no significant preference for young growth and recent clearcuts.

*Service response:* The Service accepts the comments.

*Comment:* The Bureau of Land Management stated that the number of known sites on Bureau of Land Management land increased from 350 to 461 from 1988 to 1989, largely as the result of an increased survey effort. Further, the Bureau of Land Management commented, "Clarification is required to correct the misconception that most of these new sites are being found in all forest successional stages, including even-aged young stands. The new sites located on Bureau of Land Management lands in western Oregon have been found to be strongly associated with optimum habitat (suitable) 80 year-old or greater forests that have the similar structural components of older forests."

*Service response:* The Service accepts these comments.

*Comment:* The Bureau of Land Management commented that its banding studies revealed that a pair of owls may remain in a drainage following a timber sale, but banding often demonstrates that it is a new pair of non-breeding adults. The unpaired floaters seem to be numerous, especially in less suitable habitat. The Bureau of Land Management reported that some pairs raised young in habitat that was generally thought to be unsuitable because of partial cutting or low quantities of nearby old growth or mature trees. However, the sample size was said to be too small to generalize as to what proportion of time this occurred.

*Service response:* The Service accepts the comments.

*Comment:* A researcher reported on results of a recent study on owl habitat use in the Willamette National Forest in the central Oregon Cascades (Miller and Meslow 1989). All owls used old growth for roosting more than expected on the basis of availability; mature growth stands were used in proportion to availability, and younger growth was either not used or was used significantly less than predicted on the basis of its availability. While foraging, 13 of 14 owls used old growth significantly more than on the basis of proportion of availability, and one used it in proportion to availability; mature growth was used in proportion to its presence, but in several cases at a significantly higher rate. Younger growth was used significantly less than would be predicted on the basis of availability. Some of these areas had up to 69 percent young growth, defined as trees 10 to 79 years of age.

*Service response:* The Service accepts the comments.

*Comment:* Results of a nest and roost site selection study in northwest California during 1985-1989 were submitted by Blakesley et al. (1990b). Conifer forest with trees greater than 53.3 cm was selected by owls significantly more than expected based on availability. Hardwood stands and stands dominated by smaller trees were not used or were used in proportion to their availability. Spotted owls preferred the lower third of slopes, used the middle third in proportion to availability, and avoided the upper third for roosting and nesting.

*Service response:* The Service accepts the comments from Blakesley et al. (1990b).

*Comment:* The Timber Association of California submitted additional comments which were received by the Service on April 19, 1990, shortly after the close of the last comment period. In its letter, the Timber Association of California described what it considers to be suitable nesting, foraging, and roosting habitat for spotted owls in northern California. According to the Timber Association of California, for example, nesting habitat generally includes an average canopy closure around the nest stand of over 80 percent, total conifer and hardwood basal areas within nest stands generally average 330 square feet/acre, and diameter of the nest tree is usually 25-55 inches dbh. Also according to the Timber Association of California, attributes to roosting habitat appear similar to those of nesting habitat, but are more flexible; for instance, canopy closures are usually more than 40 percent and the surrounding area can have a variable canopy closure ranging from 19-100 percent. According to this comment letter, in total basal area of conifers and hardwoods, roost stands average 330 square feet/acre. The Timber Association of California commented that the requirements for foraging habitat seem to be the most variable with canopy closures as low as 10 percent appearing usual and that foraging habitat variability over the area seems to be important.

*Service response:* The Service accepts the comments from the Timber Association of California about nesting and roosting habitat, but disagrees with the statement by the Timber Association of California that foraging habitat is the most variable of the age classes studied. The Service maintains that data from Kerns (1989 a, b) are insufficient in scope to allow for a statistically rigorous evaluation of habitat use versus availability and rejects as premature his conclusions that northern spotted owls are flexible with respect to habitat use

(USDI 1990). The Timber Association of California also maintains that Appendix B to its comments (Timber Association of California 1989b) documents a broader range of habitats used for foraging than had previously been indicated. The Service believes this to be incorrect because Appendix B deals with habitat type descriptions and roosting and nest site descriptions, not foraging habitat. Available range-wide studies of foraging owls clearly demonstrate that owls select old-growth forest for foraging (USDI 1990). The Service therefore does not accept the comment that northern spotted owls in California are highly flexible in the selection of habitat for foraging.

#### Use of Young Growth

*Comment:* A number of commenters stated that spotted owls adapt and reproduce in second growth. Another said that it was proven that spotted owls nest anywhere and cannot differentiate between old growth and second growth. One commenter noted that in a study undertaken in northern California by the Pacific Lumber Company, the vegetation components where owls were found comprised 22 percent of true old growth. According to this commenter, the remaining 78 percent of vegetation used by owls may contain some of the characteristics of old growth. Young growth in many of these stands was 60-80 years old, and managed timberlands on the Pacific Lumber Company land that are not true old growth by age are being used by the spotted owl (Kerns 1988; 1989 a, b). One commenter stated that results from studies conducted under the auspices of the Timber Association of California broaden existing young-growth owl data. Further, the commenter maintained that several reports cited in the Status Review Supplement actually show substantial use of young growth by owls (Solis 1983; Forsman 1976; 1986; Irwin et al. 1988, 1989d; Kerns 1988; Meslow et al. 1986). Additional details pertaining to recent studies of the northern spotted owl in young growth are provided in a following section entitled "New Information."

*Service response:* The Service accepts that northern spotted owls may reproduce in second growth. However, care must be exercised when using phrases like "second growth" and in concluding that owls have adapted to "second growth." This care is necessary primarily because most forests within the owl's range are to some degree young growth. Historically, a variety of natural and man-induced factors have altered forest composition and created a

mixture of older-aged and younger-aged stands. The preponderance of data indicate that northern spotted owls preferentially select old-growth forest for foraging and roosting and have in general higher densities in areas containing high amounts of old-growth forests (USDI 1990). If the owls were equally "adapted" to both "second" and "old" growth, then distribution and use patterns would indicate equivalent usage rather than the strong association with old-growth forests documented in the Status Review (USDI 1990).

Although the Service does not claim to understand the behavioral mechanisms by which northern spotted owls differentiate between old and second growth, the fact that 68 of 81 owls having a mixture of old, mature, young, and pole/sapling forest in their home range selected for old-growth forest (USDI 1990) suggests some form of discrimination by owls is occurring. Fifty-eight of 79 nests of northern spotted owls in northern California found by Blakesley *et al.* (1990b) were in forest defined as large sawtimber and old growth, while 21 of 79 were found in forest defined as small sawtimber. No nests were found in seedlings and saplings or pole timber. Although there appears to be some variability in nest site characteristics, nests are generally found in stands having a well-developed multi-layered canopy (USDI 1990). The Service does not accept the comment that owls can nest anywhere or that they cannot differentiate between old and young forest.

The Service accepts the comment that 22 percent and 78 percent of the lands surveyed by the Pacific Lumber Company and found to support owls in California were true old growth and stands containing attributes of old growth, respectively, but again notes that data from Kern's (1989 a, b) study are insufficient to analyze use patterns in a statistically rigorous manner. The Service further notes that the "young growth" on these lands is mostly redwood in coastal California, and that even though defined as "young growth" by Kerns (1988; 1989 a, b), is not characteristic of younger forests in other regions. As noted by Kerns (1988), redwood stands 60 to 80 years of age have many of the characteristics of mature and old Douglas-fir forests. Thus the age categories presented may be accurate for redwoods, but it would be incorrect to extrapolate these age classes to other forest types like Douglas-fir.

The Service contends that structure rather than age *per se* is the more important criterion. As mentioned

previously, data from the Timber Association of California and other California studies indicate that owls are associated with structurally diverse habitat (USDI 1990). While these structural characteristics may arise because of repeated harvest entries (interior California) or better growing conditions (e.g., coastal redwoods), they occur in forests structurally similar to mature and old-growth forests. Thus, the Service believes that rather than apply the term "young" to California private forest lands, it is appropriate to examine structural characteristics to define owl habitat.

*Comment:* One commenter suggested that without surveying young-growth forest, one cannot assume the spotted owl prefers old growth. Numerous commenters maintained that because spotted owl research has been concentrated in old growth, the data are biased in favor of locating owls in old growth.

*Service response:* In the proposal and the Status Review Supplement (USDI 1989), the Service considered and included results of research studies that surveyed forests of all age classes. Bart and Forsman (1990) estimated the abundance of spotted owls in tracts lacking old-growth forest but containing extensive 50 to 80 year-old stands ("young-growth tracts") and tracts containing large amounts of old-growth forest ("old-growth tracts"). The tracts were well-distributed throughout the range and each had been surveyed 3 or more times for at least one year. Young-growth tracts varied in size from 5 to 277 mile<sup>2</sup> and old-growth tracts from 17 to 113 mile<sup>2</sup>. Single owls were found on only two of the young growth tracts for a maximum estimate of 0.02 owl per mile<sup>2</sup>. Pairs were rare or absent in these tracts, occurring on only 2 sites, for a maximum estimate of 0.01 pair per mile<sup>2</sup>. In contrast, maximum abundance in old-growth tracts was 0.19 per mile<sup>2</sup> for single birds and 0.36 per mile<sup>2</sup> for pairs. Mean number of pairs per square mile was 0.01 on young-growth tracts and 0.14 on old-growth tracts. These data are not biased against younger forest and clearly demonstrate that northern spotted owls are found in old-growth forest in far greater numbers than in younger forest.

Abundance of owls on young growth on private lands in California has been described by Irwin *et al.* (1989b). Their review included surveys of 713 mile<sup>2</sup> of land, most of which was in stands <100 years of age. Most of the stands in the redwood zone were former clearcuts. The other surveys were primarily in selectively cut stands. The estimated

density for the study area was 0.35 owls per mile<sup>2</sup>.

In Washington, Irwin *et al.* (1989d), surveyed approximately 277 mile<sup>2</sup>, of which 52 percent was stands 40 to 80 years of age, and found only two pairs (one in the only large block of old growth on their study area) and an average of 4 single owls per year during their 1-year study. Estimated abundances from these data are 0.006 pair per mile<sup>2</sup> and 0.03 single per mile<sup>2</sup>.

New data received during the comment period greatly expands the coverage of younger-aged forests (e.g., Bart and Forsman 1990, Timber Association of California 1989b). When coupled with studies reviewed in the Status Review Supplement (USDI 1989), the studies cover a broad spectrum of habitat types, including young growth. The Service therefore considers young-growth surveys to be adequate in coverage and does not accept the comment.

*Comment:* According to one party, data were misinterpreted for some young-growth surveys. Another comment was that surveys by Forsman *et al.* (1977, 1986, 1988) were too brief and did not include a sufficiently broad range of forest age classes to rule out the presence of spotted owls in young forest. One commenter said that the Status Review Supplement misinterpreted the study by Meslow *et al.* (1986) in that only three of five sites were evaluated. The commenter stated that the use values only ranged from 22-33 percent compared to the 3-6 percent availability of old growth. Also, the Status Review Supplement, in the commenter's opinion, failed to note that the nests for three of these sites were in old growth, so one would expect the owl to tend to be found in this area more frequently. According to this commenter, because this study showed owls used young growth 67 to 78 percent of the time, it cannot be concluded that owls use old growth a significant part of the time. This commenter further maintained that the utilization of young growth contradicts the impression elsewhere in the Status Review Supplement that data show that spotted owls use primarily old growth out of proportion to its availability.

*Service response:* Although work by Forsman *et al.* (1977) covered a relatively short duration, from 12 to 28 July, later surveys by Forsman (1988) lasted from 31 March to 21 July. Missing from the surveys were stands 70 to 110 years of age although stands with younger-aged trees were relatively well covered. The Service does not believe

data were misinterpreted in some young-growth surveys. Since then, work by Bart and Forsman (1990) evaluated density values from areas having stands 50 to 80 years of age. Density of pairs in these areas was approximately 1 per 300 mi<sup>2</sup>. In contrast, density of pairs in areas having older forest was approximately 40 times greater. Although information on owls in younger forests may have been limited in the Status Review Supplement, information since then clearly demonstrates that northern spotted owls are not present in large numbers in young forests, with the possible exception of coastal California redwood forests (USDI 1990). The Service also believes that a wide range of age classes has been covered in sufficient detail to justify the conclusion.

Studies of habitat selection by northern spotted owls have been accomplished mainly through radio-telemetry studies. Proper analysis of the data requires an assessment of the availability of forest types in an area as well as some quantification of use of the area. Simply stating the amount of time a forest type was used without assessing the availability of that forest type does not provide a basis for judging preferential use of habitat types. In the Meslow *et al.* (1986) study, use of old-growth forest by owls ranged from 22 percent to 33 percent, even though old-growth forest comprised only 3 percent to 6 percent of the landscape. This means use in relation to availability of this forest type was greater and conversely, that use of young forest was less, than expected. Young forest, although used by owls 67 percent to 78 percent of the time, comprised 94 percent to 97 percent of the landscape. The Service considers the information that 3 of 5 nest sites were located in old growth and that the owls used these areas to be an indication that northern spotted owls select for old-growth forest. Biased use estimates would occur only if sample locations were consistently taken when the birds were at the nest rather than when the birds were away from the nest. Study protocol precluded this. The Service disagrees with the statement that utilization of young growth contradicts data elsewhere, and maintains that data such as these support the position that owls select for old-growth forest.

*Comment:* Several commenters stated that the Status Review Supplement does not adequately discuss other studies in younger growth forests. For example, maintaining that the Status Review Supplement dismisses the importance of the findings of Irwin (1967) and Kerns (1986) who found owls using young-

growth forest by stating that these sites had old-growth characteristics. One commenter wrote that the Status Review Supplement failed to discuss the 29 nest sites in young growth that were less than 80 years old, five of which were in stands that averaged 257 years old (Irwin *et al.* 1989c). Another commenter said that seven of the 1988 surveys contradict the Status Review Supplement's assumptions regarding the northern spotted owl. For example, stating that Ganey (1988) reports that the Mexican spotted owl requires larger home ranges when there is more old growth and Roberts *et al.* (1988) report high numbers of California spotted owls in Yosemite National Park. The commenter maintained that relatively high numbers of owls were found in Yakima Indian Reservation lands (letter from C. Palmer of the Yakima Indian Nation to B. Mulder, FWS, 1989). These two reports, according to the commenter, contradict a statement in the proposed rule that National Parks and Indian lands generally do not contribute significantly to spotted owl populations. According to this commenter, the reports by Ganey (1988), Roberts *et al.*, (1988), Miller (1989), Gutierrez and Call (1988), Irwin (1989), and Kerns (1986) contradict either the assumption in the Status Review Supplement that young growth is not suitable habitat or the assumption that habitat fragmentation arising from timber harvesting is detrimental to juvenile survival.

*Service response:* In the Service's opinion, the proposal and 1989 Status Review Supplement adequately addressed the use of younger forest based upon the data that were available at that time. The 1990 Status Review contains an extensive review of the abundance and productivity of northern spotted owls in young stands, including a review of Irwin (1987) and Kerns (1988). In Washington and Oregon, surveys have repeatedly shown that owls are rare or absent in stands less than 80 years old (see Discussion under Factor A). In Irwin's (1989a) study, 53 nest sites were examined, and nest tree age varied from 67 to 700 years. Many of the stands had been logged in the past several decades, using selective harvest methods, rather than clearcutting. As discussed under Factor A, it is well established that northern spotted owls sometimes persist in areas harvested by selective cutting methods. Survey work in 1988 on the Yakima Indian Reservation noted 10 individual owls (including 4 pairs), a relatively small component of the overall population estimate. The Service maintains that

when compared to the numbers and amount of suitable habitat on Forest Service and Bureau of Land Management land, the contribution from National Parks and Indian land is relatively small. Miller (1989) is discussed in the Status Review Supplement. As discussed above, the Service disagrees with the commenter who stated that 7 of the 1988 surveys contradict the Status Review Supplement assumptions regarding the northern spotted owl. The reports by Ganey (1988), Roberts *et al.* (1988), and Gutierrez and Call (1988) do not refer to the northern spotted owl but rather the California spotted owl or Mexican spotted owl, different subspecies. The stands studied by Irwin (1989a) and Kerns (1988) had been selectively harvested, contained remnant older trees, or were older than currently anticipated rotation ages. The study by Miller (1989) pertained to owl abundance and reproductive success in areas partially covered by older forest. The 1990 Status Review shows clearly that abundance and productivity decline sharply as the proportion of young forest in an area increases (see Discussion under Factor A).

*Comment:* One commenter suggested that the proposal be revised because the statement "no known reproductive pairs in second growth" now needs to be amended. The commenter noted the following: 11 sites on Bureau of Land Management land in western Oregon had owls breeding with no old growth in the habitat; seven other pairs bred in sites with less than 100 acres of old growth which amounted to less than 10 percent of the home range; 30 other sites on Bureau of Land Management land where birds bred in forests with 75 percent young, managed forest; two successful breeding sites on the Rogue River National Forest in relatively young managed forests; two dozen sites where birds were reproducing in mixed-age managed forests in the Wenatchee National Forest. The commenter noted that although many of the owl sites contain some relatively large-diameter trees, they cannot be described accurately as old growth or, on the other hand, as second growth.

*Service response:* The Service accepts the comment that owls have been observed breeding in second growth. The final rule reflects the available data on owl reproduction in younger growth. The Service agrees that owls have been observed to breed in younger forests and notes that many of the owl sites referred to by the commenter contained relatively large trees. The Service also accepts that it would be inaccurate to

describe these stands as either old growth or as young growth.

**Comment:** According to one commenter, recent data from northern California (Irwin *et al.*, 1989b; Kerns 1989 a, b; Pious 1989) indicate that owls recolonized regenerating forest, some as young as 30 years postharvest in coastal redwood. A commenter stated that ostensibly some harvested tracts that maintained relatively dense (>40 percent) canopies of coniferous timber and hardwoods still retained or developed important structural components (scattered large trees and snags, downed logs, multi-layered conditions) that have allowed for recolonization after 30–50 years. He continued by stating that spotted owls may be present, in part, because timber management practices left a hardwood understory in conifer stands. He speculated that these hardwood stands provide a cooler operative thermal condition than open-canopy situations and are, therefore, more conducive to owl use. The commenter noted that mature stands of Douglas-fir with no hardwood understory are not used. One commenter stated that forests within the mixed-coniferous/evergreen hardwoods and coastal redwood regions in northern California produce suitable habitat within 50–60 years (perhaps earlier in redwood). This commenter maintains that limited evidence from field observations would indicate that the same may be true in mixed-coniferous forest on the east side of the Cascades in Washington because of the relatively high number of owls consistently breeding in forests managed via partial harvests.

**Service response:** The Service agrees in general with this comment, but cautions that use of the lower limit of the age range (i.e., 30 years post harvest) as an indicator of when habitat may be recolonized by northern spotted owls may not be correct. More confidence could be placed in a mean value. The Service also notes that these forests frequently had remnant older trees that they did not arise as a consequence of large-scale clearcuts, and that the estimate of 30 years is for coastal redwoods only and cannot be extrapolated to other tree species or regions.

**Comment:** A researcher commented that in a monitoring study of Miller Mountain funded by the Medford District of the Bureau of Land Management, he and his colleagues examined owl use in areas with limited old growth, but relatively large amounts of diverse young forest and previously partially cut stands. They found a crude

density of 0.246 adult and subadult owl per square kilometer in one area, and 0.263 in a second (Wagner and Meslow 1989). This compares to 0.197 owl per square kilometer for the central western Cascades of Oregon (Miller and Meslow 1988) and 0.229 owl per square kilometer in northwestern California (Franklin and Gutierrez 1988). During 1989 in the vicinity of Medford, the mean number of young fledged/successful pair was 1.47 and the number of young fledged per pair was 0.437 ( $n=64$ ) (Wagner and Meslow 1989).

**Service response:** The Service accepts this comment.

**Comment:** One commenter believed the Status Review Supplement applied the Fretwell-Lucas-Rosenzweig theory of habitat distribution in birds incorrectly because all the references pertained to passerines (songbirds). Also, according to this commenter, the Fretwell-Lucas concept predicts that a average individual fitness may well be equal across a gradient of suitability because density-dependent interactions will reduce average fitness of individuals in the best habitat where populations may be more dense. Hence, the commenter maintains that northern California data collected in 1989 could be interpreted as establishing that managed forests are equally as suitable as is old growth, because densities were high and reproductive rates also appeared to be high.

**Service response:** The Service does not believe that the discussion in the Status Review Supplement pertaining to the Fretwell-Lucas theory of habitat distribution is invalidated simply because the examples presented were of passerines. The Service notes the other points raised in this comment, but considers them conjecture only.

#### Is Young Growth As Good As Old Growth for Spotted Owls?

**Comment:** According to one commenter, as suitable habitat diminishes, ecological density will increase in the short term, even if the population size remains stable, because the individuals will be occupying less habitat; therefore, ecological density is a poor measure of population change over a short sampling period.

**Service response:** The Service accepts the comment as being in general agreement with existing ecological theory and pertinent to research on the owl.

**Comment:** Irwin *et al.* (1989d) found a rate of 0.05 response/mile in 40–120-year old forest in southwestern Washington. Sixty percent of the surveyed tract consisted of trees less than 60 years old. The commenter noted that this contrasts

with a rate of 0.08 response/mile that Forsman *et al.* (1977) found in surveying the largest and oldest stands. Irwin *et al.* (1989a) found 53 nest sites, all of which were in young growth and many in 70–80-year-old stands. Five were in stands 40 years old. According to this commenter, the Status Review Supplement misrepresented the results of the Irwin *et al.* (1989c) study. He noted that Irwin *et al.*, found that owl responses per mile in younger growth were approximately one-third of that of adjacent old-growth habitat, but 82 percent of his forested area was less than 60 years of age and had a low survey effort. Also, Irwin reported that he did not sample 1,500 miles as mentioned in the Status Review Supplement because some routes were covered 2–3 times, so the actual transect length was less; however, he did not provide a corrected survey length.

**Service response:** The Service believes that the best way to compare owl abundance is to calculate number detected/mi<sup>2</sup> rather than number detected per linear mile, and Irwin *et al.* (1989d) used the former approach in their final analysis of these data. Irwin *et al.* (1989d) detected 0.01 owl/mi<sup>2</sup> and 0.002 pair/mi<sup>2</sup>. They detected one pair in one year in stands less than 80 years old. In the study by Forsman *et al.* (1977) old-growth stands occurred in small, isolated patches, which the authors hypothesized were probably too small to provide suitable habitat. In contrast, for surveys elsewhere in this region on sites where >60 percent of the area was older forest, the average number of pairs/mi<sup>2</sup> was >0.10. Examination of all currently available evidence thus shows that spotted owl abundance in southwestern Washington is much lower in young forests than in older forests. In the Service's opinion it is incorrect to characterize the stands studied by Irwin *et al.* (1989a) as 40–80 years old because they had been selectively harvested, and therefore contained trees of various ages. The nest sites, for example, were in trees varying from 67 to 700 years old.

**Comment:** One commenter cited relative owl density figures of 0.12 response/survey mile in young growth vs. 0.18 response/mile in old growth (Garcia 1979) to indicate that there is not much difference in densities of owl occurrence between the young- and old-growth stands.

**Service response:** Garcia (1979) surveyed only 11 km of transect in young forest. Since that time, many more studies, in which much larger areas were surveyed, have been carried out. The results (see discussion under Factor A) indicate clearly that northern

spotted owls are far more abundant in older forest than in stands less than 80 years old.

*Comment:* One comment provided density figures for stands ranging from 30–80-year-old managed second growth with no old growth to lands with substantial old growth and some fragmentation. On the youngest stands, densities ranged from 0.14 owl/sq. km. to 0.38 owl/sq. km. Areas with some fragmentation but substantial old growth ranged in density from 0.064 owl/sq. km. (Olympic Peninsula) to 0.235 owl/sq. km. on the Willow Creek Study Area in northern California.

*Service response:* These younger stands were either in the redwood zone and contained both remnant older trees and some stands up to 100 years old or they were in the interior of California and included stands that had been selectively harvested. The Service acknowledges that such stands often do support populations of northern spotted owls. These stands, however, occur on less than 15 percent of the range of the northern spotted owl (see discussion under Factor A). Throughout the rest of the range, even-age harvest methods predominate and the rotation age is expected to be less than 80 years on most areas. There is now abundant evidence that owls are rare or absent in such stands (see discussion under Factor A).

*Comment:* One commenter noted that about half of the 27 pairs he and his colleagues found in relatively young managed forests in northern California had access to a few trees in small patches of older forests (about 2–3 percent of the sites) (Irwin *et al.* 1989b). Further, this researcher stated that numerous fledgling owls in extensive old growth were observed to have been killed in a severe storm on Memorial Day 1989. Because their surveys started late, it is possible that the number of owls that bred may have been higher, according to this researcher.

*Service response:* The Service accepts the factual content of this comment, but notes that the speculation that more owls may have bred, is conjecture.

*Comment:* The Timber Association of California study (1989b) found densities of 0.37 owls/sq. mile or 0.14 owls/sq. kilometer in managed young-growth in northern California. Irwin *et al.* (1989b) note that these estimates for northern California surveys of private lands are similar to population densities reported in Willow Creek in the Six Rivers National Forest by Franklin and his coworkers (1986, 1987, 1988). Franklin *et al.* reported densities of 0.32 owls/sq. mile for territories and 0.56 owls/sq. mile for individuals. Industry's

preliminary findings on studies over 920,000 acres (360,000 ha) in northern California in second growth noted that the number of fledglings appeared to be greater in second growth of all types than in old growth. One commenter stated that spotted owls were living and reproducing by the 100's if not 1,000's in managed forests.

*Service response:* The Service accepts the data presented by the Timber Association of California and Irwin *et al.* (1989b).

The assertion that 100's if not 1,000's of owls are living and reproducing in managed forests is essentially correct if managed forests are defined as all forest in the range of the owl. The Service has recognized that approximately 2,000 pairs of owls have been verified throughout the range of the owl (USDI 1990). On nonreserved forest lands available for timber harvest, however, the Service estimates there exist about 1,400 pairs. Whether this estimate represents "1,000's" of owls is a subjective determination, and as such the Service does not accept the comment. Instead, the Service presents the estimate of the number of owls on lands managed for timber production.

*Comment:* The Timber Association of California submitted comments that its data indicate that timber harvesting in northern California under current regulation and practice does not diminish overall spotted owl density or viability. The Timber Association of California believes that an owl will successfully incorporate substantial clearcut areas into its home range and reconfigure its home range as needed, even relocating its nesting area following timber harvest. Also, according to the Timber Association of California, owls may successfully live in managed forests subject to any combination of silvicultural prescriptions, including those resulting in extensive fragmentation. In the Timber Association of California studies, it was concluded that the limiting characteristics to nesting and roosting habitat are tree size—at least 30 to 40 feet in height, canopy closure—greater than 50 percent, and proximity to water and foraging habitat including appropriate perch sites and prey base.

*Service response:* Assertions that owls may successfully live in any combination of silvicultural prescription, including those that result in extensive fragmentation, that they will reconfigure their home range and relocate nesting areas, and that harvest practices under current law in northern California do not diminish owl density or viability, remain untested and represent speculation on the part of the Timber Association of

California. The Service has reviewed current regulations and policies pertaining to private, State, and Federal land and concludes they are inadequate to provide sufficient protection to the northern spotted owl's habitat (see Factor D in the Summary of Factors Affecting the Species section). The Service does not accept this comment.

Although the Timber Association of California concludes that the limiting factors for owl habitat are trees 30 to 40 feet in height, canopy closure > 50 percent and proximity to both water and foraging habitat, these merely represent the lower limits to observed ranges. Mean age of trees in known and presumed nest stands evaluated by the Timber Association of California (1989a: appendix b, Part 2) ranged from 45 to 60 years in coastal redwood and redwood/Douglas-fir stands and 45 to 80 years in interior California stands dominated by Douglas-fir. Canopy closure was 80 percent to 90 percent and 70 percent to 80 percent, respectively. Two hardwood stands containing nests had mean tree ages of 40 to 65 years and canopy closure of 80 percent. Mean age and canopy closure of coastal redwood stands associated with nests in Mendocino County were similar to those reported by the Timber Association of California (44 to >150 years of age; canopy coverages 73 percent to 91 percent) (Timber Association of California 1989b: appendix b, Part 2).

Over 90 percent of the roosts examined by Forsman *et al.* (1984) were in old-growth forest. Studies from the Six Rivers National Forest, California (Klamath province), also indicate that owls roost in habitat containing both an over- and understory component (Solis 1983, Sisco and Gutierrez 1984). Overstory there was dominated by Douglas-fir > 45 inches dbh and the understory by hardwoods such as tanoak (*Lithocarpus densiflorus*) 4 to 20 inches dbh and 15 to 70 years of age. Mean estimated canopy closure for summer roosts was 87 percent. Additional estimates of canopy closure recorded at northern California roost sites in Douglas-fir habitat ranged from 40 percent to 90 percent (Gould 1975, Cordan and Cordan 1981). Information on habitat attributes of an additional 18 roost sites located on private timber lands in California was supplied by the Timber Association of California (1989b: appendix B, part 2). Overstory canopy closure ranged from 55 percent to 90 percent and 75 percent to 90 percent in sites predominated by Douglas-fir and hardwoods, respectively. Because these values are substantially in excess of those listed in

the comment, the Service rejects the specific values of the commenter.

*Comment:* One commenter stated that survey data indicate that commercial thinning as well as either selective or group harvesting methods are compatible with owls in at least some areas such as the eastside of the Washington Cascades, southwestern Oregon, and northern California. Further, he stated that population data suggest that some level of disturbance may be beneficial to owls. He noted further that during a Forest Service briefing on April 5, 1990, Dr. Barry Noon stated that if elevational effects are statistically removed, there was more chance of finding a spotted owl pair in general managed forest than within current reserved areas (Wilderness Areas, National Parks, etc.). The commenter also stated that all existing data indicate that road building is not detrimental to the owl or its habitat.

*Service response:* The Service agrees that some silvicultural practices may be compatible with owls, such as those that would enhance habitat suitability at younger stand ages, but also notes that no data exist to support this conclusion. A variety of silvicultural treatments must be assessed before definitive statements can be made on this subject (see Thomas *et al.* 1990).

The Service does not accept the comment that work by B. Noon can be used to support the assertion that disturbance is beneficial to northern spotted owls. One variable in the analysis referred to was status of land classified as reserved (i.e., mostly higher elevation wilderness areas) or nonreserved (i.e., lower elevation forest managed for timber). Densities of owls were greater on the nonreserved than reserved lands, but not because the nonreserved lands are subject to "disturbance" factors. Rather, the nonreserved lands, by virtue of their being lower in elevation, are more productive timber sites and provide more favorable owl habitat. Thus, the likelihood of owl presence is not a consequence of disturbance but rather of the fact that, once elevational effects are removed, nonreserved lands are more productive forest.

The Service agrees that effects of roads on northern spotted owls are unknown.

*Comment:* One commenter stated that the Status Review Supplement did not include results of the Gutierrez and Call (1988) report on the California spotted owl that found no significant differences between the number of California spotted owls in old growth and in second growth. The commenter continued that Wagner and Meslow

(1988) found spotted owl densities comparable to old growth in highly fragmented forests with substantial second growth.

*Service response:* Work by Gutierrez and Call (1988) was considered in preparing the Status Review Supplement. In addition, the Service notes that Gutierrez and Call's work was on the California subspecies, not the subspecies proposed for listing.

Wagner (letter of 18 April 1990) disputes the assertion that his study site could be considered as highly fragmented. The Service therefore does not accept the comment that spotted owl densities in highly fragmented forests with second growth are comparable to densities in old growth.

*Comment:* A commenter stated that current intensive timber management particularly by clearcut, has not been effective in maintaining spotted owl habitat features. She continued that current intensive management in the general forest involves short timber rotations which preclude development of multi-canopy layering that is vitally important to spotted owls. According to the commenter, it is therefore not reasonable to equate mature natural fire stands that have been studied to intensively managed second growth, which has not been studied in terms of capability to support reproductive owls.

*Service response:* The Service accepts this comment.

*Comment:* One commenter cited a definition (Pulliam 1988) of population sinks as local areas where mortality exceeds reproduction, but where the population persists because of immigration. One commenter feels that the Status Review Supplement implies that young growth represents a population sink, with lower densities, depressed reproduction, and an increase in home range size. The commenter believed this statement is incorrect with respect to the Klamath Province. One commenter expressed the opinion that the Service does not recognize the "packing phenomenon" and that if the Service embraces the packing theory, then the data used to assess habitat suitability and comparisons of habitat quality will need to be reevaluated.

*Service response:* Population "sinks" represent local areas where mortality exceeds reproduction (after Pulliam 1988). Although the commenter maintains that the characterization of young-growth forest as a sink is incorrect, he presents no evidence to substantiate his assertion. The Service maintains, as it did in the Status Review Supplement, that the implication that young growth serves as a population sink represents an hypothesis only. The

commenter provided no data or other information to support his belief that young growth in the Klamath Province does not act as a population sink.

The Service has never stated that it does not recognize the concept of "packing" and does not accept the comment that recognition of this concept would require wholesale re-evaluating of its habitat evaluations. Mobile animals have the capability to move from disturbed habitats to less disturbed habitats. Packing can be considered a temporary increase in local density of individuals (in less disturbed patches). Such local increases are not indicators of healthy populations and can, in fact, be misleading if considered as positive indicators (Van Horne 1983).

*Comment:* One researcher stated that current second-growth owl studies are at least four to six years away from demonstrating the existence of a self-sustaining population, and that birds occupying second-growth areas have fitness or survivorship equal to that of populations found in comparable geographic areas with old growth habitat. He suggests that studies document quantified habitat structure, tree species composition in the overstory and understory, age of dominant trees, habitat quantity by seral stage, and logging method or salvage prescription that resulted in the stand to assess conditions of second growth.

*Service response:* The Service accepts this comment in general, and notes that extensive research is being conducted by a variety of State, Federal, and private organizations. However, the Service notes that sufficient data are available to make a decision on the status of the owl.

*Comment:* One conservation organization responded that reports of owls in second growth are inconsequential. These commenters maintained that second growth areas that support owls are mostly coastal redwood retaining snags, coarse woody debris, and other structural features, and are extremely productive in that trees are able to grow rapidly and therefore attain some of the attributes of old growth at a much younger age than do Douglas-fir forests in Washington and Oregon. Hence, the commenters stated, this represents a special case with little relevance to other areas. Further, these commenters indicated that different silvicultural practices may permit a faster return to suitability, but that all practices result in a loss of habitat for some period of time.

*Service response:* The Service agrees that the conditions arising in coastal California redwoods are specific to that

region only, and that extrapolation of the results elsewhere in the range of the northern spotted owl would be improper. The role of silvicultural practices in "creating" suitable habitat for northern spotted owls remains uncertain and requires further research (Thomas *et al.* 1990: appendix T).

#### Is Old Growth Preferred Habitat?

*Comment:* One commenter responded that in the Status Review Supplement, it was assumed that a direct loss of owls was correlated with loss of old growth, and that only growth provides suitable habitat. According to the commenter, even though 90 percent of the presently known spotted owl sites in Oregon contained a major component of old growth forest, the Service cannot demonstrate that owls depend on old growth because surveys in young growth may have been minimal. The commenter maintained that only six surveys cited in the Status Review Supplement looked at younger growth (Meslow *et al.* (1986), Forsman *et al.* (1977, 1986), Irwin *et al.* (1988), and Kerns (1988)): of these, only Irwin tried to compare owl sites between old and young growth. As indicated by the commenter, as of early 1989, only two studies were designed to find owls specifically in young growth (Kerns 1988 and Irwin *et al.*, 1989d).

