DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018-AB32

Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for the Northern Spotted Owl

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: The Fish and Wildlife Service (Service) designates critical habitat for the northern spotted owl (*Strix occidentalis caurina*), a subspecies federally listed as threatened under the Endangered Species Act of 1973, as amended (Act). The northern spotted owl, referred to herein as spotted owl or owl, is a forest bird that inhabits coniferous and mixed conifer-hardwood forests over a range that extends from southwestern British Columbia through western Washington, western Oregon, and northwestern California south to San Francisco Bay.

This critical habitat designation provides additional protection requirements under section 7 of the Act with regard to activities that are funded, authorized, or carried out by a Federal agency. As required by section 4 of the Act, the Service considered the economic and other relevant impacts prior to making a final decision on the size and scope of critical habitat. The Service excluded some areas from designation as critical habitat due to economic and other relevant information. Final critical habitat units are designated solely on Federal lands.

EFFECTIVE DATE: This rule becomes effective February 14, 1992.

ADDRESSES: The complete administrative record for this rule is on file at the U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement, 911 Northeast 11th Street, Portland, Oregon 97232. The complete file for this rule will be available for public inspection, by appointment, during normal business hours at the above address.

FOR FURTHER INFORMATION CONTACT: Mr. Dale Hall, Assistant Regional Director for Fish and Wildlife Enhancement at the above address (503/231-6159 or FTS 429-6159; Mr. Barry S. Mulder, Spotted Owl Coordinator, at the above address (503/231-6730 or FTS 429-6730); and Dr. M.L. Schamberger, Chief, Terrestrial Branch, U.S. Fish and Wildlife Service, National Ecology Research Center, 4512 McMurray Avenue, Fort Collins, Colorado 80525-3400, FTS 323-5409 or (303) 226-9409.

SUPPLEMENTARY INFORMATION:

Introduction

The Endangered Species Act of 1973, as amended (Act) requires the Service to designate critical habitat to the maximum extent prudent and determinable concurrently with listing a species as endangered or threatened. The Service listed the northern spotted owl as a threatened species on June 26, 1990, primarily due to concern over widespread habitat loss and modification, and inadequacy of existing regulatory mechanisms. The Service recognized that critical habitat would be a valuable tool in the conservation of the owl, but lacked sufficient information upon which to base a critical habitat determination at that time. In such cases the Act provides one additional year to determine whether to designate critical habitat.

On August 10, 1990, several environmental organizations filed a motion seeking in *Northern Spotted Owl* v. *Lujan*, No. C88-573Z (W.D. Wash.), to compel the Service to immediately propose critical habitat. On February 26, 1991, the Court ruled that the Service had violated the Act in failing to designate critical habitat concurrently with listing the owl (*Northern Spotted Owl* v. *Lujan*, 758 F.Supp. 621 (W.D. Wash.)). The Court ordered the Service to propose a rule on critical habitat and to publish a final rule at the earliest possible time permitted under the appropriate regulations.

The Service published a proposed rule to designate critical habitat for the northern spotted owl on May 6, 1991 (56 FR 20816). The May 6 proposal announced the Service's intention to publish a revised critical habitat proposal in early August 1991 to allow for the fullest possible consideration of public comment on the economic and other relevant impacts of a designation and the subsequent completion of the Service's economic analysis. On August 13, 1991, the Service published its revised proposal which superseded all aspects of the previous proposal (56 FR 40001). The final rule represents the Service's decision on this issue. The Service may revise critical habitat in the future following development and implementation of a Service-approved recovery plan for the northern spotted owl.

Definition of Critical Habitat

Critical habitat is defined in section 3(5)(A) of the Act as: "(I) The specific areas within the geographic area occupied by a species * * * on which are found those physical and biological features (i) essential to the conservation of the species, and (ii) that may require special management considerations or protection; and (II) specific areas outside the geographical area occupied by a species at the time it is listed, upon determination that such areas are essential for the conservation of the species." The term "conservation," as defined in section 3(3) of the Act, means "* * * to use and the use of all methods and procedures which are necessary to bring an endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary," i.e., the species is recovered and removed from the list of endangered and threatened species. Section 3 further states that in most cases the entire range of a species should not be encompassed within critical habitat.

Role in Species Conservation

The use of the term "conservation" in the definition of critical habitat indicates that its designation should identify lands that may be needed for a species' eventual recovery and delisting. However, when critical habitat is designated at the time a species is listed, the Service frequently does not know exactly what may be needed for recovery. In this regard, critical habitat serves to preserve options for a species' eventual recovery.

The designation of critical habitat will not, in itself, lead to recovery, but is one of several measures available to contribute to a species' conservation. Critical habitat helps focus conservation activities by identifying areas that contain essential habitat features (primary constituent elements) regardless of whether or not they are currently occupied by the listed species, thus alerting the public to the importance of an area in the conservation of a listed species. Critical habitat also identifies areas that may require special management or protection. Critical habitat receives protection under section 7 of the Act with regard to actions carried out, funded, or authorized by a Federal agency. The added protection of these areas may shorten the time needed to achieve recovery. Aside from the added protection provided under section 7, the Act does not provide other forms of protection to lands designated as critical habitat.

Designating critical habitat does not create a management plan for a listed species. Designation does not establish numerical population goals, proscribe specific management actions (inside or

level in the Olympic Peninsula of Washington to over 6,000 feet above sea level in California. The range of elevations used by owls generally increases with decreasing latitude. Higher quality habitat is usually found at lower elevations.

The northern spotted owl is known from most of the major types of coniferous forests from southwestern British Columbia through western Washington, western Oregon, and northern California south to San Francisco Bay wherever forested habitat still exists. Vegetative composition of spotted owl habitat changes from north to south within the owl's range. The spotted owl inhabits forests dominated by Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) in coastal forests of Washington and Oregon. At higher elevations on the west slope of the Cascades in Washington and Oregon, stands containing Pacific silver fir (*Abies amabilis*) are commonly used by owls. Owls use mixed conifer stands that may include Douglas-fir, grand fir (*Abies grandis*), and ponderosa pine (*Pinus ponderosa*) on the east slope of the Cascades.

In southern interior Oregon, habitat changes to a drier Douglas-fir/mixed conifer composition with a corresponding shift in primary prey species, from northern flying squirrels (*Glauocomys sabrinus*) to woodrats (*Neotoma* spp.). In California, spotted owls most commonly use Douglas-fir, mixed-conifer, and coastal redwood (*Sequoia sempervirens*) forest types but are also found in mixed conifer-hardwood habitat types and in stands dominated by ponderosa pine in the eastern portion of the range.

Historically, habitat for the northern spotted owl was fairly continuous, particularly in the wetter parts of its range in northern California and most of western Oregon and Washington. Habitat for the owl in the drier portions of its range in parts of southern Oregon and northern California is not continuous, but occurs naturally in a mosaic pattern. This mosaic occurs in the southern interior portions of the bird's range, but also occurs to some extent in the eastern Cascades in Oregon and Washington.

Forest Practices

Forest structure also differs significantly because of varied timber management practices within the range of the spotted owl. Current management practices, such as clearcutting, even-aged management, and short rotations preclude development of suitable habitat. Timber harvest (predominantly clearcutting) along with natural perturbations results in the loss of owl habitat and increases forest fragmentation. In many areas, management practices have left small fragmented patches of older forests, separated by large stretches of younger forests that have yet to develop habitat characteristics used by owls. These practices have had an impact on the current presence and distribution of spotted owls, their survival and reproductive success, and their ability to successfully disperse, and also may have led to increased competition with barred owls (*Strix varia*) and predation by great horned owls (*Bubo virginianus*) and other open-forest predators. As habitat has become more fragmented, the direct effects of increased competition and predation may have become more pronounced.

Often, when forests are clearcut, the area is replanted with a single or few species of the same age. Site-preparation activities, such as prescribed burning, often remove the dead standing and down material. As timber plantations increase in age, timber managers may control competing vegetation, such as hardwoods, through the use of herbicides or mechanical methods. These actions tend to reduce or delay the ability of the site to attain the characteristics normally associated with owl presence.

Timber harvest, employing a pattern of small dispersed clearcuts, eventually leads to a situation where the remaining patches of older forests are so small as to be influenced by edge effects (e.g., windthrow, microclimate changes) which may reduce the ability of the area to support successfully reproducing owls. These types of situations may be most noticeable where past timber harvesting has been heaviest, e.g., in the Oregon Coast Ranges and on Bureau of Land Management (Bureau) lands that are interspersed in a checkerboard pattern with heavily harvested private lands. Because of the extent of past harvest using these patterns, the remaining effective (i.e., to support successful reproduction) suitable nesting and roosting habitat may be considerably less than the total amount of owl habitat remaining over the owls' range.

Historical logging practices in the drier portions of the species range, such as the mixed conifer zone of southern Oregon, along the east side of the Cascades in Oregon and Washington, and in parts of interior northern California, consisted of more selective timber harvesting than in other areas, often leaving remnant patches of stands of varying ages and with some older forest characteristics. The uneven-age management practices usually result in more ecologically diverse stands. Techniques such as individual tree selection, retention of hardwoods, and retention and/or creation of standing and down dead material seem to replicate more natural forest conditions sooner following harvest than do more intensive management practices such as clearcutting. Spotted owls are found more often in stands managed under these prescriptions (which may result in greater diversity) than in those subject to even-age regeneration following clearcutting, although the contribution of uneven-aged managed stands to maintaining a viable owl population is unknown.

Current and historic spotted owl habitat loss is largely attributable to timber harvesting and land conversion practices, although natural disturbances such as forest fires and blowdowns have caused losses as well. Habitat for northern spotted owls has been declining since the arrival of European settlers. Although the extent of nesting and roosting habitat before the 1800s is difficult to quantify, estimates of 17.5 million acres in 1800 and the current estimate of 7.5 million acres (Thomas *et al.* 1990) suggest a reduction of about 60 percent in the past 190 years. Other estimates suggest that the reported decline in historical habitat may have been as high as 83 to 88 percent (USDI 1990, Booth 1991). Historically, habitat reduction has not been uniform throughout the owl's range, but has been concentrated at lower elevations, particularly in the Coast Ranges. Past logging practices may have had the greatest impact on the status of the owl in northwestern Oregon and southwestern Washington.

Although timber harvest in the Pacific Northwest has a long history, spotted owl habitat over its range has decreased most rapidly since the 1960s, thus leading to listing the owl as threatened. Based on information from the Forest Service (USDI 1990a), the amount of suitable spotted owl habitat (i.e., for nesting, roosting, and foraging) on non-reserved Forest Service lands in Washington and Oregon has declined due to harvest by approximately 3.4 million acres (60 percent) over the last 30 years; there are no estimates on the decline of other forest types such as dispersal habitat. Of the nearly 7.2 million acres of nesting and roosting habitat on Federal lands, about 60 percent is currently classified as timber production land, 28 percent is withdrawn (mostly wilderness and parks), and 12 percent unsuitable for

timber production; much of the reserved and land unsuitable for timber production is also unsuitable for owls (USDI 1990a).