*Service response:* In the Status Review Supplement the Service reviewed all available studies on the use of young and older forests by northern spotted owls. The Service did not assert that only old growth provided suitable habitat but that surveys of spotted owls had demonstrated a clear association of spotted owl with mature and old-growth forests. In the 1990 Status Review (USDI 1990), the Service further examined the use of forest stands of various ages by spotted owls. Various studies (Forsman *et al.* 1977, Wickham 1981, Postovit 1977, Forsman 1986, Irwin *et al.* 1989d, Bart and Forsman 1990), have shown conclusively that throughout most of their range, northern spotted owls are absent or rare in stands younger than approximately 80 years of age. Irwin *et al.* (1989d) surveyed young-growth stands (<80 years) in southwestern Washington detected only 1 pair of spotted owls in a survey of 277 square miles of young growth. Bart and Forsman (1990) investigated the abundance of northern spotted owls throughout their range in areas containing extensive 50 to 80-year old stands but little older forest. They found that the density of pairs was about 40 times higher in nearby areas that had substantial areas of older forest. The Service concludes from the available biological data that northern spotted

owls require large tracts of land containing significant acreage of old-growth and mature forest to satisfy their life history requirements (i.e., foraging, breeding) and that stands less than 80 years old seldom provide habitat for spotted owls (USDI 1990).

*Comment:* In one person's opinion, the Status Review Supplement only reports limited portions of study results to support the conclusion that the spotted owl prefers old growth. The commenter further stated that although many of these studies may show some owls utilizing old growth in greater proportion than its availability, owls also use other habitat types. In the commenter's view, this coupled with a bias for surveying predominately old growth, results in misinterpretation of the study results, such as occurred with Meslow *et al.* (1986) and Solis (1983). For example, mature/old growth comprised 63 percent of the area within the home range, but was used 74.4 percent of the time by the owls (Solis 1983). The commenter concluded that although owl use in old growth was greater than expected based on the availability of old growth, these data cannot be considered significant.

*Service response:* The Service agrees that northern spotted owls do use habitat types other than old growth within a home range. The evidence, however, clearly demonstrates that owls having old growth forest in their home ranges select for it (USDI 1990). The Service rejects the comment that such habitat use studies are biased against other forest types. Within a home range, owls typically have a variety of forest types (e.g., old and mature forest comprised approximately <40 percent of the habitat in studied home ranges, USDI 1990: table 2.1) available for foraging, roosting, and other activities. Owls typically select against other habitat types, particularly pole/sapling and young forests. Clearly, since owls have access to these forest types in their home ranges, the statement of bias cannot be supported. In the example provided, availability of the old-growth forest type was 63 percent of the area and 74 percent of the owl observations were in this forest type. Using widely accepted statistical tests, such as the  $\chi^2$  test (Neu *et al.* 1974), it was demonstrated that there was a significant difference between availability and use. All owls studied by Solis (1983, table 5) demonstrated selection for mature/old growth forest. Data from surveys on both old and young forest also demonstrate that owl densities are lower on younger forests (USDI 1990). With the addition of data obtained during the recent comment

period, the Service believes there has been adequate coverage of the spectrum of forest types ranging from young to old. The Service rejects the comment that data such as these cannot be considered significant.

*Comment:* In one commenter's view, if floristic instead of age class descriptions of the habitat are used, the owl may be shown to use a different kind of habitat than what has been identified. Another commenter responded that population performance has not been evaluated across the full range of variability in structure and vegetation composition within the available environment. The commenter further stated that there is no quantified description of specific factors that constitute the niche requirement, or basic determinants, upon which the owls depend for survival and reproduction.

*Service response:* Floristic descriptions typically refer to species composition, and the Service agrees that different habitat types may be shown to be important if floristic rather than age class descriptions were used to define owl habitat. However, the Service contends that structural, not floristic characteristics, are more important to northern spotted owls. For example, owls use stands dominated by both redwood and Douglas-fir that contain structural characteristics similar to old-growth forest. Clearly, floristic definitions of these habitat types would differ.

Descriptions of stands based on structural characteristics generally agree with age class, particularly where clearcut harvest prescriptions have been used. In some areas (for example, in California), past harvest practices, such as allowing natural regeneration, retention of residual trees and selective harvests, have tended to mimic the structural conditions found elsewhere. Whether structural characteristics or age descriptions are used, owls are still associated with structurally diverse forest types. The Service recognizes that much of the confusion about age class stems from the application of age-related classifications developed in one region (e.g., Douglas-fir forests in the Oregon Cascades) to another region (e.g., redwood forests in California). For example, stands classified as "young" growth by Kerns (1989 a, b) and used to conclude that owls select for young growth can be reclassified as "old" or "mature" forest based on structural characteristics (USDI 1990). The Service maintains that structural rather than age classifications provide a better description of owl habitat.

The Service agrees that population performance has not been evaluated across the entire range of the northern spotted owl. To assess the population performance of the owl across the entire spectrum of vegetation variability would require an elaborate experimental scheme of enormous magnitude. The Service does not accept the inference that such data across the entire range of the owl are required prior to reaching a decision about the proposed rulemaking. Further, the Service rejects the comment that habitat features have not been quantified (see USDI 1990).

*Comment:* The Forest Service commented that recent Forest Service research has found more evidence that suitable spotted owl habitat is found in old growth.

*Service response:* The Service accepts this comment from the Forest Service.

#### Are Spotted Owls Dependent on Old Growth?

*Comment:* Several commenters noted that the Federal Register proposal concluded that old growth is required for survival of the owl based on several assumptions: 1. Owl density is lower in younger forests, and therefore owls are less abundant; 2. Reduction in old growth by timber harvesting will fragment habitat and increase home range size; 3. Prey is less plentiful in young forests; and 4. Spotted owls have been extirpated from private land. The commenters stated that pre-existing and new data contradict these assumptions, and that owls are almost as dense in young forests as in old growth. Further, they maintained that fragmentation does not appear to be detrimental, that home range size is not correlated with the amount of old-growth habitat, and that prey abundance is equal in young and old-growth forests.

*Service response:* The Status Review Supplement (USDI 1989) summarized information on abundance of owls in relation to stand age as presented by Forsman *et al.* (1977), Postovit (1977), and Forsman (1988), all of whom reported that owls were seldom found in forests <80 years old. Since then, analysis of owl abundance in younger and older forests clearly demonstrates that owl densities are substantially lower in younger forest, with the possible exception of some private lands in California (USDI 1990). These lands, however, have had markedly different harvest histories than the vast majority of public lands and have retained the structural characteristics of old-growth forest in some areas. Therefore, with the exception noted above, the Service rejects the comment that owl densities

are as high on younger-aged as on older-aged forest.

Effects of fragmentation considered by the Service to adversely affect northern spotted owls included direct elimination of key roosting, nesting, or foraging stands, potential increases in predation or competition risk, and the possible reduction of interactions between individuals (USDI 1989). All of these factors led the Service to conclude that fragmentation effects would be detrimental (USDI 1989). Since then, Meyer *et al.* (1990) have initiated a study examining fragmentation effects on northern spotted owls by comparing random sites on the landscape against those occupied by owls. Although results are still preliminary, sites occupied have significantly less fragmentation than randomly selected sites, suggesting that owls are less frequent in fragmented areas. Further analysis of the data is planned, but the authors "doubt that the large differences associated with old-growth habitat between random owl sites and random landscape locations will change considerably as a result of the additional data or the use of alternate statistical procedures" (Meyer *et al.* 1990). The Service therefore does not accept the comment that fragmentation does not appear to be detrimental.

The large size of home ranges in the Olympic Peninsula were assumed to reflect the adverse influence of fragmentation (USDI 1989). Although median percent acres of old-growth and mature forest within a home range varied from 25 percent in the Oregon Coast Range to 74 percent in the Klamath Province (USDI 1990), the assumption that these large ranges are a consequence of fragmentation has not been documented by the Service. Nonetheless, these data clearly indicate that northern spotted owls require large tracts of land containing significant amounts of old-growth and mature forest.

The Service never stated that prey abundance was lower in younger than older forests. Data presented in the Status Review Supplement (USDI 1989:2.7-2.8) quite clearly stated that although evidence regarding prey abundance was limited, prey abundances were similar in old and young forest stands. The Service therefore does not accept this comment.

*Comment:* Another comment stated that although the Status Review Supplement carefully avoids stating that the northern spotted owl depends on old growth, the proposed rule concludes that old growth is essential to the spotted owl's long-term survival, and assumes

that preference indicates dependence. According to the commenter, the Status Review Supplement avoided the term dependence and emphasized "preference" and "association" and offered little, if any, factual support for its assertion that old growth is necessary for the owl's survival. The commenters maintain that there is no showing that a preference for a single type of habitat evidences biological needs.

*Service response:* The Service agrees that no study has yet demonstrated true strict dependence on old-growth forest by spotted owls. Demonstration of dependence would require an elaborate experiment designed to specifically address the question. However, the overwhelming evidence is that owls are strongly associated with old-growth forest and not with young forest, and the evidence is strong enough for the Service to conclude that old-growth forest or forests with old growth structural characteristics are essential for northern spotted owls. Evidence indicating selection for older forest types and limited numbers of pairs of owls in young forests all indicate a strong association of northern spotted owls with older forest types (USDI 1990). Further, landscapes having large expanses of younger-aged forest have fewer owls and lower measures of productivity relative to landscapes with large portions of older forest. The Service contends that strong association demonstrates biological needs, particularly in the absence of significant numbers of owls in young forests throughout the range of the northern spotted owl.

*Comment:* One commenter cited testimony from a deposition of a state fish and game biologist (Gordon Gould, November 16, 1989 as cited in Oregon Lands Coalition, letter of December 19, 1989) that in a clearcut prescription for most redwood forest habitats in California, a site will be suitable for foraging by the owl within 30-60 years and roosting and nesting within 50-70 years. The commenter then asked how the Service can conclude that old growth is essential to the spotted owl's survival especially when the Service acknowledges that the spotted owl is not dependent on old growth? Numerous individuals said that knowledgeable experts believe that the owl does not select for old growth, just structural characteristics present in old growth and in other forest habitats. One commenter maintained that this issue must be resolved before the listing decision is made. Another commenter stated that because no one knows the

exact habitat characteristics selected by the spotted owl, there is significant scientific dispute and the proposal should be withdrawn.

*Service response:* Redwood forests are influenced by coastal conditions in California and are high growth sites. Strict age comparisons with old-growth forests further north which are mostly Douglas-fir, are therefore incorrect. As noted by Kerns (1988), redwood forests assume many of the characteristics of "old growth" at a younger age, presumably because of the influence of coastal conditions. The Service also notes that many of the age classes defined as young by Kerns (1989 a, b) could easily be reclassified as old or mature forest based on structural attributes (USDI 1990). These structural characteristics, while possibly arising at younger ages in redwoods, do not occur in Douglas-fir and hemlock-cedar forests until stands are > 100 years of age. The data clearly indicate that owls are associated with structural attributes that occur in older-aged Douglas-fir and hemlock-cedar forests (i.e., typical "old growth") and possibly in younger-aged redwood forests (USDI 1990). The Service therefore contends that old growth or forests with old growth characteristics are essential to northern spotted owls.

The Service agrees that structural characteristics like those present in old growth forests are most important to northern spotted owls.

The Service disagrees with the contention that a serious scientific dispute exists and contends that habitat attributes selected by owls are well documented (USDI 1990). In the Service's opinion ample scientific data exist on which to base a decision on the proposal to list the northern spotted owl.

*Comment:* Several stated that the Status Review Supplement misuses Ruggiero *et al.* (1988) because the Status Review Supplement assumes that old growth remained basically static. A number of commenters wrote that the Status Review Supplement is factually incorrect because change is characteristic of the Pacific Northwest. One commenter cited Teensma (1987) who showed that prior to arrival of Europeans, fires resulted in a rotational age of 78 years for the central western Cascades and, thereafter, rotational age was increased to 587 years (as cited in Irwin 1989b). The commenter feels that the Status Review Supplement ignores this by asserting that natural perturbations within old-growth forests have been small and localized. Several commenters maintain that to apply Ruggiero's *et al.* (1988) theory requires studying the full range of habitats over

the long-term to determine habitat preferences and this has not been done for the owl.

*Service response:* The Service acknowledges that the proposal did not place enough emphasis on the importance of natural perturbation such as fire in determining the overall forest landscape. The final rule acknowledges the significance of natural perturbations. However, timber harvesting results in a net decline over time in old-growth forest rather than a relatively constant amount that simply shifts across the landscape as might be expected in the case of natural disturbances considered over an extended period of time. Hence, the conclusion that historically the amount of old-growth forest may have been fairly constant is not unreasonable. The Service recognizes, however, that these statements represent conjecture.

Large-scale perturbations, such as the Mt. St. Helens eruption in 1980, the Tillamook burn in 1933, and the Cowlitz fire circa 1800 (Martin *et al.* 1974), do occur. However, the Service still contends that most natural perturbation would generally have been small and localized relative to the entire Pacific Northwest. Irwin (1989) cited Teensma (1987) as calculating a rotational age of 78 years in central western Cascades of Oregon. In contrast, Martin *et al.* (1976: table 2) estimated fire frequencies of 50 to 400 years and > 150 years for western Cascade Douglas-fir and hemlock forests, respectively. They further recognized that there exist a wide variety of factors influencing forest types and hence fire frequency, and implied that fire frequency should be expressed as a broad spectrum rather than a specific average value. Thus, while the Service accepts the fire rotation value of 78 years cited by Irwin *et al.*, it also recognizes that variability in fire frequency as noted by Martin *et al.* casts doubt on the use of a single average value as a meaningful estimate of fire rotation time.

Franklin *et al.* (1988) also examined the scale of 14 major fire events in Mt. Rainier National Park from 1230 to 1703 and estimated that these fires burned from 8 percent to 47 percent (median of 24 percent) of the park's reconstructed forested area. Fire rotation in the park was estimated at 465 years (Hemstrom and Franklin 1982). Given that these represent major fires events, it is not unreasonable to conclude that the impact of most other, non-major natural perturbations would be smaller. Moreover, since the arrival of European man, the most common disturbance in Pacific Northwest forests is clearcutting, a disturbance regime whose impact

differs markedly from wildfire (Franklin 1988).

The Service agrees that further study is required before Ruggiero *et al.*'s hypothesis can be validated for most species, not just northern spotted owls. However, the Service contends that overwhelming evidence exists that owls are strongly associated with forests having old growth structural characteristics and not with young forest lacking those characteristics (USDI 1990), and that the evidence is strong enough for the Service to conclude that forest with old-growth forest characteristics is essential for northern spotted owls. The Service does not accept the comment that data across the entire range of the northern spotted owl is required before reaching a decision on the proposed rulemaking.

*Comment:* According to one commenter, Ruggiero *et al.* is not persuasive because it does not discuss a number of scientific articles one would anticipate to be included in an in-depth review of ecological dependency and population persistence. The commenter maintained that Ruggiero *et al.*'s concept of ecological dependency does not account for cases where an important habitat is used less often than predicted by availability because the animal does not have to be there often to acquire a resource critical for survival.

*Service response:* The Service quoted Ruggiero *et al.* (1988) as stating "It is likely \* \* \* that habitat preferences are indicative of the long-term needs of a species \* \* \*," not that preference is equated with strict true dependency. The Service contends that Ruggiero *et al.*'s statement constitutes an hypothesis that remains largely untested. Questions about the adequacy of the literature base in Ruggiero *et al.*'s paper or its failure to account for all possible uses of habitat merely reflect opinion and as such are considered by the Service to represent opinion. Much like the conclusion that Ruggiero *et al.*'s concept of ecological dependency remains a largely untested hypothesis for northern spotted owls, the hypothesis that important habitat features could be used less often than predicted by availability is a largely untested hypothesis.

*Comment:* Before the Service adopts Ruggiero *et al.*'s theory of habitat association as the equivalent of ecological dependence, one commenter stated that it must, under the Endangered Species Act, determine whether the three subspecies are only ecotypes adapted to different climates and geographic regions (Smith 1989). In this commenter's view, the absence of variation between northern and

California spotted owls supports the ecotype theory (Smith 1989).

*Service response:* The Service accepts the decision of the American Ornithologists' Union that the northern spotted owl is a recognized subspecies (N. Johnson, letter of 12 December 1989) and rejects the comment.

*Comment:* The Forest Service commented that its recent research reiterates the importance of old growth in physiographic provinces where research is most complete (Oregon Coast Range, western Oregon Cascades). For example, Carey *et al.* (1990) restated the importance of old growth in this region; the proportion of home ranges in old growth explained 64 percent of the variance in the minimum convex polygon home range size, using regression analysis. The Forest Service concludes that these results provided strong evidence that spotted owls depend on old growth in the western hemlock zone in Oregon.

*Service response:* The Service accepts the comment from the Forest Service.

#### Issue 16. Habitat Trends

##### Definition of Old Growth

*Comment:* A number of commenters questioned the definition of old-growth forest—how old is old growth? Several commenters asked how it can be argued that only ten percent of the critical habitat is left when there is no agreement on a definition of old growth or how and when it was measured.

*Service response:* The Service recognizes that there exist numerous definitions of what constitutes old growth. In general, old-growth forest is characterized by a multi-layered canopy, dense tree canopy closure and the presence of dead and down material. Ages used to characterize old-growth vary as well, although age in excess of 200 years is generally agreed on (e.g., Forsman *et al.* 1994, Carey *et al.* 1990). Tree diameter at breast height has also been used in some instances (e.g., Allen *et al.* 1983, Hays *et al.* 1989b). Northern spotted owls, however, do not select habitat based on its age *per se*. Instead, owls likely select for structural characteristics that are correlated with older trees in some instances (e.g., Douglas-fir and Hemlock/cedar forests) and with younger trees in others (e.g., coastal California redwood forest). The Service believes it is more appropriate to emphasize structure instead of age. Hence, use of the term old-growth refers to the structural characteristics important to owls, not tree age *per se*.

##### Historical Amount

*Comment:* Several commenters noted that there is no widely accepted estimate of the amount of historical old-growth forest in the Pacific Northwest. They stated further that the assumption of 17.5 million acres in the Status Review Supplement is unsubstantiated and discounts the role of fire. Several commenters argued that the Service does not have the data to construct the historical quantity of old growth and concludes such an estimate is a guess, especially considering the impacts of natural disasters.

*Service response:* The Service agrees that estimating historical amounts of old growth is difficult. The estimate in the Status Review Supplement was based on published reports, which are cited in the Status Review Supplement. The Service did estimate the decline in amount of suitable habitat on lands managed for timber production by Region 6 of the Forest Service. In making its estimate, the Service assumed that approximately 70 percent of this land provided suitable habitat for northern spotted owls prior to widespread timber harvest. The basis for this estimate is explained in Factor A, and it was developed in consultation with staff of Region 6, Forest Service. The Service does not discount the role of natural perturbations such as fire, windstorms, volcanic eruptions, etc.

While it is true that the precise amount of old growth originally present in the Pacific Northwest is impossible to determine, the Service accepts the estimate of about 17.5 million acres provided by the Forest Service (USDA 1989) and accepted by ISC (Thomas *et al.* 1990). This figure does factor in the probable fraction of forest land in young stages due to fire, volcanism, storms, and other natural events. It is quite clear that old growth has been severely reduced due to harvest, and that there is considerably less than what was originally present.

*Comment:* A conservation organization quoted Norse (1989) regarding the amount of historical old growth; estimates range from 78.5 percent (27 million acres) (Brown and Curtis 1985) to 90 percent of western Washington and 80 percent of western Oregon (Harris 1984) as being old-growth forests. The commenter felt that these estimates seem high and allowed for an overestimate of 20 percent, resulting in an estimate of 19 million acres of old growth before settlement.

*Service response:* Because of the difficulties of determining the amount of original old growth in the Pacific Northwest, it is not surprising that

estimates differ. The Service accepts the Forest Service estimate of 17.5 million acres (see above comment).

##### Current and Future Habitat Trends, Amount of Old Growth Remaining

*Comment:* Another commenter noted that the Forest Service's estimate of 6 million acres of old growth remaining west of the Cascade Range in Oregon and Washington is too high and that a more realistic estimate is about 3 million acres. When The Wilderness Society analyzed six National Forests, it found the amount of old growth to be about 45 percent of that estimated by the Forest Service. Hence, The Wilderness Society calculated that 1.1 million acres of suitable habitat remained on these six national forests. Further, the Society stated that had its estimate of available suitable habitat been used in the viability analysis presented in the Forest Service SEIS, a much lower probability for survival would have been predicted under the preferred alternative F. When one considers that a substantial proportion of the remaining old growth is adjacent to roads or clearcuts, the amount of viable old growth may be less than one-third of that estimated by the Forest Service, according to one view. One commenter reported that a recent survey of the Willamette National Forest by the Forest Service found that the actual old growth was 36 percent less than what was presented in the draft forest plan.

*Service response:* The Forest Service currently (USDA 1989) estimates that about 4.2 million acres of habitat suitable for the spotted owl is found in its lands in Oregon and Washington. This includes old growth and mature forest that has structural characteristics similar to that of old growth. The Wilderness Society (Morrison 1983) used a more restrictive criterion for old growth. The Service accepts the Wilderness Society figures that 1.1 million acres of old growth exists on the six forests he studied (Mt. Baker-Snoquaimie, Olympic, Gifford Pinchot, Mt. Hood, Willamette, and Siskiyou): the Forest Service estimates that there are 2.6 million acres suitable for spotted owls (about 44 percent of which is old growth by Morrison's criteria in these 6 forests). The Service accepts the Forest Service acreage figures as suitable for owls because spotted owls do, in fact, use mature forests.

Morrison points out that 52 percent of old growth forest occurs in areas modified by roads and clear cuts, and thus fragmented to varying degrees. Owls are adversely affected by fragmentation, responding to a

decreasing percentage of suitable habitat with decreasing density (USDI 1990). An unknown fraction of suitable habitat may, in fact, be incapable of supporting any owls because it is so highly fragmented (USDI 1990). Because the impacts of fragmentation were not adequately considered, the FSEIS (USDA 1988) estimate of spotted owl viability was probably too high.

In the draft forest plan, the Forest Service estimated that the Willamette National Forest contains 639,000 acres of mature and old growth habitat and later revised the estimate to 636,600 acres (USDA 1989). However, updated estimates suggest 552,920 acres of suitable habitat remains, a decline of just under 9 percent. Because old growth and mature forests are being logged, these acreage figures will continue to decline. The Service has found no evidence that Forest Service estimates of the amount of remaining old growth are 36 percent less than presented in the draft forest plan.

*Comment:* The Forest Service's Regional Forester, Region 6, estimates that there are 6.23 million acres of old growth in Oregon and Washington, of which approximately 2.97 million acres are available for timber harvesting. One commenter cited Norse (1989), who estimated that only 13 percent of old growth acreage present in the Pacific Northwest prior to European settlement remains.

*Service response:* The Service has calculated that there are about 5.84 million acres of habitat suitable for spotted owls (mature plus old growth) in Washington and Oregon, of which about 3.59 million acres (61 percent) is available for timber harvesting. This does not include some State, tribal, or private lands with habitat available for harvest; estimates are small. About 17.5 million acres of old growth was present in the Pacific Northwest at the time of settlement. About 6.79 million acres of mature and old growth forest is currently estimated. According to Morrison (1988), somewhat less than half of suitable owl habitat meets his old growth definition. Spotted owls now inhabit some coastal redwood stands that were cleared at the end of the 19th century. However, the occupied stands show many of the characteristics of old growth, which develop far more rapidly in redwoods growing under the high-site conditions in coastal northern California than do other tree species elsewhere within the range of the spotted owl. It is incorrect to assume growing conditions in the redwoods, which comprise about 7 percent of the owl's range, apply elsewhere. Spotted owls thrive primarily

in those areas on public lands (especially the National Forests) that have been little-modified by timber management. Their density decreases as the percentage of suitable habitat in the landscape declines (USDI 1990). With the possible exception of the coastal redwood zone and some forests that have been selectively harvested, there is no evidence that spotted owls thrive on private land that has been harvested. Only 38 of 906 known reproductive pairs have been located on private land, only two of them in Washington and Oregon (Thomas *et al.* 1990)

*Comment:* Several commenters stated that because spotted owls are now known to be living on land cleared at the turn of the century, spotted owl habitat lost during clearcutting develops into suitable habitat more quickly than previously believed. These individuals stated that spotted owls thrive within national forests and private forested lands and are abundant in second growth. A commenter said that the status review is notably deficient in its forecasts of future timber harvesting trends (see graph on 2.19 of status review). He had heard that the Forest Service, the Bureau of Land Management, and industry say they need 25 more years before they enter second growth. Hence, by his calculations there are still 25 more years of old growth on non-reserved lands plus 2.7 million acres in reserved lands (74 percent of what is now present). Another said there are 6.2 million acres of old growth in the Pacific Northwest, plus an additional 943,000 acres of old growth in national parks within Oregon and Washington, and 403,000 acres owned by the Bureau of Land Management for a total of 7.3 million acres. Of this amount, the commenter stated that 2 million acres are preserved and cannot be harvested and asked how it can be said that we are on the verge of cutting the last old growth.

*Service response:* The Service acknowledges that there are spotted owls living in regenerated forest in the redwood zone and some interior areas of northern California that were clearcut at the turn of the century. However, as described under Factor A, some of these areas contained residual old growth. Because of favorable site conditions, stands in the redwood zone apparently grow more rapidly than in the rest of the range and achieve the old growth structural attributes that are characteristic of spotted owl habitat at an earlier age.

Private timber companies are currently harvesting second growth timber. Also, the Siuslaw National

Forest anticipates that 74 percent of its annual harvest over the next 10 years will consist of trees 60 to 80 years old. The Forest Service plans to harvest about 40,000 acres of old growth per year (1 percent of its supply); this represents a decline in the harvest rate of about 20,000 acres/year. The Bureau of Land Management is currently harvesting 3 percent of its old growth/year, and anticipates running out of old growth in 12 years on the Eugene District, 14 years on the Salem District, and 17 years on the Coos Bay District. Therefore, the Service does not agree that a 25-year supply of old growth remains available for harvesting.

The Service agrees that there are about 2.7 million acres of suitable habitat in reserved lands (National Parks, Wilderness Areas, Research Natural Areas, etc.). The Service calculates that there are about 6.796 million acres of suitable owl habitat remaining in all ownerships in the Pacific Northwest; this includes 5.06 million acres held by the Forest Service, .878 million by the Bureau of Land Management, and .570 million by the National Park Service. However, this does not include State, tribal, or private land. Anticipated harvest schedules will continue to result in a decline in spotted owl numbers.

*Comment:* The Wildlife Society stated that the 1989 surveys on the Olympic Peninsula showed an increased loss of critical habitat in the Cedar River watershed, Interstate 90 Corridor, Clearwater block on the Peninsula, Columbia River Gorge area, southwestern Washington, and many other areas. Further, The Wilderness Society stated that it had examined the amount of old growth now available and concluded that the northern spotted owl has lost over 80 percent of its preferred habitat. The Society cites Morrison's (1989) estimates that suitable habitat consists of 1,153,000 acres, including 816,000 acres of optimum habitat; this is compared to 2,714,000 acres of habitat that is referenced as being available in the Forest Service SEIS.

*Service response:* The Service accepts that there has been a continuing decline in suitable habitat throughout the range of the spotted owl, and calculates that about 6.79 million acres of suitable habitat remains (39 percent of what was present at settlement). Morrison (1988) excludes mature forest (which is used by spotted owls) from his calculations of suitable owl habitat (old growth), yet mature (>100 years old in Region 6) forest is used by spotted owls. Recent Service calculations (USDI 1990) show that there are 4.2 million acres of

suitable habitat on Forest Service land in Region 6 (not 2.7 million), of which 1.5 million is reserved or unsuited for harvest.

*Comment:* One commenter who owns over three million acres in second growth in Oregon and Washington provided data on the number of acres of habitat that would be present in 60–120, 130–240, and > 250 year old stands in the future.

*Service response:* The Service has considered the information presented.

*Comment:* Simpson Timber Company argued that owls return to regenerating forest after 30 years. Simpson noted that it takes perhaps 10–20 years to harvest substantially one drainage. Since this company is on a 60 year rotation, it stated that for 40 out of every 60 years, each drainage will have owls and that at any one time about 50 percent of Simpson's 380,000 acres in California will support owls. Given that if it takes 10 years to harvest a drainage, Simpson stated that 20 years after the logging operation is completed, at least some of the regenerating stand will be 30 years old and will provide suitable owl habitat.

*Service response:* The Service cautions that use of the lower limit of the age range (i.e., 30 years post harvest) as an indicator of when habitat may be recolonized by northern spotted owls may not be correct. More confidence would be placed in a mean value. The Service also notes that these forests had remnant older trees, that they did not arise as a consequence of large-scale clearcuts, and that the estimate of 30 years is for coastal redwoods only and cannot be extrapolated to other tree species or regions. Hence, in regard to current logging practices, the Service believes it would be premature to conclude that for 40 years of a 60-year rotation schedule, suitable habitat for owls will be present throughout all stands > 30 years of age.

*Comment:* One commenter said that evidence indicates there are several million acres of land currently 30–60 years of age that is available for spotted owls. Further, the commenter stated that existing inventory data indicate the presence of 4.4 million acres in pole timber stands, 11.6 million acres in small saw timber (11–21 dbh), and 4.1 million acres in large saw timber.

*Service response:* With the possible exception of coastal California redwood forest, the evidence clearly indicates that forest 30 to 60 years of age is selected against by nesting, roosting and foraging northern spotted owls, and that few owls exist in landscapes containing large amounts of forest 30 to 60 years of age (USDI 1990). The Service does not

accept the comment that all commercial forests 30 to 60 years of age can be considered available for northern spotted owls.

The Service has considered the comment regarding the estimates of timber, but has no way to verify the amounts indicated or the exact condition or structural characteristics of the stands indicated. In the Service's opinion not all of this timber is considered suitable owl habitat.

*Comment:* One commenter asked how much young growth is on private lands today that will provide habitat over the next few decades; what percent of private timber lands will constantly be coming into or existing in a successional stage that will provide owl habitat; and how much land currently 30–60 years of age is available in the Pacific Northwest?

*Service response:* Although the figures requested by the commenter are unavailable, the Service has found that spotted owls do not occur in significant numbers or densities on lands under even-aged management (clearcuts), the principal method of timber harvest on about 95 percent of all forest land, private and public. Thus very little acreage in young growth today will reach an age suitable for owls because rotation ages will preclude the growth of young stands into habitat suitable for owls.

*Comment:* Several commenters argue that the Status Review Supplements' failure to consider future new forests is fatal to estimating future habitat trends. According to the commenter, the Status Review Supplement ignores young-growth forest acreage that may develop old-growth characteristics or conditions during the next 60 years, because conversion of younger habitat to mature was not expected to be significant unless current logging practices change. The Timber Association of California commented that it estimated that at least 1,137,999 acres of industrial California forest land is expected to produce owls. Another commenter referenced the State of California's "California's Forests and Rangelands: Growing Conflict Over Changing Uses" (1988) and stated that by the year 2010, the amount of tree volume in California will begin to increase by 50,000,000 mbf in 50 years from the regrowth of forests. The Timber Association of California estimated the number of acres of land subject to different management intensity and stated that it believes over 8,400,000 acres in California will be available for owl nesting within and for the foreseeable future, an amount "significantly larger than the Status Review Supplement would lead one to

believe (over 8,400,000 acres vs. 963,000 acres (Status Review Supplement 2.25, Table 1))." Sierra Pacific Industries stated that it had used the Wildlife Habitat Relationships system of vegetation typing to estimate the amount of habitat that will be maintained and created on its land. According to the commenter, this system underestimated the amount of suitable owl habitat because its vegetation types are based on the size and density of overstory trees and generally neglects understory components. Further, Sierra Pacific retains 60,000 acres in watercourse protection zones (8.5 percent of its land base) and stated this is superior owl habitat. An additional 120,000 acres is unsuitable for timber production. Hence, Sierra Pacific commented that about 180,000 acres or more than 25 percent of its ownership is dedicated to non-timber management.

*Service response:* The Service agrees that forests systems are dynamic and that "new" forests arise through time. However, much of this new forest is harvested before it reaches the age it can be considered suitable habitat for owls. For example, current timber plans call for the harvest of most Douglas-fir forest at approximately 70 years of age, close to the age at which stands begin to be used by owls. Thus, conversion of young forest to mature is not expected to add significant amounts of habitat suitable for owls unless current logging practices change.

The Timber Association of California's submittal to the Service included estimates derived from Smith and Self (1989), who present a table entitled "Suitable Habitat Table" (page 24) for owls in California. It contains estimates for five categories of land, including industrial lands with a timber emphasis, non-industrial lands with a timber emphasis, non-timber emphasis lands, retained lands (i.e., incidental timber production), and preserved lands. Under each of the categories is an estimate of the amount of each land type (acres) multiplied by a proportion that, according to the Timber Association of California, represents the proportion of each land base that is available owl habitat (e.g., Preserved  $1,723,935 \times .9$ ). For example, the "lightly or never harvested" subcategory is multiplied by 20 percent. The Timber Association of California assumes that all lightly or never harvested land constitutes suitable owl habitat, even though this amount is defined as rock outcrops and landslide, land that clearly cannot be considered suitable owl habitat. Consequently, a land base multiplied by this figure overestimates owl habitat.

Similar concern can be expressed about the 90 percent multiplier used to estimate the amount of suitable habitat on retained and preserved lands. The 90 percent multiplier for preserved lands was created by recognizing that 10 percent of the land is unsuitable due to fire, disease and other natural disturbance (100 percent—10 percent=90 percent). Clearly not subtracted were the same geographic features mentioned under the industrial lands category. The Service contends that it is unreasonable to assume these features are present on industrial lands, but not present on preserved lands, and that they constitute suitable owl habitat. Therefore, the 90 percent estimate used to estimate the amount of suitable habitat in both preserved and retained lands is too high and results in an overestimation by the Timber Association of California of the amount of suitable habitat. The Service notes that the "regenerated but unharvested" subcategory is multiplied by 0.4, but the accompanying description provides no explanation as to how the 0.4 estimate was derived. In fact, no explanations were provided for any of the proportional estimates used. The Timber Association of California states that these resultant values are estimates of the amount of timber not being harvested at any one time (e.g., "When harvesting prescriptions other than clearcut are appropriate, vegetation after harvest is often suitable owl habitat" page 20) or of habitat " \* \* \* considered unsuitable for harvest \* \* \* " (page 21). Apparently the Timber Association of California is maintaining that all the resultant value (amount  $\times$  proportion) in each category is suitable/potential habitat capable of providing the habitat attributes necessary to sustain viable populations of northern spotted owls. Moreover, many of these values are carried through all the calculations used to estimate available land, resulting in probable overestimations for every land category mentioned by the Timber Association of California. By letter dated February 21, 1990, the Service asked the Timber Association of California to provide clarification of this table including an explanation of how the figures were estimated. However, no response was received.

In evaluating this table, ISC (Thomas *et al.* 1990) notes for example the Timber Association of California calculated that at any given time 40 percent of the 1,750,787 acres of industrial timber land that has regenerated (700,307 acres) will be in stands old enough to provide suitable spotted owl habitat. However,

in making its predictions, the Timber Association of California assumed that all such habitat is capable of supporting owls and used rotation ages for coastal areas of 50 to 60 years and inland areas of 80 to 90 years, whereby suitable habitat would become available in 25–30 years and 40–50 years post harvest in each area, respectively (Thomas *et al.* 1990). Although some habitat within these age-classes does support owls, the ISC believes that the Timber Association of California underestimated by about 50 percent the age at which habitats in these areas usually attain the attributes associated with spotted owl habitat (Thomas *et al.* 1990). Similarly, the ISC believes that the Timber Association of California has provided an optimistic prediction that 1,037,671 of 2,599,177 acres of timber-emphasis lands owned by small landowners will be suitable owl habitat at any given time (Thomas *et al.* 1990). The degree to which these lands will be subject to harvest will depend on the timber market which reflects the demand for lumber, changes in company ownership, impacts of corporate takeovers, and other market uncertainties.

The Service also notes that 103,100 acres of spotted owl habitat were estimated for reserved areas (parks, Wilderness Areas, or other protected ownership) in California by the ISC (Thomas *et al.* 1990). In contrast the Timber Association of California calculated there were 1,732,985 acres of preserved lands (parks, Wilderness Areas) in California of which 90 percent (1,559,886 acres) were predicted by the Timber Association of California to be suitable spotted owl habitat at any given time. The Service estimates there are 1,145,000 acres in Wilderness Areas in California of which 148,900 or 13 percent is estimated to be suitable spotted owl habitat (USDI 1990, USDA 1989). Hence, whereas the Timber Association of California predicted 1,559,886 acres of preserved lands would be available at all times as suitable spotted owl habitat, the Service estimates this figure to be 148,900 acres, and the ISC estimates it at 103,100 acres. Although data are not available to review every component of the Timber Association of California's suitable habitat table, it is the Service's opinion that the Timber Association of California's overall estimate of 8,408,531 acres of "expectable and owl habitat" in California at any given time is substantially overestimated. Given the lack of explanation for how the estimates were derived, the clear lack of any reasonable biological basis for some

of the multipliers used to estimate suitable owl habitat, and what the Service contends is the resultant overestimation of the amount of suitable habitat in preserved lands, the Service rejects the specific figures of available habitat presented by the Timber Association of California.

Although the State of California's "California's forest and rangelands: growing conflict over changing uses" document states that the amount of tree volume will begin to increase by approximately the year 2010 (California Department of Forestry and Fire Protection 1988), the Service contends that current rates of loss of suitable owl habitat are such that the owl population is undergoing a rapid decline (USDI 1990).

The Service does accept the comment that the Wildlife Habitat Relationships (WHR) underestimated suitable owl habitat. Because the WHR system only identifies overstory trees, there is no way to determine whether an understory component is present or absent. Consequently, it is impossible to distinguish between lands having an understory and overstory component from lands having only an overstory. In this circumstance the WHR system will more likely overestimate suitable habitat by including all habitat having an overstory component.

Streamside protection zones are narrow strips, at most a few hundred feet wide, that are found along certain streams. Not every stream has a streamside protection zone. Although they cannot be clearcut, 50 percent of the canopy within the zone in California can be removed at each harvest entry. Sierra Pacific states these zones occupy 8.5 percent of its land base; however, owls make little use of areas with less than 20 percent older forest (USDI 1990). Hence, streamside protection zones do not provide a significant amount of suitable habitat for northern spotted owls. Given that owls demonstrate selection for forest having high canopy coverage for roosting, nesting and foraging purposes, it is unlikely that canopy coverage of 50 percent can be considered superior habitat. The Service does not accept the comment that streamside protection zones provide superior owl habitat.

Areas outside streamside protection zones and considered unsuitable for timber production are not necessarily suitable for owls. For example, many of these areas are too small, lack one or more of the structural characteristics of suitable owl habitat, or lack forest cover. Furthermore, as harvest techniques improve or timber prices rise,

areas once considered unsuitable for timber production may be reclassified and harvested. For these reasons, lands considered unsuitable for timber production cannot be relied upon to provide suitable habitat for northern spotted owls. The Service does not dispute the commenter's estimate that 25 percent of its land base is dedicated to non-timber management, only that not all of the noncommercial acreage can be considered suitable owl habitat.

*Comment:* The Timber Association of California submitted additional comments during the last comment period. The Timber Association of California reports using a growth and yield computer model to estimate the approximate time to grow timber to size classes and densities in which owls have been found roosting, nesting, and foraging. Based upon these models, the Timber Association of California suggests that the commercially managed regenerating tracts alone may provide all the attributes needed by owls. Further, that when combined with non-managed areas that contain "residual trees" such as riparian areas, the Timber Association of California believes that between 20-35 percent of the interior managed landscape in California will support these "residual tree" stands that maintain suitable spotted owl structural characteristics. The Timber Association of California stated that the previous studies used the age of "wild" rather than managed stands to predict the time required to attain structural characteristics attributed to suitable spotted owl habitat. In the Timber Association of California's opinion, by applying appropriate forestry techniques, stands with these attributes can be achieved in one-half to one-third the time that would be required for wild stands.

*Service response:* The Service notes that this comment is conjecture only. There is no evidence that commercially managed tracts alone will provide all the attributes required by spotted owls. Although studies on private land in California indicate that stands managed using uneven-aged methods often continue to support owl populations or support them at earlier ages than if the stands had been clearcut, it also is clear that stands less than 80 years of age seldom provide suitable habitat for northern spotted owl (USDI 1990). Further, northern spotted owls are rare or absent where less than 20 percent of the region is suitable habitat (USDI 1990). Most timber production land is managed using even-aged logging methods. Once stands more than 80 years old have been harvested it is

improbable that these areas will support spotted owls (USDI 1990). Although clearly the stands less than 80 years of age in the redwood zone in California support spotted owls, such stands are expected to eventually fall into a 60-80 year, or possibly less, rotation schedule whereby they will attain the attributes of spotted owl habitat for a relatively brief period before they are harvested. Further, harvesting methods today in this zone are less likely to leave the remnant old growth as was done in the early 1990s. In fact, under current harvest management such large, remnant trees will not be present in future stands (USDI 1990). Further, analysis indicates that owl productivity per pair was lowest in areas with little older forest; hence, this suggests that even if some owls persist in these areas, it is probable that their productivity rate would be insufficient to maintain the population long-term (USDI 1990). The Service maintains that it is extremely unlikely given current and anticipated management strategies for commercial forest lands, that these lands will provide a significant amount of suitable northern spotted owl habitat. Moreover, the commenter provided no empirical evidence that modern forestry techniques are capable of regenerating spotted owl habitat in one-half to one-third the time required for wild stands to be reforested, although there is evidence that uneven-aged management may provide suitable habitat in younger stands.

*Comment:* One researcher stated that he was not aware of any owl populations that exist in young even-aged (<40 years) stands established by clearcuts, followed by site preparation and planting, and he hypothesizes that spotted owls depend on old growth. He maintained that if the predicted harvest trends are coupled with preferred clearcutting harvest methods and short rotation age, then the limited managed (i.e., second growth) conditions under which spotted owls now exist would be eliminated. He argued that if spotted owls are abundant and widespread in second growth, then spotted owl populations will be more heavily impacted in the future because a much larger proportion of the population will be unmanaged or unprotected. The commenter stated that for private land to make significant contributions would entail a change from clearcut to alternative harvesting methods, a change in appropriate silvicultural prescription, longer rotation time, and encouragement of hardwoods, in some forest types.

*Service response:* The Service accepts the comment that no populations apparently exist in young even-aged (<40 years) stands established by clearcuts and followed by site preparation and planting. The Service also contends that northern spotted owls clearly and consistently select old-growth forest or forest with old-growth characteristics (USDI 1990).

The Service maintains that northern spotted owl habitat will continue to decline if predicted harvest trends and current harvest methods continue. Forest systems are dynamic, and timber not considered suitable at one point in time may become suitable at another. However, current timber plans call for harvest of most Douglas-fir at approximately 70 years of age, close to the age at which stands begin to be used by owls. Moreover, the rate at which old-growth forest is declining due to harvest far exceeds the rate at which it is regenerating.

The Service accepts the comment that for private lands to make a significant contribution to the habitat base for northern spotted owls they would have to change some silviculture practices, but notes that several private landholders in California already practice some of these techniques.

#### Impacts From Natural Perturbations

*Comment:* A commenter stated that new forests are quite vulnerable to climatic shifts resulting in the loss of more habitat. Natural forest ecosystems in old growth are expected to show greater resistance to change and to recover more quickly from wildfire, storms, pest and pathogen disease than intensively managed forests.

*Service response:* The Service accepts the comment.

*Comment:* Massive natural disturbances (wind, fire, disease) are common in the Douglas-fir forests of the Northwest according to numerous commenters. That being the case, if these natural disturbances have not led to the extinction of the spotted owl, the commenters asked why will logging. In the view of several commenters, because uncontrolled natural disturbances of the past did not threaten the owl, modern timber harvesting which mimics natural disturbances in a controlled manner should not pose a threat.

*Service response:* The Service agrees that natural disturbances like fire are an integral component of coniferous forests in the Pacific Northwest. According to Franklin (1988), windthrow tends to accelerate succession towards climax species by eliminating larger trees and

leaving shade-tolerant seedlings and saplings untouched. Fire, in contrast, tends to favor the establishment of early successional species. However, impacts from clearcutting, the common current perturbation on Pacific Northwest forests, are not analogous to natural disturbance (Franklin 1988). Successional paths and nutrient cycling are disrupted by logging and subsequent replanting and other silvicultural practices (Franklin 1988). Other factors important to the proper functioning of a diverse ecosystem, such as nonarboreal plant species and snags and down logs, also are typically removed during logging. These factors distinguish logging from natural disturbances. Wildfire, in contrast, typically leaves individual trees and groups and stands of trees that enhance rapid revegetation and reestablishment of trees, even when the fire is extremely large (e.g., the Tillamook Burn) (Franklin 1988). In addition, timber damaged from windstorms and light intensity wildfire obviously was not salvaged until the arrival of European man and would have been left on the landscape. Current U.S. Forest Service practices call for the timber from natural perturbations like wildfire and windstorms to be salvaged as soon as possible for commercial interests. Clearly this does not mimic natural disturbance regimes, where the residuals from wildfire and windstorm would naturally recycle into the ecosystem. Pathogens can create significant disturbances in some situations but are not considered as important a disturbance factor in the Pacific Northwest as in other conifer forests (Franklin 1988). The Service contends that the assertion that current logging practices mimic natural disturbance patterns is unwarranted and the Service rejects the comment.

*Comment:* Fire intensity, severity, and duration were exacerbated by managed young-growth in the 1987 fires in California that burned thousands of acres of potential SOHA stands distributed throughout the landscape according to one researcher. He continued that these younger stands carried the fire to the crown of many old growth stands.

*Service response:* The Service accepts the comment.

*Comment:* One researcher stated that of 52 nest sites on the Wenatchee National Forest that he studied, 97 percent were influenced by fire in the last 40 years (Irwin *et al.* 1989a). The commenter cites Huff (1984) who notes that wildfire is considered important in the distribution of Pacific Coast conifers and without such fires (or other

disturbances) to remove the canopy and duff layers, establishment of Douglas-fir would be severely restricted.

*Service response:* The Service accepts the comment that fire plays an important role in the Pacific Northwest but again notes that current logging practices do not mimic natural disturbances.

#### *Issue 17. Fragmentation*

*Comment:* Issues pertaining to the impacts of forest fragmentation on owl distribution and numbers were raised by various commenters. One asked if the increased home range of birds residing on the Olympic Peninsula relative to birds further south could be attributed to something other than habitat fragmentation. Another commenter suggested that fragmentation of habitat on the Olympic Peninsula may only be a contributing factor to the population decline and that a combination of factors, such as natural causes and being on the edge of the subspecies' range, may be responsible. Another asked if we are trying to maintain the spotted owl on the Olympic Peninsula in a portion of its range which may not be conducive to its survival.

*Service responses:* It is probable that the increased home range exhibited in the northern part of the northern spotted owl's range results from a combination of factors. Possibilities include a different or sparser prey base, harsher climatic conditions, and perhaps different vegetation composition or structure. There is no indication that any factor, other than amount of suitable habitat, has changed during the past few decades on the Olympic Peninsula. The Olympic Peninsula is within the owls' historic range. There is no reason for believing that populations there will not be viable if adequate habitat for them is available.

*Comment:* Several commenters argued that larger home range sizes in Washington and Oregon may be attributable to this being the periphery of the distribution of the owl, rather than reflecting any effects of fragmentation. In the view of these commenters, if home range size was directly correlated with poor quality habitat, then presumably home range in Oregon and Washington would be smaller because home ranges there contain a large proportion of old growth. Several commenters stated they believe that prey is equally abundant in young and old-growth forests and, therefore, the adverse effects from fragmentation are disproved. They argued that high densities of owls in fragmented private forest lands in California, coupled with successful reproduction, indicate that

the concern for impacts of fragmentation is unwarranted. One commenter wrote that the issue needs to be further researched.

*Service response:* The Service agrees that the large home range size in Washington may be related to being near the edge of the subspecies' range. The relative abundance of different prey in old-growth and in different kinds of young-growth has not been studied well enough for clear patterns to emerge. Evidence does exist, however, that over all or most of the northern spotted owl's range, including public land in California, increasing fragmentation is associated with decreasing owl abundance (see discussion under Factor A). The Service agrees that the issue of prey abundance in different habitats warrants additional research.

*Comment:* Another commenter stated that the proposal failed to account for or address the implications of harvest unit size restrictions imposed by the National Forest Management Act on fragmentation of spotted owl habitat. Someone stated that the proposal ignores a study done on highly fragmented Bureau of Land Management land that shows some of the highest densities and best reproduction known for the spotted owl.

*Service response:* The National Forest Management Act sets upper limits on the size of clearcuts, but under current harvest schedules, most of the land will be maintained at ages too young to support owls (see discussion under Factor A or Issue 15). The Service agrees that some highly fragmented land managed by the Bureau of Land Management contained high numbers of northern spotted owls, but they were associated with the few remaining parcels of old-growth, and, as in other areas, numbers were higher in portions of the study area with the greatest amount of old-growth. The Service also accepts that densities in these areas may be examples of "packing."

*Comment:* Several parties assumed the position that no ill effects for the owl have been demonstrated to result from habitat fragmentation. These commenters argued that the Status Review Supplement implies that fragmentation is detrimental to the owl, yet predation and competition were not shown to increase because of fragmentation. According to several commenters, the impacts of fragmentation on home range and the importance of these impacts, if any, is unclear. Further, there is nothing detrimental per se to increased home range size. One commenter argued that because spotted owl hunting methods do

not involve long flight, home range size should not even be an issue. Another commenter argued that data in the States Review Supplement on home range contradicts the Status Review Supplements' assumption that an increase in home range size is related to fragmentation.

*Service response:* The discussion of Factor A shows clearly that owl densities in landscapes with little old growth are significantly lower than those in less fragmented landscapes containing more contiguous old growth. The number of owls, number of pairs, and number of young produced per square mile all decline significantly as the level of fragmentation increases. The mechanism that leads to these declines is not known nor has it been demonstrated that fragmentation leads to increased home range size.

*Comment:* The Forest Service reports that results of recent research (Carey, in review) suggest that light fragmentation may increase the variety of prey available, but that this benefit is short-lived as the young seral stages grow into closed-canopy sapling-pole stands. One commenter noted that according to a recent study (Chavez-Leon 1989), owls within areas of highly fragmented spotted owl habitat in northwestern California may have lower fitness than owls in nearby more contiguous habitat.

*Service response:* The Service noted the cited studies with interest and anticipates that additional research on these points will be carried out.

*Comment:* One commenter stated that isolation is not demonstrated to result from fragmentation, at least not in California. Another commenter maintained that survival of the spotted owl is only dependent on two families being able to exchange members and breed: as there are many such families capable of interbreeding, the northern spotted owl is neither endangered nor threatened.

*Service response:* The Service agrees that slight isolation, caused by timber harvest or other factors, undoubtedly does not endanger a population. But if current trends in California and elsewhere continue, then large portions of the northern spotted owl's range will contain only widely separated patches of suitable habitat (see discussion in Factor A). Under these conditions successful dispersal and genetic exchange would be difficult or impossible. The Service maintains that survival of the spotted owl is predicated on the maintenance of sufficient suitable habitat to provide for long-term viability throughout the range. By maintaining well distributed owls, genetic exchange should be sufficient. The Service does

not believe that the future success of the spotted owl is merely dependent on two owl families interbreeding.

*Comment: Meyer et al. (1990)* submitted a progress report on work assessing the influence of habitat fragmentation on spotted owl site selection, reproductive status or site occupancy for Bureau of Land Management lands in western Oregon. In the Coast Ranges and Klamath Provinces, the results indicated that considerably more old-growth habitat and larger average tree size in old-growth patches were found within random owl sites than within random landscape sites. Although the results are preliminary because not all data have been evaluated, the authors stated that they doubt these general preliminary findings will change with the incorporation of additional data into the analysis. One commenter stated that the Meyer *et al.* progress report suggests that once a pair of spotted owls has 500 acres of suitable habitat available, there is less of an effect of fragmentation of the remaining landscape on the pair's reproduction and behavior.

*Service response:* This commenter seems to imply that habitat outside the 500 acres surrounding an owl site is of little importance to northern spotted owls. The study by Meyer *et al.* (1990), however, does not lead to that conclusion. Meyer *et al.* (1990) found significant differences between randomly selected sites and both 0.8-km-radius circles centered on owl sites and 3.4-km-radius circles centered on owl sites. The differences were larger between the 0.8-km circles and random sites, but the larger circles were also significantly different from the random sites indicating that "site selection may also be influenced to at least some degree by habitat quality in an area at least as large as 3500 ha (8800 acres) \* \* \*" (Meyer *et al.* 1990). The Service agrees with Meyer *et al.* (1990) that habitat in an areas of at least 8,800 acres around the owl site appears to be important to northern spotted owls. Meyer *et al.* (1990) reported that their analysis of reproduction showed similar trends to the site occupancy results; they did not study behavior.

#### Issue 18. Management Activities

##### Estimates of the Amount of Habitat Per Pair

*Comment:* One commenter expressed the opinion that the Chief of the Forest Service said he will set aside 7,800 acres per pair; thus making it impossible for the Forest Service to implement the short-term timber sale compromise pending before Congress (note; section

318 did pass). Someone else said that the Fish and Wildlife Service announced a tentative plan to set aside 8,000 acres, or 14 square miles for every pair of spotted owls. A party commented that only 10-15 acres of old growth are needed to support a pair of owls. Others said there was no proof that an owl cannot survive in 1 acre, 100, or 640 acres. Someone else said that in Roseburg, Oregon, the Bureau of Land Management found two pairs over a 10-year period in an isolated 80 acre tract of old growth, and questioned the owls' requirement for large blocks (2,000 acres or more) of old growth for survival. One commenter stated that it is unclear why the emphasis is on preserving old growth in large acreage tracts when the spotted owl seems to need more specialized habitat which might be enhanced rather than hindered by management techniques.

*Service response:* The Chief of the Forest Service in the Forest Service Record of Decision, established the following SOHA acreages: Olympic Peninsula, 3,000 acres; Washington Cascades, 2,200 acres; Oregon Cascades, 1,500 acres; Oregon Coast Range, 2,000 acres; and Klamath Province, 1,000 acres.

Median home range size of paired northern spotted owls ranged from 1,411 acres in the Klamath Province to 9,930 acres in the Olympic Peninsula (Thomas *et al.* 1990). Not unexpectedly, as the home range size increased, so did the actual acreage of suitable habitat contained in the home range. The median percent of old-growth forest within home ranges varied from 25 percent to 74 percent. Even when the lowest percentage value is multiplied by the lowest median range size, the value exceeds the 10 to 15 acres suggested adequate for owl survival. Data from home range studies clearly demonstrate that northern spotted owls require large tracts of land containing substantial amounts of suitable habitat.

The Service considers the observation of 2 pairs in an isolated 80 acre block of old growth over a 10 year period an incidental observation and not indicative of the requirements of northern spotted owls.

The Service agrees there is some indication that owl habitat might be enhanced through certain silvicultural practices (see also Thomas *et al.* 1990), although the effects of specific silvicultural prescriptions remain unknown at this time.

##### Spotted Owl Habitat Areas (SOHAs)

*Comment:* Several commenters asked if the SOHAs were established based on

biological or economic considerations. Setting aside SOHAs with large blocks of old growth is a misguided approach according to one person because there was no systematic attempt to sprinkle SOHAs on private land, yet the birds are still there. One individual believes that SOHAs have increased in size from 640 to about 4,600 acres without a sound basis.

*Service response:* The establishment of SOHAs is based primarily on biological considerations; SOHAs must include certain amounts of habitat suitable for owls within a 1.5 mi. or 2.1 mi. radius circle. The amount of suitable habitat required depends upon the physiographic province in which the SOHA is established, and this is based upon owl home range sizes. For example, in the Klamath Province of California and southern coastal Oregon, where median home range sizes vary from 1,692–3,314 acres that include 800–2,484 acres of suitable habitat, SOHAs should contain 1,000 to 1,250 acres of suitable habitat, respectively. In the Olympic Peninsula (Washington), the median home range of a pair of spotted owls is 9,930 acres, of which 4,579 is suitable habitat: SOHA acreages are 3,200 acres of suitable habitat within a 2.1 mi. radius circle. Site selection for SOHAs depends on both biological and management considerations. The Forest Service has no authority to establish and manage SOHAs on private land. A system of areas managed for the owl is necessary on public lands because northern spotted owls generally are scarce in privately managed timberlands throughout most of its range. No reproductive pairs are known from private lands in Oregon, 2 have been found in Washington, and 36 are known from private land in California (of a total of 906 known reproductive pairs) (Thomas *et al.* 1990).

The basis for the SOHA dimensions was determined by radio-tracking spotted owl pairs and determining their spatial requirements. The largest SOHAs (on the Olympic Peninsula) are required to contain 3,200 acres of suitable spotted owl habitat.

*Comment:* Someone reported that the Forest Service had sold a sale adjacent to a SOHA so that it could study the effects of logging on the northern spotted owl. Even though road construction and logging were underway during the course of this study, the owls were located and found to be nesting. Juveniles were observed, but not every year. A biologist stated that on the Siuslaw National Forest, there were 11 breeding pairs between 1984 and 1989 of which seven were in SOHAs. Of the

four breeding pairs outside of SOHAs, two have logging within 100 yards of the nest sites and habitat of the third may be included in a land exchange.

*Service response:* The SOHA system is designed to protect a limited amount of suitable habitat within a specified radius (1.5 or 2.1 miles). Other commercial forest stands within that circle, including parcels adjacent to protected units with breeding pairs of owls, can be harvested.

According to the Forest Service, there are 22 designated SOHAs on the Siuslaw National Forest, of which 8 (36 percent) contained reproductive pairs of spotted owls. Sixty-nine percent of all known reproductive pairs on the Siuslaw were found in reserved land, SOHAs, or in lands unsuited to timber production. The Siuslaw Forest Plan anticipates a 29 percent decline in spotted owl habitat over the next 50 years.

*Comment:* The Forest Service commented that in 1989, 92 percent of the SOHAs in Region 6 and 95 percent in Region 5 were occupied. In 1988 and 1989, more than 50 percent of SOHAs in each physiographic province in Region 6 had a resident pair at least for one of these years. During 1989 in Region 5, 95 percent of the SOHAs were occupied by at least one owl, 58 percent contained pairs, and 46 percent contained pairs with young. In comparison, for random sample areas in reserved sites, 40 percent were occupied, 14 percent contained pairs, and 83 percent contained pairs with young; for random sample areas in non-reserved sites 67 percent were occupied, 25 percent contained pairs, and 82 percent contained pairs with young.

*Service response:* The Service has considered these data in the assessment of the status of the spotted owl. Most forests report modest occupancy of SOHAs by owls. Forest Service figures indicate that 67 percent of SOHAs on the Olympic National Forest have contained breeding owls in the last 10 years. Comparable figures are 52 percent for the Washington Cascades, 36 percent for the Oregon Cascades and Coast, and 47 percent for the Klamath Province (best year, 1988–89). It is equally important to consider how many reproductive owls occur in areas other than SOHAs, reserved areas, or lands unsuitable for timber production. The figures for this suitable and available habitat range from 79 percent (Winema National Forest) to 0 percent (Okanogan National Forest) in Region 6, and from 84 percent (Six Rivers National Forest) to 24 percent (Klamath National Forest) in Region 5.

*Comment:* The Forest Service comments included a report by Lamberson *et al.* (1989) that concluded that crowding of adult owls into remaining suitable habitat as logging of spotted owl habitat continues is likely to lead to very high occupancy rates in SOHAs—much higher than expected under long-term stable conditions. Therefore, the authors conclude that caution should be exercised when using occupancy data to infer the condition of the population.

*Service response:* The Service accepts the comment.

*Comment:* One commenter questioned the statement in the Status Review Supplement, "Future management options are lost if SOHAs are deficient" because of the amount of small and large saw timber in the Pacific Northwest, and suggested that the Service interpret net habitat change over the region.

*Service response:* Most SOHAs have been placed in areas with good owl habitat. Even so, few of them could be enlarged if it were required. In Region 5, for example, the percentage of SOHAs with 1,000 acres of suitable habitat within a 2.1 mi. radius circle ranges from 56 percent (of 50 SOHAs in Mendocino National Forest) to 100 percent (of 50 SOHAs in Six Rivers National Forest). These figures reduce to 14 percent and 82 percent for 1,500 acres on the Mendocino and Six Rivers National Forests, respectively, and 4 percent and 68 percent, respectively, for 2,000 acres. Clearly, options have already been lost in forests like Mendocino, in which barely half the SOHAs contain the requisite acreage.

Larger areas of suitable owl habitat are required in most forests in Region 6. For example, Olympic National Forest must provide 3,200 acres in its SOHAs, yet only 69 percent of them have 3,000 acres. Because habitat is so fragmented over the owl's range, it would be difficult to add new SOHAs, or expand many of those already established.

The Service has considered net habitat change over the entire range of the spotted owl. About 1 percent of suitable habitat on Forest Service lands and 3 percent on Bureau of Land Management lands is being cut each year, leading to an inexorable decline in the owl population. Even though younger forest is regenerating, anticipated rotation ages are short enough to prevent most of this younger growth from developing to a stage where it would provide suitable habitat for the spotted owl.

*Comment:* A recent survey of Bureau of Land Management and Forest Service

personnel by the Interagency Spotted Owl Scientific Committee indicated that fewer than one-half of the SOHAs could be expanded (Thomas *et al.* 1990). Also, existing SOHAs within most of the physiographic provinces would need to be increased 65–80 percent to reach mean amounts of suitable habitat in spotted owl home ranges. The general opinion as revealed in the survey was that options are fast disappearing. Sales for fiscal years 1989 and 1990 are in proximity to a high proportion of SOHAs. A commenter stated that its organization had been informed by the Forest Service that there exist empirical data from spotted owl inventories over the last two years indicating that the SOHA network may have been working as intended, with only moderate long-term risk to the species.

*Service response:* The Interagency Scientific Committee found that about 20 percent of the SOHAs in the Pacific Northwest failed to contain their 1988 target acreages because of insufficient suitable habitat before section 318 called for expanded SOHA acreages (for one year) throughout the range of the owl. Clearly, there are no options for these SOHAs, for no suitable habitat remains to add to them.

Most SOHAs do not need to be increased 65–80 percent to include the acreages required in the Record of Decisions or Section 318. In Olympic National Forest, 27 of 30 SOHAs contain 2,000 acres of suitable habitat, while 21 (89 percent) contain the 3,000 acres required under the Record of Decision. In the Siuslaw National Forest, 21 (95 percent) SOHAs contain the requisite 2,000 acres, and all could be expanded to include 2,500 acres as required under Section 318. The Four National Forests in the Washington Cascades have designated 138 SOHAs: 83 (60 percent) of them contain the requisite 2,500 acres within a 2.1 mi. radius circle. The Mendocino National Forest in California has many SOHAs with small acreages of suitable habitat, and only 30 percent of them contain 1,000 acres, and only 2 (4 percent) of them could be expanded to 1,500 acres. While 20 percent of the SOHAs in Region 6 (Oregon and Washington), and about 38 percent of those in Region 5 (California) fail to meet their acreage requirements, the shortfall is about 20–60 percent, not as severe as suggested by this commenter.

Many timber sales are near SOHAs simply because that is where much of the good timber remains. According to the Thomas *et al.* (1990) report, and contrary to the Forest Service's Record of Decision, options are fast disappearing, and will no longer be

available in 5 years. In a thorough review, the ISC (Thomas *et al.* 1990) concluded that the SOHA network is fatally flawed and does not provide long-term protection to the owl.

#### Interagency Spotted Owl Scientific Committee (ISC) Conservation Plan

In August 1988, an interagency agreement was signed by the Forest Service, Bureau of Land Management, National Park Service, and Fish and Wildlife Service establishing the Interagency Scientific Committee to Address the Conservation of the Northern Spotted Owl. This committee prepared a conservation plan (Thomas *et al.* 1990) for the northern spotted owl and released the plan in April 1990. To accommodate inclusion of the biological information in the plan pertaining to the status of the owl, the Service reopened the comment period on the listing proposal on March 29, 1990.

*Comment:* Numerous commenters reviewed the ISC conservation plan and submitted comments on the plan to the Service. A number of commenters stated that the plan was sufficient to postpone or delay indefinitely the listing decision. Others said the plan went too far in restricting harvesting. A number of commenters said that if the plan is approved and implemented, there will be no need to list the spotted owl and, therefore, the Service should withdraw the proposal. Still others stated the plan was unproven and that the owl should be listed regardless of whether the plan is accepted and implemented. A commenter stated that the public comment period should remain open indefinitely until such time as the documents used to develop the ISC plan are available for public review, inspection, and analysis such that the public can comment on the management plan. The commenter further wrote that the Service's consideration of the ISC plan should be limited to the information that is documented in the plan and should give no weight to the overall conservation strategy in the listing decision. Moreover, it is the commenter's opinion that the underlying data used in the ISC report are not part of the Service's administrative record on the owl listing proposal and, therefore, the Service cannot consider personal communications regarding such data.

*Service response:* The Service has responded to comments generated by the ISC plan only insofar as they are germane to the listing decision. Comments pertaining to the adequacy of the plan or the need or lack thereof to list the owl in light of the plan will not be addressed specifically. As discussed under Factor D "Inadequacy of Existing

Regulatory Mechanisms," the Service regards the ISC document as a draft plan that remains largely untested. Its possible effectiveness, therefore, is yet to be tested. There is no assurance that the plan will be approved by the four agencies, nor that it will be implemented. Most importantly, however, it is uncertain whether the plan, if fully implemented, would be sufficient to recover the northern spotted owl. Even if the plan were to be implemented using accredited, proven methodology with a high likelihood of success in protecting the species, anticipated implementation of the plan is not sufficient justification for the Service to withdraw the proposal or delay its decision on listing. The Service sees no need to reopen the comment period further for individuals to comment on the validity or lack thereof of the ISC plan. Although the specific strategy suggested in the plan did not enter into the Service's decision on the proposal, the Service did review data on which portions of the plan were based. These data were entered into the administrative record on this listing proposal during the open comment period and were available along with the entire record for public inspection, by appointment. It is the Service's opinion that the conservation strategy developed in the ISC plan presents a possible starting point for the development of a recovery plan for the owl. Under provisions of the Act (Section 4(f)), the Service is required to develop recovery plans for listed species that are likely to benefit from such plans. If any conservation strategy is undertaken and successfully implemented so that the northern spotted owl no longer requires the Act's protection, the Service will consider a delisting action.

#### Other Management Plans and Options

*Comment:* One commenter reported that because owls can live in mixed-age managed forests, the Service should be able to provide suitable habitat for owls. Numerous commenters stated that recent research suggests that it is possible to provide owl habitat in managed forests. Others said that remnant old-growth trees remaining after timber harvesting contain nesting pairs of spotted owls, and provide further evidence that it is possible to provide suitable owl habitat in managed forest. Another commenter argued that owl research, to date, has focused on assessing habitat damage caused by timber harvesting and this is the wrong approach. According to this commenter, the question that needs to be asked is.

"What habitat conditions must be present in a managed forest to insure the survival of a viable owl population?"

*Service response:* The Service agrees it may be possible to provide suitable owl habitat in managed forest in some locations and under certain conditions. Evidence from private lands in California, for example, suggest that owl populations may survive in forest subjected to repeated harvest entries. Such methods tend to create a multilayered canopy with mixed ages of trees. However, more than 95 percent of the timber harvest occurs using clearcuts, a method not immediately conducive to the creation of mixed-age timber stands.

The Service does not accept the comment that owl research has focused on assessing damage caused by timber harvest. Most research has assessed how owls perform in a landscape where timber harvest has occurred and is made independent of any subjective assessment of damage. In general, habitat conditions in most managed forest—even aged stands with little structural diversity, young age classes of trees due to short rotation periods—are not conducive to a viable owl population.

*Comment:* Several commenters stated that Bureau of Land Management and Forest Service personnel are capable of developing habitat management plans for the owl, that they are doing a fine job, and that they should be trusted to continue to do so. In contrast, another party stated that current forest plans do not protect habitat. Someone else asked what effect Forest Service plans will have on the Service's decision and whether they are sufficient to maintain the spotted owl. Several commenters expressed confidence in reforestation plans that will suffice for all species.

*Service response:* Although Forest Service and Bureau of Land Management personnel have developed an elaborate network of habitat areas for the spotted owl, there is no guarantee that those areas will protect the owl. The Bureau of Land Management has set aside 121 agreement areas, yet 12 of these are temporary (one year), and the other 109 (228,000 acres) are not permanently protected—they could be changed when new management plans are completed in 1992. In fact, 72 percent of all known owls on Bureau of Land Management land are not covered in the agreement area network. Overall, suitable habitat on Bureau of Land Management land is declining (being harvested) at a rate of about 3 percent per year. There are 644 SOHAs in the Forest Service network, as well as additional acreage in

wilderness areas and other reserved lands. However, the SOHA system has been criticized and may be incapable of sustaining a population of owls due to inherent problems with fragmentation, and loss to fire, storm, volcanos, or administrative decisions. Additionally, with harvest rates anticipated to be about 39,400 acres per year, about 1 percent of spotted owl habitat on Forest Service lands will be lost each year.

Obviously, the anticipated loss of most Bureau of Land Management suitable habitat, and about 70 percent of Forest Service habitat, has been carefully considered by the Service. It is the Service's opinion that current management plans are insufficient to prevent the continued loss or degradation of suitable spotted owl habitat and that current regulatory mechanisms are inadequate (see Factor D in "Summary of Factors Affecting the Species" section).

Reforestation plans may prove insufficient to provide suitable spotted owl habitat if the rotation age is such that the regenerated stands are harvested prior to attaining the attributes associated with owl habitat. The role of silvicultural treatments needs to be assessed to determine which management systems produce suitable spotted owl habitat and the amount of such habitat that can be regenerated.