Forest-management practices result in a forest age distribution unnaturally skewed toward younger stands with rotation ages reflecting the demand for timber. Harvest currently comes from a broad spectrum of age classes, but in two decades, harvest will almost entirely come from young stands as the older stands are harvested (USDI 1990). Planned harvest in the next 50 years is expected to reduce the average age of trees harvested to 80–90 years or less on Forest Service lands, to 50-year trees on Bureau lands, and to 45–65 years on private lands (Sessions *et al.* 1990).

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. On some Forests and Bureau Districts, the unprotected habitat could disappear within 10 years (USDI 1990a). The Bureau reported in 1987 that at the current rate of harvest older forest on their lands will be harvested within 25 years. These recent trends may have had a large impact on the sustainability of current harvest rates into the future as well as the ability of the ecosystem to withstand continuing rapid change for all species.

These patterns have led to concern over the isolation of local and provincial populations of owls, which in turn could lead to further genetic and especially demographic instability. Without changes in forest management practices, remaining suitable habitat will exist as small islands of varying size, spacing, and suitability, and recruitment of new suitable habitat will not offset the rate of loss and conversion. As a result, local populations will become smaller in number and more isolated from other populations, which increases the risk of extirpation of such populations. Those habitat-driven processes of local colonization and extirpation will lead to further instability of the subspecies.

Provincial Variation

The range of the northern spotted owl encompasses a number of physiographic provinces that depict local climatic and geological conditions in the Northwest (Franklin and Dyrness 1973); the report covered only Oregon and Washington. These conditions are responsible for the development of the respective vegetative landscapes within each province. The Forest Service (USDA 1986) used this information as a method of subdividing owl populations for administrative purposes. From north to south, their subdivisions included the Washington Cascades, Olympic Peninsula, Washington and Oregon Coast Ranges, Oregon Cascades, and Klamath Mountains; California was not originally divided into provinces. The ranges of the northern and California spotted owls (*S. o. occidentalis*) adjoin in the Pit River area of Shasta County, California; the Recovery Team is currently reviewing the location of the line dividing the two subspecies.

Thomas *et al.* (1990) used this information to identify 10 separate areas that reflect differences in spotted owl numbers, distribution, habitat use patterns, and habitat conditions. Their provincial breakdown includes the Olympic Peninsula, Washington Cascades East and West, Southwestern Washington, Oregon Cascades East and West, Oregon Coast Ranges, Klamath Mountains (Oregon/California), Northern California Coast Range, and California Cascades/Modoc. The following provides a summary of problems identified in each area (Thomas *et al.* 1990, USDI 1990a, USFWS 1991c):

—Olympic Peninsula: Isolation of owls due to lack of linkage to other provinces; poor distribution and quality of existing habitat; high level of fragmentation; low population size; and variable to low reproductive success;

—Washington Cascades East and West: Poor distribution and quality of existing habitat; high level of natural and manmade fragmentation (e.g., north Cascades); high susceptibility to catastrophe (east side); low population size; low reproductive success; competition with barred owls; and localized deficiencies in habitat connectivity;

—Southwest Washington: Lack of connectivity; little remaining habitat; poor distribution and quality of existing habitat; very low population size; and lack of Federal ownership;

—Oregon Cascades East and West: Localized deficiency in habitat connectivity; poor distribution and quality of existing habitat in some areas; high level of fragmentation in some areas (e.g., areas of concern); high susceptibility to catastrophe (east side); and low population size in some areas (e.g., east side);

—Oregon Coast Ranges: Low population size; poor distribution and quality of existing habitat; high level of fragmentation; lack of sufficient linkage to other provinces; low reproductive success; high susceptibility to catastrophe; and large areas of land not in Federal ownership;

—Klamath Mountains (Oregon/California): Poor distribution and quality of existing habitat in some areas; high level of natural and manmade fragmentation; high susceptibility to catastrophe; and localized deficiencies in habitat connectivity;

—Northern California Coast Range: High level of human-induced fragmentation; and little land in Federal ownership; and

—California Cascades/Modoc: Low population size; poor distribution and quality of existing habitat; high level of natural and human-induced fragmentation; poor reproductive success; competition with barred owls; insufficient linkage among provinces and with the range of the California spotted owl; high susceptibility to catastrophe; and interspersed landownership.

In its status reviews and biological opinions (USFWS 1991a, b, and c) addressing the spotted owl, the Service further identified areas of concern within these areas where habitat linkage within and among provinces is at greater risk due to past management practices. These areas are frequently associated with interspersed (checkerboard) Federal and non-Federal landownership patterns. The areas of concern are the Interstate 90 area within the Washington Cascades province; the Columbia Gorge, which encompasses an extensive zone between the Oregon and Washington Cascades provinces; Santiam Pass, within the Oregon Cascades province; the Interstate 5 area in southern Oregon; and the Shasta-McCloud area within the Klamath Mountains province of northern California. The Interstate 5 area consists of three distinct sub-areas: South Willamette-North Umpqua, Rogue-Umpqua, and South Ashland, where linkage among the Oregon Cascades East and West, Oregon Coast Ranges, and Klamath Mountains provinces is at risk.

These subdivisions provided more manageable subunits that were used to help conclude the designation process; these subdivisions will also help managers and others in reviewing local impacts to critical habitat. The subdivisions are identified in the Service's administrative record for this issue (USFWS 1991e).

Current Situation

Populations of spotted owls are not evenly distributed throughout its range due to variation in habitat conditions resulting from human-induced disturbances, often exacerbated by

landownership patterns, and to a lesser extent due to natural disturbances. Densities of owls vary over its range with the greatest numbers of spotted owls found in the west-central Cascade region of Oregon and the Coast Range of northwestern California (Thomas *et al.* 1990). The owl is uncommon in certain areas, e.g., in southwestern Washington and northwestern Oregon; thus, its distribution is now somewhat discontinuous over its range. About 90 percent of the known population (estimated over the past 5 years) is on Federal lands; about 19 percent is on Bureau lands in Oregon (USDI 1990a).

Comparatively good information exists on the amount, quality, stand size, distribution, and contiguity of nesting and roosting habitat on Federal lands and its ability to support spotted owls. Most owl habitat (about 7.2 million acres of nesting and roosting habitat, or about 85 percent of remaining habitat) is currently found on Federal lands throughout the owls' range; about 20 percent is reserved (in wilderness and parks). For Federal lands, about 2.4 million acres (34 percent) of this type of habitat occur in Washington, 3.6 million acres (51 percent) in Oregon, and 1.1 million acres (15 percent) in California (Thomas *et al.* 1990, USDI 1990a). There is little information available on the amount and distribution of additional habitat that supports dispersal; many areas especially on Bureau lands in Oregon are already below the standard recommended by the ISC (USFWS 1991a). The distribution of forest habitat that meets the dispersal criteria was not available. As a result of the distribution and abundance of habitat, Federal lands will play the significant role in the current protection and future conservation of the northern spotted owl.

About 400,000 acres of existing suitable habitat are found on State lands in the 3 States; the majority (about 300,000 acres) are found in Washington (G. Gould, Endangered and Threatened Species Coordinator, California Dept. of Fish and Game; D. Hays, Spotted Owl Coordinator, Washington Dept. of Wildlife; V. Johnson, Spotted Owl Coordinator, Oregon Dept. of Fish and Wildlife, pers. comm.). State lands tend to occur in large blocks of ownership; existing suitable habitat on these lands for the most part may be less widely dispersed and found in larger blocks than on private lands. More information exists for State lands in Washington then the other two states; there is less information about the quality of owl habitat on most State lands than on Federal lands. Because of availability and distribution, the quality of remaining habitat on State lands may be less than that on Federal lands.

State lands will be important to the recovery of the owl since most are located in key areas that provide inter- and intra-provincial linkage where little if any Federal lands occur (primarily in southwest Washington, northwest Oregon, and on the western Olympic Peninsula); currently few owls are known to occur on some of these lands. These lands support critical links to the Olympic Peninsula, across the Columbia Gorge between northwest Oregon and southwest Washington, and in the California Coast Range. This linkage function prompted the ISC to recommend designation of Habitat Conservation Areas (HCAs) incorporating key blocks of State lands.

Existing suitable spotted owl habitat on tribal lands (about 350,000 acres) is found mostly on five Indian Nations (Yakima and Quinault in Washington; Warm Springs and Grande Ronde in Oregon; and Hoopa in California) (C. Ogden, Spotted Owl Coordinator, Bureau of Indian Affairs, pers. comm.). The majority of existing suitable habitat (about 250,000 acres) is found on the Yakima Indian Nation; information on the quality, stand size, and distribution of suitable habitat on the other four areas is variable. The Yakima Nation predominantly harvests timber selectively throughout their lands that currently support pairs of spotted owls.

Private lands in Oregon and Washington currently provide less than 500,000 acres of nesting and roosting habitat (< 5 percent of total owl habitat although estimates are incomplete) (Hays and Johnson, pers. comm.). Most stands are remnant patches of older trees that had not previously been harvested or stands resulting from past uneven-aged harvest methods. Incomplete information exists on the quality, stand size, and distribution of habitat on these lands or their present ability to support spotted owls (no habitat maps are available). Most known remaining stands of suitable habitat are highly dispersed in small patches throughout the range of the owl in these two States. Most of these lands may contribute in supporting dispersal and have the potential to support roosting and nesting (if trees are allowed to mature and harvest patterns change).

In California, about 500,000 acres of existing owl habitat occur on private lands; about 450,000 of these acres are found in the coastal redwoods, although estimates are incomplete (Gould, pers. comm.). Lands on the east side of the owls' range in California are similar to those described for private lands in Oregon and Washington. Many of these lands are selectively harvested and support owls. As discussed earlier, the redwoods present a unique situation due to their rapid growth and other factors. As a result, extensive tracts of habitat exist on private lands in the redwood region along with a large number of owl pairs. Although surveys on private lands in the redwoods have not been completed, and knowledge of owl distribution is incomplete, currently about 40 percent of the known pairs are found on non-Federal lands in California.

Previous Management Attempts

The history of the spotted owl issue began before the passage of the Endangered Species Act in 1973. Prior to listing the spotted owl as a threatened species, many different approaches to spotted owl management and research were being implemented by Federal and State resource agencies. Attempts to focus on owl management (primarily through temporary protection of pair sites) began in the mid-1970s, often in an uncoordinated and inconsistent fashion; coordination among involved parties has been a continuing problem.