*Comment:* According to one opinion, at the current rate of harvest there is a 60-70 year supply of old growth left. By that time there will be new stands of trees to take the place of old growth. Another party believes it is possible to harvest without decreasing the spotted owl population yet maintain the sustained yield and timber harvest to supply the needs of industry from an economic standpoint. One individual maintained that with so much habitat already preserved, options exist to accommodate both the owl and timber-dependent communities. According to a commenter, owl populations persist in eastern Oregon and Washington because logging techniques have resulted in timber growth patterns that mimic old-growth forest in western Oregon and Washington, thereby suggesting that viable owl populations can be sustained in managed forests.

*Service response:* The supply of old-growth forest remaining depends upon the National Forest or Bureau of Land Management District. To talk about a 60-70 year supply oversimplifies the issue. For example, about 23,400 acres (3 percent) of old-growth forest on Bureau of Land Management lands in Oregon are being cut each year. The Eugene District will run out of old growth in 12

years, Coos Bay District in 17 years, and Salem District in 14 years. The Forest Service plans to log just under 40,000 acres of old growth each year, which is about 1 percent of its total remaining spotted owl habitat. Much of the remaining old growth is in small, fragmented acreage, and forests with less than about 20 percent old growth are little used by owls (USDI 1990).

In most situations, managed forests provide poor habitat for spotted owls. Anticipated rotation ages will lead to harvest schedules that remove the trees before they become suitable for spotted owls.

Some silvicultural prescriptions (i.e., selective removal) allow owls to persist, or repopulate, managed forests at younger ages. However, selective logging is practiced on only about 5 percent of the timber base in the Pacific Northwest (USDI 1990). Also, after 2 or 3 entries, selective removal techniques generally fail to provide an adequate crop of commercial trees, and clearcuts are then used to increase future production. Abundant data show throughout much of the range that owls persist only in very low numbers in areas managed for timber production, especially when the amount of remaining old growth decreases to less than about 40 percent of the total acreage, and that areas with less than 20 percent old growth are little used by owls (USDI 1990).

Habitat preserved in National Parks, Wilderness Areas, and lands unsuited for timber production exists in a highly fragmented patchwork. Owl population densities and reproductive output are lower in protected areas than in non-protected old growth (USDI 1990). This is because a high percentage of suitable habitat in reserved status is at higher elevation or on poor timber sites. The Service believes that options do exist to accommodate both the owl and the timber-dependent communities, but also believes that more old growth and mature forest than is currently reserved will have to be left standing to assure the owl's survival.

There is no evidence to suggest that owls persist because of logging techniques. There is more habitat available in the Cascades than in the Coast Ranges of both Oregon and Washington, and habitat availability explains the larger populations there.

*Comment:* Someone suggested that timber harvesting be allowed to continue under current sustained yield management while intensive research and planning for owls continues. A number of commenters stated that non-use of renewable natural resources is

not in keeping with sound forest management for multiple use, that much of the old-growth timber is deteriorating and should be systematically harvested, and that harvested old growth should be replaced with young healthy forests.

Another writer asked that no further cutting be allowed on disputed lands until it is definitely known whether there is or is not endangerment to the owl. If the Forest Service continues with its current harvesting program, this commenter believes that the spotted owl would not become extinct for 300 years.

*Service response:* There is abundant information available on the requirements of the northern spotted owl, and an equally rich source of information that suggests that current forest management is resulting in an inexorable decline in owl numbers and a reduction in future management options for the species. Therefore, it would be imprudent to assume that continued harvesting would not be deleterious to the owl even if research were being conducted concurrently.

Non-harvest of commercially-suitable trees does not equate with non-use of old-growth forest in a multiple-use strategy. Old-growth forest is a dynamic ecosystem with a complex flow of energy through countless organisms. It serves a number of crucial human uses, such as watershed protection, and is used extensively for hunting, fishing, and many non-consumptive types of outdoor recreation. Old growth is not "deteriorating"—it constantly renews itself through the replacement of old trees by young ones.

Injunctions against harvesting certain lands were lifted by the courts subsequent to the passage of section 318. In the Service's opinion, continued harvesting of old growth and mature forest will result in further decreases in owl numbers. The need is to implement a management plan that provides for the continued existence of the northern spotted owl in perpetuity. The Service does not agree that the owl could persist for 300 years if the present rate of harvesting were to continue.

*Comment:* One commenter indicated that even-aged management was presumed to be incompatible with the maintenance and development of spotted owl habitat. In the Service's proposal it was implied that uneven-age management would perpetuate owl habitat. This commenter disagreed and argued that over much of its range Douglas-fir is less shade tolerant than its associated species and that it naturally develops an even-age structure within much of its range. He stated that forest openings (created by a group selection form of timber harvesting) or

minor perturbations in the primary tree canopy (created by single tree selection) will create seral conditions conducive to the germination and establishment of Douglas-fir and that this type of uneven age-management creates within-stand fragmentation and edge effects that favor invasion by great horned owls.

*Service response:* Even-aged management may produce suitable owl habitat under certain circumstances, such as when reserved trees are left after a selective harvest entry (Thomas *et al.* 1990). Silvicultural treatments that produce a multiple-canopy structure may also provide one possibility for integrating owl habitat requirements with timber demands. However, the extent to which silvicultural treatments could produce habitat suitable for northern spotted owls is unknown.

Current evidence clearly indicates that even-aged Douglas-fir stands do not become suitable for owls until >100 years of age (USDI 1990), well in excess of the current more or less 70 year rotation plans. The Service recognizes that Douglas-fir is a shade-intolerant tree species whose growth may be inhibited under less than clearcut prescriptions, but considers the relation between owls and alternative silvicultural treatments a potentially fruitful area of future research.

Whether smaller, more localized fragmentation impacts resulting from uneven-aged management favor invasion of great horned owls relative to even-aged managed stands is unknown.

*Comment:* One commenter maintained that a recovery plan is needed to provide consistent direction for public land managers to follow. Another stated that the owl should be listed and a habitat conservation plan developed.

*Service response:* The Service is required by provisions of the Endangered Species Act (Section 4(f)) to prepare a recovery plan for each listed species. The Interagency Scientific Committee to Address the Conservation of the Northern Spotted Owl has produced "A Conservation Strategy for the northern spotted owl" (Thomas *et al.* 1990) that will provide a significant contribution to the development of a recovery plan. A habitat conservation plan is prepared by private parties applying for an "incidental take" permit under Section 10(a) of the Act (see Issue 4 for details).

*Comment:* A commenter provided an extensive report pertaining to management alternatives and suggesting future research activities.

*Service response:* The Service recognizes that many potential management alternatives can be developed for the northern spotted owl,

and further realizes that some spotted owls persist in, or recolonize quickly, forests harvested under selective cut prescriptions. However, such prescriptions now occur in less than 5 percent of managed forests, and have had little overall positive impact on owl numbers. Until adaptive management strategies have been shown to benefit the owl, the Service concludes that current harvesting methods are resulting in a continued decline of the species.

Reserved, Set Aside, or Land Otherwise Unavailable for Timber Harvest

*Comment:* Another party stated that old growth will never be eliminated totally because about one-third of Federal lands are set aside for total preservation with another approximately one-third designated for multiple-use other than timber production. The commenter maintained that it is pure conjecture that wilderness areas may be logged someday.

*Service response:* There were originally about 17.5 million acres of old growth that may have contained forest land suitable for the spotted owls in the Pacific Northwest. Much of this has been harvested. Presently about 6.7 million acres of suitable habitat (old growth and mature) still remain. Of this, about 2.7 million acres is preserved in National Parks, Wilderness Areas, watershed management areas, wild and scenic rivers, research natural areas, etc. Not all of this is "totally preserved." For example, watershed areas such as Bull Run (Mt. Hood National Forest) serve a multitude of functions, are extensively roaded, have reservoirs, and can be salvage-logged. The 2.7 million acres also contain areas unsuited to timber harvest (about 0.8 million acres), and some of this may be logged as silvicultural techniques change. As an example, the Siuslaw Forest Plan (1990) changed the protected stream headwall areas from 5 to 4 acres, thus increasing their timber base and reducing the area considered unsuitable for timber production and tallied as protected. In reality, about 84 percent of the timber base is available to timber production. The Service agrees that it is conjecture that wilderness areas may someday be logged.

*Comment:* Numerous parties argued that enough land is set aside already to manage for spotted owls and with 4.2 million acres of old growth in Oregon and California, there is more than enough habitat. One party stated that there are 3 million acres of roadless and other areas that are protected. Another said there were 5 million acres set aside and if the spotted owl cannot survive

within that area, let it become extinct. Some asked how much more habitat does the spotted owl need. Several commenters maintained that even if further study establishes the dependence of owls on old growth, adequate old-growth timber is now protected in wilderness to maintain viable spotted owl populations. According to one commenter, more forest and national park lands (53 percent) are available to the owl than are designated for multiple-use. One individual questioned how the northern spotted owl can be "endangered" if it has more land than people do. A number of commenters stated that no more timber lands should be taken out of the economy to create additional protected habitat. Another questioned why spotted owls must be found in every National Forest.

*Service response:* As stated above, the widely accepted figure for the amount of old growth set aside today is about 2.7 million acres. In the Service's opinion, considering anticipated logging prescriptions and rotation ages, the protected owl habitat is not sufficient to provide for long-term viability.

The owl needs sufficient, well-distributed habitat to ensure its survival. How much secure habitat is enough? In a thorough review of the needs of the northern spotted owl, Thomas *et al.* (1990) described a management plan that set aside 193 Habitat Conservation areas in California, Oregon and Washington that totalled about 7.6 million acres. It was the reasoned opinion of Dr. Thomas' team of scientists that this much suitable habitat was required to maintain the owl in perpetuity. Only about one-third of this acreage is contained now in National Parks, Wilderness Areas, SOHAs, and other reserved lands.

There are about 4.7 million acres in the wilderness system in the Pacific Northwest. Much of this does not provide owl habitat. It is estimated that only about 1 million acres is suitable for spotted owls, and owls in wilderness sites studied have lower densities and lowered reproduction compared to owls in non-reserved forest lands, which tend to have better habitat (USDI 1990). The Service has concluded that wilderness areas are not sufficient to assure the long-term survival of the spotted owl.

The amount of land available to owls is nowhere near the 53 percent claimed by the commenter. For example, of the 13.8 million acres of lands controlled by the Forest Service in Oregon and Washington, 2.6 million acres (19 percent) is reserved, but only .8 million (6 percent) is suitable for spotted owls. About 2.7 millions acres (15 percent) is

now protected: the rest are available for timber harvest (multiple-use).

Clearly, owls do not have more land than people, and will only survive with prudent land management.

The issue to list the northern spotted owl as threatened or endangered must, by law, be made without considering the potential economic impacts of the listing decision.

The likelihood that a species will persist through time is increased if its original distribution can be maintained. An interconnected population covering a large geographic area is much less vulnerable to natural disasters (such as fires, severe storms, volcanic activities, or disease) and less susceptible to the deleterious effects of inbreeding than a population broken into fragmented, isolated units. Also, the National Forest Management Act of 1976 requires that the National Forests maintain "a minimum number of reproductive pairs and that habitat must be well distributed so that those individuals can interact with others in the planning area" (36 CFR 219.19). Hence, the Service believes that a reasonable approach at owl management would involve maintaining viable owl populations on all National Forests within its range.

#### *Issue 19. Regulatory Mechanisms*

##### Existing Management Plans for Federal Lands

*Comment:* According to one commenter, in the *Federal Register* the Service failed to consider the adequacy of existing regulatory mechanisms. Someone argued that listing is not needed because the Bureau of Land Management and Forest Service already have considered the biological needs, allocated habitat, have a monitoring program, and the flexibility necessary to provide for the continued existence of the spotted owl. Another commenter stated that the Fish and Wildlife Service is now doing a forest-by-forest, distribution-by-distribution review of the plans and allocation process; hence, it is not necessary to list.

*Service response:* The Service considered all the major applicable regulatory mechanisms in place that deal with timber harvest and spotted owls on private, State, and Federal (Bureau of Land Management, Forest Service, and National Park Service) lands in California, Oregon, and Washington (see 54 FR 26673-4). These issues are again considered and discussed in the 1990 Status Review, and in this *Federal Register* document (see Factor D). It is the Service's opinion that existing management plans

pertaining to timber harvest and the spotted owl are inadequate to ensure the long-term viability of the species.

The Bureau of Land Management, which administers about 11 percent of all spotted owl habitat, operates under constraints imposed by the Oregon and California Act, which mandates that their lands (over 2,000,000 acres in Oregon) provide for production of timber in perpetuity. Lands can be set aside for the protection of owls for short periods of time (10 years). Even though the Bureau of Land Management has 121 SOHAs with over 230,000 acres set aside, these are temporary, and may last only until a new management plan is completed in 1992. Although it is true that the Forest Service has a comprehensive network of SOHAs, research, and monitoring programs, the SOHA system is considered flawed because it is scattered, subject to natural disasters, and isolates small numbers of birds (generally pairs). Of about 5 million acres of suitable spotted owl habitat on Forest Service land, 3.2 million acres (63 percent) is suitable for harvest, and logging of these lands is anticipated to greatly reduce owl numbers.

The most comprehensive Fish and Wildlife Service study of the spotted owl is the most current status review (USDI 1990) to assess the current and future status of this species.

*Comment:* The Bureau of Land Management noted that it manages 2 million acres of commercial forest lands in western Oregon, of which over 800,000 acres is considered suitable spotted owl habitat (mature and old growth). Less than three percent of these lands will be harvested in any one year. There are 122 management agreement areas on Bureau of Land Management land during fiscal year 90. Further, 254,000 acres of mature/old growth is constrained from harvesting to protect owls.

*Service response:* The Service agrees with these comments. There are 121 management agreement areas (one was lost in a land transfer to the Bureau of Indian Affairs) that protect over 230,000 acres of forest for spotted owls. Twelve of these are one-year interim areas required by section 318 of the FY 1990 Interior Department Appropriations Act. All 121 areas are interim areas, and may be changed or eliminated when management plans are finalized in 1992. Since none of them are permanently dedicated to owl protection, the Service cannot rely on their long-term adequacy. While it is true that 3 percent of the suitable habitat is being harvested each year, habitat will be lost from entire

districts much sooner than implied by these figures (i.e., <33 years). For example, it is expected that all suitable habitat will be lost from the Eugene District in 12 years, the Salem District in 14 years, and the Coos Bay District in 17 years. Only the Medford District anticipates that available habitat will last more than 33 years.

*Comment:* The Forest Service commented that 5 million acres of suitable spotted owl habitat exist on National Forests in California, Washington, and Oregon and that 51 percent of this (2.6 million acres) is not available or suited for timber harvesting. The Forest Service defines suitable habitat as "forest that includes considerable large dominant trees, multi-layered canopy with moderate to high canopy closure, and downed logs."

*Service response:* The Service agrees that there may be about 5 million acres of spotted owl habitat on Forest Service land in California, Oregon, and Washington. However, according to the Service's estimates only about 1.8 million acres (37 percent) of this is not available for timber harvest (USDI 1990). This represents about 10 percent of the original spotted owl habitat in the Pacific Northwest.

*Comment:* One commenter urged the Service not to list the spotted owl in the Quinalt Ranger District on the Olympic Peninsula because of the unique status of the unit. This unit was established by the Chief of the Forest Service in 1949 who dedicated this portion of the area's timber supply for manufacture within communities so vitally dependent on it.

*Service response:* The Service is required by law to consider the status of the owl throughout its range on biological grounds only, and thus cannot apply non-biological criteria to the Quinalt Ranger District.

*Comment:* According to one opinion, the Status Review Supplement cavalierly treats the Forest Service's expected compliance with its statutory duty under the National Forest Management Act. The commenter stated that the anticipated compliance is speculation on the part of the Fish and Wildlife Service and should be given no weight. Contrary to a statement in the Status Review Supplement, one commenter maintained that forest plans under the National Forest Management Act are legally binding upon the Forest Service. The commenter noted that the Status Review Supplement asserts that cutting rates and forest harvest activities will eliminate most spotted owl habitat that is available within the next 60 years; yet forest plans and regulatory guides establish land protection and preservation of spotted

owl habitat. In this commenter's opinion, regulatory mechanisms exist on Forest Service and Bureau of Land Management land to permanently protect what is now perceived to be spotted owl habitat and these mechanisms are flexible enough to take into account new information on habitat use.

*Service response:* In the Service's opinion, the responsibilities of the Forest Service under the National Forest Management Act were carefully considered in the previous status reviews (USDI 1987, 1989) as well as the proposal. The 1990 Status Review (USDI 1990) has reached similar conclusions about the effects of harvesting upon the long-term survival of the spotted owl. The continued harvest of old-growth forest, coupled with anticipated shorter rotation ages for younger even-aged stands (the Siuslaw Forest Plan anticipates that 74 percent of their harvest will come from 60 to 80 year old stands) will guarantee that suitable habitat will be lost, with a diminished chance that it will be replaced by growing managed forests. The Service agrees that the Forest Service has assumed an active role in, but has concluded that current measures are not enough to guarantee the survival of the owl. If the Bureau of Land Management's and Forest Service's regulatory mechanisms are flexible in managing for the owl, then there is no assurance that any plans developed and implemented under such regulations could not be altered in the future to the detriment of the owl and its habitat. Current management, however, is inadequate to prevent the continued decline of the northern spotted owl.

*Comment:* WDW commented that it filed an administrative appeal to the Forest Service's Region 6 Record of Decision. About 80 percent of the spotted owl population in Washington is on Federal land. According to WDW, the Forest Service management plan (Final Supplement Environmental Impact Statement/Record of Decision) will prevent the state from fulfilling its mandate "to preserve, protect, and perpetuate" the native wildlife of Washington. It will foreclose options to recover the northern spotted owl. WDW commented that there is no scientific evidence to support the Chief of the Forest Service saying that the plan will ensure viable populations. Further, WDW stated that habitat areas have about a 50 percent chance of being occupied and provide about 50 percent of the average amount of suitable habitat used by owls in Washington and Oregon. WDW argued that silvicultural options to manage for spotted owls are

experimental and untested, and further that no current evidence exists that spotted owl habitat can be created or maintained through silvicultural management. WDW noted that the Gifford Pinchot National Forest recently revised its estimate of old growth downward by 30 percent. According to WDW, the Forest Service failed to consider cumulative impacts of harvesting on spotted owls and did not consider all pertinent information. Hence, in WDW's view, the Forest Service violated NEPA.

*Service response:* The Service shares the concerns expressed by WDW. The Forest Service has 168 SOHAs on the 5 National Forests in Washington; 92 of them (55 percent) have had reproductive pairs in the last 10 years, and only 87 of them (52 percent) hold 3,000 acres of suitable habitat. Continued harvest will further reduce owl populations and reduce future options to manage the species.

*Comment:* Several commenters argued that evidence indicates that current levels of timber harvesting can be continued for five years without jeopardizing the owl, during which time additional information will be provided to determine available habitat and future needs and plans. They maintained that current management plans provide adequate habitat protection and allow time to study owls before making a decision regarding listing. According to comments from the Forest Service presented at one of the public hearings, about 95 percent of habitat capability for spotted owls during the next five years is protected and this approach provides for 95 percent of the timber supply that would have been available without the added protection of owl habitat.

*Service response:* Evidence indicates that current levels of timber harvest are resulting in adverse impacts to the owl. Spotted owls are reduced to lower levels by timber harvesting, cut blocks are regularly placed near SOHAs and non-network pairs of owls, and a large portion of SOHAs do not contain the required acreage of suitable habitat. The SOHA system itself is flawed, and options for management of larger areas will be lost with continued harvest. Thomas *et al.* (1990) disagree with the Record of Decision that five more years of harvesting will not affect the availability of future options. There is ample evidence already available to determine the status and management needs for the owl. Thomas *et al.* (1990) have concluded that the present distribution and quantity of old-growth

forest is not enough to guarantee the long-term survival of the spotted owl.

An assessment and survey of current management by the Forest Service and the Bureau of Land Management (Thomas *et al.* 1990) indicates that it is not adequate to protect the owl. In 5 years about 15 percent of suitable owl habitat on Bureau of Land Management lands, and 5 percent on the national forests, will be lost at current harvest levels. The harvest on Forest Service lands does not equate, however, to a retention of a 95 percent capability of the habitat to support owls. Many timber sales are adjacent to SOHAs or in concentrations of suitable habitat: 60 percent of all 1989 and 1990 timber sales were in the vicinity of known spotted owls. The impact of harvesting where owls are most abundant will further reduce management options in future years.

*Comment:* Numerous commenters said there is no evidence that the Forest Service can continue to allow timber harvesting for five more years with no risk to the long-term viability of the spotted owl. The commenters argued that the proposed rule failed to communicate the information available at the time of publication, which demonstrated the problems associated with existing efforts to protect the owl on public lands. Several commenters stated that the Forest Service consistently refused to adopt guidelines protecting non-SOHA owls or pairs, that it failed to adopt guidelines to maintain management options during the five-year operating period of the Record of Decision, and that it chose to ignore its own established guidelines for timber harvesting in the vicinity of all nest sites or owl pair activity sites (USDI 1989). A commenter noted that Forest Service staff were forced to pass over more suitable habitat occupied by owls to establish SOHAs that met spacing requirements and that in 1982-88 only 44 percent of SOHAs in Region 5 supported breeding pairs during at least one season.

*Service response:* The Service accepts this comment (see above), but disagrees that the proposed rule failed to adequately acknowledge the inadequacies of Forest Service management as it pertains to the spotted owl. The ISC (Thomas *et al.* 1990) surveyed Forest Service staff throughout the range of the owl, and found little consistency with direction related to how timber sales impacted non-network owls. "The general sense appeared to be that the situation is so dynamic that policy is not keeping up with events" (Thomas *et al.* 1990, p. 107). The Service

was told by Forest Service biologists that spacing requirements did necessitate placing some SOHAs in areas of marginally suitable habitat, or areas lacking owls, rather than placing them in areas that supported owls. In the best year during the 10-year period 1980-89, 128 of 263 SOHAs (48 percent) in Region 5 held reproductive pairs of owls (USDA 1989).

#### Possible Adaptive Management Alternatives

*Comment:* One commenter expressed the view that the Service professes not to know whether the opportunity exists for a successful adaptive management strategy and states that the Service concluded that adequate regulatory management mechanisms do not exist because: 1. It is not known if the number of sites and allocated acreage of habitat per managed site will provide for long-term population viability; 2. flexibility in future management options may be limited; and 3. little or no allowance has been made for long-term catastrophic environmental changes in habitat which may affect small habitat patches. In this commenter's view, these conclusions are wrong and not supported by the record. He states that Forest Service management activities as early as 1972 were routinely modified to protect the owl habitat. In this commenter's opinion, the Service has been part of this regulatory system on public lands and has been accommodated at every step.

*Service response:* Management activities to date have not demonstrated that adaptive management is a viable option for the owl on land subjected to clear cutting. About 95 percent of all commercial land, public and private, is harvested using clearcut prescriptions. While it is true that younger-aged stands that have been selectively harvested do harbor owls when they structurally resemble old growth (especially in Klamath Province and the California redwoods), such prescriptions account for only about 5 percent of all potential owl habitat in the timber base. There is no indication that adaptive management will be undertaken. The two most recently-completed Forest Plans (Siskiyou and Siuslaw National Forests) rely predominately upon clear cutting, and anticipate further declines in owl numbers. The owl has continued to decline since 1972 under Forest Service, Bureau of Land Management, and private land management practices. The Service continues to maintain that existing regulatory mechanisms are insufficient to provide for the long-term population viability of the owl. Further, the Service disagrees that its concerns

for the owl on public land have been routinely accepted and accommodated.

*Comment:* One commenter wrote that the Status Review Supplement assumes that an intensively managed forest of even-aged trees with an average cutting rotation of 70-120 years will no longer develop or retain the variation of old-growth characteristics which require about 200 years of development. In the commenter's view, this type of analysis is flawed because it assumes that all non-public forested lands will be managed on a short rotation, even-aged basis and ignores the fact that owls can live in younger forest.

*Service response:* The Service agrees that some silvicultural treatments may create the structural attributes of old-growth forest at younger stand age, but also notes that the long-term effectiveness of this approach is untested (Thomas *et al.* 1990). The Service also agrees that not all nonpublic timberlands are even-aged forests managed on a short-term basis. However, lands subject to other than harvest clearcut prescriptions, the basis of even-aged management, comprise less than 5 percent of the managed timber base in the range of the northern spotted owl (USDI 1990).

#### Forest Service Old-Growth Guidelines

*Comment:* The Forest Service commented that it had issued new old-growth guidelines on October 11, 1989, to provide for considering old-growth values in managed National Forest lands. The Forest Service estimates that about 15 percent of the old growth in Region 6 is scheduled for harvesting during the 1990s. By memo dated November 3, 1989, Mr. John Butruille, Regional Forester for Region 6, in responding to the new Forest Service guidance stated, "It is important to note the new statement by the Washington Office [re: policy on old growth] does not alter any of the land allocations set forth in the forest or draft forest plans, nor does it indicate a need to halt completion of plans or the need for immediately revising completed plans." In an accompanying position statement, dated October 11, 1989, the Forest Service stated that old growth land suitable for timber production and not subject to extended rotations is to be scheduled for harvest to establish young stands which more fully utilize potential timber productivity and also meet other resource objectives.

*Service response:* The Service agrees with this comment. Since Mr. Butruille's statement, the Siuslaw Forest Plan has been published, and there is no indication of a policy change on old

growth. The Siuslaw holds about 33,800 acres of old growth (3.7 percent of the land base), of which 23,100 acres is reserved. Of the 10,700 acres of non-reserved old growth (32 percent), old patches >40 acres will not be cut *until a new inventory is completed*. The plan anticipates a 29 percent decline in spotted owl habitat over the next 50 years—virtually eliminating all the unprotected old growth remaining on the forest. Apparently the Forest Service will continue its policy of converting old growth to younger stands, with subsequent losses to the spotted owl.

#### Management on Non-Federal Lands

*Comment:* In another's view, the owl policy on Federal land is forcing the cutting of private forest lands that should grow another 40–60 years. A number of commenters stated the proposal has hastened the extinction of the owl as companies increase the cutting of old growth because they fear they will be unable to continue to harvest if the owl is listed.

*Service response:* Very few reproductive pairs of owls (2) are known to remain on private land in Oregon and Washington, and only 36 are known from California (Thomas *et al.* 1990). Cutting on private land has been at the discretion of the landowner, with whatever State approvals are required. There has been no acceleration of the sale of old-growth timber on Forest Service or Bureau of Land Management land, where the majority (92 percent) of the known reproductive pairs of owls occur. Indeed, because of litigation, the Allowable Sale Quantity (ASQ) has declined about 9 percent on Forest Service lands in the past two years.

*Comment:* The Washington Department of Natural Resources stated that there is a program to defer logging for 15 years on 15,000 acres of spotted owl habitat on trust lands on the Olympic Peninsula during which time research will be conducted to ensure an improved information base for future decisions. It anticipates eventually applying a new ecosystem-based approach to forestry on all the 260,000 acres of state owned lands in the area. Another commenter responded that the recent recommendation by the Washington Department of Natural Resources for the Olympic Peninsula by the Commission on Old Growth Alternatives for Washington's Forest Trust Lands (Commission) will result in the reduction of habitat for 24 pairs or single owls and certainly eliminate at least five pairs and five single spotted owls.

A commenter maintained that given the nature of experimental science and

that logging will occur in areas now occupied by spotted owls, it is likely there will be a loss of existing spotted owls on experimental forest lands. Further, the commenter stated that implementation of the Commission's recommendations will likely result in a significant reduction in the spotted owl population on the Olympic Peninsula.

*Service response:* The Service accepts the comments. The Service agrees that if experimental forests containing spotted owl are harvested in the usual manner, it is likely that owl numbers there will decline. The Service also agrees that it appears that spotted owl numbers on Washington Trust Lands on the Olympic Peninsula will decline if all but 15,000 acres of old growth are eliminated.

#### Section 318

*Comment:* In commenting on Section 318, one commenter wrote that under this amendment the Forest Service would have to sell almost all the old-growth timber currently locked up by a Federal court order, violate Forest Service guidelines on protection for the owl, and exceed its own long-term timber production capacity.

*Service response:* The normal ASQ for the "owl forests" in the Pacific Northwest has been about 3.2 billion board feet/year (USDA 1988). Sec. 318 of P.L. 101-121 mandated a sale of 5.8 bbf for 1989-1990. This is a 9 percent reduction in the normal ASQ. The Service understands that one difficulty with Section 318 is the short time constraints under which the volume must be sold (by September 1990). This makes it difficult to apply all the proper environmental safeguards when developing the timber sales.

*Comment:* WDW recently looked at 50 sales and found that 30 of these contained sale units within 2 miles of spotted owl nests or activity centers. According to WDW, several nests or activity centers are inside of or within one-half mile of sale units and a large percentage of the 1990 timber sales will have impacts to spotted owls. The Department is particularly concerned about the area in the central Cascades (I-90 Corridor).

*Service response:* The Service concurs with these findings.

*Comment:* One commenter stated that the protective measures provided for by Section 318 are being ignored or cannot be met. The commenter noted that some SOHAs have sale units within expanded SOHA boundaries or in large old-growth blocks adjoining SOHAs.

*Service response:* It is clear that the requirements for expanded SOHA areas cannot be met for a large number of SOHAs throughout the Pacific

Northwest. In California, only 210 of 267 SOHAs (79 percent) include 1,000 acres. On the Oregon Coast Range (Suslaw National Forest), 21 of 22 (95 percent) SOHAs can hold 2,000 acres, and 20 of them (91 percent) can achieve the required 2,500 acres. On the Olympic Peninsula, fewer than 21 (69 percent) can be expanded to 3,200 acres. These figures are typical for the entire SOHA system, and illustrate how options for managing the owl have been lost. The SOHA consists of protected acreage within the bounds of a circle. For example, a 2.1 mi. circle contains 8,867 acres. On the Olympic Peninsula, only 3,200 acres within that circle needs to be protected. By Forest Service policy, timbers sales can be (and often are) placed on other acreage within the 2.1 mi. circumference.

#### Issue 20. Finite Rate of Population Increase and Modeling

*Comment:* Another commenter questioned the use of population models because these relatively new models are predicated on hypotheses that have not been tested and proven over time. One commenter maintained that the Status Review Supplement relies on several population viability models that have been criticized as inadequate to support the opinion that the spotted owl population is declining. Another commenter noted that subsequent to the release of the Status Review Supplement (1989), Review Team Leader Barry Mulder wrote in a letter that population viability models played no role in the listing decision. The commenter maintains that this subsequent recanting of the population viability analysis chapter in the Status Review Supplement shows the Service failed to establish a rational basis for its proposed rule. The commenter questioned why the population viability analysis was discussed if it did not affect the decision.

*Service response:* Population viability analysis played no role in the Proposed Listing (June 23, 1989) or in the 1989 Status Review Supplement (USDI 1989). The issue was reviewed briefly in the 1990 Status Review (USDI 1990) and the use of these techniques was again dismissed from consideration. Careful review of all information is required and appropriate. If some material is found to be unreliable, the reasons for this are provided and no further consideration is given in the decision.

*Comment:* It appeared to one commenter that the Status Review Supplement relies on four theoretical ecology and modeling studies to corroborate that the spotted owl is

declining (See Ewens 1989; Lande 1988, 1989; Pulliam 1988). However, the commenter argues that the projections from these models contradict the conclusion that the population is declining. The commenter maintained that Lande (1988) states that the owl population growth rate is not significantly different from that of a stable population, even assuming that all available old-growth habitat is clearcut. Further, the commenter stated that Ewens (1989) concludes that geographically subdivided populations, like that of the spotted owl, are actually more likely to maintain their overall genetic diversity than geographically homogeneous populations. The commenter cites Pulliam (1988) as stating that interspersed population "sources" and population "sinks" represent a stable condition for a species.

*Service response:* The estimates of population parameters have been updated in the 1990 Status Review (USDI 1990). Estimates are based on the most current data, the best models and estimation methods, and the best model selection methods. These current estimates make all other estimates in survival and fecundity parameters obsolete. Using the best available information, it is clear that populations are declining (USDI 1990). In fact, there is solid evidence that the populations are declining at a statistically significant rate. The new information makes prior analyses, based on former estimates, of no relevance.

Ewens (1989) speculated that genetic diversity may be enhanced in geographically subdivided populations. Nothing is said about the northern spotted owl by Ewens (1989). The spotted owl is currently subdivided by forest fragmentation. In addition, the ISC Habitat Conservation Plan, if implemented, would allow geographic subdivision. Pulliam's (1988) theoretical paper examines model populations and model stability. He does not mention the northern spotted owl, nor did he examine models where habitat and carrying capacity were declining drastically. The Service did not consider any of these 4 models in its decision.

*Comment:* According to one commenter, three growth rate figures used in the Status Review Supplement (USDA 1988, Lande 1988, and Noon and Biles 1989) have serious methodological, factual, analytical errors. The commenter states that each study assumes a constant rate of survival and reproduction, but this assumption is not supported by demographic data. Hence, the estimated asymptotic finite rates of

population increase values (ranging from 0.85 to 0.98) are not the best available data. According to this commenter, both the Forest Service and Noon and Biles use incorrect reproduction and survival data; with correct data the Forest Service and Noon and Biles would have to conclude the spotted owl population is increasing. This commenter maintains that if these parameters are corrected, all the respective studies show the population is stable, the USDA rate being 0.99 and Noon and Biles being 0.96.

*Service response:* Although specific statistical tests were made, no significant year to year variation could be found in survival or fecundity for the two sets of demographic data (northwest California 1984-1989 and Roseburg Study Area 1985-1989). Therefore, it is reasonable to assume a constant rate of survival and reproduction during the 5 or 6 year study periods. The result of likelihood ratio tests are given in USDI (1990). Likelihood ratio test allow 2 models, each making different assumptions, to be statistically compared. Thus, parameters constant over years were estimated and were used in the estimation of lambda (the average finite rate of population change). The best estimate of survival (or fecundity) of a given year, is the constant (average) value. This applies to the estimates of lambda. The estimate of the sampling variance of the constant parameter includes a year to year component using quasi-likelihood theory where appropriate (e.g., section 3 of USDI, 1990).

Previous estimates of the rate of population change were from 0.85-0.98. The best estimates currently available show a significantly declining population in both areas where sufficient data are available (see USDI 1990 for details). Had the Forest Service and Noon and Biles (1990) used the best estimates of parameters now available, it is the Service's opinion that they also would have concluded that the population was declining. The Service has estimated the finite rate of population change to be 0.95 for northwest California and 0.86 for the Roseburg Study area in southwest Oregon. The populations are declining at a significant annual rate.

The estimates of lambda of 0.99 and 0.96 are based on old data, and the parameter estimates are based on a model that is not the best. Estimates of precision were only approximations. If the best and most current estimates were based on the most current data and the best models, the estimates of

lambda would be 0.95 and 0.86 for northwest California and southwest Oregon, respectively. Lambda values less than 1 indicate declining populations.

*Comment:* A commenter remarked that using work by Marcot and Holthausen (1987), the Forest Service assumed the spotted owl's life span was 15 years (USDA 1988), yet Lande (1988) states that spotted owls may live as long as 55 years. The commenter maintained that this changes the asymptotic rate of population increase from 0.85 to 0.985. The commenter stated that with a corrected life expectancy value, the Forest Service calculated 0.99 as the rate of population increase and used this value in its analysis of spotted owl management in Region 6 National Forests (USDA 1988). Even so, according to this commenter, the Status Review Supplement did not recognize this fact and concluded the Forest Service assumed a decline of 0.85.

*Service response:* The issue of senescence is now summarized in a recent paper by Noon and Biles (1990). USDI (1990) provides insight on this matter and concludes that the failure to include senescence in the survival and reproductive process might lead to substantial overestimates of lambda. This overestimation is particularly relevant to northwest California where the estimate is 0.95, as the true rate might be substantially less than this. If this is the case, the rate of decline is underestimated.

There is no evidence to support the commenter's statement that the corrected value of lambda should be 0.985. This value is based on data, methods, and models that are obsolete or poor, relative to what is currently available.

*Comment:* According to one commenter reproductive rates are significantly higher than those cited in the Status Review Supplement. Using these new data, the commenter claims that the growth rate model in the Status Review Supplement now projects that the northern spotted owl population throughout the range has been increasing at a rate of 1 percent per year since 1986. The commenter remarked that lambda value for 1986-1989 were 1.008 for Oregon (a population increase of 0.8 percent/year), 1.018 for California (a population increase of more than 1.6 percent per year), and 1.01 for Oregon, California, and Washington combined (a population increase of more than 1 percent per year). The commenter did not provide a separate growth rate value for Washington.

*Service response:* The reproductive rates given in USDI (1990) are the best available, based on the current data, and estimates of precision are provided. Age- and year-specificity are tested and final estimates are given. The estimates of lambda cited by the commenter are based on old and crude estimates of parameters (e.g., lambda=0.94).

Estimates of lambda > 1.0, cited by the commenter are simply incorrect because they are based on old data, poor models and methods. In addition, the demographic data for Washington (Olympic Peninsula) consist of only three years of data and are, therefore, inadequate for a rigorous analysis. At least 4 years of capture-recapture/resight data are required to perform a rigorous analysis and assess goodness of fit. The northern California data were taken over 6 years while 5 years of data are available on the Roseburg area in Oregon.

*Comment:* One commenter noted that the Forest Service (USDA 1988) model and that of Lande (1988) both conclude the spotted owl population is nearly stable. Several commenters stated that the models developed by the Forest Service and Lande have numerous errors and inadequacies and cannot be used to conclude the owl population is declining. One commenter stated that these models are flawed, ignore valid biological factors and common sense, and do not allow for variations in demographic parameters. Further, the commenter noted that the analyses by Lande (1988) and the Forest Service (USDA 1988) both assume that owls are dependent on old growth. As indicated by several commenters, Lande's population model for the northern spotted owl was criticized for predicting extinction in 20 years and for estimating unreasonably large historical spotted owl numbers based on the amount of available habitat. One individual stated that Dr. Mark Boyce's comments criticizing the Lande and Forest Service models were omitted from the Status Review Supplement discussion. The commenter stated that the Service cannot ignore criticism and this constitutes an important omission. According to one commenter's view, population demographics were subject to scathing criticism by noted scientists yet the status review did not mention this criticism much less discuss the work of those who disagree.

*Service response:* The Service agrees with the comment that the Forest Service (USDA 1988) model and that of Lande (1988) both concluded that the population was "nearly stable" but an indication of population decline was

found. The data and the analysis methods available at the time the above work was done are now obsolete and the results are no longer useful. USDI (1990) presents a full analysis, using the best models, the best estimation methods, and the most current demographic data available. Thus, comments concerning prior analyses, possible errors and flawed models are no longer relevant. Tests were conducted to determine if significant variation existed in the demographic parameters over years (i.e., both survival and fecundity rates). No such year-specific variation could be found in either demographic data set for the parameter estimates used in the calculation of the finite rate of population change. However, significant year-dependent adult survival was found and the estimated standard errors incorporated this component of the variance using quasi-likelihood methods (USDI 1990). Both Lande (1988) and the Forest Service (USDA 1988) assumed that owls were dependent on old growth. The Service has strong evidence that owls are tightly linked with characteristics found in old-growth forests (USDA 1990, Thomas *et al.* 1990). This is not to say that owls are never found in other age stands.

A full discussion of the criticisms mentioned by the commenter, of the population viability models, including those were omitted from the Status Review Supplement because this type of model was not used by the Service in its decision. While the Service recognizes that such analyses have been the subject of extensive criticism, their shortcomings and other associated problems are not pertinent to a decision on this proposal. Basically, these analyses have not been demonstrated to have credibility and, hence, were evaluated but not considered by the Service in its deliberations.

*Comment:* Frank Wagner (OCWRU, Oregon State University) submitted comments on results of his research on spotted owls in the Elk Creek watershed, near Medford, Oregon. He noted that there is some evidence in his study area for substantial immigration of owls in 1988-1989. He calculated lambda values for three areas; 6 sites on the Miller Mountain Telemetry Study Area (with less than 200 acres of old growth near the activity center); 12 sites dominated by partial cut or young forest; and 11 sites in which old growth within the vicinity was greater than 1,000 acres. Lambdas for the three areas were 0.78, 0.87, and 1.05, respectively. The calculations were done by setting first year juvenile survival at "an

optimistic rate of 0.60." Many of the birds in this study carried radio-transmitters.

*Service response:* The Service found the pattern in the estimates of lambda values interesting; however, the results are inconclusive for two reasons. First, the sample sizes are extremely low and the precision (although not reported) would be quite poor. Second, all of the birds on the Miller Mountain Telemetry Study Area and approximately one-half of the birds on the Meslow *et al.* (1986) area carried radio transmitters (see issue 23). Setting the juvenile survival rate at 0.60 is simply incorrect and not substantiated by any evidence.

*Comment:* One population modeler (M. Boyce) stated that his preliminary results of a density-dependent model suggest a low probability that spotted owls will go extinct under the Forest Service's preferred alternative.

*Service response:* The Service agrees that models incorporating a density dependent component generally predict a lower probability of extinction than models that are density independent. The Service did not give serious consideration to population viability models because they are based on too many assumptions that cannot be validated and because they lack credibility (see USDI 1990).

*Comment:* One commenter stated that the Service should not cite significantly flawed analyses and then conclude the errors are overborne by preconceived ideas; rather the errors should be corrected. In this commenter's opinion, for the Service to rely on these studies to justify the reversal of the previous decision is arbitrary and capricious.

*Service response:* New analyses in USDI (1990) correct previous errors. Flaws in analyses were discussed in USDI (1990) with respect to population viability models and these models and results were not considered in the Status Review. The Service did not rely upon the various models to reverse a previous decision on the status of the owl. In the proposal to list, the Service presented the data and other information on which the proposal was based.

*Comment:* If current Forest Service and Bureau of Land Management counts are showing a greater number of owls, one commenter asked if the prediction formula would be changed regarding the base number.

*Service response:* USDI (1990) and the ISC report contain updated estimates of owl numbers and are the best estimate currently available. The Service is not in a position to answer the question whether or not the Forest Service will modify its prediction formula based

upon an updated spotted owl population estimate.

*Comment:* Several commenters stated that the Status Review Supplement uses incorrect juvenile survival, adult survival, and reproductive rates and misinterprets Franklin's data for Willow Creek. One weakness, according to a commenter, is that Franklin never statistically corrected for the absence of owls that cannot be attributed to specific causes. One commenter stated that the low adult survivorship value for spotted owls without radio transmitters in the Roseburg demographic study area may be a consequence of the birds not being fully territorial and simply relocating elsewhere. Hence, the commenter believes the low adult survival may be in error and that no reliable data exist to demonstrate any present population decline in spotted owl populations anywhere within the range.

*Service response:* The Service believes the comment is in error regarding the low adult survivorship in the Roseburg demographic area. Thomas *et al.* (1990) presented data on the emigration of adults from the Roseburg demographic study area. They found only one occurrence of permanent emigration of adults in 100 bird-years. Thus, the estimated adult survival rate is not in error and the sharp population decline in the Roseburg area is fully supported by the data.

USDI (1990) reports the best and most current estimates of survival and fecundity available. The Status Review Supplement (USDI 1989) used the best estimates of population parameters available; however, these estimates are obsolete because more data and better analysis methods are now available.

*Comment:* The survival problem of the young is a factor one would expect since the owl habitat is at carrying capacity and this is a no vacancy situation according to one commenter.

*Service response:* The Service agrees that the survival of young owls may be depressed because the population may be above long-term carrying capacity. Habitat has decreased in some areas faster than the owl population. Hence, there may be insufficient habitat available to support juvenile owls.

*Comment:* One commenter believed the Status Review Supplement and Forest Service SEIS placed a great deal of faith on an untested HSI model, developed using assumptions about relative value of habitat other than old growth. The commenter stated that data for this HSI model came from a small population size.

*Service response:* USDI (1990) gave no consideration to the HSI model concept.

However, the Forest Service has considered this approach in the SEIS and the Status Review Supplement mentioned the methods briefly.

In its status reviews (USDI 1987, 1989, 1990), and listing proposal, the Service did not consider the HSI model concept.

#### *Issue 21. Experimental Design/Statistics*

*Comment:* According to one commenter, the use of stand classifications in the literature and Status Review Supplement is confusing. Several commenters stated that little, if any, of the research referenced in the Status Review Supplement was conducted totally in old-growth timber stands. Many authors have lumped data from forest stands of various ages. Several commenters wrote that it is grossly inadequate to use age as a shorthand for forest stand characteristics as stand classification varies widely even among age groups, depending on latitude, elevation, species, and growing site qualities. A number of commenters stated that most owl studies were conducted on Federal lands which contain an inadequate representation of age classes and forest stand conditions. According to these commenters, because these forests usually have only older, unmanaged forests or regenerated stands less than 60 years old, studies are not available that conclusively examined habitats between 50–200 years.

*Service response:* The Service believes that terminology regarding old growth, second growth, young growth and stand age has been carelessly used and is, thus, confusing. USDI (1990) is more specific regarding these matters. Stand age is often quite useful, but not adequate in many cases (e.g., the Klamath Province). Data on younger stands, but those having some old-growth characteristics, notably coastal redwood forest, are reviewed in the USDI (1990). Information on owl use in various stand classifications is provided. The Service acknowledges that Federal lands have few regenerated stands over 60 years of age. The commenter is correct in that most studies have been conducted on Federal land where more old-growth forests still exist. However, during the past three years a number of studies have been conducted in younger stands, including private lands (e.g., Irwin *et al.* 1989b,d; Diller 1989; Pious 1989). Studies on Bureau of Land Management lands (Forsman 1980a,b; Thrailkill and Meslow 1989; and Wagner and Meslow 1989) all involve intermingled private and Federal lands.

*Comment:* Several commenters stated that studies showing preferential use of

old growth are subject to statistical errors that may mask owls using young forests more often because none had a sample size greater than 20, the minimum size to avoid this defect. The commenters noted that this problem is not addressed in the Status Review Supplement. According to one view, Chi-square statistical tests (a statistical test to determine deviation from randomness) are used to calculate the distribution of the habitat in proportion to use, however, this statistical test minimizes a Type I statistical error but is subject to a Type II error in cases with a small sample size. Hence, these commenters maintain that habitat use calculations may omit a habitat type that the species actually prefers, such as young-growth.

*Service response:* Contingency tables are frequently analyzed and a test statistic *T* computed. Under some general conditions, *T* is asymptotically distributed as chi-square. Generally, *T* is approximately chi-square if the smallest expected value is greater than 2 (not 20 as was suggested). Habitat use versus availability studies analyzed by the Service typically had five or fewer habitat categories and greater than 50 independent observations per bird (USDI 1990). The number of owls followed per study ranged from 5 to 16 (USDI 1990: table 2.4). In a paper examining error rates for a variety of statistical methods used to assess selection studies, Alldredge and Ratti (1986) estimated Type I and II error rates for studies having different numbers of animals, observations per animal and habitat types. Type I error occurs when the null hypothesis, in this case the hypothesis that owls do not preferentially select any forest type, is rejected when in fact it is true. A type I error rate <0.05 percent is considered acceptable. Type II error is the acceptance of a false null hypothesis, that is acceptance of the null hypothesis that northern spotted owls do not preferentially select a particular habitat when in fact the hypothesis is false. Type II error is a function of several factors in studies of habitat selection by northern spotted owls, including the number of owls studied, number of habitats and number of observations per owl. A Type II error rate of 10 percent to 20 percent is considered acceptable (Snedecor and Cochran 1980:102 cf. Alldredge and Ratti 1986).

One method of resource selection analyzed by Alldredge and Ratti was that proposed by Neu *et al.* (1974), a method used in studies of habitat use versus availability by northern spotted owls (e.g., Forsman *et al.* 1984). The

estimated Type II error rate for studies using the Neu *et al.* method and having <7 habitats and > 50 observations per animal. One potential problem, however, is the number of animals analyzed in each study. The maximum estimated Type II error rate for studies of 20 animals, <7 habitat classes and 50 observations per owl was 3.6 percent. Although all studies evaluated by the Service had fewer than 20 owls, and therefore likely have a Type II error rate greater than 3.6 percent, the criticism regarding number of study animals would be valid only if the studies had statistically analyzed the population of owls (i.e., the number of study animals). Instead, owls were analyzed individually and discussions of habitat selection were restricted to statements like "4 of 5 birds studied exhibited preference for \* \* \*". In studies of relatively few animals, such as most of the studies examining habitat selection of northern spotted owls, "conclusions should be restricted to the \* \* \* study animals per se" and not extrapolated to other populations (Alldredge and Ratti 1990:17). As noted above, conclusions about habitat selection were restricted to the study animals.

Given the preponderance of birds exhibiting selection for old growth (68 of 81, USDI 1990), however, there is little need for additional statistical analysis on the population. The data clearly indicate selection by owls for old-growth forest. The Service therefore does not accept the comment that the results of habitat selection studies on northern spotted owls were affected by Type II error rates due to small sample sizes.

*Comment:* One researcher noted that many of his observations resulting from nighttime surveys on Pelican Butte, Klamath County, Oregon, were in second growth, whereas all roost sites and the one nest site in its particular study were in mature/old growth. The second growth had been logged less than 40 years ago. Because spotted owls are attracted to limitations of their call, this researcher believes he could have falsely concluded that this was a population using second-growth forest if he had relied totally on nighttime surveys. He concluded that nighttime surveys were inappropriate to draw inferences about habitat use.

*Service response:* Surveys using owl calls can be misleading, particularly if only a single visit is made. Owls from surrounding areas may fly toward the observer and then call. If the observer is in a young stand, the owl's call might thus be misinterpreted and the observer could conclude that the owl was using

the young stand. In fact, the owl had been in another stand type, but flew to the young stand prior to calling and being heard. Therefore, the Service acknowledges that caution should be exercised when interpreting nighttime survey results regarding habitat use.

#### *Issue 22. Studies Using Radio Telemetry/Potential Impacts of Radio Transmitters*

*Comment:* According to several commenters studies by Forsman *et al.* (1984) and Reid *et al.* (1987) of radio-equipped owls do not prove that owls prefer old growth even though owls spent far more time in old growth than expected based on the availability of old growth in the home range. For these commenters, the studies at best indicated that owls do not prefer very young forests.

*Service response:* There is no evidence to question the home range and habitat use data gained via radio telemetry. The data sets used for estimates of home range and habitat use rely on a pair of owls or individual owls, respectively, tracked for 1 or more years; such birds demonstrated their capabilities, habitat selection and home range use over 12 months or longer without apparent impairment. The impact of radio transmitters on actual population performance of spotted owls is slight; at any one time only a very small proportion of the overall population has borne transmitters.

*Comment:* The Forest Service commented that on the Olympic Peninsula, Forsman (1989) found that survival of radio-tagged adult owls was not significantly different from color-banded owls. A commenter noted that similar work in the Oregon Coast Range, Sierra Nevada, and northwestern California on birds fitted with radio backpacks caused concern.

*Service response:* Backpack radio transmitters have been used since the mid-1970's as a standard technique to allow research of home range, habitat use, dispersal and behavior of spotted owls. The Service notes that results from several studies found statistically significant differences in some measures of owl demographic rates and none in others in comparing results of birds equipped with transmitters versus those without. Observations of apparent differential mortality between radio-marked owls and color-banded owls at some study sites (Paton *et al.* 1990, Forsman unpublished data) prompted close examination of both survival and reproduction of radio-marked owls. Data from radio-marked owls were not used in calculating demographic parameters.

Research requiring use of radio-telemetry techniques is currently adopting methodology to avoid or minimize use of backpack transmitters on spotted owls. Lightweight transmitters, less than 9 g, are available that can be attached to the central tail feathers or used as a backpack. Research utilizing radio-telemetry has had no significant effect on northern spotted owl populations and has been an important source of information for spotted owl conservation plans.

*Comment:* In the view of several commenters, data show a high juvenile mortality rate that cannot exclude radio-transmitters as the primary cause of death in dispersing owls. According to one commenter, virtually all the mortality data, especially for juveniles, are derived from studies using radio transmitters and are, therefore, biased because the use of transmitters affixed to the birds affects the results.

*Service response:* Backpack radio transmitters were used between 1982 and 1985 in studies of juvenile dispersal (Miller 1989, Gutierrez *et al.* 1985); these studies were also the source of some survival rates of juvenile spotted owls. The computed annual survival rates varied between years and between regions and averaged 19 percent. Various individuals have questioned the accuracy of the estimated rates because they viewed the rates as high and suspected that the radio transmitters were responsible for elevating the rate of mortality. Because some studies have demonstrated elevated mortality rates in radio-marked adult owl the Service cannot dismiss these concerns. Dispersing juvenile owls carrying backpack transmitters weighing about 20 g had an annual survival rate of about 19 percent (Miller 1989). Whether or not this is a low or high rate is unknown; it is simply the average rate observed over 4 years of studying radio-marked juveniles. The only other survival rates of juvenile owls are based on banding studies and these averaged 13.8 percent for northwest California and 21.9 percent in the vicinity of Roseburg, Oregon (USDI 1990). Hence, there is no evidence to conclude that mortality in radio-marked juvenile owls was higher than that of birds without radios. Neither is there evidence that the sustained mortality was related to the use of radio-transmitters. Nevertheless birds carrying radio transmitters were excluded from calculations of survival rates employed in computation of lambda values (USDI 1990).

*Comment:* Several commenters stated that the Status Review Supplement dismisses the impacts of radio

transmitters even though Forsman (1988) had data indicating that radio transmitters interfered with reproduction. One commenter remarked that the Forest Service's Pacific Northwest Research Station found that 24 percent of radio-tagged birds fledged young versus 81 percent for non-radio tagged owls (USDA 1988). Another commenter wrote that in a study conducted on the Roseburg District of the Bureau of Land Management comparing radio-tagged to color-banded spotted owls, it was found that the proportion of radio-tagged owls nesting was significantly lower than that of banded birds (Forsman, unpubl. data), but that over a five-year period, no clear relationship was detected in nesting success. The commenter stated that radio-tagged birds produced fewer young, but this apparently reflected that such birds had fewer nesting attempts rather than a higher failure rate. A researcher reported that in a monitoring study conducted for the Bureau of Land Management on Miller Mountain, Oregon, there was no significant difference between mean annual number of young fledged at sites occupied by radio-marked and non-telemetry owls in 1986, 1987, 1988, and 1989 (Wagner and Meslow 1989).

*Service response:* At least in some studies it appears that backpack radio transmitters decrease survival of adult spotted owls. The effect of backpack radio transmitters on reproduction seems more widespread. Radio-marked owls have been excluded from all calculations of adult survival and reproduction; therefore, any effect of radio-transmitters on survival or reproduction does not extend to or bias the various estimations of population increase/decrease or models of population viability.

Paton *et al.* (1990) working in California, and Foster *et al.* (1990) working in Oregon and Washington contrasted survival and reproduction of radio-marked adult spotted owls with a color-banded sample matched temporally and geographically. In California female radio-marked owls experienced significantly lower survival rates than their color-banded control group. The California sample of radio-marked pairs also was less likely than color-banded owls to attempt nesting. In Washington and Oregon there were no significant differences between the survival rates of combined made and female radio-marked owls and their color-banded counterpart. The radio-marked cohort of owls in Oregon and Washington exhibited evidence of lower reproduction than the color-banded

cohort in some areas; in other areas that was not the case.

*Comment:* One commenter stated that many credible scientists believe that heavy radios interfere with a young bird's ability to hunt and forage. Someone asked why Dr. Fred Gilback's (Baylor University) data on tagged screech owls were not reviewed. His study according to one commenter, revealed that tagged screech owls were not as successful in prey capture as those that were not tagged.

*Service response:* Dr. Frederick Gehlbach of Baylor University (Texas) has studied screech owls for a number of years, mostly in a suburban setting. He has presented no reports of differential capture success between radio-marked and unmarked screech owls. Dr. Gehlbach indicated that he had conducted limited experiments with 2 radio-marked owls versus 2 unmarked owls in flight cages and free-flying (pers. comm., March 1990). Dr. Gehlbach interprets the results as indicating radio attachment severely limits the performance of the screech owls. He further stated that he believes that radio attachment influences the performance of a wide variety of wildlife.

#### *Issue 23. Foraging and Prey Base*

*Comment:* Several individuals remarked that owls move from old growth to areas where food and mates are available and that studies in which researchers assumed that an owl had died if it could not be relocated in old growth were in error. A number of commenters maintained that openings created by clearcuts are beneficial to owls because that is where they hunt. The commenter also maintains that wildlife, in general, does better in clearcuts. A further comment was that owls use old growth only for shelter because there is no food under the forest canopy. One commenter wrote that loggers enhance foraging for owls as they walk through woods and flush rodents and other prey that spotted owls can capture. Another viewpoint was that second growth provides more foraging habitat for spotted owls.

*Service response:* Extensive data obtained by radio-tracking 81 individual northern spotted owls in the various physiographic provinces offers no evidence that owls leave old forest areas to preferentially use young forests (USDI 1990). Survival rates of spotted owls do not utilize information from birds marked with radio transmitters. Survival rates of spotted owls are calculated using repeat observations of individually marked owls on demographic study areas; search for missing, marked owls is not limited by

forest age class. Hence, such studies did not assume that an owl with a radio-transmitter had died if it was not relocated in old growth. The suitability of young stands or clearcuts as foraging habitat is best addressed by examining locations of foraging spotted owls. In examples cited from across the range of the subspecies the 1990 Status Review (USDI 1990) reported that in studies comparing habitat used to habitat available 68 of 81 owls selected old forest for foraging. In contrast, none of 57 owls selected for pole stands and only 3 of 81 owls selected young stands for foraging. In the proposal and previous status reviews (USDI 1987, 1989) similar habitat use patterns were reported. Spotted owls forage heavily on nocturnal arboreal mammals; these prey are either not present in adequate numbers or are apparently not available to spotted owls in clearcuts (Thomas *et al.* 1990). Because spotted owls are nocturnal and most human beings, including loggers, use the forest during daylight hours, it is unlikely that people walking in the forest assist the owls by flushing prey. Although a considerable area of the landscape is young forest, spotted owls disproportionately avoid young forest and choose to forage in old forest.

*Comment:* A commenter noted that data available on prey cannot be cited to conclude that old growth provides more or better prey for owls than does young growth. The commenter stated that the Status Review Supplement refers to old growth as supporting a high density of prey species for the spotted owl, apparently implying that old growth provides a better prey base than any other habitat type.

*Service response:* The Service concurs that recent summaries of prey abundance (Thomas *et al.* 1990) do not support a generalization that prey are more abundant in old than in younger forests. Rather, abundance of prey species by forest age varies with the species of prey, geographic region, and probably year. The fact remains that spotted owls forage disproportionately in older forests with the clear inference that they obtain prey in proportion to the time spent in the various age classes of forest.

*Comment:* According to one commenter, studies cited in the Status Review Supplement to indicate a high density of prey species in young growth were misinterpreted. Another asked why, if the owl survives only on red voles, can it be easily enticed to catch a white mouse that has been released near the owl by a biologist? A party stated that disease and food supply are

the limiting factors on the spotted owl population.

*Service response:* The Status Review Supplement (USDI 1989) indicated that on the H.J. Andrews study area densities of flying squirrels were not significantly different in old-growth versus young-growth stands; that interpretation is correct for the specific study. The fourteen papers cited on p. 2.1 of Status Review Supplement (USDI 1989) were cited primarily to document descriptions of spotted owl habitat. These papers provide only a limited assessment of prey habitat relationships. Red tree voles are only one of a variety of prey taken by the spotted owl (see review in Thomas *et al.* 1990). Adult spotted owls can be enticed to take a variety of offered prey items including white mice especially when young owls are present. The Service concurs that food supply is likely a limiting factor for spotted owls as it is for most wildlife. No new evidence since the Status Review Supplement (USDI 1989) leads the Service to suspect that disease currently plays an important role in limiting the spotted owl population.

*Comment:* Several commenters maintained that the Status Review Supplement inadequately assesses the relationship between prey base and the spotted owl by omitting data suggesting that prey base is a significant component of reproductive success. According to these commenters, the Status Review Supplement is contradictory in that it states that high prey density is an important factor in selection of old growth. Elsewhere prey abundance is said to be similar in old growth and young growth, thereby suggesting that prey abundance may not be the determining factor in selecting for old-growth forest, yet the revised finding states that fluctuation in reproductive success may be attributed to prey availability. According to these commenters, the Review Team failed to appreciate the importance of understanding prey relationships. Several commenters wrote that the team concluded that the study by Ward and Gutierrez (1989) showed no correlation between prey abundance and reproductive success, but that this was an improper conclusion. It appears to several commenters that studies present contradictory findings and no conclusion can be reached based on current data. In their view, these contradictions are indicative of a significant scientific dispute on the relation of prey base to the definition of suitable habitat. Further, commenters argued that the interpretation in the

Status Review Supplement that prey density is comparable in old-growth and young-growth forest is not supported. One commenter recommended that the proposed rule be withdrawn until information on prey abundance and availability in young- and old-growth forest is available.

*Service response:* The most recent comprehensive review of spotted owl food habits and prey is presented in Appendix J of the Thomas *et al.* (1990) report. The hypothesis that variation in reproduction by spotted owls is linked to variation in prey abundance is based on such studies as those of tawny owls (Southern 1970) and great horned owls (Rusch *et al.* 1972). The relationship of spotted owl reproduction to abundance of prey has not been well established. The reported positive association between reproduction and the frequency of large prey in spotted owl diets may represent either differential capture or differential transport of large prey to the nest; this issue is unresolved. The Ward and Gutierrez (1989) study was unable to demonstrate differences in prey abundance between reproducing and nonreproducing owl pairs by sampling prey at foraging sites used by the male owls (Thomas *et al.* 1990). Small mammal populations vary greatly from location to location and from year to year. It is not surprising, therefore, that investigators in different regions, and often in different years, report differing measures of abundance of the same or different species over a variety of forest types and age classes. It is not accurate to portray the lack of strong congruity among the assortment of studies as evidence of significant scientific dispute. There is ample evidence to indicate that spotted owls obtain their necessities from forests with old-growth characteristics and are present at much reduced densities, if at all, when forests lack such characteristics. It is unnecessary to resolve the question of prey availability in old versus young forests, or, managed versus unmanaged forests, to make a determination of the status of the northern spotted owl.

*Comment:* A possible hypothesis regarding prey availability and habitat use by owls was provided by one commenter who speculated that general prey unavailability in most young (40-60 year old) even-aged stands may be the result, in part, of dense overlapping crowns preventing access to prey. He suggests that pre-commercial or commercial thinnings may improve habitat quality for owls.

*Service response:* Even-aged stands 40 to 60 years old that have not been thinned often develop a dense

overlapping crown. The dense crown intercepts most light and thereby limits the development of the understory; such stands have little structural diversity which is likely reflected in a reduced complement of small mammals, the primary prey of spotted owls (Forsman *et al.* 1984). A dense overlapping canopy may also limit maneuverability of foraging spotted owls and preclude their effective use of such habitat. Whether thinning stands would increase prey abundance or availability and, thus, increase use of managed stands by spotted owls has not been demonstrated.

#### *Issue 24. Home Range*

*Comment:* According to one commenter, the proposal assumes that spotted owls are very territorial, yet this ignores empirical study to the contrary. Further, the commenter maintained that basic data included in the home range analysis are also problematic in that overestimation is possible. Also, one commenter stated that because the use of transmitter backpacks appear to affect the owl's ability to forage, they probably also modify home range data. According to one viewpoint, the convex polygon method of measuring home range contains numerous mathematical and biological problems such as a high probability of overestimating the area of use (e.g., Samuel and Garton 1985).

*Service response:* There is no empirical evidence indicating that northern spotted owls are not territorial and the Service rejects the comment.

The minimum convex polygon method for estimating home range (Southwood 1966) results in the smallest possible convex polygon containing all the observed locations. The area of this polygon represents the home range. One problem with use of the convex polygon method as a means of estimating home range size is a tendency for the estimated home range to increase in size as the number of locations increases (Jennrich and Turner 1969, Schoener 1981, Anderson 1982). As the number of locations increases, the probability of an "outlier" location being noted increases. Because the method connects the most distant points from the center of location points, a particularly distant "outlier" results in a larger area being contained within the polygon.

For example, the method is likely to overestimate the home range if a bird has two different use areas some distance apart, that is it forages in one area, nests in another, and tends to move in a straight line between the two (e.g., a barbell shaped territory). No one approach to estimating home range.

however, is free of problems (Anderson 1982, Samuel and Garton 1985). Because of the difficulty in comparing home range estimates derived from different methodologies, a more important concern than the technique *per se* is whether different investigators used the same technique so that comparisons can be made. Comparisons of home range estimated from different methodologies are incorrect. Most estimations of home range size for northern spotted owls were obtained using the minimum convex polygon method, and although the Service recognizes there is a tendency for overestimation to occur under some circumstances it nonetheless considers the estimates reliable.

An informal "rule" for biologists planning to place radio transmitters on birds is that the weight of the package should not exceed 5 percent of the bird's mass (Cochran 1980, Caccamise and Hedin 1985). Effects of the "rule" on attributes such as behavior (e.g., home range size, distance for foraging bouts) and survivorship have not, however, been evaluated for many species. Gessaman and Nagy (1988) demonstrated that homing pigeons wearing backpack transmitter of 2.5 percent and 5 percent of their body mass expended more energy and flew slower, but their work was on high performance homing pigeons (i.e., birds trained to fly as rapidly as possible and in as straight a line between two points as possible), inferences to other bird species like the northern spotted owl are limited. In fact, Gessaman and Nagy conclude that since the majority of flights of birds in the wild are at or near the most efficient flight speeds, effects of transmitters on energy expenditure should be smaller than those demonstrated for homing pigeons. Effects of transmitters on behavior such as home range size are, at this time, unknown, but it is reasonable to assume that if there was an effect it would lead to smaller, not larger, home range estimates.

*Comment:* One commenter disagreed with the statement in the Status Review Supplement that (2.16). "Home range size increases as quality and quantity/unit area of preferred habitat decreased" and believes there are no data to support this as no one has measured habitat quality relative to population fitness. According to this commenter, large spotted owl home ranges have larger amounts of old growth than contained in small home ranges. He speculates that home range size may be affected by continuity of acceptable habitat (fragmentation effect), and hypothesizes that home

range increases in fragmented habitat (see Solis 1983, Forsman et al., 1984, Carey 1985, Gutierrez 1988). Although this is a reasonable hypothesis, there is no proof, according to this commenter.

*Service response:* The Service agrees with the comment that there are no data to support the suggestion in the Status Review Supplement (USDI 1989:2.16) that home range size increases as the quality and quantity per unit area of suitable habitat decreases. The current Status Review (USDI 1990) reflects this change. The hypothesis that home range size increases with increasing fragmentation is reasonable, but has not yet been demonstrated.

#### *Issue 25. Nesting and Roosting*

*Comment:* One commenter stated that the Status Review Supplement noted that nesting activities of northern spotted owl are strongly associated with old-growth forests, but fails to support this contention. Several commenters wrote that in California, studies on private lands show that nests are located in managed forests containing considerably less canopy cover than 100 percent. Commenters cited studies on private land to show that broken tree tops and/or large cavities are not required nor even preferred as nest sites.

*Service response:* Nest sites of northern spotted owls are strongly associated with old-growth forest and forest containing structural characteristics similar to old growth (USDI 1990).

The Service rejects the specific assertion that nests on private managed forests in California contain considerably less than 100 percent canopy. Canopy coverage in coastal redwoods and redwood/Douglas-fir ranged from 80 percent to 90 percent, and 70 percent to 80 percent, respectively. Two hardwood stands containing nests had canopy coverage of 80 percent. The lowest reported value by the Timber Association of California was 70 percent (1989b; appendix B, part 2). Although the Service recognizes that there undoubtedly are nests in stands having canopy coverage <70 percent, the vast majority are in excess of 70 percent, a value the Service does not consider to be "considerably" less than 100 percent.

Evidence from across the range of northern spotted owls suggests owls exhibit considerable flexibility in the nesting substrate (USDI 1990) and the Service accepts the comment.

*Comment:* Results of a recent study of 53 spotted owl nest sites within the Wenatchee and Okanogan National Forests in Washington were reported by

one commenter (Irwin et al. 1989a). Many of the stands had been selectively logged within the past 70-80 years and five nests sites had been harvested over 40 years ago. Nest trees were 67-700 years old (average 194 years) and nests were mostly found in platforms created by mistletoe or in nests originally constructed by hawks. The majority of nests were in uneven-aged stands classified as mid-successional (climax species were grand fir or western red cedar and western hemlock, these were overtopped by residual Douglas-firs which survived previous logging or fires). Twenty of the nests were in trees 67-125 years old.

*Service response:* The Service accepts the comments.

*Comment:* According to one view, the Status Review Supplement has not proven the point that owls prefer to roost in old growth because the studies they cite (Miller 1989, Forsman et al., 1984) failed to analyze a complete range of age classes. Further, commenters stated that the studies rely almost exclusively on public lands that only have mature/old growth and very young stands. Moreover, several commenters noted that the studies lumped various age classes and covered a limited geographical area. One commenter maintained that the Status Review Supplement omitted relevant data from Franklin et al., (1986) in which none of 10 roost sites in 1983 and seven of 14 roost sites in 1984 were in old growth. A study by Diller (1989) was quoted to indicate that on Simpson's lands the average age of the dominant trees used for roosting was 57 years even though an old-growth stand was within 8.6 miles on average.

*Service response:* Studies by Thraikill and Meslow (1990) and Miller and Meslow (1989) both examined use versus availability of forest type used by roosting northern spotted owls. Both studies examined three age classes of forest, including old, mature and young. Young was defined as <100 years of age by Thraikill and Meslow and "less than mature" by Miller and Meslow. An additional study by Carey et al. (1990) analyzed the same three classes plus pole/sapling forest. Owls in all three studies selected for old-growth forest and against young and pole/sapling forests. The Service considers the age classes examined sufficient and therefore rejects the comment that studies examining habitat use of northern spotted owls failed to include a broad representation of all age classes of trees. Recent work by Blakesley et al. (1990b) also supports the contention that roosting owls select old growth.

Franklin *et al.* (1986) did not state that none of 10 roost sites in 1983 and 7 of 14 roost sites in 1984 were in old growth. The Service therefore does not accept the comment that relevant data was omitted from the Status Review Supplement (USDI 1989).