Attempts to avoid conflicts by managing spotted owls and old growth forest habitat were increasingly unsuccessful in the 1980s and resulted in a series of lawsuits, challenges, or appeals under the National Environmental Policy Act, the Migratory Bird Treaty Act, the National Forest Management Act, and the Federal Lands Policy and Management Act mostly prior to the listing of the northern spotted owl in 1990. These lawsuits have had a significant impact on recent timber harvest levels and on the way that the Forest Service and Bureau have managed for spotted owls (i.e., changes in previous management of Spotted Owl Habitat Area (SOHAs), Spotted Owl Management Areas (SOMAs), or Bureau/Oregon Department of Fish and Wildlife (ODFW) agreement areas) and old growth, and have contributed to the current situation leading to the development of the ISC Plan (discussed below) and the listing of the owl. The challenges have also increased congressional interest in resolving the issue of forest management conflict in the Pacific Northwest (of which the owl is only one part). A complete discussion of the history and chronology of past spotted owl management attempts can be found in the ISC Plan (Thomas *et al.* 1990).

In light of the growing uncertainty surrounding the status of the spotted owl, an Interagency Agreement was signed in 1989 by the Bureau, the Service, the Forest Service, and the National Park Service establishing the ISC, a committee of scientists and management biologists, to reevaluate the current management status of the subspecies. The charter commissioning the ISC, mandated in section 318 of Public Law 101–121 in October of 1989, specifically directed the group to develop a scientifically-based conservation strategy for the northern spotted owl; the Charter did not address the Act. On April 4, 1990, the ISC Plan (Thomas *et al.* 1990) was released. This plan, which focused primarily on Federal and to a lesser extent State lands, used the best available biological information on the subspecies and outlined a strategy to ensure long-term viability for the owl in well-distributed numbers throughout its range.

The ISC developed a scientifically credible conservation strategy, applying principles of ecology and conservation biology and utilizing available spotted owl research data. The ISC recommended implementing a system of HCAs capable of supporting multiple pairs of spotted owls and a management standard, thought to be consistent with sustained yield management, for the remaining forest matrix to provide for dispersal among the HCAs (50–11–40 rule) where 50 percent of the forest habitat would be managed for 11 inch dbh and 40 percent canopy closure. In addition, the ISC recommended an adaptive management strategy to modify the plan as further data on the owl's biology and forest management were obtained.

The ISC concluded that, if fully implemented by the Forest Service and the Bureau beginning in Fiscal Year 1991 and with continuing adaptive management, the plan should provide for the owl's survival for a 100-year period. No individual part of this management plan was designed to stand alone and the future success of the plan was dependent upon full and timely implementation. Recommendations were also made to establish HCAs on key State lands (mostly in important linkage areas where there are few or no Federal lands) and habitat management on private and tribal lands throughout the owls' range was encouraged. Even with the development of the ISC Plan existing information indicates little change in the status or management of owl habitat since the owl was listed. Current forest management continues to reduce the quantity and quality of spotted owl habitat.

The ISC acknowledged a number of population and habitat risk factors associated with the long-term nature of the strategy that may increase over time. Full implementation of the ISC Plan provides protection for a spotted owl population that is smaller than currently known to inhabit Northwest forests, and, in fact, will probably result in a near-term loss of a "significant portion" of the existing spotted owl population (Thomas *et al.* 1990). The ISC Plan, under a worst-case scenario, may result in a protected population that would be about 50 percent of the currently known number of spotted owl pairs. The projected number was based on the loss of all owl pairs outside of HCAs, although some unknown number of pairs would occur in other reserved areas, forested areas unsuitable for timber harvest, and older managed forest stands.

The long-term success of the ISC Plan is based on the expectation that (1) the HCAs would eventually recover sufficiently to support the hypothesized numbers of owls and thus a stable population of owls and, (2) linkage through the surrounding forest matrix would suffice for genetic and demographic exchange among the HCAs and physiographic provinces. The ability of HCAs to contribute to maintaining a viable and recoverable owl population is directly correlated with the quality and quantity of suitable nesting and roosting habitat within these areas; no timber harvest was recommended by the ISC within HCAs.

The ISC Plan was prepared before the owl was listed as threatened and did not explicitly address recovery, critical habitat, or other aspects of the Endangered Species Act. The Service recognizes the importance of the ISC Plan and the essential role of the HCAs in the owls' conservation. The ISC Plan complements this critical habitat determination by stressing the need for protection for all facets of the owls' life history, including dispersal (through 50–11–40) outside of areas identified in this rule as critical habitat. The ISC concept emphasizes the importance of managing large and well-distributed blocks of suitable owl habitat that are sufficiently connected to maintain a stable and well-distributed population throughout the owls' range.

With respect to implementation of the ISC Plan, the Forest Service issued a notice on October 3, 1990, (55 FR 4112) which vacated their previous spotted owl management guidelines and established the agency's intent to conduct future timber operations "* * * in a manner not inconsistent with * * *" the ISC Plan. On August 6, 1990, the Bureau released its management guidelines, referred to as the Jamison Strategy (USDI 1990b), for the northern spotted owl that incorporated parts of the ISC Plan (i.e., HCAs, the 50–11–40 rule only where possible), while emphasizing the Bureau's requirements under the Federal Land Policy and Management Act (FLPMA) and the National Environmental Policy Act (NEPA) to analyze other alternatives during preparation of new resource management plans. The Bureau's guidelines established interim guidance until Fiscal Year 1993 when resource management plans were to be completed.

Both the Forest Service and the Bureau are currently nearing completion of their resource management planning efforts. On May 23, 1991, the Western District Court in Seattle ruled against the Forest Service for failing to complete the NEPA process in vacating the old SOHA system and implementing the ISC Plan; the ruling affects timber sales in owl habitat. The Forest Service issued a draft EIS, in September 1991, including the ISC Plan as their preferred alternative. The Court requires them to complete their management plan and accompanying EIS by March 1992.

On September 11, 1991, the U.S. District Court in Oregon enjoined the Bureau's Jamison Strategy over the Bureau's failure to consult with the Service pursuant to section 7 of the Act. The injunction did not affect actual timber sales. The Bureau continued to harvest in some areas below the 50–11–40 standard and has proposed timber sales originally planned in 1990 within HCAs; salvage sales are also planned within HCAs. On June 17, 1991, the Service determined that 52 timber sales proposed by the Bureau, located primarily in the Oregon Coast Ranges, would jeopardize the continued existence of the northern spotted owl (USFWS 1991a). The Bureau modified 8 of the sales and requested exemption from the requirements of section 7 of the Act on the remaining 44 sales. The exemption ("God Squad") process is currently underway; some of these sales are in critical habitat.

Recent Developments

In late May 1991, the Agriculture and Merchant Marine and Fisheries Committees of the U.S. House of Representatives established a Scientific Panel to address the needs of all forest species and forest-related ecosystems in the Pacific Northwest so as to determine

a possible course of action for developing a long-term solution to current and expected resource conflicts with emphasis placed on conserving the spotted owl. On October 8, 1991, the Panel provided a report to Congress entitled "Alternatives for Management of Late-Successional Forests of the Pacific Northwest" which outlined 14 alternatives that provided different levels of protection for forest ecosystems along with different timber harvest levels (Johnson *et al.* 1991). The Scientific Panel concluded, among other things, that continued high timber harvest rates are inconsistent with ecosystem protection and both cannot be accomplished. At this time no decision has been made by Congress as to adoption of that report or any of its alternatives.

The Service is currently coordinating with a number of public and private entities to develop management or habitat conservation plans to help offset impacts to owls resulting from current or future actions. Private timber companies and the State of California are actively pursuing completion of habitat conservation plans (HCPs) under Section 10 of the Endangered Species Act on the east side of the Klamath province and in the redwoods. The Bureau of Indian Affairs and the Yakima Indian Nation are developing a harvest management plan for their lands that is intended to be compatible with spotted owls.

In February 1991, the Department of the Interior established a Recovery Team for the northern spotted owl that represents the major Federal and State agencies involved with this issue. The Recovery Team is evaluating critical habitat, the ISC Plan, and all other new and pertinent information; it expected to produce a draft recovery plan in 1992 that outlines the goals and objectives for recovering (i.e., delisting) the northern spotted owl. This plan should help define management prescriptions for critical habitat. The Service will review the scope and extent of this critical habitat rule following completion of the recovery planning process.

Criteria for Identifying Critical Habitat

The maintenance of stable, self-sustaining, and well-distributed populations of northern spotted owls throughout their range is dependent upon habitat quality and its ability to support clusters of successfully reproducing owls that are sufficiently integrated to avoid or reduce demographic and/or genetic problems through time. The biological and physical characteristics of the forest habitat that support nesting, roosting, foraging, and dispersal are essential for this purpose.

The Service's primary objective in designating critical habitat was to identify existing spotted owl habitat and to highlight specific areas where management considerations should be given highest priority to manage habitat. Critical habitat focuses on the nesting and roosting habitat as the most important elements of spotted owl habitat. However, in its designation of critical habitat, the Service has considered all habitat types needed by the owl through its definition of the primary constituent elements.

Using habitat maps, the Service developed criteria to identify which parcels containing these attributes would be included as critical habitat. Because habitat maps available to the Service were generally based on the varying definitions of "suitable habitat" used by the agencies, the major focus was on habitat that provides nesting, roosting, and some foraging attributes. The quality of remaining habitat varies across the owls' range, and so the Service made judgments about the appropriateness of including specific areas. To assist in these determinations, the Service relied upon the following principles (Thomas *et al.* 1990):

—Develop and maintain large contiguous blocks of habitat to support multiple reproducing pairs of owls;
—Minimize fragmentation and edge effect to improve habitat quality;
—Minimize distance to facilitate dispersal among blocks of breeding habitat; and
—Maintain range-wide distribution of habitat to facilitate recovery.

Several qualitative criteria were considered when determining whether to select specific areas as critical habitat. The following discussion describes the criteria and provides an explanation of their use in selecting specific areas. The Service did not establish population goals for individual critical habitat units, provinces, or the range of the owl as part of the selection criteria. It is assumed that these may be identified in the recovery plan, if appropriate.

(1) *Presently suitable habitat emphasized:* The Service concentrated on the existence of presently suitable owl habitat in coniferous and coniferous/mixed-hardwood forests that contained one or more of the primary constituent elements (primarily nesting and roosting, but also foraging and dispersal). The definition of "suitable" habitat was generally equivalent to the structure of Douglas-fir stands 80 or more years of age (with adjustments for local variation or conditions).