The Service accepts the data from Diller's (1989) study in coastal California redwoods. However, the Service again notes that redwood stands have many of the structural characteristics of old growth at younger ages (Kerns 1988) and that selection of stands for roosting by northern spotted owls is more likely related to stand structural characteristics than age *per se*.

#### Issue 26. Reproductive Rates

*Comment:* Several commenters stated that industry data for northern California indicate that young growth supports owls as well as does old growth and reproductive rates are similar. Although the Timber Association of California did not band birds, did not have several years to conduct the study, and did not undertake numerous site visits in the survey areas, it believes its results are comparable to studies on Federal lands (note that the Timber Association of California also included data on the California spotted owl). Therefore, the Timber Association of California concludes that the Status Review Supplements' hypothesis that northern spotted owls only successfully reproduce in old growth is disproved or at least unreliable. The Timber Association of California data from California show a reproductive success rate (50 percent) slightly higher than other reported rates in Franklin *et al.*, (1986, 1987, 1988) (42-47 percent). Furthermore, one commenter maintained that recent data show an increase in reproductive success.

*Service response:* The Timber Association of California data from the coastal redwood zone included many stands of up to 100 years in age, whereas rotation ages in the future are likely to be approximately 60 years or less. The surveyed stands also included remnant older trees (see discussion under Factor A) which are believed to have been important in making the stands usable by northern spotted owls. These remnant older trees, however, would not be present in the future if the stands are clearcut. The Timber Association of California data from inland areas were gathered primarily on lands that had been harvested using selective cutting methods. These lands contain the structural characteristics that are associated with spotted owls. These methods are seldom used on

public land and are not used on much of the private land in northern California. The Timber Association of California study therefore did not characterize typical commercial timberland in California.

*Comment:* One commenter stated that the actual reproductive rates are significantly higher than the Status Review Supplement indicates. For example, the rangewide mean reproductive rate for 1982-1985 was 0.20 + .16 and for 1988-1989 was 0.32 + .09.

*Service response:* The Service believes that the Status Review Supplement provided a thorough review of the information available at the time the Status Review Supplement was prepared. Since the Status Review Supplement was prepared, new information has become available which indicates that reproductive rates are higher than the estimates contained in the Status Review Supplement. Current estimates (female fledglings produced per adult female) are 0.32 and 0.38 for study sites in Oregon and California, respectively. Even when these higher rates are used, however, analyses indicated that both populations are declining (USDI 1990).

*Comment:* According to one commenter, data regarding spotted owl reproductive success do not conclusively show that the rate of reproduction is insufficient to maintain a viable population and averages between 40 and 60 percent. One commenter wrote that the Status Review Supplement states there was no reproduction in young growth, yet this was inaccurate because Irwin *et al.* (1989c) had reported 29 nest sites in young growth in the Wenatchee and Okanogan National Forests.

Numerous commenters argued that data on spotted owl survival, especially of juveniles, and reproductive rates, are not the best available data and reveal significant information gaps in population trends and dynamics.

*Service response:* The Service has conducted a thorough analysis, since the Status Review Supplement was prepared, of all existing data (see Discussion under Factor A). The analysis used state-of-the-art methods both to estimate the demographic parameters and to estimate whether populations in the Willow Creek Study area of California, and in the Roseburg Study Area in Oregon, are reproducing at replacement rates. The conclusion was that resident birds in both populations are not reproducing at self-sustaining rates. The reproductive rate was 0.38 and 0.32 fledglings/adult

female in the Willow Creek and Roseburg Study Areas, respectively. These values are less than those cited by the commenter and in the Service's analysis were found to be insufficient to maintain a stable population size. Data are insufficient from other sites to make such an assessment. The study by Irwin *et al.* (1989a) was in stands harvested using selective methods. Many of the trees were much more than 100 years old. For example, nest site trees varied in age from 67 to 700 years. Thus, these were not young stands.

#### Issue 27. Competition and Predation

*Comment:* One commenter stated that the Status Review Supplement concludes that the barred owl competes with the northern spotted owl for habitat, however, this is conjecture. Another party stated that it was not shown that the presence of the barred owl is detrimental to the spotted owl. In contrast, another said that the real threat to the northern spotted owl is the presence of the barred owl and the expansion in range of the latter species, and that this threat will continue even if the old-growth trees are not removed. According to one commenter, because the barred owl is a much better competitor, it will replace the spotted owl regardless of the management efforts implemented to protect habitat. One commenter stated that recent work seems to indicate that barred owls displace spotted owls.

*Service response:* The 1989 Status Review Supplement did not reach a conclusion regarding the impact of the barred owl on the distribution, reproductive success, abundance, or survival of the spotted owl. Rather, the Status Review Supplement indicated that the long-term impact of the expansion of the barred owl into the range of the spotted owl was unknown, but of concern. The issue remains unresolved (USDI 1990).

*Comment:* One investigator submitted a recently completed study on the relationship between barred and spotted owls (Hamer *et al.* 1989). The study concluded that by reducing the amount of available habitat to spotted owls, barred owls appear to be placing more food stress on at least one spotted owl population (northwestern Washington on the west slope of the North Cascade Mountains) that shows signs of being near its energetic and ecological limits (Hamer *et al.*, 1989).

*Service response:* The Service accepts the comment noting that the Hamer *et al.* (1989) study was conducted on the northern edge of the spotted owl's distribution.

*Comment:* One commenter stated that the Status Review Supplement assumes that predation in combination with timber harvesting poses a threat to the owl. According to one commenter, assumptions pertaining to a small area were extrapolated to the entire range. One individual maintained that the listing team was selective in its use of terminology and studies to avoid finding that the owl might be increasing at other places.

*Service response:* The Status Review Supplement (USDI 1989) recounted both the observation of predation on spotted owls by great horned owls and the concern that such predation may increase with increasing habitat fragmentation. The Status Review Supplement did not make a judgment as to the impacts of great horned owl predation on the spotted owl population; the 1990 Status Review (USDI 1990) deals with the situation in a similar fashion (Sec. 3.5). The Service employs the best scientific information available and extrapolates where warranted and does not believe that unwarranted conclusions were drawn concerning the significance of predation or competition to the status of spotted owl populations. Nor does the Service accept the commenter's statement that the listing team was selective in its use of terminology or in its review of studies.

#### *Issue 28. Captive Propagation, Relocation, and Miscellaneous*

*Comment:* Several commenters stated that the forest products industry should propagate northern spotted owls in captivity so that there would be no need to list them. A number of commenters recommended that northern spotted owls be relocated to wilderness areas from areas scheduled for timber harvesting. Another commenter asked if studies are being done to enable the transfer of spotted owls from areas scheduled for timber harvest to areas already preserved as wilderness or roadless areas.

*Service response:* Among the purposes of the Act are to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved and to provide a program for the conservation of such endangered and threatened species (section 2(b)). It would not be in keeping with the intent of the Act to substitute a captive propagation program for maintaining the owl in its native habitat.

The Service generally dismisses proposals to transfer listed individuals from known suitable occupied habitat to other areas simply to expedite or permit destruction or adverse modification of

existing suitable habitat. Instead, the Service may require compensation for habitat losses through section 7 consultation process with other Federal agencies for activities proposed that require Federal funding, approval, or authorization. Nor would the Service encourage capture and translocation of owls to other areas. Generally spotted owls have large home ranges. There is no reason to believe that large blocks of suitable, but currently unoccupied, habitat exist within wilderness or other protected areas that are free from logging pressure. Evidence indicates that home range size increases with elevation. As most wilderness areas within the owl's distribution are at higher elevations, home ranges in such locations would tend to be larger than those in many of the nearby lower elevation, non-wilderness areas scheduled for harvesting. The premise that owls occurring within the scheduled harvest areas could be captured and successfully established at translocation sites in wilderness or other protected areas is without foundation. Presumably the majority of suitable owl habitat located within wilderness areas already is occupied by spotted owls.

*Comment:* One commenter feels that the Service's analysis should be expanded to address many non-timber cutting uses of Forest Service land and that there should be guidelines for recreation and other non-consumptive activities. Without such guidelines, the commenter feared that restrictions may be developed for timber harvesting and inadvertently applied to forest activities that have little or no impact on the owls such as ski developments, camping, and off-road vehicle use.

*Service response:* In its assessment of the status of the northern spotted owl, the Service did not restrict its analysis to timber harvesting activities on Forest Service land. The Service recognizes that modification and loss of owl habitat can occur as the result of other activities. However, it is the Service's opinion that logging is the major factor affecting the continued availability and distribution of suitable habitat on Forest Service lands. Under section 7 provisions of the Act, the Forest Service will review any proposed projects that it is considering authorizing, funding, or carrying out to determine if such activities may affect the northern spotted owl. If proposed projects, including recreational activities, may affect the northern spotted owl, the Forest Service must consult with the Service who will evaluate the potential impacts of actions on the owl. These section 7 consultations will provide the guidance suggested by the commenter.

*Comment:* Several commenters were concerned that owls were being killed by loggers and other individuals and that immediate enforcement action is needed. The commenters referenced an article in the Oregonian that a mutilated spotted owl had been found hanging in a noose from a Forest Service kiosk. Others were concerned about the, "If it flies, it dies" bumper stickers.

*Service response:* As a listed threatened species, the northern spotted owl will be protected against "take" under prohibitions outlined in section 9 of the Act upon the effective date of this rule. Hence, at that time Service law enforcement agents may investigate possible violations of the Act and take whatever legal action is deemed appropriate. The Migratory Bird Treaty Act provides inadequate protection against take (see Factor E for details).

*Comment:* Several commenters indicated that the greenhouse effect will alter vegetation patterns in the Pacific Northwest and will have far more significant effects on the spotted owl than timber management. One said that these dying old-growth forests are contributing to the greenhouse effect.

*Service response:* The possible implications of the greenhouse effect have not been studied in relation to long-term viability of the northern spotted owl. The Service infers from this comment that if a threat is identified that may possibly have a more significant impact on the spotted owl than timber harvesting does, that the effects of clearcutting and other logging activities should be dismissed as inconsequential. However, the Service must include in its review and assessment, past, current, and foreseeable impacts on the habitat of the spotted owl. Clearly, timber harvesting has contributed and will continue to contribute to modifying and reducing the amount of suitable owl habitat. The Service cannot minimize the import of this impact simply because there may be other elements impinging on the owl's status. Furthermore, in a recent article in *Science*, Harmon *et al.* (1990) reports that old-growth forests capture and store much larger amounts of carbon from the atmosphere than younger forests. For landscapes with rotations of 50, 75, and 100 years, the carbon stored is at most 38, 44, and 51 percent, respectively, of that stored in an old-growth stand. Moreover, this study concludes that, contrary to the commenters' opinions, logging old growth contributes to the global greenhouse effect by releasing large amounts of carbon dioxide into the atmosphere, even when the old trees are

replaced by new seedlings. More than half of the wood harvested from old-growth stands is burned or used in other ways that releases carbon dioxide into the atmosphere (Harmon *et al.* 1990).

*Comment:* One commenter asked if there was a comprehensive report of the scientific literature on the owl that included current studies.

*Service response:* The scientific literature on the northern spotted owl is extensive. Anyone wishing a list of references pertaining to research findings on this taxon may contact the Service. Moreover, the Northern Spotted Owl 1987 Status Report, 1989 Status Review Supplement, the 1990 Status Review (prepared by the Service), and the ISC report (Thomas *et al.* 1990) provide a comprehensive report which discusses much of the scientific literature available on the owl.

*Comment:* Another noted that recently the eastern boundary line of habitat for the northern California province had been extended to the east to include part of Modoc County, California.

*Service response:* The Service has heard of several possible northern spotted owl occurrences in western Modoc County, California, as referenced by the commenter. However, further survey work has not verified the permanent status of these owls (G. Gould, pers. comm.; Don DeLorenzo, pers. comm.). Additional work may substantiate the presence of northern spotted owls in western Modoc County.

*Comment:* In the view of one party, if nest boxes and hunting posts were erected, there would be plenty of owls.

*Service response:* Suitable habitat of the northern spotted owl includes a host of characteristics, not just suitable nest sites and foraging posts. For example, quantity and quality of appropriate prey species as well as vegetation to protect against inclement weather conditions and to provide escape cover from predators are a consideration. There is no evidence that installation of nest boxes and perch sites will overcome the threats affecting the northern spotted owl.

*Comment:* One commenter noted a low level of infestation of a parasitic fly in spotted owls. He stated that Hippoboscids are known vectors of Haemoproteus, an internal blood parasite.

*Service response:* It is not known at this time to what extent the northern spotted owl is infected with the referenced internal blood parasite. Hence, the Service presently cannot assess the threat this possible condition may pose to the owl.

### Summary of Factors Affecting the Species

The provisions of section 4 of the Act and regulations promulgated to implement the Act (50 CFR part 424) were followed. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1). These factors and their application to the northern spotted owl (*Strix occidentalis caurina*) are as follows:

**A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range.** Western Oregon and Washington were covered by approximately 24 to 28 million acres of forest at the time of modern settlement (early to mid-1800s), of which about 70 percent (14 to 19 million acres) may have been old growth (Society of American Foresters Task Force 1983, Spies and Franklin 1988, Morrison 1988, Norse 1988). Historical estimates for northwestern California are not as precise, but suggest there were between 1.3 and 3.2 million acres of old-growth Douglas-fir/mixed conifer and about 2.2 million acres of old-growth coastal redwood (Society of American Foresters Task Force 1983, Laudenslayer 1985, Fox 1988, California Department of Forestry and Fire Protection 1988, Morrison 1988).

Habitat for northern spotted owls has been declining since the arrival of European settlers. Although the extent of suitable habitat before the 1800s is difficult to quantify, estimates of 17.5 million acres in 1800 and 7.1 million acres today (Thomas *et al.* 1990) suggest a reduction of about 60 percent in the past 190 years. Other estimates (Spies and Franklin 1988, Morrison 1988, Norse 1988) suggest that the reported decline in historical habitat, in fact, may have been as high as 83 to 88 percent. Habitat reduction has not been uniform throughout the range of the spotted owl, but has been concentrated at lower elevations and the Coast Ranges. Reduction of old growth is largely attributable to timber harvesting and land conversion practices, although natural perturbations, such as forest fires, have caused losses as well.

Current surveys and inventories have shown that while northern spotted owls are not found in all old-growth forests, nor exclusively in old-growth forests, they are overwhelmingly associated with forests of this age and structure (USDI 1989). It is well-established that northern spotted owls tend to be associated with forest stands in which many of the trees are more than 80 years old ("older forest") (USDI 1990, Thomas

*et al.* 1990). For example, in 9 studies throughout the range of northern spotted owls, 85 percent of 81 radio-marked owls spent more time foraging in old growth than expected by chance, whereas only 4 percent spent more time foraging in young-growth stands than expected by chance (USDI 1990). Studies also show clearly that northern spotted owls preferentially select old growth for roosting (USDI 1990, Thomas *et al.* 1990).

Approximately 90 percent of suitable habitat for northern spotted owls now occurs on public land (Thomas *et al.* 1990). In Washington and Oregon less than 5 percent of the suitable habitat is in private or State ownership. Relatively speaking, little old growth presently exists on private, State, or tribal lands (Society of American Foresters Task Force 1983, Old-Growth Definition Task Group 1986, Morrison 1988, Spies and Franklin 1988, California Department of Forestry and Fire Protection 1988, Thomas *et al.* 1988, Greene 1988). In California, a significant amount of habitat may occur on private land but the exact amount is currently difficult to estimate. Historically, non-Federal lands probably contained a significant amount of owl habitat and may still offer the opportunity to provide vital linkages between islands of federally managed habitat in many areas. However, current logging practices, such as clearcutting, even-aged management, and short logging rotations, preclude development of future mature and old-growth conditions from most existing young forest stands.

The Forest Service manages 79 percent of the habitat on federal land, the Bureau of Land Management manages 14 percent, and the National Park Service manages 7 percent (Thomas *et al.* 1990). Of the 6.8 million acres of northern spotted owl habitat in government ownership, 60 percent is classified as timber production land, 28 percent is withdrawn from timber harvest (principally land in Wilderness Areas and National Parks), and 12 percent is classified as unsuitable for timber production (Thomas *et al.* 1990).

The amount of northern spotted owl habitat on land suitable for timber production has decreased rapidly since 1960 as indicated in Figure 1 for Forest Service land in Washington and Oregon. While future events are difficult to predict, past trends strongly suggest that much of the remaining unprotected spotted owl habitat could disappear within 20 to 30 years, and on some forests, the unprotected habitat could disappear within 10 years.

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### DECLINE OF NORTHERN SPOTTED OWL HABITAT ON LAND SUITABLE FOR TIMBER PRODUCTION

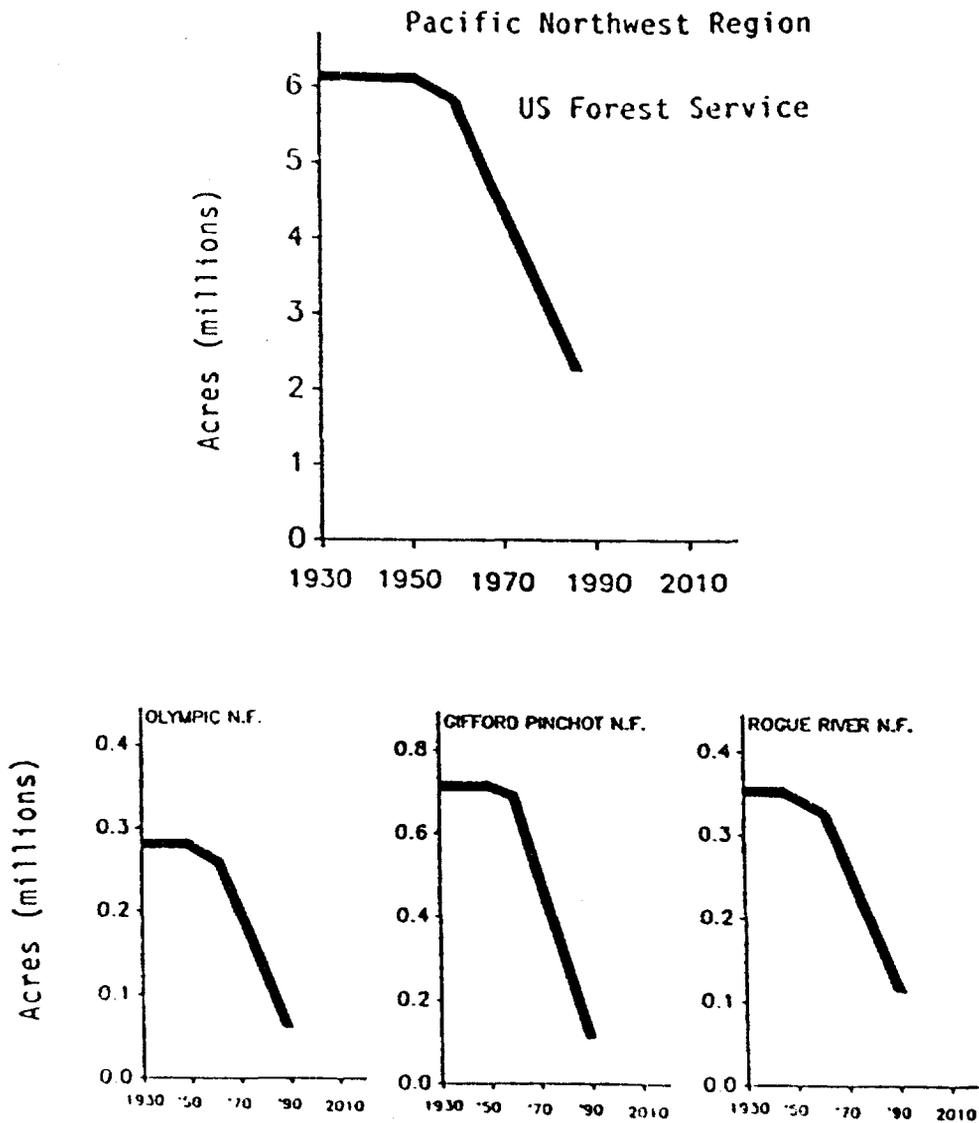


Figure 1. Decline in acreage of unprotected suitable northern spotted owl habitat on Forest Service lands also suitable for timber production. Based on information provided by the Forest Service (Pacific Northwest Region, Timber Management).

Conversion of younger habitat to old-growth condition is not expected to be significant unless current logging practices change (Beuter *et al.* 1976, Heinrichs 1983, Society of American Foresters Task Force 1983, Harris 1984, Spies and Franklin 1988). As a result of habitat fragmentation, reduction in individual stand size, and edge effects, it has been speculated that the amount of suitable habitat presently available for the spotted owl (i.e., a matrix of patches of suitable habitat of sufficient size to support reproductively successful owls) may actually be less than 50 percent of the total habitat remaining today. This reduction in the quality of remaining forest habitat under present logging patterns will continue to the point where less than 10 percent of historical levels remains (Harris 1984; Harris *et al.* 1992; Morrison 1988, 1989; Norse 1988).

At present, a substantial amount of land on Forest Service and Bureau of Land Management land has been dedicated to spotted owl management areas. This system, however, has been called into question by Thomas *et al.* (1990), who consider it inefficient and unlikely to succeed in preserving northern spotted owls. They have urged that this approach be abandoned and have proposed a new system.

Under current management plans, the distribution of spotted owl habitat remaining in the near future will closely coincide with National Parks, reserved areas on federally managed forests, or other lands that are not considered suitable or available for timber harvest for other reasons (e.g., lands too steep or rocky for timber production, lands needed for hydrologic protection, scenic areas, etc.). These areas will contribute to maintaining spotted owl populations only to the extent that they contain suitable habitat of adequate size and quality for the birds (USDI 1989). By then, most remaining suitable habitat will no longer be continuous, but will exist as islands of varying size, spacing, and suitability spread over the range of the subspecies. Although more suitable habitat is likely to develop with time, it does not seem probable that recruitment of suitable habitat will significantly offset currently anticipated losses resulting from timber harvesting and natural events such as fire and wind storms (Thomas *et al.* 1990). With the currently anticipated timber harvest schedules, there is no assurance that this developing habitat will exist long enough to contribute significantly to northern spotted owl viability (Thomas *et al.*, letter dated December 20, 1989). Moreover, rotation age for managed forest stands is expected to be as low as

40-60 years on private land (Thomas *et al.*, letter dated December 20, 1989). Many of the current Wilderness Areas and parks are largely high-elevation lands above timberline and it is unlikely that northern spotted owl populations would be viable if their habitat were restricted to these areas (USDI 1990). These protected areas are concentrated within only about one-third of the current range (USDI 1990). Furthermore, abundance and reproductive success of northern spotted owls in these areas is much lower than in good habitat outside the protected areas. The low productivity is especially significant because it suggests strongly that reproductive success in these areas would be too low to balance mortality due to natural causes (USDI 1990). Lands unsuited for timber production may have poor soil conditions or be too steep or rocky for successful reforestation; such areas generally are not suitable habitat for spotted owls, nor are they likely to effectively support successfully reproducing pairs of owls (Meslow, pers. comm.).

To achieve the primary objective of timber management in Oregon, Washington, and northern California of producing wood at a non-declining rate, forests must be intensively managed with average cutting rotations of 70 to 120 years (USDI 1984, USDA 1988). Current preferred timber harvest systems emphasize dispersed clearcut patches for even-age management as the pattern of harvest. Thus, public forest lands that are intensively managed for timber production are, in general, not allowed to develop "old-growth characteristics," which often require about 200 years to develop. As a result, loss and fragmentation of remaining forests and old-growth stands suitable for spotted owls will continue if current management practices are unchanged. Suitable spotted owl habitat can develop in considerably less than 200 years depending on stand history, site productivity, and precipitation. There are examples of accelerated stand development in northern California, the Coast Range, and the east slope of the Cascades (Thomas *et al.* 1990).

The effect of timber harvest on northern spotted owls depends on whether even-aged, or mixed-aged techniques are used. Even-aged stands are created by clearcutting, or other methods in which only a few older trees are left, and by complete burns or blowdowns. Mixed-aged stands are created by selective cutting or partial burns or blowdowns. More than 90 percent of the timber harvest throughout the range of the northern spotted owl is

accomplished using clearcutting or other methods that produce even-aged stands (USDI 1990). In considering the effect of timber harvest on northern spotted owl populations, primary attention must be given to the effects of even-aged harvest methods.

Several studies have concluded that northern spotted owls are seldom found in even-aged stands younger than currently planned rotation ages. For example, Forsman *et al.* (1977) surveyed 104 miles of roads in western Oregon and detected only one pair and four single northern spotted owls (0.06 owls/mile). In a nearby area with more abundant older forest, they detected 0.93 owls/mile. Forsman *et al.* (1987) surveyed some of the same areas lacking older forest 10 years later and obtained similar results (0.03 owls/mile). Postovit (1977) surveyed roads in Washington. He detected only 2 single birds (0.006 owls/mile) on routes lacking older forest. On nearby routes with abundant older forest he detected 0.052 owls/mile. Irwin *et al.* (1989d) surveyed 277 miles<sup>2</sup> in southwestern Washington in areas lacking older forest. They found only one pair (in one of two years) and detected 0.01 owls/mile<sup>2</sup> and 0.002 pairs/mile<sup>2</sup>. Bart and Forsman (1990) tabulated data from eight surveys excluding the ones mentioned above in areas containing extensive 50 to 80 year-old stands but little older forest. The surveys covered a total of 679 miles<sup>2</sup> and were located throughout the range of northern spotted owls. The density of owls was only one per 100 miles<sup>2</sup> and of pairs was one per 300 miles<sup>2</sup>. In contrast, nearby areas with substantial areas of older forest, surveyed using similar methods, had a density of one pair per 7 miles<sup>2</sup>, approximately 40 times higher than the density reported from areas lacking older forest (Table 1) (USDI 1990).

The Service (USDI 1990) analyzed data from the Forest Service monitoring program (O'Halloran 1989, Simon-Jackson 1989). Northern spotted owl abundance and productivity decreased steadily as the amount of older forest decreased and areas with <20 percent older forest had few owls (Table 2). Meyer *et al.* (1990), in comparing habitat fragmentation at owl sites with random sites on Bureau of Land Management land in Oregon, found significantly lower levels of fragmentation at the owl sites. Bart and Forsman (1990) obtained data from 186 study areas covering 4,319 miles<sup>2</sup> located throughout the range. Their analysis demonstrated that in areas with less than 20 percent older forest, northern spotted owls were rare, and had low reproductive success

(Figure 2). Further, these trends were similar throughout the range (Figure 3).

TABLE 1.—Results of Surveys for Northern Spotted Owls in Landscapes With Abundant 50–80-Year-Old Stands But Little Older Forest (BART AND FORSMAN 1990).

Location	Area surveyed (mi <sup>2</sup> )	Percent of area covered by 50–80 yr. stands	Owls per mi <sup>2</sup>	Pairs per mi <sup>2</sup>
Washington Cedar R. Watershed.....	20	50	0.00	0.00
Packwood Ranger Dist.....	9	92	0.00	0.00
Randle Ranger Dist.....	36	75	0.00	0.00

TABLE 1.—Results of Surveys for Northern Spotted Owls in Landscapes With Abundant 50–80-Year-Old Stands But Little Older Forest (BART AND FORSMAN 1990).—Continued

Location	Area surveyed (mi <sup>2</sup> )	Percent of area covered by 50–80 yr. stands	Owls per mi <sup>2</sup>	Pairs per mi <sup>2</sup>
Olympic Peninsula.....	16	81	0.00	0.00
Southwestern Wash.....	277	52	0.01	0.00
Oregon Cascades				
Oakridge Ranger Dist.....	21	68	0.00	0.00
Eugene District, BLM.....	115	57	0.04	0.02

TABLE 1.—Results of Surveys for Northern Spotted Owls in Landscapes With Abundant 50–80-Year-Old Stands But Little Older Forest (BART AND FORSMAN 1990).—Continued

Location	Area surveyed (mi <sup>2</sup> )	Percent of area covered by 50–80 yr. stands	Owls per mi <sup>2</sup>	Pairs per mi <sup>2</sup>
Klamath Province				
McCloud Ranger Dist.....	185	59	0.00	0.00
All areas.....	679	67	0.009	0.003

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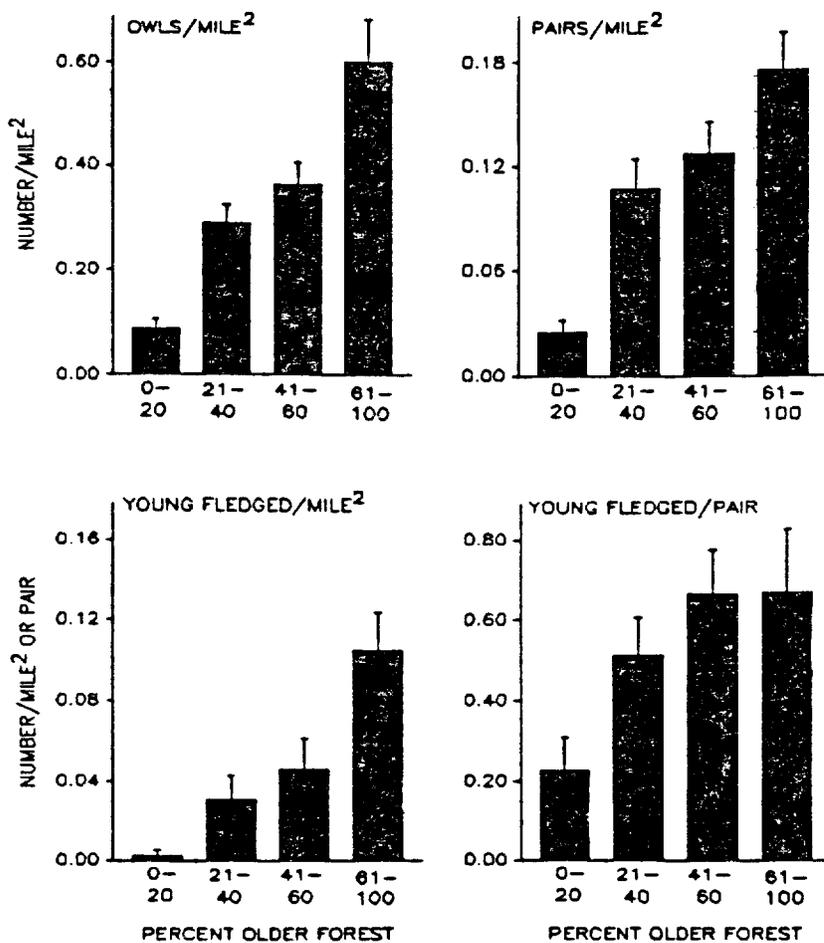


Figure 2. Abundance and productivity of northern spotted owls in relation to amount of older forest on the surveyed areas. Vertical bars indicate 1 standard error (Bart and Forsman 1990).

TABLE 2.—ABUNDANCE AND PRODUCTIVITY OF NORTHERN SPOTTED OWLS IN RELATION TO AMOUNT OF OLDER FOREST AS INDICATED BY FOREST SERVICE MONITORING DATA (USDA 1989)

Variable	Percent suitable habitat			
	0-20	21-40	41-60	<60
Owls/site.....	<sup>a</sup> 0.31	<sup>b</sup> 0.64	<sup>b</sup> 0.85	<sup>b</sup> 0.95
Pairs/site.....	<sup>a</sup> 0.04	<sup>b</sup> 0.19	<sup>b</sup> 0.29	<sup>b</sup> 0.27
Young fledged/ pair.....	0.33	0.77	0.67	0.93
Young fledged/ site.....	<sup>a</sup> 0.01	<sup>b</sup> 0.13	<sup>b</sup> 0.21	<sup>b</sup> 0.22
Number of sites.....	101	56	58	39

<sup>a</sup>, <sup>b</sup> Different superscripts indicate significantly different ( $P < 0.05$ ) values within rows.

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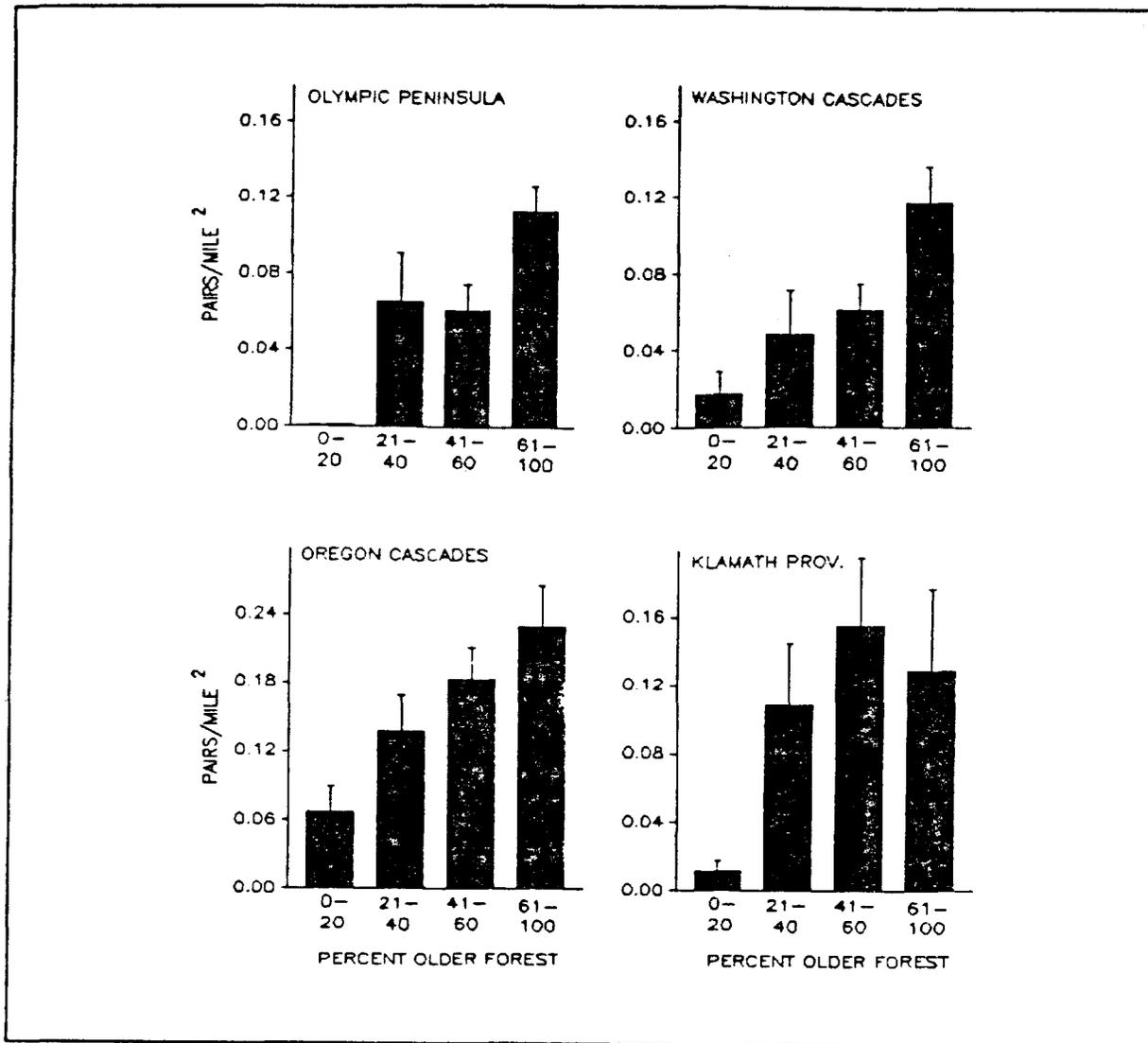


Figure 3. Abundance of spotted owls in four portions of their range in relation to amount of older forest on the surveyed area. Vertical bar indicates 1 standard error (Bart and Forsman 1990).