(2) *Large contiguous blocks of habitat emphasized:* To respond to the habitat needs of the northern spotted owl, the Service identified large, contiguous blocks of habitat or areas that mostly consisted of owl habitat. To accomplish this the Service began with areas previously designated as Category 1 HCAs (areas with potential to support 20 or more pairs), Category 2 HCAs (areas with potential to support fewer than 20 pairs), and clusters of Category 3 HCAs (single pair HCAs) within its critical habitat designation. Habitat not previously included in HCAs was also was considered for designation where large areas of fairly unfragmented habitat existed outside of an existing HCA. For the most part these areas needed to be of sufficient size to support two or more pairs (based upon the mean home range size for the province) and fall within the spacing recommendations identified in the ISC Plan. In selecting areas for designation as critical habitat the intent was to follow rules similar to those outlined in the ISC Plan on contiguity, shape, habitat quality, spacing, and location within the range. For example, areas were selected so that critical habitat units would be as compact as possible; spider-shaped areas are less valuable for spotted owls because of the large amount of forest edge.

(3) *Quality of existing habitat:* The Service evaluated the quality of existing habitat based on available habitat maps and tried to encompass the best available habitat (i.e., the least fragmented, most contiguous, lower elevation habitat areas) in the critical habitat units. The Service focused on habitat that was within, adjacent to, or in close proximity to an existing HCA; areas with minimal fragmentation were selected over areas with more extensive fragmentation. In carrying out this evaluation, the Service reviewed all available information regarding the habitat quality existing in the HCA's identified by the ISC and made an independent determination regarding the existence of the primary constituent elements essential to the species.

(4) *Dispersal distances minimized:* Designation of critical habitat provides no protection for lands not included in the designation. As a result, the Service made the determination not to violate the spacing guidelines in the ISC Plan. Critical habitat units minimize distance between adjacent units, thereby facilitating dispersal and linkage. In some areas units are nearly contiguous which will help reduce gaps within the

range of the owl, especially in areas of concern (e.g., Bureau lands in the Oregon Coast Range).

(5) *Occupied habitat emphasized:* In selecting critical habitat, the Service gave primary consideration to habitat currently occupied by pairs or resident singles; however, some unoccupied areas were selected if they were important for other reasons (e.g., linkage). All areas selected, however, have potential for supporting owls.

(6) *Maintain rangewide distribution:* The Service designated critical habitat units throughout the existing range of the owl which will help maintain the variation that occurs over its range. In some cases, the only constituent habitat element currently supported by these areas is dispersal habitat. These areas should provide sites where owls moving across the landscape can find shelter and prey and should eventually provide nesting habitat as well. To be truly successful as stepping stones to improve linkage, these areas must in the future provide nesting habitat to support an adequate distribution of owls. For example, relatively few owls remain in the area between the Olympic Peninsula of Washington, east to the Washington Cascades, or south to the Siuslaw National Forest of Oregon; however, linkage within this area is essential to the recovery of the subspecies and to maintain a population in the Olympic Peninsula.

(7) *Need for special management or protection:* The Service evaluated the need for special management because of the existing situation (e.g., current quality of existing habitat), low population density, or connectivity problems (e.g., areas of concern). Although most critical habitat units were designated based upon the presence of existing habitat, some were selected because of their need for special management or protection. Primary emphasis was given to areas of concern (as identified in the ISC Plan and the Service's status reviews) that require special management. Emphasis was also given to the contribution that area would make to the conservation of the owl.

(8) *Adequacy of existing regulatory mechanisms:* The Service considered the existing legal status of areas (i.e., whether areas were already protected for other reasons such as wilderness or parks) and did not formally designate protected areas as critical habitat. Some HCAs or portions of HCAs were not included in this rule because they were already protected in wilderness, State parks, or National Parks and Monuments. The Service also considered the value of other processes (e.g., the HCP process currently underway in California) and the ability of those processes to provide owl habitat.

Results of Applying the Selection Criteria

Application of these criteria resulted in the consideration of a number of items that are explained below. A full discussion of the items that were considered for each individual critical habitat unit is included in the Service's narratives (USFWS 1991d; a copy is contained in the Service's administrative record for this rule).

Habitat Conservation Areas

HCAs are only one part of a plan to manage spotted owls. The areas selected as HCAs were identified by experts familiar with the species and its habitat, were identified through application of accepted ecological principles, and are currently considered essential to the conservation of the species. The ISC Plan was based upon the best information available at that time on spotted owls. The ISC Plan represents the best science on the conservation of the northern spotted owl, is consistent with ecological principles, and has been thoroughly peer-reviewed. The success of the ISC Plan or other acceptable conservation plans in recovery will depend upon the time of implementation and the long-term protection of the recommended network combined with management to maintain dispersal habitat in the remaining forest matrix (e.g., 50–11–40 rule).

The Service thoroughly reviewed the ISC Plan, strongly endorses the science and principles espoused by this plan, and has used the ISC Plan in other conservation efforts (e.g., it has been the focus in Section 7 consultations). The Service believes there is a greater opportunity in the near term for conserving owls on lands identified as HCAs. Therefore, HCAs form the basis for critical habitat and were selected as the starting point for designation of critical habitat.

By using the HCAs as the basis for critical habitat, the Service accepted the fact that critical habitat would primarily apply to those Federal and State lands where HCAs had been recommended by the ISC. This resulted in the initial proposed selection of critical habitat primarily on Federal lands and some State lands in key areas, which would place a greater emphasis on the need for Federal and State land managers to participate in efforts to conserve the northern spotted owl.

The HCAs were accepted by the Service, as recommended by the ISC, except where new information (e.g., updated suitable habitat maps) indicated that areas of poor-quality habitat had been included in an HCA and/or higher quality habitat was located immediately adjacent to an HCA. Because it was constructing a management plan, the ISC did not include all good owl habitat in HCAs. In some cases, better habitat was found outside of an existing HCA that had not been previously identified by the ISC. Portions of HCAs were not included in critical habitat if (1) unsuitable areas were identifiable on available maps, (2) there was suitable habitat adjacent to the HCA that could be included in the critical habitat unit, and (3) exclusion of the unsuitable habitat would not violate the size and spacing recommendations. Where possible these areas were exchanged for areas of better quality habitat currently adjacent to the HCA.

About 5.7 million acres (5.2 million Federal) currently included in the HCA system were proposed as critical habitat because they met the criteria for designation. Over 200,000 acres of non-reserved lands in HCAs were not included in critical habitat since they did not meet the criteria; all reserved lands were also excluded because they were already protected (about 2.1 million acres). Some owl habitat outside HCAs and currently managed under the 50–11–40 Rule was included in critical habitat because it met the designation criteria.

Increase in Size Above Non-Reserved HCA Acreage

Designation of critical habitat does not accomplish the same goals or have as dramatic an effect upon owl conservation as does the ISC Plan, because critical habitat does not apply a management prescription to designated areas, nor does it affect the forest matrix outside of critical habitat (estimated as an additional 12–15 million acres). Since critical habitat designation is not a management plan, there was not a limitation on the size of the area added to any HCA, although emphasis was placed on areas documented to support the pair targets identified in the ISC Plan.

Primary consideration was given to existing suitable habitat and known pairs of spotted owls, particularly where the Service felt that additional protection should be considered and would enhance the existing HCA. For example, suitable nesting habitat, usually supporting known owl pairs, was included along with adjacent HCAs

primarily to provide near-term population stability for the spotted owl to help reduce the near-term risk associated with the ISC Plan. Such adjustments may shorten the recovery period by increasing habitat protection around existing HCAs that are deficient in suitable habitat or numbers of pairs. The inclusion of areas adjacent to HCAs included additional pairs of owls and resident singles that may help meet the pair targets identified in the ISC Plan in the near-term. However, the focus was on habitat quality and not on population numbers.

The Service focused on the existing situation in each of the physiographic provinces. Variations within and among provinces (e.g., existing habitat quality and quantity, distribution of existing suitable habitat, low numbers of pairs) led to differences in application of the criteria. Habitat was included in the designation to help specify areas of importance (e.g., to improve connectivity in areas of concern, to highlight areas for land exchanges, to ensure good distribution over the species' range, etc.). The Service identified areas of concern where habitat linkage within and among physiographic provinces is at risk due to past management practices. These areas are frequently associated with interspersed (checkerboard) Federal and non-Federal landownership patterns.

The Service evaluated different ways to approach critical habitat in these areas of concern. In the initial May 6, 1991, proposed rule, the Service identified the entire areas of concern as critical habitat to provide additional protection for key movement corridors. In response to public comments, the Service reevaluated this approach in the August 13, 1991, revised proposal primarily because owls appear to disperse randomly, not along well-defined corridors, and there are unanswered questions about the biological effectiveness of movement corridors. In the August proposal the Service included both the HCAs and adjacent blocks of existing suitable habitat within critical habitat. This not only focused on the immediate need for suitable habitat blocks in the areas of concern, but also resulted in closer blocks of habitat that facilitate movement of owls among critical habitat units and throughout their range. The need to protect linkage throughout the owl's range will increase if habitat conditions (quality and/or quantity) continue to decline. The size of critical habitat units in these areas is somewhat misleading since in areas under checkerboard ownership (in particular Bureau lands) only about half of the area may actually be included in critical habitat.

Although the designation of critical habitat emphasizes the importance of maintaining suitable habitat for all four constituent habitat elements, nesting and roosting habitat should be emphasized to improve opportunities for successful linkage. For example, in the Oregon Coast Ranges province, additional areas were identified as critical habitat due to the extremely fragmented habitat conditions and low owl pair numbers. New areas were identified within the Shasta/McCloud area of California where the Service determined that existing HCAs, although important to the owl, did not contain the most suitable habitat. In the southern portion of the Washington Cascades, areas of suitable habitat were included within critical habitat because large portions of the habitat within the HCAs are presently unsuitable and were deleted. Regardless of the existing variation, all of these areas play an important role in maintaining a stable owl population over its range.

Adjustments to Legally-Described Boundaries

The Act requires the Service to specifically identify and describe areas designated as critical habitat. This process previously has been accomplished by publishing illustrative maps and detailed written legal descriptions. To facilitate legal definition, in the August proposal all critical habitat unit boundaries were described to adjacent section lines external to the unit (including HCAs), unless other legally definable boundaries were available. In all cases the decision to use a section line was dependent on the existence of known owl habitat within the selected boundary that met the criteria.

In adjusting the ISC's HCA boundaries to the nearest section lines, the Service made the decision to include a section depending upon the amount and quality of habitat within that section; these additions provided a biological buffer to the HCAs. In some cases when a small portion of an HCA (e.g., 100 acres) crossed the corner of a section, but contained little to no existing owl habitat, the section was not included in critical habitat.

Lands Outside of Critical Habitat

Not all suitable nesting and roosting habitat was included in critical habitat. The Service recognizes the importance of all lands, but did not incorporate all habitat, especially all dispersal habitat, within critical habitat units, primarily because most of these lands did not meet the designation criteria. It was impractical to include all dispersal habitat within critical habitat, since relatively little is known about this aspect of the owls' life history. Emphasis was placed on those areas requiring more immediate protection due to habitat conditions within the critical habitat units, provinces, or in relation to the need for range-wide distribution. This does not mean that lands outside of critical habitat do not play an important role in the owls' conservation. These lands are also important to providing nesting, roosting, foraging, and dispersal habitat for owls.

In order to achieve recovery, habitat must be available for owls to move throughout their range to provide genetic and demographic exchange among subpopulations, to recolonize formerly occupied portions of the subspecies' range (linkage), and for juvenile owls to disperse from their natal areas (dispersal). All of these functions require that forested habitat exist between protected areas to provide connectivity. Dispersal habitat must provide protection to owls from avian predators, provide at least minimal foraging opportunities, and allow juvenile and adult owls to move successfully among blocks of nesting habitat. Because owls disperse and move randomly, and given general harvest practices, the ISC suggested that the general forest landscape on Federal lands should be maintained in a condition that would allow successful owl movement between HCAs and other protected areas, through utilization of the 50–11–40 rule (Thomas *et al.* 1990). The 50–11–40 rule also was recommended for non-Federal lands, but on a voluntary basis.

However, the ISC Plan affects a much greater amount of acreage in the forest matrix beyond those lands designated as HCAs through application of the 50–11–40 rule (estimated to apply to an additional 12 to 15 million acres). The 50–11–40 rule applies to significant acreage that is not included in critical habitat. The Service expects that the dispersal needs of the owl will be addressed through Federal compliance with the 50–11–40 rule or other scientifically acceptable approaches. Although the Service assumes that the 50–11–40 rule or an equivalent rule will be followed in this portion of the forest matrix after designation of critical habitat, there is no assurance that this will occur. Even though distances between critical habitat units were often less than between HCAs (which should facilitate linkage), these shorter distances do not replace the need to

manage the forest matrix not included in critical habitat.

Wilderness, Parks, and Other Reserved Areas

The current classification of wilderness areas and parks provides adequate protection against potential habitat-altering activities, because they are primarily managed as natural ecosystems. The Service considered their relative contribution to the owls' conservation but did not include them in critical habitat because of their current classification. These lands are certainly essential to the conservation of the species as they provide important links and contain large areas of contiguous habitat not previously harvested. However, these lands, by themselves, do not provide adequate habitat for supporting a viable spotted owl population.

Reserved areas do not provide a well-distributed network of owl preserves because they are concentrated within only about one-third of the owl's range. They usually have poor soil conditions or are too steep or rocky; such areas generally do not contain suitable habitat for spotted owls. Owl density and reproductive success within these areas is generally less than in other areas (Thomas *et al.* 1990). Although these lands may contain some high-quality, lower-elevation habitat that is important for the species, they generally include a large percentage of high-elevation, alpine habitat that is unsuitable or only marginally suitable for spotted owls. Furthermore these areas are often separated by wide gaps of 30 to 80 miles. Without intervening populations, these protected areas may become demographically isolated.

Congressionally-designated wilderness and national and state park systems contain less than 2.1 million acres of suitable habitat (about 23 percent of the total amount of owl habitat rangewide) and may support fewer than 300 pairs of owls (Thomas *et al.* 1990). There are 55 wilderness areas totaling over 4.7 million acres in the 18 national forests in the owls' range; there is very little wilderness on Bureau lands in these areas (USDI 1990a). It is estimated that less than 25 percent of wilderness lands (about 1.3 million acres of the 4.7 total) provide suitable nesting and roosting habitat; about 15% of the total amount of nesting and roosting habitat estimated for all lands. Most of that habitat is highly fragmented by intervening areas of high elevation. National Parks may provide about 600,000 acres of suitable owl habitat. Most existing owl habitat currently on Park lands is found in the Olympic National Park (about 16 percent of all known suitable habitat within reserved areas).

In addition, there are areas which are reserved administratively at the local level for hydrological, scenic, biological, or other reasons. Total acreage estimates were not available, but these areas are believed to comprise about 20–30 percent of the habitat currently identified as being in the timber base. For the most part these areas are small and of low or poor quality habitat that may only suffice for limited nesting or for dispersal. Since these latter areas could not be readily identified on habitat maps, some were included in critical habitat if they met the selection criteria.

Management Planning

The Service's intent in designating critical habitat for the northern spotted owls is to provide protection for habitat that contains constituent habitat elements in sufficient quantities and quality to maintain a stable population of owls throughout the owl's range. The emphasis for future management will be on maintaining or developing habitat that has the characteristics of suitable nesting and roosting habitat and to avoid or reduce the adverse effects of current management practices.

Although critical habitat is not a management plan, the areas selected for inclusion are interlinked and play a role in maintaining a stable and well-distributed population of owls. Identification of these areas concluded the first step in the designation of critical habitat for the northern spotted owl. This step was primarily the focus of the August 13, 1991, proposal to designate critical habitat. Final modifications to this proposal resulted from the economic analysis and consideration of the exclusion process, and led to the final designation of critical habitat (see following sections for final designation).

Economic Summary of August 13 Proposal

Section 4 of the Act directs the Secretary to designate critical habitat and to consider economic and other relevant impacts in determining whether to exclude any proposed areas from the final designation of critical habitat. The Secretary has delegated these authorities to the Director of the Service. Section 4(b)(2) states:

> The Secretary shall designate critical habitat, and make revisions thereto, under subsection (a)(3) on the basis of the best scientific data available and after taking into consideration the economic impact, and any other relevant impact, of specifying any particular area as critical habitat. The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species concerned.

The Service analyzed the economic effects of the August 13, 1991, revised proposal to designate critical habitat (USFWS 1991d). A summary of that analysis was provided in the proposed rule (56 FR 40001); the complete analysis can be found in the draft economic analysis report. That analysis examined how designation of critical habitat was expected to affect the use of Federal lands or State or private activities with some Federal involvement, and the economic costs or benefits which would ensue in the Northwest. These were the regional economic effects of the proposed designation that were over and above those expected to result from previous actions (e.g., the ISC Plan), including the listing of the owl as threatened. The economic analysis assumed those values which were in place prior to critical habitat designation (e.g., the ISC Plan and final Forest Service and Bureau plans, section 7 jeopardy standard, and section 9 prohibitions) as the baseline for this analysis. As a result, critical habitat effects were those incremental impacts that would occur solely as a result of the critical habitat proposal above and beyond the effects of these other actions.

The proposed critical habitat covered a broad geographic area in three States and included both Federal and State-owned lands. Because the designation would affect only Federal agency actions under section 7 of the Act and only to those areas currently outside of HCAs, it was assumed that any ensuing economic impacts of the designation would occur only on Federal lands or on non-Federal lands where there was Federal involvement. The Service concluded that the impacts on Federal lands would be largely limited to timber harvest and to a lesser degree non-timber activities that may affect owl habitat. The Service had excluded all private and tribal lands in the August 13 proposal to help reduce the overall impacts (about 3.1 million acres). The Service believed that the benefits from inclusion of these areas in critical habitat did not outweigh the potential costs resulting from their inclusion (see following discussion on the exclusion process) and that there were other

mechanisms underway in some areas (e.g., HCPs) that would provide greater conservation benefits.

As a result of that analysis, the Service concluded that the August 13 proposal would have the potential to reduce timber harvest by about 167 million board feet (mmbf) with the net loss to the U.S. Treasury of about $43 million. The potential reduction in timber-based employment was estimated at 2,458 jobs (1,538 direct jobs; 920 indirect jobs) with an estimated $20 million reduction in payments to counties. These figures represented about a 4–5 percent impact on the timber industry in the Northwest. It was estimated that Oregon would be the most affected by the proposal. The relative importance of the industry also varies by county with some counties much more dependent on the timber industry than others. These counties would be expected to be more affected by the designation than others that are more diversified. The Service expects a number of factors to partially offset employment and other losses over time, such as changes in stumpage prices or improvements in silviculture techniques, but it was difficult to quantify these estimates.

The Service also concluded that the conservation of the spotted owl and its habitat through designation of critical habitat would result in a wide range of benefits, including recreation values, watershed protection, and others, as well as the values that society places on conservation of the owl and its ecosystem. However, it was not possible to place dollar estimates on these values.

As a result of this analysis, the Service concluded that the overall effects on the Northwest timber industry and to some counties in particular, were potentially severe and that further consideration should be given to excluding additional acreage from the final designation to reduce the overall economic impacts that may result from the designation of critical habitat.

Summary of the Exclusion Process

To determine whether or not to exclude areas from the designation of critical habitat pursuant to Section 4(b)(2) of the Act requires determinations of (1) the benefits of excluding an area as critical habitat, (2) the benefits of including an area, and (3) the cumulative effects of exclusions on the probability of species extinction. This process consists of estimating the benefits of retaining or excluding critical habitat units, weighing those benefits, and determining if exclusion of an area or areas will lead to the extinction of the species. If the exclusion of an area or areas from critical habitat will result in eventual species extinction, then the exclusion would be prohibited under the Act. A full discussion of this process and its conclusions can be found in the Service's report on the exclusion process (USDI 1991b).

Extinction

Critical habitat consists of areas with habitat characteristics that are essential to the conservation of a listed species. However, the exclusion process focuses upon a threshold for species extinction. Conservation (recovery) and extinction are separate standards. Recovery and extinction are at opposite ends of a continuum, with the likelihood of a species' continued survival increasing the closer the species is to the recovery end of the continuum. It may be more difficult to predict the point at which extinction would be inevitable than to determine where recovery may occur.

Each such determination may be different for different species and may vary over the range of a species. It may be related to a number of factors, such as the number of individuals, amount of habitat, condition of the habitat, and reproductive success. Extinction of a wide ranging species such as the northern spotted owl would most likely occur as a result of increased fragmentation of its habitat (affecting quality) and range, and isolation of subpopulations (affecting population stability). Portions of its range would no longer support owls before the species would become extinct. Cumulatively, reductions in range would inevitably lead to the species extinction. The focus of the analysis was on those factors that pertain to these issues and included consideration of the condition and location of habitat, area by area.

Criteria and Decision

The Act specifically prohibits consideration of economic effects when listing species as threatened or endangered, but requires an analysis of the economic and other relevant impacts of designating critical habitat. Therefore, economic costs and benefits of critical habitat designation were defined as the economic effects which: (1) Exceed those that resulted from listing the northern spotted owl as a threatened species in June 1990; (2) are above those economic effects resulting from the previous implementation of owl protection measures by the Forest Service and Bureau (e.g., the ISC Plan); and (3) are beyond limitations that may have been imposed by other statutes, regulations, or court actions. Consideration of those acres available for exclusion was, therefore, limited to those areas proposed for critical habitat but currently outside of HCAs as defined in the August 13 proposal.