Abundant evidence from surveys of large areas also shows that northern spotted owls become rare or are absent on lands managed for timber production once the older forest is harvested. In one of the first comprehensive summaries of northern spotted owl locational data, Forsman *et al.* (1977) concluded that northern spotted owls in Oregon were found primarily in areas with abundant older forest, and only occasionally in areas with little or no older forest. In Washington, Hays *et al.* (1989a) surveyed northern spotted owls in regions that differed in amount of older forest and detected more owls in regions with more older forest. For example, ten times more owls were detected in the Olympic Peninsula, where older forest was more common, than in southwest Washington where there was no older forest in the surveyed areas.

Additional evidence that northern spotted owls are rare in timber production lands once the older forest has disappeared comes from the numerous surveys on public and private land in portions of the range that lack older forest. The largest such region includes the Coast Range north of the Siskiyou National Forest and south of the Olympic Peninsula. Throughout this region, 50 to 80 year old stands are common, but few older stands are present. If land managed for timber production provided suitable habitat, then northern spotted owls should be widespread in this area. In fact, however, owl density is extremely low, and is approximately one-eighth that recorded in a nearby study with substantial amounts of older forest (Thomas *et al.* 1990). The few birds present are concentrated around the remaining blocks of older forest. Thomas *et al.* (1990) discuss several other areas of special concern where northern spotted owls have largely disappeared due to timber harvest activities.

Northern spotted owls appear to use at least some land that has been managed to produce uneven-aged stands, but this silvicultural approach is generally rare throughout the range. Land managed to produce uneven-aged stands includes small patches of older forest along streams and in areas unsuitable for timber harvest, but such lands generally comprise 20 percent or less of the area (USDI 1990). In these areas northern spotted owls are rare and have low reproductive success. The abundance and productivity of northern spotted owls in mixed-age stands has been studied on private land in California. In the interior, Douglas-fir zone, preliminary data indicate that owl

abundance and productivity on the selectivity harvested areas approximated the levels on clearcut areas containing about 40 percent older forest (Irwin *et al.* 1989b, USDI 1990). In the coastal redwood zone, abundance and productivity is high in stands containing remnant older trees (Diller 1989, Irwin *et al.* 1989b, USDI 1990). It is difficult to predict whether these lands will support owl populations in the future because current harvest methods favor even-age stands and trees younger and smaller than many of the trees that were present in these studies.

Annual cutting rates of old-growth and old-growth/mature age classes of trees have been established by the Forest Service and the Bureau of Land Management (USDI 1989). During the 1980s, the Bureau has been harvesting old-growth and old-growth/mature trees at the rate of about 22,000 acres per year in Oregon. At the present time, the Forest Service estimates its harvesting of spotted owl habitat (mature and old-growth classes) at the rate of about 36,000 to 40,000 acres per year in Oregon and Washington combined, and 12,000 acres annually in California. Unless these cutting rates or patterns of cutting are altered, much of the existing spotted owl habitat remaining that is available for timber harvest will be gone within about 20 to 30 years (USDI 1990). Much of what remains may be too small and fragmented to support successfully breeding pairs of owls.

As a result of past and present harvest patterns, potential isolation of several subpopulations of northern spotted owls is also of considerable concern (e.g., the Olympic Peninsula, the Coast Ranges in southwestern Washington and northwestern Oregon, and the Marin County area in California) (USDA 1988, USDI 1989). The central problem of subpopulation isolation is one of maintaining a critical population size level in the absence of genetic or demographic contributions from other subpopulations. The smaller a population or subpopulation and the greater its isolation from other populations, the greater the risk of its elimination as a result of chance demographic and environmental events or genetic effects (Shaffer 1987).

The population of spotted owls on the Olympic Peninsula may be isolated demographically, and perhaps even genetically, from other owl populations, since there does not appear to be an effective, self-sustaining population in either southwestern Washington adjacent to the Olympic Peninsula or the northwestern Oregon Coast Ranges (Irwin *et al.* 1988, 1989d; A. Potter,

Wash. Dept. of Wildlife, Olympia, WA, pers. comm.; Forsman *et al.* 1977; Forsman 1986; W. Logan, Bureau of Land Management, Salem, OR, pers. comm.). While the population in the Oregon Coast Ranges may not be currently isolated due to a tenuous connection to the Cascade populations at the southern part of the range provided by lands managed by the Bureau, the scale of habitat fragmentation throughout the range is of considerable concern (USDI 1989). As one moves north along the Oregon Coast Ranges, habitat ownership becomes fragmented because of checkerboarding of Bureau and private lands. Remaining old growth and mature forests become more fragmented as well. During the next 10 to 15 years, given the existing direction of land management, the current degree of isolation on the Olympic Peninsula and the potential for isolation of portions of the Oregon Coast Ranges provinces are likely to become exacerbated, as most intervening habitat is privately owned. Currently there are few pairs of owls in the northern part of the Oregon Coast Range and under current management trends, these may disappear as remaining suitable habitat is lost or becomes too isolated.

The Washington and Oregon Cascade populations of owls are at risk of becoming demographically isolated from one another by loss of habitat along the Columbia River corridor. The impounded section of the Columbia River upstream of Bonneville Dam and the associated transportation and urban/agricultural corridor downstream from Bonneville Dam may serve as a significant dispersal barrier to the north-south movement of owls. In addition, the Columbia River downstream from Portland is very wide with little or no old-growth and mature habitat adjacent to the river, nor is there a self-sustaining spotted owl population in this area (Logan, pers. comm.; Forsman *et al.* 1977; Forsman 1986; Potter, pers. comm.). No evidence exists of spotted owls moving across the Columbia River, nor have birds been observed crossing the Willamette Valley (Thomas *et al.*, letter dated December 20, 1989).

Other possible problems with isolation of populations of spotted owls, or at least areas that present possible "bottlenecks" in distribution, occur in the central Washington Cascades ("I-90 corridor"), the Santiam Pass area, the Shasta/Modoc area, the Pit River connection to the Sierras, and the juncture of the Oregon Cascades and Klamath physiographic provinces.

Northern spotted owl surveys conducted on private commercial

timberlands during 1989 documented that owls were more numerous in 30-100-year-old even-aged and mixed-age forests than had been previously reported (Irwin *et al.* 1989b; Kerns 1989a, b; Pious 1989). At the present time it is not known if this portion of the population is self-sustaining; however, these areas do represent the potential to contribute to the regional owl population. Because these lands provide a habitat link southward from Forest Service holdings and inland to National Park Service lands in Marin County, the Marin-Sonoma-Napa County northern spotted owls may not be as isolated from adjoining populations as was previously suggested (Thomas *et al.*, letter dated December 20, 1989). However, current timber management regimes indicate it is economically beneficial to harvest stands 60-90 years of age, the approximate age at which these stands are beginning to support spotted owls (Thomas *et al.*, letter dated December 20, 1989). Further, although the hardwood component of many of these stands has had little commercial value, in the future it may be removed to produce pulp (Thomas *et al.*, letter dated December 20, 1989).

Although natural habitat is never constant, the old-growth forest habitat prior to 1900 was more continuous than the present landscape. Natural perturbations have been significant in terms of the amount of area influenced as evidenced by, for example, the Tillamook Burn(s) in Oregon, the first of 1987 in the southern portion of the range, the "21 blow" in Washington, the Columbus Day storm in 1962, and the eruption of Mount St. Helens (Thomas *et al.*, letter dated December 20, 1989). However, most natural perturbations would generally have been small and localized relative to the entire Pacific Northwest. Franklin *et al.* (1988) examined the scale of 14 major fire events in Mt. Rainier National Park from 1230 to 1703 and estimated that these fires burned from 8 percent to 47 percent (median of 24 percent) of the park's reconstructed forested area. Given that these represent major fire events, it is not unreasonable to conclude that the impact of most other, nonmajor natural perturbations would be smaller and more localized. Because natural disturbances are less uniform both in effect and in time than those precipitated by broad-range timber harvest, such natural disturbances usually create more heterogeneous forest structure throughout the landscape (Thomas *et al.*, letter dated December 20, 1989). The current habitat situation for spotted owls continues to

change from the original condition where unsuitable habitat patches were small and isolated, to the reverse where suitable habitat now occurs in small and isolated patches. These factors all interact to decrease habitat suitability or effectiveness for supporting a well-distributed population of spotted owls over time (Greene 1988; Harris 1984; Meslow *et al.* 1981; Spies and Franklin 1988; Thomas *et al.* 1988).

Timber harvesting and natural perturbations result in the loss of suitable spotted owl habitat and an increase in forest fragmentation. Habitat fragmentation may be defined as the breakup of contiguous tracts of forest habitat into smaller, more isolated parcels (USDI 1989). Timber harvest, employing a pattern of small, dispersed clearcuts, eventually leads to a situation where parcel sizes are so small as to be influenced by edge effects (windthrow, invasion by alien species, microclimatic changes, etc.). As a result, the original parcels may no longer be able to sustain the species or the community originally found in the larger and contiguous tracts of habitat and the quality (i.e., effectiveness of the habitat to support successful reproduction) of remaining preferred forest stands may be lessened considerably when the effects of adjacent roads and clearcuts are considered. Impacts from edge effects and environmental disturbances may be most noticeable in areas where little old growth currently remains, for example, in the Oregon Coast Ranges.

A recent assessment of the effects of forest fragmentation suggests that in areas of highly fragmented and isolated habitats in northwestern California, there may be lower reproductive fitness among owls relative to birds in nearby, more contiguous habitat (Chavez-Leon 1989). Ripple *et al.* (1990) contrasted the percentage of cutover lands, in circles of various diameters, at 30 northern spotted owl nest sites and 30 random sites on the Willamette National Forest, Oregon. The percent cutover land was significantly lower near nest sites compared to random sites. Statistically significant differences existed at all circle sizes. They concluded that northern spotted owls appear to select for low levels of cutover land adjacent to their nests. Meyer *et al.* (1990) selected 50 owl sites and 50 random sites and compared several indices of habitat fragmentation in the two data sets. According to preliminary results, habitat at owl sites was significantly less fragmented than the habitat at random sites. The findings of Meyer *et al.* (1990) and Ripple *et al.* (1990) that areas selected by northern spotted owls

have lower levels of habitat fragmentation than random sites is consistent with other studies showing lower abundance in areas with little older forest (USDI 1990).

Fragmentation of habitat also may adversely affect spotted owls by: (1) Directly eliminating key roosting, nesting, or foraging stands; (2) indirectly reducing the survival of dispersing juvenile owls; (3) perhaps increasing competition or predation, and (4) reducing population densities and interaction between individuals. These factors may interact to decrease habitat quality, suitability, or effectiveness for supporting a well-distributed population of spotted owls over time (Greene 1988, Harris 1984, Meslow *et al.* 1981, Spies and Franklin 1988, Thomas *et al.* 1988).

Fragmentation can also have harmful genetic consequences through its effect on the effective population size. Each subpopulation occupying a discrete habitat patch, such as those that result from habitat fragmentation, comprises a component of the overall population, referred to as a "metapopulation." The processes of extinction and colonization within individual patches can have deleterious genetic effects that might not be predicted by models that do not consider metapopulation structure (USDI 1989).

The patchwork pattern of even-aged, dispersed, clearcut timber harvest systems has imposed a checkerboard pattern on present old-growth and mature forests, fragmenting remaining habitat throughout the owl's range and reducing the total amount of suitable spotted owl habitat. This fragmentation of spotted owl habitat may be especially noticeable on Bureau lands which are additionally checkerboarded because of land ownership patterns. However, it should be noted that the present timber cutting pattern may provide a more persistent distribution of some relatively mature forest stands throughout the landscape (Thomas *et al.*, letter dated December 20, 1989). If a "minimal" fragmentation strategy were to be implemented using even-age forest management, more extensive areas may consist of young-growth stands (Thomas *et al.*, letter dated December 20, 1989). Relatively large areas of early young-growth forest may prevent or reduce the interaction of northern spotted owls. It is not known whether the dispersed clearcuts or broad expanses of young forest stages would provide the better situation for northern spotted owls in managed forests (Thomas *et al.*, letter dated December 20, 1989).

Although the actual numbers of owl sites and pairs on all lands is not

precisely known, recent surveys (1985–1989) indicate that there are about 2,000 known pairs of northern spotted owls within the present range of the subspecies, although 3,000–4,000 pairs are suspected (Thomas *et al.* 1990). Of these, approximately 90 percent are found on federally managed lands (USDI 1989, Thomas *et al.* 1990). Data contributing to estimates of present population size have been collected for about 20 years, with counts of owls increasing over that period as greater areas of habitat were surveyed (Gould 1985; Gould, pers. comm.; Forsman *et al.* 1987; USDA 1988; Robertson 1989; Vetterick 1989). However, the increase in numbers of spotted owls counted in these surveys reflects an increase in inventory effort and improvements in inventory methods rather than an indication of any upward population trend. Not all forest habitat has been fully surveyed, as some areas, particularly Wilderness Areas, are difficult to inventory. An estimate of population trends in relation to habitat over time is likely to provide a better understanding of the status of the population than just total numbers of individuals and pairs.

Information about population trends for spotted owls is provided by three different kinds of data: (1) Changes in spotted owl habitat; (2) changes in spotted owl population size; and (3) survival and reproductive rates. Both the close association between the spotted owl and old-growth and mature forests and the dramatic reductions in old growth that have occurred have been thoroughly discussed earlier. This loss of old-growth and mature habitat continues, with projected losses on Federal lands of about 3 percent per year on Bureau of Land Management and 1 percent per year on Forest Service land (USDI 1990). Northern spotted owls that are displaced when suitable habitat is lost within their home ranges will likely relocate into nearby remaining habitat, creating an apparent increase in densities, referred to as the "packing" phenomenon, in the remaining habitat (Thomas *et al.*, letter dated December 20, 1989). If this results in competition

with owls already present in the habitat, there may be a decline in reproductive success. Hence, high owl densities in such areas must be assessed with care to determine their true significance as the same population may provide two different estimates of trend (Thomas *et al.*, letter dated December 20, 1989). The first pertains to the actual numbers of birds and may be interpreted as an indication of increasing population. However, the second estimate would be based on demographic parameters and would suggest a declining population (Thomas *et al.*, letter dated December 20, 1989). The disparate results can be reconciled by invoking recruitment from outside the population being assessed to account for the increases in numbers (Noon and Biles 1990). Finally, when the best available estimates of spotted owl survival and reproductive rates are combined and analyzed, resulting values point to a declining population (USDI 1989, USDI 1990).

The Service conducted an analysis of the effects of the substantial loss of suitable habitat on the dynamics of the spotted owl population using the results from two large demographic studies: (1) Willow Creek (113 mi.<sup>2</sup>) and surrounding Regional Study Area (3,861 mi.<sup>2</sup>) in northwest California, studied from 1984–89 (Franklin *et al.* 1990a) and (2) the Roseburg Study Area (1,200 mi.<sup>2</sup>) in southwest Oregon, studied from 1985–89 (Forsman 1989a). The study areas in northwest California were managed by the Forest Service and although these had been substantially clearcut, there were still extensive areas of suitable habitat. The Roseburg area, a checkerboard ownership pattern consisting of Bureau of Land Management and private lands, has been intensively clearcut; thus the remaining habitat is highly fragmented. These areas are the only ones currently available with adequate data (four years or more) for a thorough, comprehensive, and rigorous analysis.

Estimates of age-specific survival and fecundity of females were needed as these values were used to estimate trends in the size of the population of resident, territorial owls. Estimation of

the number of immigrants were important in understanding the dynamics of the population. Further technical details of the methodology and results of the analysis of the capture-recapture data used to estimate the needed values from these areas can be found in USDI (1990). The Service's results (see USDI 1990) update all prior estimates of population parameters of the northern spotted owl for these two study areas. To eliminate any possible bias that radio transmitters may have imposed, birds equipped with radio devices were not used in these analyses. As is typical of these types of analyses, the female component of the population was emphasized.

Intensive analysis of the data for females provided the following estimates of annual survival probabilities and standard errors (a measure of precision):

Area and parameter <sup>a</sup>	Estimate <sup>b</sup>	Standard error (est.)
Northwest: Juvenile survival.....	0.130	0.046
California:		
Subadult survival.....	.903	.024
Adult survival.....	.903	.024
Roseburg: Juvenile survival.....	.219	.072
Oregon:		
Subadult survival.....	.588	.086
Adult survival.....	.812	.025

<sup>a</sup> Juvenile—0–12 months of age, subadult—12–24 months, and adult more than 24 months.

<sup>b</sup> Probability of female of that specific age class surviving until the next year.

The Service concluded that the estimated survival of adults on the Roseburg area was quite low and that there was no significant year to year variation in the survival parameters. The mean life span of adults was 9.80 years (se—2.55) and 4.79 years (se—0.71) for northwest California and Roseburg areas, respectively. Many other technical details are contained in USDI (1990).

Information on fecundity (the number of young fledged per female of age *x*) of individuals was averaged across years to provide estimates of average fecundity:

Age	Northern California			Roseburg Study Area		
	n	Fecundity	Std. error	n	Fecundity	Std. error
Subadult 1.....	17	0.147	0.083	23	0.0652	0.0477
Subadult 2.....	23	.261	.088	23	.0652	.0477
Adult.....	197	.376	.032	215	.3209	.0281

No significant year to year variation was found in the fecundity on either

study area. The estimates of age-specific survival and fecundity (above) have

little bias and are quite precise. Because these estimates employ the best and

most current data available and the analysis is based on the best statistical theory for the analysis of capture-recapture data, the Service believes these to be good estimates.

The entry of new owls into the adult female component of the population was found to be statistically significant each year on both study areas. Average annual estimates of this augmentation are summarized below:

Study area	Total entry	Internal recruits	Immigrants
Northwest CA .....	6	2	6
Roseburg, OR .....	42	3	39

These estimates clearly suggest that most new adult females entering these areas were immigrants and that relatively few young females, produced on the study areas, were recruited into the resident population of territorial females (USDI 1990). The estimates (above) made it clear that the resident population of territorial females on both study areas was being augmented each year by female owls from surrounding areas. These immigrants included "floaters" (nonterritorial subadults or adults) and perhaps dispersing juveniles and subadult birds from surrounding areas. The size of the floating component of the population was perhaps drawn down as these birds found territories and entered the resident population. Some of the immigrants were likely birds displaced by timber harvest in surrounding areas that had been clearcut and fragmented.

In its analysis, the Service found that a statistically significant number of owls entered these two study areas each year, and this by itself is strong evidence that the resident population of territorial birds was decreasing. Very substantial immigration was occurring, especially on the Roseburg area, where relatively little suitable habitat remained.

Lambda was computed from the age-specific survival and fecundity rates (above) using traditional methods (e.g., Leslie 1945). If  $\lambda = 1$ , the population is "stationary," but if  $\lambda < 1$ , then a declining population is indicated. To estimate if the owl population has declined in response to habitat loss and fragmentation from timber harvesting, the Service estimated lambda values and tested the hypothesis that  $\lambda = 1$  vs.  $\lambda < 1$ . The estimates of survival (above) were derived from marked, territorial birds residing on the two study areas and the estimates of fecundity (above) were computed for resident females on the

two study areas. Thus, lambda answers the question, "Have the resident territorial owls replaced themselves?"

The Service believes its estimates of lambda update previous estimates, including those in Thomas *et al.* (1990). The estimates of lambda are properly interpreted as the average annual rate of population change of female owls during the period of investigation and data collection (i.e., 1984-89 for northwest California and 1985-89 for the Roseburg area). No inference was made about the value of lambda prior to these studies or in the future. These estimates of lambda represent a "snapshot" of the average annual change in the resident female component of these two populations and their recruitment. Because no significant year-to-year variability in survival or fecundity rates was found in either area, interpretation of lambda is possible. Final estimates of lambda are given below with their estimated standard errors:

Area	Lambda	se (Lambda est.)
Northwest CA .....	0.9524	0.0284
Roseburg, OR .....	.8588	.0286

A one-sided test of the null hypothesis  $\lambda = 1$  vs. the alternative  $\lambda < 1$  was statistically significant for both areas, where  $z$  is a test statistic:

Area	$z$	P
Northwest CA .....	1.676	0.0469
Roseburg, OR .....	4.944	0.0000

These results indicate that the resident population of females was declining on both of these large study areas and was not able to replace itself. The declining population in northwest California was of particular interest because it occurred in an area with considerable amounts of suitable owl habitat. Here the annual rate of decline in the resident female population was approximately 5 percent. Over the five years of study, the population of territorial females declined an estimated 21.6 percent ( $se = 11.7$  percent) per year. In contrast, the Roseburg area in southwest Oregon contained much less suitable habitat, had been extensively clearcut, and was highly fragmented. Here the estimated rate of population decline of resident females was approximately 14 percent per year. Over the four years of study, this population of territorial females declined an estimated 45.6 percent ( $se = 7.2$  percent). Based on habitat quality and

quantity, it was expected *a priori* that lambda would be smaller in the Roseburg area compared to the northwest California area and this was shown to be the case.

According to the Service's results, the resident population of owls on these areas was declining sharply and significantly in both areas but was sustained each year by owls from surrounding areas, including floaters on the areas (the "rescue effect"). Hence, the Service maintains that these areas are population sinks where mortality exceeds recruitment. Because there has been a dramatic loss of suitable habitat throughout the range of the northern spotted owl, it seems likely that the population of owls has declined substantially throughout its range. This population decline was the fundamental basis for the interagency conservation strategy (Thomas *et al.* 1990). Moreover, there is a high likelihood that the population is currently above the carrying capacity. Franklin *et al.* (1990a) provided evidence of packing where birds crowd into suitable habitat with the resulting increased competition for resources affecting both survival and fecundity rates. Floaters probably constitute most of the immigrants, and this tends to mask the drastic rates of population decline of the resident populations. Further, standard survey counts tend to remain little changed because immigrants cannot be distinguished from the resident birds in most cases. Current counts of owls may be misleading (optimistic) because the population was above the carrying capacity due to habitat loss. Thus, even if the loss of habitat were halted, these data suggest that the population would continue to decrease substantially for, at least, several generations (also see Thomas *et al.* 1990). At some future time, the population would come into a new equilibrium with the habitat and become somewhat stationary.

USDI (1990) also provides the results of a simple approach to estimating the population change for northwest California, somewhat independent from the results outlined above. Here, the estimate of average population change was even less optimistic ( $\lambda^* = 0.929$ ). The available evidence indicates sharply declining populations of owls as a result of the intensive clearcutting of suitable habitat at least in these two study areas.

Sources of bias in the estimates of lambda were reviewed in USDI (1990). First, emigration of (especially) juvenile birds that survived the year, left the study, and did not return was not accounted for by the analysis

Federal, State, and private groups is being conducted on this subspecies. This work is providing valuable information and is not having a negative impact on the subspecies. The spotted owl is not a game bird, nor is there any known commercial or sporting use.

**C. Disease or Predation.** Predation by great horned owls (*Bubo virginianus*) has been identified as a major source of juvenile mortality in spotted owls (USDI 1987; Dawson *et al.* 1986; USDA 1986; Simberloff 1987; and USDA 1988). Concern has been expressed that increasing habitat fragmentation may be subjecting spotted owls to greater risks of predation as they move into or across more open terrain, or come into more frequent contact with forest edges where horned owls may be more numerous. Hamer (1989) has been studying spotted owl and great horned owl interactions in the north Cascades of Washington. His survey of the 145-square-mile Mt. Baker study area showed that great horned owls were more common than spotted owls in this mostly fragmented habitat. He found, with a limited sample size, that spotted owls avoided areas intensively used by pairs of great horned owls. In young-growth forests in southwestern Washington, Irwin *et al.* (1989d) reported that great horned owls, along with the western screech owl (*Otus asio*), were the most commonly found owls, and that spotted owls were frequently found. Specific impacts of great horned owl predation on the overall spotted owl population are unknown, but this remains an issue of concern.

In a recent study, the incidence of hematozoa in spotted owls was found to be one of the highest of any avian species yet examined (Gutierrez 1989). Recent research indicates there may be both long- and short-term ecological effects of hematozoa on birds such as the possibility of adversely influencing their energetics (Gutierrez 1989).

**D. The Inadequacy of Existing Regulatory Mechanisms.** Although there are numerous State and federal laws and regulations that, if enforced, may protect spotted owls and, to a lesser extent, spotted owl habitat, the implementation and effectiveness of these laws to date has been variable (Thomas *et al.* 1990). The precarious status of the northern spotted owl has been recognized in Washington where it is listed as endangered, in Oregon where it is considered threatened, and in California where it is classified as a sensitive species.

Private companies own approximately 9.7 million acres of forested land within the range of the northern spotted owl in

Oregon and Washington (USDA 1984). In northern California, private companies own an additional 8.6 million acres (Thomas *et al.* 1990). This resource base is being utilized for the commercial production of timber. The actual amount of suitable owl habitat is unknown. The California Department of Forestry and Fire Protection (CDF), however, estimates that about 70 percent of the stands in private ownership are less than 16 inches dbh (diameter at breast height) (R. Tuazon, pers. comm.); these are unlikely to provide suitable spotted owl habitat. An even smaller amount of suitable habitat is estimated on private lands in Oregon and Washington. Commercial logging on private and State-owned land is regulated by forestry practice laws in each of the three states.

In Washington, logging practices on State, State Trust, and private lands are regulated by the State Department of Natural Resources. Harvest of timber on lands containing endangered species requires that an "environmental checklist" be addressed or possibly a more detailed environmental statement be written, before harvest can be approved and initiated. Timber sales with owl conflicts are decided on a case-by-case basis. In 1989 the Washington Commission on Old Growth Alternatives for Washington's Forest Trust Lands, which exist to provide revenue to trust beneficiaries, agreed to defer harvest on 15,000 acres (out of 80,000 acres) of old growth in western Washington for 15 years. This represents less than 6 percent of the land base in State ownership in the area, and would protect, at most, two of 15 pairs of spotted owls on these lands (Wash. Dept. Wild. 1989). The 15,000 acres withheld would be included in normal harvest schedules after the 15-year period specified in the agreement. However, "Implementation of the Old Growth Commission recommendations will likely result in a significant reduction in the Olympic Peninsula Spotted Owl population" (Wash. Dept. Wildl. 1989). Current management practices provide little hope for the long-term protection of spotted owl habitat on Department of Natural Resources lands.

In Oregon, logging practices on State and private lands are regulated under the Oregon Forest Practices Act (FPA), which does "not specifically mention the northern spotted owl" (Brown 1989). However, the spotted owl is listed by the Oregon Fish and Wildlife Commission as threatened within the State. Relatively new legislation (HB 3396, 1987) in Oregon directs the Oregon Department of Forestry to protect

species that the State designates as endangered or threatened and develop appropriate guidelines to implement this protection. However, these guidelines are not scheduled for completion until 1991. As part of this effort, the Department of Forestry has issued "forest practices rules" that are applicable to State and private lands. However, the only protection for northern spotted owls appears to be short-term protection of nest sites that become apparent prior to or during harvesting operations (Thomas *et al.*, letter dated December 20, 1989). Most State lands in Oregon (786,000 acres) are managed by the Department of Forestry (ODF), but only 25,000 acres are reserved from timber production (Thomas *et al.* 1990). The Interagency Scientific Committee (Thomas *et al.* 1990) estimates that fewer than 20 pairs of owls are found on State land in Oregon, and that most of this habitat will be harvested within the next 20 years.

In California, decisions on timber harvest management plans for private timber land are made by the California Department of Forestry. Although harvesting plans are reviewed by the California Department of Fish and Game (CDFG), approval by that agency is not required. Despite the spotted owl being classified as a Species of Special Concern, this classification confers no special protection to either the owl or its habitat. The Department of Forestry and Fire Protection has initiated a timberlands task force to address the needs of wildlife on forest lands throughout the State. This will include consideration of a habitat conservation plan for spotted owls if the owl is listed. The California Department of Parks and Recreation currently provides protection to about 56,000 acres of suitable spotted owl habitat in its redwood parks. These areas, managed for their natural values, provide protection to a small number (five known breeding pairs) of spotted owls (USDI 1990).

Based on present State regulations and policy, clearly no State legislates adequate protection for spotted owls. Private and State-owned forest lands in Washington, Oregon, and northern California total over 21 million acres. Less than 1 percent, mostly in State parks in northern California, provides long-term protection to the northern spotted owl. Although approximately 4 percent of known reproductive pairs occur on private lands (Thomas *et al.* 1990), particularly in northern California, current regulatory mechanisms neither account for their presence, nor protect them.

The Federal Migratory Bird Treaty Act (16 U.S.C. 703 *et seq.*) prohibits taking of spotted owls or their eggs or nests except as permitted by regulation, and imposes criminal penalties for unlawful taking. However, no Federal regulations deal specifically with protecting spotted owl habitat throughout its range.

The above laws and policies offer little protection for spotted owl habitat. The Endangered Species Act offers additional possibilities for protection and management of this species' habitat as discussed below in the Available Conservation Measures section.

Approximately 85-90 percent of the northern spotted owl habitat is under Federal ownership by the National Park Service, Bureau, and Forest Service. These forested lands are managed under a variety of regulations, objectives, and policies.

The National Park Service manages nine National Parks, Monuments, Seashores, and Recreation Areas containing about 8 percent (570,000 acres) of potential spotted owl habitat (USDI 1990). The National Park Service is required by statute to manage National Parks to conserve their wildlife (16 USC 1) and, hence, timber harvesting and most forms of habitat alteration are not permitted. Owl surveys on National Park Service lands are not as complete as those on lands of other Federal agencies, documenting only 28 pairs, although many more undoubtedly occur (USDI 1990). As many as 100 spotted owls could enjoy legal protection on National Park Service lands (Thomas *et al.* 1990).

The National Forest Management Act of 1976 and its implementing regulations require the Forest Service to manage National Forests to provide enough habitat to maintain viable populations of native vertebrate species, such as the spotted owl. These regulations define a viable population as one which "has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well-distributed . . ." (36 CFR 219.19).

The Forest Service manages about 70 percent of the remaining northern spotted owl habitat and is the largest Federal land-holding agency in the Pacific Northwest. Spotted owl habitat on National Forest lands in Washington, Oregon, and California is estimated to cover about 5 million acres (USDI 1990). Although Forest Service lands are managed for multiple use purposes, 63 percent of its land base within the range of the spotted owl is subject to timber harvest (USDA 1989, Table 1), whereas the remaining 37 percent of its forested lands is reserved (1.0 million acres) or

unsuited to timber production (834,000 acres). In Oregon and Washington, about 64,000 acres of old-growth and mature forests suitable for spotted owls have been logged on the National Forests each year over the past nine years; this represents a decline in nonreserved owl habitat on Forest Service land of about 2.3 percent per year and a reduction of about 1.5 percent per year in the total amount of owl habitat on National Forests in Oregon and Washington (Thomas *et al.* 1990). The anticipated harvest rates for old-growth and mature forests for the next 10 years are about 39,400 acres/year, or roughly 1.4 percent of the nonreserved old-growth and mature forests on Forest Service lands annually in Oregon and Washington. About 1 percent (4,700 acres) of the suitable habitat on Forest Service lands in California will be harvested each year (Thomas *et al.* 1990). These cuts will have a significant impact because a majority of recent timber sales have occurred in or near forest stands occupied by owls (Thomas *et al.* 1990).

Spotted owl management on National Forest lands in California, Oregon, and Washington is based on regional guidelines adopted by the Pacific Southwest Region (Region 5) for California and by the Pacific Northwest Region (Region 6) for Oregon and Washington. These guidelines provide for a network of forest-wide owl sites (Spotted Owl Habitat Areas or SOHAs) containing 1,000 acres of suitable habitat in California and from 1,000 to 3,000 acres in Washington and Oregon in conjunction with existing suitable habitat in parks, wilderness, and other reserved areas. Additional acreage (about 25 percent) was added to these sites in Oregon and Washington under Section 318 of the 1990 Interior Appropriations Bill (P.L. 101-121), but for one year only. Some of these sites are located in areas not available for timber harvest (e.g., natural areas, research areas, wilderness), but the majority of the sites (60 to 70 percent) would be surrounded by commercial timber land available for logging. SOHAs, as well as the Bureau of Land Management/Oregon Department of Fish and Wildlife agreement areas discussed below, are designed to protect the habitat needs of small numbers (usually one, but sometimes two or three) of spotted owl breeding pairs by reserving from harvest an area of suitable habitat (old or mature forest) within a 1.5-mile radius circle in California and a 2.1-mile radius circle in Oregon and Washington. By the end of 1989 there were 644 SOHAs totaling 722,127 acres (USDI 1990) on the 17

National Forests containing northern spotted owls (USDA 1989, Appendix H).

To implement forest plans to manage about 375 spotted owl habitat areas within its lands in Oregon and Washington, the Forest Service prepared a Final Supplemental Environmental Impact Statement (USDA 1988) with a preferred alternative. In late 1988, the Forest Service made its final Record of Decision on spotted owl management guidelines for National Forests in Washington and Oregon. The decision provides guidance (habitat amount, location, juxtaposition) to set aside a network of selected Spotted Owl Habitat Areas, totaling approximately 374,000 to 477,000 acres in Washington and Oregon forests.

The Forest Service's Record of Decision for Oregon and Washington set a timetable of 5 years for a full review of the Forest Service's owl management program, continued implementation of a \$5 million annual Research, Development, and Application Program, and reaffirmed the Forest Service's commitment to coordinate and cooperate with other agencies. In addition, the final Forest Service spotted owl decision only addresses regional standards and guidelines for spotted owl management. The actual implementation of owl management was intended to be based on individual forest plans once they are finalized. "Networks" of northern spotted owl habitat are now in place on National Forests that support northern spotted owls and fulfill the Forest Service's plan for the management of spotted owl habitat pending completion and approval of individual forest plans (Thomas *et al.*, letter dated December 20, 1989). To date, only the Siuslaw and Siskiyou National Forest Plans have been approved.

The Siuslaw and Siskiyou Forest Plans are the most recently completed planning documents from the Forest Service in Region 6 (Oregon and Washington). They clearly demonstrate that timber production will remain the primary mission of the Forest Service and that timber harvest will continue to have a major impact on spotted owl habitat. Under the Siskiyou National Forest plan, nearly 50,000 acres of mature and old-growth habitat would be cut in this decade. On the Siuslaw National Forest, the harvest of younger-aged stands (60 to 80 years) would preclude the development of habitat suitable for the spotted owl in the decades ahead. This loss of habitat, with no planned replacement, is the primary threat facing the northern spotted owl on forests currently managed for timber.

procedures; this bias would result in an estimate of lambda that was too low (perhaps 2-3 percent). Secondly, the analysis procedures failed to account for senescence in either survival or fecundity rates; thus, providing estimates of lambda that were too high (perhaps by 2-3 percent). Little could be done to correct for either bias. Although it is unlikely that these two biases would exactly cancel each other, it appears that considered jointly, they would provide little impact to the final results. Other sources of bias were reviewed in USDI (1990) and found to be of little probable importance. In summary, the best and most current estimates of the finite rate of annual population change are those given above (e.g., 0.95 for northwest California and 0.86 for the Roseburg area in southwest Oregon). These results indicate a sharply declining population of resident, territorial owls due to habitat loss. The populations are above carrying capacity and are being temporarily maintained by immigration.