The Service used the following process to evaluate the designation of critical habitat to determine whether to exclude areas because of concerns over economic effects:

—Areas were identified that are essential to the conservation of the species based upon the criteria described in this document;

—An economic analysis was conducted to ascertain the anticipated economic consequences of designating areas as critical habitat, using the county as the basic level of economic analysis;

—Economic criteria were developed to help identify areas of vulnerability and to identify areas which would be affected by the critical habitat designation. The analysis was done at the county level because the county level is the lowest level for which national economic data are compiled. However, consideration was also given at the agency, national, and province level to help clarify impacts and to provide comparable measurements; and

—Economic thresholds were established and all counties were screened against the criteria to identify their economic vulnerability. Those with the greatest vulnerability or highest overall impacts were identified for additional review and discussion.

The Service determined that criteria based upon the effect on timber and timber-related employment would be used to help determine when a county should be reviewed because of the effects of the designation of critical habitat. Two initial criteria were selected to determine an economic threshold: (1) If the projected number of timber jobs expected to be lost exceeded 3 percent of the total number of timber jobs in that county, and (2) If the effect of the designation resulted in a projected loss to county budget of 5 percent or more. After reviewing these criteria, the Service chose to reduce the criteria for projected employment reductions to 2 percent. The Service believes that impacts of this magnitude present a significant loss to local economies. These percentages are equivalent to the indicators that the Federal government uses to identify economic concerns.

The Service believes that when losses in revenues reach as high as 5 percent or more of previous budget levels, significant reductions may occur in county services. The Service adapted

the criteria for "substantial and persistent unemployment" effects set forth in the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies" (March 1983). The threshold for a substantial effect (i.e., a current unemployment rate of at least 6 percent and an annual average unemployment rate 50 percent above the national level) was modified to reflect the future effect on currently employed workers in the three State area. The county level unemployment rate was used in place of the national level rate, and the "50 percent above" criteria was defined as future unemployment effects that would be potentially created by critical habitat designation. This process resulted in a 3 percent unemployment threshold for timber related employment. In order to account for uncertainty and to develop a more conservative estimate, the Service reduced the unemployment threshold to 2 percent.

After completing its economic analysis and considering other factors that may be pertinent to any decision to exclude areas from designation as critical habitat, the Service made the following decisions:

(1) A total of 865,000 acres were excluded from designation. These acres were excluded from:

—13 counties where the Service determined that the benefits of exclusion outweighed the benefits of inclusion and that the economic costs needed to be mitigated to reduce the number of timber-related jobs projected to be lost locally, and/or where losses to county revenues exceeded the threshold; and

—Most counties to help reduce the overall economic costs over the owls' range where acres had been included primarily to expand critical habitat units incorporating HCAs to meet section lines for use in legal descriptions.

(2) All presently existing projects and all proposed projects where all Federal, State, and local permitting processes had been completed and final approvals and permits issued as of the date of the final rule were excluded from designation to help reduce any impacts from additional regulatory burden (e.g., existing mines, ski areas, etc.); future project changes are not included in the decision.

(3) All State lands (about 580,000 acres) are excluded because the potential costs resulting from a designation outweighed the minor conservation benefits expected to result from protection under the Act applicable to critical habitat on State lands.

The Service has removed (1) the areas added to HCAs to facilitate legal descriptions, (2) additional areas within specific counties, (3) existing projects, and (4) State lands, on the ground that the benefits of excluding such areas from designation outweigh the benefits of including them within critical habitat. This resulted in an exclusion of nearly 37 percent of the acres proposed for critical habitat that were above the HCA acreage included in critical habitat, plus nearly 600,000 acres of State lands. Those exclusions will reduce the economic and other relevant impacts expected from this designation. The above decisions to exclude areas from critical habitat are in addition to the reductions and exclusions reported in the August 13 proposed rule. In that proposal, the Service excluded private and tribal lands (3.1 million acres estimated); some State and Federal lands that did not meet the designation criteria also were deleted prior to completion of the August 13 proposal (about 200,000 acres net).

Although the Service believes all lands are important to the recovery of the northern spotted owl, it did not include the above lands because it felt that the conservation benefits to be gained from including them in critical habitat did not outweigh the potential costs to the public. The Service believed that the above actions were justified because in comparison there are very few owls or owl habitat currently on non-Federal lands, except in the redwoods in northern California. For the most part the best remaining owl habitat exists on Federal lands throughout the range of the owl. Because of this situation most conservation activities for the owl are expected to be carried out by the Federal agencies (particularly the Forest Service and Bureau). Non-Federal land management actions are not subject to section 7 consultation unless Federal approval or authorization is required. Since there is little direct opportunity to apply additional protection to critical habitat through section 7 on non-Federal lands, the Service made the decision to exclude these areas because of the potential economic concerns and because their designation would provide little additional conservation benefit to the owl. The Service believed that there are other mechanisms on private, State, and tribal lands that would provide a greater conservation benefit for the spotted owl than that provided under designation (e.g. the HCP process underway in California). The areas that were excluded from the designation were those the Service believed would have the least biological impact on the intent of the designation for this species.

In the August 13 proposal, the Service also excluded all sold and awarded timber sales as of the date of that proposal. The potential market value of these sales is over $1 billion (T. Rogan, Head of Engineering, Forest Service, pers. comm.; B. Neitro, Threatened and Endangered Species Coordinator, Bureau of Land Management, pers. comm). The Service believes that the cost of buying back those sales or causing further regulatory burden as a result of designation justified their exclusion.

A comparison of the major effects of designating critical habitat between the August 13 proposal (56 FR 40001, USFWS 1991d) and the final designation (see ECONOMIC IMPACTS OF THE FINAL DESIGNATION in this document and USDI 1991a) shows that the exclusion process resulted in significant reductions in potential economic impacts resulting from the designation. The final rule results in an increase in annual timber volume of 65 mmbf over the August proposal. The increased availability of timber in the final rule, valued at $4 million annually, may result in 1,038 more jobs than the August proposal and may reduce the loss of payments to the States by $1.8 million annually. These reductions in economic effects are due primarily to the reduction in acres of Federal land designated as critical habitat, although some small reductions are also attributed to the use of updated job coeffecients and to the use of slightly different timber yield per acre figures.

The above exclusions increase the importance of the remaining critical habitat and associated consultation processes to the conservation of the owl and place a greater dependence on other processes for recovery. The exclusions may reduce the biological buffer in some areas, thus reducing the Service's flexibility under section 7. Deleting or dropping areas from the designation also changes the value of the remaining units, thereby affecting how these areas should be reviewed under section 7. Additionally, potential population losses in the range of the owl may occur because of linkage problems, particularly on the Olympic Peninsula and in southwest Washington and northwest Oregon. However, the Service has considered the cumulative effect of these decisions, and has concluded that they will not result in the extinction of the northern spotted owl over its range.

Exclusion of these areas or activities from critical habitat applies only to the potential protection provided under

section 7 consultation (adverse modification) for critical habitat. Excluded lands and projects are still subject to the other prohibitions mandated by the Act, such as section 7 consultation (jeopardy) and section 9 (take).

Conclusion

The Service has reviewed the overall proposal to designate critical habitat and the benefits and costs associated with designating critical habitat for the northern spotted owl. The Service has determined that the overall conservation and other benefits to be gained from the designation outweigh the benefits from excluding additional areas and, therefore, has made a final determination to designate critical habitat for the northern spotted owl. A full discussion of the economic analysis (USDI 1991a) and exclusion process (USDI 1991b) are included in the Service's administrative record.

Effects of the Designation

The revised proposed rule for the designation of critical habitat for the northern spotted owl published on August 13, 1991, identified 181 areas encompassing a total of approximately 8.2 million acres. It included 61 critical habitat units totaling 1.8 million acres in California, 77 units totaling about 3.8 million acres in Oregon, and 43 units totaling 2.7 million acres in Washington. This included 6.4 million acres of Forest Service land, 1.2 million acres of Bureau land, 580,000 acres of State land, and approximately 62,000 acres of military lands.

In applying the exclusion process to the areas included in the August proposal, the Service reviewed habitat maps to identify specific areas for deletion. Areas that had been added (to HCAs) solely to facilitate identification of legal descriptions were deleted except where there was a clear conservation benefit to the owl, e.g., areas were retained if they were part of a larger area recommended as critical habitat. In the counties where the Service decided to exclude an additional specific number of acres, the Service used public comments and available habitat information to select which areas to exclude from the designation. As much as possible, the Service selected areas so that the remaining areas included in the final designation did not violate the intent of the designation criteria (e.g., spacing, unit contiguity). To do this the Service chose to remove areas bordering critical habitat units and in areas where spacing between units would not be significantly affected. The final maps reflect these changes. The number of areas and total acreage involved in the final product are discussed below. Table 1 provides a summary of the acreage changes that have occurred from the May 6 proposal through the final designation.

TABLE 1.—SUMMARY OF ACRE REDUCTIONS BETWEEN ORIGINAL MAY 6 PROPOSAL, AUGUST 13 REVISED PROPOSAL, AND FINAL CRITICAL HABITAT DESIGNATION [1]

	May to August	August to December	Total acre reduction
Forest Service	[2] −12,000	−778,000	−790,000
BLM	[2] −146,000	−86,000	−232,000
State	[2] −30,000	−582,000	−612,000
Tribal	−74,000		−74,000
Military	[2] −19,000	−4,000	−23,000
Private	−3,020,000		−3,020,000
Total	−3,301,000	[3] −1,450,000	−4,751,000

[1] See Table 3 for comparison with the total number of acres proposed and designated as critical habitat.

[2] These acres were deleted because they did not meet the designation criteria.

[3] This is about 37 percent of the number of acres proposed (August 13 proposal) for critical habitat that were outside of HCAs, a reduction of 62 percent from the May 6 proposal (when combined with the 3.3 million previously excluded).

Total Acres Included in Critical Habitat

As a result of the exclusion process, the Service is designating approximately 1.4 million acres less than proposed in the August 13, 1991, rule and 4.7 million less than the original May 6, 1991, proposal. The final rule for the designation of critical habitat for the northern spotted owl identifies 190 areas, encompassing a total of nearly 6.9 million acres; this is about 84 percent of the total acres included in the August proposal and 62 percent of the total originally identified in the May 6 proposal. The total number of final designated units is more than the number of units proposed in the August 13 proposal because some were subdivided into separate units as a result of the exclusion process. The Service has designated 61 units totaling 1.4 million acres in California, 76 units totaling 3.2 million acres in Oregon, and 53 units totaling 2.2 million acres in Washington. The final designation encompasses approximately 5.7 million acres of Forest Service land, 1.2 million acres of Bureau land, and 58,000 acres of military land (see Table 2).

TABLE 2.—APPROXIMATE ACREAGE [1] OF FINAL CRITICAL HABITAT UNITS (CHUS) FOR THE NORTHERN SPOTTED OWL (ROUNDED TO THE NEAREST THOUSAND ACRES)

	California	Oregon	Washington	Total
Forest Service	1,301,000	2,211,000	2,163,000	5,675,000
Bureau of Land Management	108,000	1,046,000		1,154,000
Military	0	0	58,000	58,000
Total	1,409,000	3,257,000	2,221,000	6,887,000
Number of CHUs	61	76	53	190

[1] Acreage figures include only Federal lands.

Of the approximately 6.9 million acres, 20 percent is in California, 47 percent in Oregon, and 32 percent in Washington. These percentages are similar to the current distribution of nesting and roosting habitat located on public lands in these three States. Ownership is similarly distributed among Federal agencies with Forest Service lands comprising about 82 percent of critical habitat. The percentages of critical habitat administered by each land managing agency is similar to the percentage of total suitable nesting and roosting habitat currently administered by each agency.

State, private, tribal, and other non-Federal lands are not designated as critical habitat even if they are physically situated within the boundaries of critical habitat units. Acreage totals for any State, private, tribal, or other non-Federal lands that are interspersed within the critical habitat units were not included in the totals if the areas were large enough (e.g., $\geq$ 20 acres) to be identified through the geographic information system (GIS). This is particularly important in checkerboarded areas (e.g., Bureau lands) where the visual size of a critical habitat unit is misleading since only about half of the area is actually designated as critical habitat.

Some small areas of naturally-occurring non-habitat (i.e., areas that have never been nor will likely ever be owl habitat, such as lava flows, alpine areas, poor timber sites, airports, roads, parking lots, and water bodies) were included within the physical boundaries of critical habitat. Although they may be located physically within the boundaries of a unit, these areas are not affected by the designation because they will never contain the constituent elements. To the extent possible these areas were either directly deleted from critical habitat or identified as areas that would not be subject to any regulatory mechanisms governing critical habitat. If these areas were found along the periphery of critical habitat units, boundaries were drawn to physically exclude them from the final maps. This was not possible for areas imbedded within individual units. Acreage totals were adjusted where possible to reflect their exclusion. However, in some cases it was not possible using the GIS to physically remove these acres from the total acreage figures; they should not make a significant difference in actual total acres, although the total acreage figures may be slightly overestimated. Projects and timber sales that were excluded as a result of the exclusion process were also not mapped; their exclusion will be handled through the normal consultation process.

Comparison With Previous Actions

Comparison of the maps that have been developed over the past few years underscores the limitations that exist in trying to identify habitat to be protected or conserved for this or other forest species. There is a limited remaining habitat base; all land management planning exercises must focus on this same habitat base. For example, the Scientific Panel focused on HCAs to ensure that owls were adequately protected in any potential late successional forest reserve system that would also address other forest species and processes. The ISC, critical habitat designation, and the Forest Service's recent draft EIS (USDA 1991a) also used the same basic information, as will the Recovery Team. All of these proposals, although created to meet different goals, are based on a habitat base that is diminishing over time. The size of areas included in these different processes reflect differences between the purposes for the respective exercises and are not directly comparable. However, critical habitat is compatible with these planning efforts, since management prescriptions that may be recommended can be applied to critical habitat.

Table 3 provides acreage totals from the ISC, the Service's May 6 and August 13 proposals, and this final determination (the late successional information was not included although critical habitat is similar to alternatives 6 and 8). The Service updated all landownership data for the three States and entered these data into the GIS. The HCA information that was entered into the GIS was the most recent version used by the agencies and provided through the Scientific Panel, although boundaries were not exactly the same as the HCAs originally proposed by the ISC and are different than some maps currently being used by the Forest Service's EIS team.

TABLE 3.—COMPARISON OF TOTAL ACREAGE FOR THE ISC HABITAT CONSERVATION AREAS (HCAs), MAY 6 PROPOSED CRITICAL HABITAT AREAS (CHAs), AUGUST 13 REVISED CRITICAL HABITAT UNITS (CHUs), AND FINAL CRITICAL HABITAT UNITS (FIGURES ARE APPROXIMATE AND ARE ROUNDED TO THE NEAREST THOUSAND)

	ISC HCA [1] acres		May 6 CHA acres	August 13 CHU acres	Final CHU acres
	Categories				
	1&2	3			
Forest Service	5,356,000	427,000	6,465,000	6,453,000	5,675,000
Bureau of Land Management	859,000	106,000	1,386,000	1,241,000	1,154,000
National Park Service	652,000	NA	NA[2]	NA[2]	NA[2]
State	661,000	NA	612,000	582,000	0
Military	72,000	NA	81,000	62,000	58,000
Private	0	NA	3,020,000	0	0
Tribal	0	NA	74,000	0	0
Subtotals	7,600,000	533,000			
Totals	8,133,000[3]		11,638,000	8,337,000	6,887,000
Number of Areas	193	unk.[4]	190	181	190

[1] Category 1 and 2 HCAs from ISC Plan; includes wilderness and National Park acreage (about 2.1 million acres); Category 3 HCAs were mapped independently by agencies and not previously included in HCA totals. All data derived from the GIS.
[2] Acreage for National Park Service lands (and other lands already in protected status) are not included in critical habitat.
[3] About 5.2 million acres of HCAs are included within critical habitat.
[4] Category 3 HCAs were recommended by the ISC only on Bureau and Forest Service lands in areas where the owl situation was most precarious; this included nearly 100 different areas (the actual total number was not available).

HCA and critical habitat acreage totals are not directly comparable. HCAs contain acreage of reserved areas (wilderness and parks) that are not designated as critical habitat because they are already protected and HCAs are only applicable when placed in the context of the total ISC plan (with 50–11–40). HCA estimates include nearly 2.1 million acres (approximately 25 percent of the total acres) of reserved lands (wilderness and parks). Subtracting these 2.1 million acres from the HCA totals leaves about 6.0 million acres of nonreserved acres remaining in the HCA system. The 6.0 figure contains the acreage of Category 3 HCAs; Category 3 HCAs represent 533,000 acres that was

not included in previous estimates of the total amount of acres affected by the ISC Plan.

Final critical habitat designation includes about 6.9 million acres of non-reserved areas, a difference from the HCA network of nearly 900,000 acres when all lands are considered. This is less than a 13 percent difference in total acres between HCAs and critical habitat, thus imposing restrictions on about 13 percent more acreage than those affected by HCAs. HCAs also include acres of State and military lands; military lands are not managed primarily for timber harvest. Comparing only Forest Service and Bureau lands results in a difference between HCAs and critical habitat on these lands of about 1.6 million acres. The apportionment of acres for HCAs and critical habitat is similar for Federal land managers and reflects the differences in total acreage managed by these agencies.

The ISC (Thomas *et al.* 1990) estimated, based on agency data, that about 20–30 percent of the acres outside of wilderness and parks were reserved locally (e.g., streamside or scenic corridors), areas unsuitable for timber harvest (e.g., unstable soils), or set aside for other reasons (e.g., bald eagle nest sites); these designations can also be changed locally and are not expected to always be so designated. The actual data were not available to the Service. However, using these percentages indicates that of the 6.0 million acres (in HCAs outside of wilderness or parks) or the 6.9 million in critical habitat, about 4.2–4.8 million acres (HCAs) or 4.8–5.5 million (critical habitat) of the total acres included in these two different designations respectively may actually be on lands available for timber harvest.

In addition, the above HCA estimate also does not contain acres managed under the 50–11–40 rule. Although no one has fully compiled these figures, it is estimated that they would cover up to 12 to 15 million acres of the existing forest base within the range of the owl that are above the amount in the HCAs. Critical habitat does not include management prescriptions for forested lands not included in the designation.

Owls and Acres of Nesting and Roosting Habitat

To help place the acreage totals (from the above tables) in perspective, the Service updated the estimates previously identified in the ISC Plan and the Service's 1990 status review. The majority of owls and suitable spotted owl habitat (i.e., for nesting, roosting, and some foraging) are found on Federal lands, primarily on Forest Service land (about 70 percent). A large percentage are also located on Bureau lands in Oregon (about 12 percent). In some cases the quality of owl habitat in areas included within critical habitat but outside of existing HCAs is better than the habitat within HCAs, although all designated lands met the criteria for critical habitat.

There are no current estimates of the amount of additional habitat that contributes to dispersal (e.g., that currently would be managed under the 50–11–40 rule on Federal lands); some of these lands are included within critical habitat because they are interspersed with nesting and roosting habitat, but the majority of these lands were not designated as critical habitat.

In the August 13 proposal (56 FR 40001) the Service provided a comparison of the estimated amount of nesting and roosting habitat and owl pairs currently located within the HCAs and critical habitat units to the total known number of pairs and estimates of nesting and roosting habitat throughout the range of the owl; these numbers were updated through the summer of 1991. Additional protection was proposed for about 60 percent (3.2 million acres) of the total estimated amount of suitable nesting and roosting habitat on Federal lands that is outside of existing reserved systems. In comparison the HCA network included about 32 percent of suitable habitat outside of reserved areas on Federal lands; these totals include estimates of suitable habitat for category 3 HCAs.

The Service did not fully reanalyze these data to determine the actual amount of suitable habitat that remains within the designated areas after completion of the exclusion process. However, based on a review of habitat maps, it is believed that the percentage of suitable habitat excluded from the designation is in proportion to the percentage of total acres excluded. Therefore, the total amount of suitable habitat remaining is approximately 83 percent (or 2.6 million acres) of the amount included in the August 13 proposal. This amounts to about 49 percent of the amount on Federal lands outside of reserved areas, a decrease of 11 percent.

Adding the 2.1 million acres of reserved lands to the critical habitat totals results in about 65 percent (4.7 million acres) of remaining owl habitat on Federal lands receiving additional levels of protection (about 50 percent of all lands). However, the actual amount of suitable nesting and roosting habitat within reserved areas is unknown; the 2.1 million reflects total acreage containing expected suitable habitat within reserved areas. Therefore, all totals that include reserved acreage overestimate the total amount of protected owl habitat.

The final designation of critical habitat includes the areas on Federal lands that contain the best remaining spotted owl nesting and roosting habitat. The total amount included in the final designation also reflects the Service's concern over the status of the remaining nesting and roosting habitat on these lands.

Economic Impacts of the Final Designation

The economic analysis (USDI 1991a) provides the Service's conclusions on the potential impacts of the areas selected for final designation as critical habitat. This analysis served as a decision document in evaluating economic consequences of the action leading to the final decision to designate critical habitat. The analysis also provides additional information so that the cumulative effects of this and previous Federal actions on the timber industry can be understood in perspective.

Consistent with the requirements of section 4 of the Act, the economic analysis reviews the final economic impact of designating critical habitat. Only these incremental costs and benefits of designation may be considered in determining whether to exclude lands from designation. The economic analysis examined the costs and benefits of precluding or limiting specific land uses within the portions of critical habitat that are outside of HCAs recommended under the ISC Plan. Incremental analysis was the appropriate method to use, because the designation of critical habitat is the only action for which the Service now has decision authority. The economic costs of listing the species have already been incurred, and the economic effects of actions taken by other Federal or State agencies are outside the purview of the Service. The analysis was cast in a "with" critical habitat versus a "without" critical habitat framework and measures the net change in various categories of benefits and costs when the critical habitat designation was imposed on the existing baseline. The analysis evaluated national economic, or efficiency, costs and benefits that reflect changes in social welfare. The standard measure of those costs and benefits is economic surplus in the form of economic rents and consumer surplus. The Service recognizes, however, that in the case of the spotted owl, one region of the country and one sector of that

region's economy was primarily affected by this action. The analysis included, therefore, an examination of some of the primary regional economic, or distributional, impacts expected to occur, such as employment changes, county revenue impacts, and social costs to the affected communities.