It is unknown whether the amount and distribution of spotted owl habitat remaining at the end of commercial harvest of old-growth forests on public lands (USDI 1989) will be adequate to support a viable population of the northern spotted owl. Attempts to answer this question by using the concepts and tools of population viability assessments have been undertaken by the Forest Service (USDA 1986, 1988), Lande (1987a, 1987b, 1988), and Doak (1989). Although subject to criticism on a number of grounds, the population viability assessments indicate that implementation of the Forest Service's preferred alternative for managing the spotted owl in Oregon and Washington (Alternative F, USDA 1988) will not provide a high probability of persistence for the spotted owl over the next 50 to 100 years, at least not in significant portions of its range. Litigation has been initiated regarding the Forest Service's preferred alternative. At this time it is not known whether this alternative will be implemented. Moreover, at this writing, final individual forest plans pertaining to spotted owl management based on the regional guidelines have been adopted only for the Siskiyou and Siuslaw National Forests.

Moreover, spotted owl population viability assessments performed to date (USDA 1986, 1988; Lande 1987a, 1987b, 1988) have not explicitly considered habitat differences in reproductive rates and how different fitnesses of owls in different habitats would affect population dynamics. In particular, the

life table and population viability analyses that have been performed to date may present an optimistic view of the future status of spotted owl populations for two reasons (USDI 1989). First, the population viability analyses conducted by the Forest Service were based on a single frequency distribution of reproduction rates, with a mean value from owl pairs in the most preferred habitats. However, as discussed previously, theory and empirical data suggest that owl pairs in less suitable, younger habitats may have significantly lower per capita reproductive rates. Therefore, as more preferred habitat is cleared, population growth rates may be reduced to values lower than were used in existing models. Second, the Forest Service's population viability analyses assume that a given Spotted Owl Habitat Area (SOHA) will be occupied with a probability proportional to the amount of old-growth forest within the SOHA. However, the assumed relationship is based on the present landscape configuration, the existing amounts of old growth, and the current spatial relationships between old growth and young growth forests. The assumed SOHA occupancy probabilities are likely to decline as surrounding old growth is cleared and SOHAs become more isolated from other large patches of preferred habitat. These points are intended to emphasize the fact that the models should be interpreted cautiously, and that planning for the owl should include built-in safety factors to insure that future habitat requirements for a viable population are not underestimated.

Forest Service modeling (USDA 1986) predicts that the mortality of dispersing juvenile owls will increase whenever the amount of suitable habitat areas decreases. As spotted owl habitat continues to be reduced further by timber harvest, the current spotted owl population is expected to decline correspondingly, and perhaps more precipitously.

Based on ecological theory, several predictions about the effects of continued harvesting of suitable habitats on the future demographic performance of spotted owls can be made. Given the data, it is likely that continued harvest of preferred habitat will adversely affect spotted owl populations. As more of this habitat is removed and fragmented, a number of possible scenarios may occur: (1) Individual owls will have to use habitats comprised of a higher proportion of young forests, necessitating an increase in their home range size to meet their

energetic and nutritional requirements and resulting in an overall decrease in density of spotted owls; (2) as more owls use less suitable habitats, there will likely be a decrease in the average reproductive success of the population as a whole; and (3) displaced individuals may be unable to encounter suitable nesting habitat. Analysis of available information for spotted owls seems to support these theoretical predictions (USDI 1989).

In a second possible scenario: (1) Displaced owls may become concentrated in the remaining suitable habitats (Thomas *et al.*, letter dated December 20, 1989); (2) thus, occupancy rates of spotted owls in such habitats may remain inordinately high or even increase ("packing") even if the total population size within a larger area is declining (Thomas *et al.*, letter dated December 20, 1989); (3) a greater proportion of the population could consist of non-territorial owls ("floaters") (Thomas *et al.*, letter dated December 20, 1989); (4) in turn, the floaters could consist of an increasing proportion of older birds, perhaps with a preponderance of males (Thomas *et al.*, letter dated December 20, 1989); (5) hence, juvenile survivorship could decrease as the periodically few vacated sites are usurped by subadult and adult floaters (Thomas *et al.*, letter dated December 20, 1989).

The reported variation in per capita reproductive rates between habitats of different suitability implies that owls using young-growth forests may actually contribute proportionately less to population recruitment than their numbers would suggest. Because of apparent differences in reproductive rates, it would be incorrect to assume that a given owl population, normally concentrated in old-growth forests, could be maintained for any length of time on a relatively larger area of less suitable, young forests. The data on spotted owls suggest that use of young forests by owls is largely dependent on the presence of old-growth stands within the home range.

The dependence of northern spotted owls on older forest, the low probability that significant amounts of suitable habitat will persist outside of preserved areas, and the inability of the protected areas to support a viable population of northern spotted owls, all indicate that the northern spotted owl is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

**B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes.** Considerable research by

In California, the Forest Service is implementing a network system similar to that in Washington and Oregon to manage about 265 owl habitat areas within the Klamath province on both lands dedicated to multiple use management (including timber production) and lands reserved from such activities. Sites are to be selected based upon distribution of habitat and owl presence. Some sites were selected for their potential to contain owls rather than on the basis of current occupancy. The potential success of this effort cannot be determined yet, since there have been insufficient time and data to determine trends. The Forest Service in California is preparing to finalize Forest plans implementing a similar habitat management plan on the four National Forests in the northern spotted owl's range.

The intent of this system in both Forest Service Regions is to maintain the viability of the subspecies through a network system that is evenly distributed over the range of the owl. SOHAs in Region 5 tend to occur in groups of two or three, which may provide a more stable management approach than the single SOHA strategy in Region 6.

The Bureau of Land Management manages over 2.4 million acres of forest land in Oregon, of which an estimated 858,700 acres is currently suitable for spotted owls (USDI 1990). Eighty-two percent of this (701,100 acres) is suitable for harvest; most of the remaining 157,600 acres is on extended rotation (i.e., will not be reharvested for approximately 80-250 years). Bureau of Land Management forested lands represent about 11 percent of the overall spotted owl habitat. The Bureau of Land Management manages numerous small parcels of forest lands in California and none in Washington. Only 15,000 acres have been surveyed for owls in California, revealing an estimated 14 pairs (Thomas *et al.* 1990). Most Bureau forest lands in Oregon are administered under the provisions of the Oregon and California Lands Act, which mandates management of these lands for permanent forest production on a sustained yield basis. In Oregon, an average cutting rate of 23,400 acres per year is anticipated to continue. The Bureau of Land Management estimates an annual loss of owl habitat on its Oregon lands of about 3 percent, thus eliminating all northern spotted owl habitat on non-protected Bureau lands, except for the Medford District, within the next 26 years (USDI 1990). These lands cannot be withdrawn or set aside for other long-term management

objectives unless other applicable statutes permit. However, short-term (10-year) restrictions can be placed on certain tracts during a 10-year planning period (W. Nietro, Bureau of Land Management, Portland, OR, pers. comm. 1989). Currently, there are timber harvesting restrictions on 109 spotted owl agreement areas that are managed by the Bureau of Land Management under a cooperative agreement with the Oregon Department of Fish and Wildlife through 1990. Twelve additional sites were added pursuant to direction given in Section 318. However, it is not known what will happen to these 12 additional sites after the dates covered in Section 318. The intent of the agreement areas is to provide linkages and habitat for pairs of owls between Forest Service lands in the Oregon Cascades and Coast Ranges and to preserve the integrity of these sites into the next planning period. As currently established, the Bureau of Land Management's network of 121 spotted owl agreement areas protects about 100 pairs of owls, approximately 25 percent of the known pairs on Bureau of Land Management lands in Oregon. Most of the remaining approximately 300 pairs (approximately 75 percent of the known population on Bureau land) are in areas subject to timber harvest.

At current logging rates all remaining suitable habitat on Bureau of Land Management lands will be eliminated in 12 (Eugene District) to 52 (Medford District) years (USDI 1990). The primary management emphasis has been, and continues to be, timber production. Because the spotted owl network is based on interim agreements (Section 318 is effective only through September 1990, and the Bureau of Land Management/Oregon Department of Fish and Wildlife agreements will persist only until the Bureau of Land Management resource plans are completed in 1992), it does not provide long-term habitat protection. Nor is there any legal requirement for the Bureau of Land Management to protect spotted owl areas beyond these dates. An estimated 14 pairs of northern spotted owls are associated with the Bureau's California land (Thomas *et al.* 1990). Although some of these pairs could be protected under proposed Wilderness Areas or as Areas of Critical Environmental Concern, such protection depends upon finalizing a Resource Management Plan. One pair of spotted owls is protected on the Northern California Coast Range Preserve, which is co-owned by the Bureau of Land Management and The Nature Conservancy.

There are 55 Wilderness Areas totaling over 4.7 million acres in the 17 National Forests on which the owl occurs (USDI 1990). Initially, the wilderness system would appear to provide a well-distributed network of owl preserves. However, this is not the case. For the most part, wilderness areas have been established on sites relatively unsuited to timber production and, therefore, generally unsuitable for spotted owls as well. As a result, less than 25 percent of wilderness lands provide suitable owl habitat, and most of that is highly fragmented by intervening areas of high elevation (USDI 1990). The fact that owl density and reproductive output are lower in reserved than nonreserved sites (USDI 1990) provides emerging evidence that Wilderness Areas, and National Parks, at best provide only marginally suitable habitat for northern spotted owls. Without a major change in policy, owl habitat on all land ownerships will be reduced to about 2.7 million acres scattered in a mosaic of fragmented habitat islands in Wilderness Areas, National Parks, and other set-aside lands, plus an unknown number of acres in SOHAs, and on an undetermined and unpredictable amount of private lands (USDI 1990). This may represent about 15 percent of the original suitable forest within the range of the northern spotted owl in Washington, Oregon, and California (USDI 1990). For the reasons discussed above, it is unlikely that the land will be capable of sustaining a viable population of spotted owls over the long-term (USDI 1990).

Both the Bureau of Land Management and Forest Service have policies regarding dispersions of clearcut areas. For example, the Forest Service requires trees in regenerating clearcut stands to attain a height of 4.5 feet and 200 trees per acre before the adjacent stand can be clearcut. Although there is no set width for leave strips (land located between adjacent harvested areas that remains uncut, at least temporarily until reforestation has been achieved at a certain level in the harvested sites), most are 200 to 300 feet wide. Regulations implementing the National Forest Management Act specify that in the Douglas-fir zone and in the mixed-conifer/pine zone, clearcuts can have a maximum size of 20 and 60 acres, respectively. However, in cases of salvage operations resulting from blowdown, fires, or extensive insect infestation, clearcuts may exceed these limits. On Forest Service lands, streamside protection zones varying from 50 to 300 feet, depending on steepness of slope, are required for

certain types of streams. Each National Forest has the latitude to develop its own requirements in the respective forest plans as long as they are no less restrictive than the regional guide (S. Paulsen, U.S. Forest Service, Portland, OR., pers. comm.).

According to Bureau of Land Management policy, cutting units generally should not exceed 40 acres. However, harvest units more than this size may be allowed for salvage operations where larger units would minimize road construction and other activities that otherwise would result in more extensive adverse environmental impacts. Streamside buffer strips along perennial and intermittent streams are necessary; however, the width varies with the steepness of the terrain, the nature of the undercover, soil type, size of the stream, the width of the riparian area, and the amount of timber that is to be removed. Although there is no requirement to leave space between clearcuts, in consideration of wildlife values, Bureau policy suggests that 10 years expire before expanding clearcuts, but only if the 10-year wait is compatible with timber management prescriptions.

In August 1988, an Interagency Agreement established in 1987 between the Fish and Wildlife Service and the Forest Service was expanded to include the Bureau of Land Management and the National Park Service. This agreement requires the four agencies to cooperate, coordinate, exchange data, and review proposals designed to manage and protect owl habitat; it also commits them to manage land to maintain viable, well-distributed spotted owl populations. However, at this time, there are no coordinated management schemes in place among the agencies; the Forest Service and Bureau have developed timber harvest proposals and spotted owl protection strategies independently of each other. On April 13, 1990, a new Interagency Agreement was signed among the four Federal agencies and the three States (California Resources Agency, Oregon Department of Fish and Wildlife, and the Washington Department of Wildlife). The anticipated role of this new group is being determined but offers hope for improved coordination and cooperation.

In 1989 an interagency committee of scientists (Interagency Scientific Committee to Address the Conservation of the Northern Spotted Owl) was established by joint agreement among the Forest Service, Bureau of Land Management, National Park Service, and Fish and Wildlife Service to prepare a conservation strategy for the northern

spotted owl. This plan analyzes the current status of the owl, provides an in-depth critique of present management networks, and calls for the protection of large blocks of habitat (Habitat Conservation Areas or HCAs) from the Canadian border to Marin County, California. It recommends a change in management strategy for the Forest Service and the Bureau of Land Management and will, if implemented, require extensive revision of Forest Service regional guides and forest plans as well as Bureau of Land Management district plans. Moreover, it proposes that an interagency group implement the plan and monitor its effectiveness in managing the owl in the decades to come. The Forest Service must decide on this plan by September 30, 1990. The Bureau of Land Management may not reach a decision on the plan until its resource plans are completed in 1992. At this time, the Service is unable to speculate on whether the plan will be accepted and to what extent, if any, it will be implemented. Hence, the Service cannot consider this plan in its decision as it has been neither accepted nor implemented. Moreover, even if the plan were to be fully implemented, testing would be required to prove its success in maintaining long-term viable spotted owl populations.

The success (viability) of spotted owl pairs, in terms of survival and reproductive output, is predicated largely on the sufficiency of their habitat to support their full range of physical, behavioral, and nutritional needs as expressed by measurement of owl use. The size of the Forest Service's SOHAs and of the Bureau of Land Management/Oregon Department of Fish and Wildlife agreement areas is generally less than the mean amount of preferred habitat documented within the home ranges of paired owls studied in nearly all physiographic provinces (USDI 1989). As a consequence, some pairs may not persist in less than optimally sized habitats (Ruggiero *et al.* 1988).

The SOHA network has been criticized for many shortcomings such as inadequate size (20 percent do not have designated acreages), lack of owls, isolation of SOHAs, adjacent logging activities, fragmentation within SOHAs, shifting SOHAs at administrative discretion (which can either benefit or harm owls), lack of contiguity with other reserved lands within the National Forests or adjacent National Parks, or sporadic and irregular occupancy by owls. Because of these and other factors, it is estimated that only about 50-60 percent of SOHAs will hold pairs of owls, except in the Olympic National

Forest, where the figure is 85 percent (Thomas *et al.* 1990). This suggests that this extensive network may, at best, protect about 364 pairs. SOHAs may be lost to fire, windthrow (fragmented SOHAs with much edge are particularly vulnerable), volcanic activity, or other unpredictable events. As logging proceeds to reduce the amount of suitable forest around them, options to replace or create additional SOHAs continue to decrease. In an analysis of the SOHA system, Thomas *et al.* (1990) concluded that a scheme that protects isolated pairs is flawed due to problems associated with the high probabilities of local extinctions over short periods of time, loss of social facilitation, physical and biological limits to dispersion, and the susceptibility to loss of habitat through stochastic events. In comparing the advantages and disadvantages of SOHAs and HCAs, ISC (Thomas *et al.* 1990) recommended that most of the SOHA system be abandoned in favor of HCAs. Further, ISC noted that the committee " \* \* \* believed the SOHA network system to be a prescription for the extinction of spotted owls, at least in a large proportion of the owl's range" (Thomas *et al.* 1990, p. 38).

According to the final regional guidance, and the Record of Decision (for Oregon and Washington), the Forest Service does not quantitatively provide for long-term contingencies in the case of catastrophic environmental events. Similarly, current spotted owl habitat management by the Bureau of Land Management does not take into consideration or provide for such events.

The cumulative impact of timber-cutting practices by land managing agencies increases and exacerbates the fragmentation of existing owl habitat. The proposed spotted owl management plans of the Forest Service and Bureau of Land Management are untested. Recent legal actions aside, there is no indication from the land management agencies that the current rate of change from old growth to young, even-aged forest management will diminish. Further, as agencies concentrate their clearcutting activities outside designated spotted owl habitat management areas, future habitat management options will be lost if currently planned habitat networks prove later to be deficient. Existing regulatory mechanisms are insufficient to protect either the northern spotted owl or its habitat.

*E. Other Natural or Man-Made Factors Affecting Its Continued Existence.* The barred owl (*Strix varia*) has undergone rapid range expansion

over the past 20 years into the range of the spotted owl in the northwestern United States (Hamer 1988; USDI 1989). Gould (pers. comm.) indicates that the barred owl now occurs as far south as Mendocino County, California. Furthermore, it has at least replaced, and possibly displaced, the northern spotted owl in some areas (Forsman and Meslow 1986; Allen *et al.* 1985; Hamer and Samson 1987). Hamer (1988, 1989) noted that barred owls seem to be more prevalent in cut-over areas than spotted owls. On his study area in the northern Cascade Mountains of Washington, the barred owl is now 2.1 times more numerous than the spotted owl.

The barred owl's adaptability and aggressive nature appear to allow it to take advantage of habitat perturbations, such as those that result from habitat fragmentation, and to expand its range where it may compete with the spotted owl for available resources. The long-term impact to the spotted owl is unknown, but of considerable concern. Continued examination is warranted of the role and impact of the barred owl as a congeneric intruder in historical spotted owl range and its relationship to habitat fragmentation. The potential for interbreeding of the two species also merits concern and monitoring.

There are numerous examples of extrinsic factors such as fires, wind damage, and volcanic action affecting forest habitat, including known spotted owl habitat. These natural occurrences have not been factored in an objective way into any future projections of population persistence of the spotted owl, and their impact is unknown. In recent years such natural perturbations have included the Tillamook burns, fires in southern Oregon and northern California in 1987, the "21 blow" wind storm, the Columbus Day Storm, the eruption of Mount St. Helens, and various small fires. It is likely that in the future similar losses in suitable spotted owl habitat will occur from these types of occurrences. In its risk assessment, the Forest Service subjectively considered the impacts of catastrophic events on the probability of persistence of spotted owl populations. However, the Record of Decision did not incorporate provisions for replacement of habitat lost as the result of natural calamities.

Genetic problems (such as inbreeding) have not yet been considered a problem with spotted owls.

Several instances of malicious taking of spotted owls have been reported. In one case, a mutilated spotted owl was found hanging from a Forest Service kiosk. It is not known how widespread

or to what extent northern spotted owls are deliberately killed or injured.

In its Status Review (USDI 1987), Supplement (USDI 1989), and 1990 Status Review (USDI 1990), the Service has compiled and carefully assessed the best scientific and commercial information available regarding the past, present, and future threats faced by this species in determining to issue this rule. Based on this evaluation, the Service has found that listing the northern spotted owls as a threatened species throughout its range is warranted. The Endangered Species Act of 1973 (Act), as amended states that the term "endangered species" means any species which is in danger of extinction throughout all or a significant portion of its range. The term "threatened species" means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Given the loss of a substantial amount (60 percent) of historical habitat from timber harvesting, and continuing and planned reduction and fragmentation of a large portion of the remaining old-growth and mature habitat, the northern spotted owl population will continue to decline unless steps are taken to offset these losses.

The northern spotted owl shows a clear preference throughout its range for old-growth forests and forests with old-growth characteristics for nesting, foraging, and roosting. Structural characteristics that provide suitable northern spotted owl habitat may occur in forests 60-200 years of age, depending on stand history, location, and site potential. As a result of historical and ongoing timber harvest the once extensive and continuous old-growth forests are being converted to a patchwork landscape dominated by young, even-aged stands. Existing timber management planning and policies offer little opportunity to generate stands with the structural characteristics of spotted owl habitat replacement because rotation periods range from about 70 to 120 years on Federal lands to as little as 40 years on private lands. The point in time at which managed stands being to acquire the structural attributes of spotted owl habitat often coincides with the rotation age and next major removal activity. Hence, there is no provision for long-term maintenance of regenerated spotted owl habitat in existing timber management planning and policies.

If current management practices continue, in the near future most commercial old-growth forests will have been logged and converted to younger,

even-aged management forests. This would represent an estimated total decline of 60 percent from the amount of suitable habitat originally estimated for the western part of the Pacific Northwest, including northern California (Thomas *et al.* 1990). Impacts from timber harvesting are rangewide and, in addition to causing the direct loss of preferred habitat, appear to be affecting the quality of the remaining forest habitat throughout much of the species' range. Moreover, the total population of spotted owls is relatively low (recent surveys indicates about 2,000 known pairs, although 3,000 to 4,000 pairs are suspected) and pairs are relatively widely spaced (Thomas *et al.* 1990). This subspecies has very specific habitat requirements. With a low, variable reproductive rate and a low population density, a consequence partly of its large home range requirements, the spotted owl would be especially vulnerable to localized catastrophic events. Lastly, current and proposed management practices may not be designed for nor be sufficient to ensure long-term population viability of the spotted owl. On the basis of the best scientific and commercial data available, the Service believes that threatened status is warranted rangewide for the entire population of the northern spotted owl.

Under the Act's definition, to be considered for endangered classification, the spotted owl would have to be currently in danger of extinction throughout all or a significant portion of its range. While the available data indicate a gradual, rangewide decline in the species commensurate with habitat loss, they do not suggest that extinction is an imminent possibility. The Service recognizes that the situation is most serious in the California Cost Range (especially Marin and Sonoma Counties), the Shasta/Modoc area in California, the Oregon Coast Ranges (beginning with Coos Bay Bureau of Land Management lands north to the Columbia River), and from the Olympic Peninsula south to the Columbia River. However, when the status of the entire subspecies is analyzed rangewide, it is the Service's conclusion that the likelihood of extinction of the subpopulations of the owls in these areas is not so immediate as to justify a rangewide endangered classification at this time. The Olympic Peninsula population of the northern subspecies may be the only unit that could qualify as a distinct population under the Act. However, it was not clear that identifying this as a separate population was fully justified by the

data or that the immediacy of threat in relationship to other areas was sufficient to warrant a separate designation as endangered at this time. For the reasons given below, no critical habitat is being designated.

#### Critical Habitat

Section 4(a)(3) of the Endangered Species Act (Act), as amended, requires that, to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time a species is determined as endangered or threatened.

The Service finds that critical habitat for the northern spotted owl is not presently determinable. The Service's regulations (50 CFR 424.12(a)(2)) state that critical habitat is not determinable if information sufficient to perform required analyses of the impacts of the designation is lacking or if the biological needs of the species are not sufficiently well known to permit identification of an area of critical habitat. Critical habitat includes specific areas within the geographical area currently occupied by a species on which are found the physical or biological features essential to the conservation of the species and that may require special management considerations or protection (50 CFR 424.02(d)).

The extensive range of the northern spotted owl from British Columbia to San Francisco Bay involves over 7 million acres of its preferred old-growth and mature forest habitat and an undetermined amount of other forest types that may also be of significance to the survival and recovery of the subspecies. Much of this habitat has been fragmented by logging, and many stands are isolated from each other or of such small size as not to support viable populations of spotted owls. The specific size, spatial configuration and juxtaposition of these essential habitats as well as vital connecting linkages between areas necessary for ensuring the conservation of the subspecies throughout its range have not been determined at this time. However, the Interagency Scientific Committee's (Thomas *et al.* 1990) conservation strategy, released in April 1990, includes maps outlining northern spotted owl habitat conservation areas (HCAs). The plan proposes establishment of habitat blocks containing multiple pairs of owls that are distributed throughout the range and thought to be spaced closely enough to facilitate dispersal among the HCAs (Thomas *et al.* 1990). The Service is in the process of reviewing and evaluating the HCAs described within the ISC plan to determine whether they, in addition

to possibly other areas, should be proposed as critical habitat.

When a finding is made that critical habitat is not determinable at the time of listing, the Service's regulations (50 CFR 424.17(b)(2)) provide that the designation of critical habitat be completed within two years from the date of publication of the proposed rule to list the species. The Service will continue to evaluate the available information to assess whether designation of critical habitat is prudent. Should the Service decide to propose critical habitat, a proposed rule will be published in the *Federal Register*. For such a proposal, the notification process parallels that of a proposed listing and provides for a public hearing, if so requested within 45 days of the date of publication of the proposed rule. In addition, as required under Section 4(b)(2) of the Act, the Service will evaluate the economic and other relevant impacts of designating critical habitat. If a designation of critical habitat is proposed, a final determination would be published by June 23, 1991.

#### Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Endangered Species Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing encourages and results in conservation actions by Federal, State, and private agencies, groups, and individuals. The Endangered Species Act provides for possible land acquisition and cooperation with the States and requires that recovery actions be carried out for all listed species. The protection required of Federal agencies and the prohibitions against taking and harm are discussed, in part, below.

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter

into formal consultation with the Service.

The U.S. Forest Service and Bureau of Land Management have active timber sale programs in the Pacific Northwest, including northern California, whereby private timber companies bid for the right to log Federal land. Because habitat loss and modification resulting from timber harvesting activities represents the primary threat to the northern spotted owl, the Forest Service and Bureau have reviewed and assessed the potential impacts of timber sales on this species to ensure compliance with section 7 of the Act, as described above.

Section 318 of the Interior and Related Agencies Appropriation Act for fiscal year 1990, required the sale of 5.8 billion board feet (bbf) from 13 national forests with owls in Oregon and Washington, and 1.9 bbf from Bureau of Land Management land in Oregon. These sales represent a reduction in allowable harvests of about 9 percent.

In Fiscal Year 1989, the Forest Service planned 425 timber sales containing about 48,000 acres that included at least some northern spotted owl habitat. The Forest Service had been enjoined through court action from completing 165 timber sales, totalling approximately 22,500 acres, largely because of spotted owls and old growth issues. About 52 timber sales, representing roughly 2,600 acres, were released by the Court and subsequently offered for sale (G. Gunderson, USDA Forest Service, Portland, OR, pers. comm.). The remainder were released by the Court subsequent to the passage of Section 318.

Annual logging rates of mature and old-growth forest on the owl forests are expected to decline from about 64,000 acres/year (average from the last nine years) to about 39,400 acres/year over the next 10 years in Washington and Oregon based on draft forest plans (Thomas *et al.* 1990).

On March 30, 1990, the Service issued an informal conference report to the Forest Service for its timber sale schedule in fiscal years 1989-1990 in Oregon and Washington. Section 318 mandates the sale for harvest of 7.7 bbf of timber from the 19 National Forests in the Pacific Northwest Region. Of this aggregate timber sale level, 5.8 bbf is targeted for the 13 National Forests known to contain spotted owls in Oregon (4.0 bbf) and Washington (1.8 bbf) during fiscal years 1989 and 1990. Approximately 2.3 bbf were sold by the Forest Service in fiscal year 1989. The Service conferred with the Forest Service on timber sales totaling 24,940 acres and 68,140 acres for fiscal years

1989 and 1990, respectively in Region 6. Under section 318, the Forest Service's timber harvest schedule consists of 1,295 sales. Sales are primarily to clearcut green timber. Partial cut harvests include shelterwood cuts, selective cuts, and salvage of both green and dead timber. The Service concluded that 716 pairs or 64.4 percent of the estimated 1,113 pairs of owls on the 13 National Forests are likely to be affected by the section 318 timber sale schedule. Of these, 235 pairs are likely to be subject to the most significant (level 1) impacts (e.g., sales would remove owl habitat within 0.5 miles of a pair activity center; reducing the amount of suitable habitat within the 2.1/2.5 mile radius of a pair below the minimum known to be used by pairs in each respective province, and removing owl habitat from an area of concern). Moreover, 116 sales are within areas of special concern and are considered to represent level 1 impacts. Approximately 93,080 acres (2.2 percent) of suitable habitat on the 13 National Forests in Oregon and Washington will be harvested as per the Forest Service's Section 318 timber sale schedule. Within non-reserved lands, this results in a reduction of 4.2 percent of suitable owl habitat.

In California, the Fish and Wildlife Service and Forest Service informally conferred on 165 timber projects. The Service recommended no modification in 130 of these, some modification for 24, reduction in volume of timber for 9 projects, and deferral on two projects. It is anticipated that about 1 percent of suitable owl habitat will be logged on Forest Service lands annually.

Section 318 of Public Law 101-121 (1989) mandates the sale for harvest of 1.9 billion board feet (bbf) of timber from Bureau lands within Oregon during fiscal years 1989-1990. About 0.8 bbf were sold in fiscal year 1989, thus, an additional 1.1 bbf must be sold during fiscal year 1990. Prior to this amendment, about 1.18 bbf were authorized for harvest annually from 1987 through 1990. The Bureau of Land Management manages more than 2.4 million acres of timber land in Oregon and about 19,000 acres in northern California of which an estimated 858,700 acres is forest land suitable for spotted owls. Of this, 82 percent (701,100 acres) is subject to harvest (USDI 1990).

In 1988, the Bureau of Land Management advertised 229 timber sales for a total of 29,798 acres. Of these planned sales, 41 (5,330 acres) were involved in a lawsuit. During 1989, the Bureau of Land Management planned to advertise 190 timber sales to harvest 24,655 acres; a lawsuit was initiated

involving 75 of these sales, covering 9,750 acres (Nietro, pers. comm.). these sales also were released by the Court subject to passage of Section 318. On an annual basis, the Bureau of Land Management awards contracts to harvest 32,940 acres, of which 22,800 acres are clearcut and 10,140 acres are partially cut. Of the acreage cut, approximately 66 percent of the harvest is in forests over 200 years old (Nietro, pers. comm.). On Bureau of Land Management lands in Oregon, an average cutting rate of 23,400 acres/year is expected to continue. This would eliminate all northern spotted owl habitat on non-protected Bureau of Land Management lands, except for the Medford District, within the next 26 years (USDI 1990). At current logging rates all remaining suitable habitat will be eliminated in 12 (Eugene District) to 52 (Medford District) years (USDI 1990). In fiscal year 1989, the Bureau of Land Management offered sales totaling 0.745 bbf and 0.451 bbf through March 1990. The Service, after screening 314 proposed timber sales for Bureau of Land Management land in western Oregon, prepared 79 informal conference reports following the Section 7 conferencing procedures.

This rule brings Section 5 and 6 of the Act into effect with respect to the northern spotted owl. Section 5 authorizes the acquisition of lands for the purpose of conserving endangered and threatened species. Pursuant to Section 6, the Fish and Wildlife Service would be able to grant funds (should they become available) to the States of California, Oregon, and Washington for management actions aiding the protection and recovery of the northern spotted owl.

Listing the northern spotted owl as threatened allows for development of a recovery plan which will draw together the State, Federal, and local agencies having responsibility for conservation of the spotted owl. The recovery plan will outline an administrative framework, sanctioned by the Act, for agencies to coordinate activities and cooperate in their conservation efforts. Habitat conservation plans (HCPs) and other comprehensive plans may be a part of any coordinated effort through the recovery plan process. The recovery plan will describe recovery priorities and estimate the costs of various tasks necessary to accomplish them. It will recommend appropriate functions to each agency and a time frame within which to implement them.

The Act and implementing regulations found at 50 CFR 17.21 and 17.31 set forth a series of general prohibitions and

exceptions that generally apply to all threatened wildlife. These prohibitions, in part, make it illegal for any person subject to the jurisdiction of the United States to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these), import or export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. It also is illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

Permits may be issued to carry out otherwise prohibited activities involving threatened wildlife species under certain circumstances. Regulations governing threatened species permits are at 50 CFR 17.32. Such permits are available for scientific purposes, to enhance the propagation or survival of the species and/or for incidental take in connection with otherwise lawful activities. For threatened species, there are also permits for zoological exhibition, educational purposes, or special purposes consistent with the purposes of the Act.

The northern spotted owl is not used for economic purposes, is not a commercial species, and is not legally hunted, sold, or traded. Only a few requests for taking permits are anticipated. This bird is presently protected under 50 CFR parts 10 and 20 as a migratory bird.

On June 28, 1979, the order *Strigiformes*, which includes all owls, was included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The effect of this listing is that export permits are generally required before international shipment may occur. Such shipment is strictly regulated by CITES party nations to prevent effects that may be detrimental to the species' survival.

#### National Environmental Policy Act

The Fish and Wildlife Service has determined that an Environmental Assessment, as defined under the authority of the National Environmental Policy Act of 1969, need not be prepared in connection with regulations adopted pursuant to Section 4(a) of the Endangered Species Act of 1973, as amended. A notice outlining the Service's reasons for this determination was published in the *Federal Register* on October 25, 1983 (48 FR 49244).

**Effective Date**

The Administrative Procedure Act (5 U.S.C. 553(d)) requires the effective date of a rule to be no less than 30 days after the "publication or service" of the rule, except "as otherwise provided by the agency for good cause" (5 U.S.C. 553(d)(3)). In this case, the Service is submitting the signed rule to the **Federal Register** over 30 days prior to the July 23, 1990 effective date. More importantly, the Service is extensively publicizing the signing of the rule both in the Pacific Northwest and Washington, DC. The Service therefore believes that it is giving actual notice of the availability of the rule within the meaning of 5 U.S.C. 553(d) at least 30 days prior to the effective date. Alternatively, this extensive publicizing of the rule over 30 days prior to the effective date is good cause for allowing less than 30 days between the date of **Federal Register** publication and the July 23, 1990, effective date.

**References Cited**

A complete list of all references cited herein is available upon request from the Regional Director (Attention: Spotted Owl Coordinator), U.S. Fish and Wildlife Service, 1002 NE. Holladay Street, Portland, Oregon 97232.

**Authors**

The primary author of this final rule is Dr. Kathleen E. Franzreb, U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement, U.S. Fish and Wildlife Service, 1002 NE. Holladay St., Portland, Oregon 97232-4181 (503/231-6150 or FTS 429-6150), with the assistance of the other members of the Service's Northern Spotted Owl Listing Review Team.

**List of Subjects in 50 CFR Part 17**

Endangered and threatened wildlife, Fish, Marine mammals, Plants (agriculture).

**Regulation Promulgation**

**PART 17—[AMENDED]**

Accordingly, part 17, Subchapter B of Chapter I, Title 50 of the Code of Federal Regulations, is amended as set forth below:

1. The authority citation for part 17 continues to read as follows:

**Authority:** 16 U.S.C. 1361-1407; 16 U.S.C. 1531-1543; 16 U.S.C. 4201-4245; Pub. L. 99-625, 100 Stat. 3500; unless otherwise noted.

2. Amend § 17.11(h) by adding the following, in alphabetical order under Birds, to the list of Endangered and Threatened Wildlife:

**§ 17.11 Endangered and threatened wildlife.**

\* \* \* \* \*  
(h) \* \* \*

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
Birds:							
Owl, northern spotted.	<i>Strix occidentalis caurina</i> ...	U.S.A. (CA, OR, WA), British Columbia.	Entire .....	T .....	393	NA .....	NA

Dated: June 22, 1990.  
**John F. Turner,**  
 Director, Fish and Wildlife Service.  
 [FR Doc. 90-14889 Filed 6-22-90; 3:50 pm]  
 BILLING CCDE 4310-55-M