Critical habitat designation for the spotted owl will result in a regional reduction of timber available from Federal lands, at least in the foreseeable future. That reduction will have a number of economic effects, in both the near- and long-term. From a national perspective, economic impacts are expected to be minimal.

The costs of designating an area as critical habitat are the net economic costs of precluding or restricting certain land uses over the period of analysis. Costs are measured as the difference between the resource's value in its economically best use without critical habitat and its next best use (opportunity cost) when that use is precluded by critical habitat. Economic effects include a mixture of efficiency and equity measures.

(1) National economic (efficiency) costs include:

—The change in economic rents and consumer surpluses attributable to the designated areas, with and without critical habitat. The reduction in Federal revenues from foregone timber sales is the primary component. In addition, there is a loss of consumer surplus caused by the rise in stumpage price;

—The change in capital asset values. Decreases in the value of formerly productive but now idle sawmills and processing plants represent a loss of national economic income. The change in asset value is measured as the asset's value before critical habitat designation less its scrap value when it is no longer in use; and

—Wages lost by displaced workers who remain unemployed or are reemployed at lower wages. The loss is measured as the difference between earnings in the timber industry and labor's opportunity cost.

(2) Regional economic (distribution) impacts include:

—Reductions in county revenue sharing from Federal timber sales, partially offset by increased revenue sharing from those Federal sales that remain;

—Social costs to individuals and communities caused by a slowdown in timber dependent economies, including higher welfare, counselling, and other additional costs that counties will be faced with as unemployment increases; and

—Changes in state and county property and severance tax revenue as a result of lower property values for houses and mills, and higher values for private timber holdings.

(3) Effects not considered as national economic costs include:

—Increases in profits (rents) of timber producers, including the Federal government for timber sales that remain, caused by higher stumpage prices, or the increased value of private timber stands. Those increases represent a transfer of surplus value from consumers of timber to producers, hence there is no net effect on national income; and

—The decrease in real estate (housing) values in affected areas. Such losses represent monetary losses to individual owners but are transfers from (potential) sellers to buyers and do not affect national economic income.

The reduction in Northwest Federal timber sales due to spotted owl critical habitat designation may have effects at the national and international levels as well, although they are expected to be minimal. Higher stumpage prices in the Northwest may increase demand for timber and cause higher stumpage prices in other timber producing areas of the U.S. and other timber exporting countries. Those higher prices may increase timber production, employment, and asset values in those regions, but significant national changes are not anticipated. At the national level, once all of the markets have adjusted to the new timber supply, the negative effects on the Pacific Northwest may be at least partially offset by positive effects in other timber producing areas. The economic analysis evaluated gains and losses regionally in the Northwest and did not attempt to quantify effects at the national level.

Critical habitat will result in benefits in terms of gains in spotted owl conservation as well as preserving economic benefits provided directly by the spotted owl and indirectly by its habitat. The spotted owl and its critical habitat currently provide a wide range of benefits. They include: biodiversity, aquatic and water quality, scenic beauty, intrinsic or preservation values, and recreation values.

Baseline

The economic effects of designating critical habitat, as well as the conservation benefits, are in addition to those created by listing the spotted owl as threatened and the effects of earlier actions taken by land management agencies to protect the owl under other statutes and authorities. Thus, critical habitat effects are incremental and represent only a portion of the total effect of owl conservation, both in terms of protection of the owl, other benefits, costs to the national economy, and economic impacts to the regional economy. For that reason, it is the marginal increase in owl protection provided by designation of critical habitat and the marginal change in costs, regional impacts, and benefits that the designation produces that are relevant to the analysis.

The Service proposed critical habitat for the spotted owl in May 1991, at which time the owl and most of its habitat were already provided considerable protection by previous actions by the land management agencies, as well as by the jeopardy/take provisions of the Act. The portions of critical habitat units outside the HCAs are expected to have reduced timber harvest beyond the ISC's 50–11–40 rule, and the areas within the HCAs are not expected to be harvested. The formation of the ISC and the subsequent interim adoption of all or part of the ISC Plan for spotted owl conservation by the Forest Service and Bureau have been prompted by NFMA and other management requirements. Although the Bureau has not formally implemented the ISC Plan, it incorporated important elements of that strategy in its plans and directives before the owl was listed as threatened and before critical habitat was proposed for designation (USDA/USDI 1990).

Timber-related effects of designating critical habitat concern primarily those Forest Service and Bureau timber harvests not already curtailed by earlier decisions. The designation of critical habitat outside of HCAs may reduce timber sales more than would the 50–11–40 rule. Section 7(a)(1) of the Act requires Federal agencies to utilize their authorities to conserve threatened and endangered species. Because the ISC recommendations remain the best available conservation strategy for the owl, the Service assumes that the agencies will follow the ISC recommendations in HCAs. Therefore, potential timber harvest reductions in the areas of critical habitat outside the HCAs that go beyond the 50–11–40 rule, as well as limitations on non-timber activities, will be due in part to listing of the owl (section 7 (jeopardy) and section 9 (take)), which would have occurred without critical habitat, and in part to adverse modification, which only will occur with critical habitat.

Non-timber activities in critical habitat will also be subject to section 7

consultations according to the same scenario described above. For both timber and non-timber activities, it is the incremental effects of avoiding adverse modification of critical habitat, and the marginal changes in ensuing benefits and costs, that are the appropriate measures of the effects of critical habitat designation.

For Forest Service and Bureau timber harvest, this analysis considers four levels of timber sales:

—Final Plans: Actual or Projected Final Plan timber sales, which may include some elements of old growth habitat preservation (e.g., Spotted Owl Habitat Areas);
—With-ISC: The level of timber sale which reflects agency decisions prior to listing of the owl as threatened on June 26, 1990;
—Listing: Timber sales if only the jeopardy and take provisions of the Act are applied to timber sales in the critical habitat outside of HCAs; and
—Critical Habitat: Timber sales if adverse modification provisions are also applied to timber sales in the critical habitat areas outside of HCAs.

The With-ISC timber sale level reflects the Forest Service and Bureau intention not to harvest on HCAs and to implement 50–11–40 in whole or, in the case of the Bureau, in part on areas outside of the HCAs (USDI 1990b, 1991d; USDA/USDI 1990; USDA 1991c). The Listing sale level is the timber sale remaining after the effects of applying the jeopardy/take provisions in the critical habitat outside of HCAs.

Final Plans are used as the starting point in the analysis rather that the 1985–1987 average because the Service believes they best reflect what the land management agencies would have done in the absence of the ISC Plan and other measures taken to protect the owl. The 1983–1987 average harvest level and planned harvests as of 1990 are alternatives that have been used in other analyses of owl protection efforts (see for example, Lippke *et al.* 1990 and USDA/USDI 1990). Both alternatives have harvest levels that are significantly higher than the Final Plans used here, but those higher harvest levels do not appear to be sustainable over time, given changes in management emphasis. Using either would be misleading and would overestimate job and other losses attributable to spotted owl conservation efforts.

This conclusion is supported by other analyses. For example, Mead *et al.* (1991) in their assessment of the projected impacts of implementing the ISC Plan began their analysis using the planned agency harvest levels. Likewise, Stevens (1991), after a careful review of Olson (1990) and other documents that suggested using the 1983–1987 data, concluded that: "In any case it appears that the baseline should be the 1991–2000 planned average annual harvest for those areas to be affected by the owl protection strategy before that strategy is imposed. Most important, it would seem incorrect to attribute to the ISC Strategy those harvest reductions that had been planned in the absence of that strategy." Thus, the Forest Service and Bureau Final Plans are used as a starting point from which harvest reductions for owl conservation actions were calculated.

Limitations of the Analysis

This analysis does not include, or covers only minimally, several topics that lie outside the scope of analysis, including the effects of critical habitat designation on State and private lands and State legislation. Since State and privately-owned lands are not included in critical habitat, the designation will affect activities on these lands only in instances where some Federal approval or authorization is required for access or other purposes. In addition, some States have enacted legislation that is linked to Federal actions under the Act, such as critical habitat designation. Because such State laws are not mandated by the Act, and may be rescinded or changed at any time, this analysis does not address effects of such State requirements.

Timber Industry Background and Trends

Designation of critical habitat is the latest in a long series of court and regulatory actions concerning the spotted owl and old growth habitat that began in 1987; earlier efforts to protect spotted owls began in the early 1970's. These actions continue to affect planning activities and timber harvest on Forest Service and Bureau lands in the Northwest. The accompanying debate was focused on old growth forest protection and wildlife conservation provisions of NFMA and FLPMA, as well as on spotted owl protection. Industry trend data demonstrate the reduction of Federal harvest of 990 million board feet (mmbf) between 1988 and 1989, particularly from Forest Service lands, prior to listing the owl (June 26, 1990) and prior to the May 6, 1991 proposal to designate critical habitat. Thus, a portion of the impacts being attributed by some observers to the Act resulted from prior legal actions and changes in agency plans related to broader issues, such as old growth protection under the NFMA. The role of the timber industry in regional economies is declining in importance in all regions, including the Northwest. The incremental effect of critical habitat designation on the timber industry can best be understood in the context of the market environment of the timber industry.

The industry is dominated by a cyclical market that has historically been demand-oriented. The previous low cycle occurred in 1981–1982; westside (western Washington, Oregon, and northwestern California) industry employment dropped from a high of 165,000 in 1977 to 125,000 in 1982, a 24 percent reduction, and harvest fell from 16 billion board feet (bbf) in 1977 to 11 bbf, a 31 percent reduction.

In the mid-1980s, the forest products industry of the Northwest was in the middle of a period of reorganization and retrenchment and this process is continuing (Adams 1986). Changes in employment and labor income from the late 1970s to the mid-1980s came about primarily from mechanization and structural changes in the industry, as well as recessionary pressures. The fundamental restructuring of this industry came about for several reasons, but two seem most prominent: The exhaustion of private supplies of old growth and the rising costs of production in the Northwest compared to other regions.

Nationwide, 1986 employment in the wood products sector was 1,644,000 employees, of which 166,000 or about 10 percent were employed in the westside (USDA 1990). Employment in the Northwest dropped by 40,000 workers from 1979 to 1985; this trend has continued since 1985, but at a lower rate. A number of factors are contributing to this decline, including the continuing need for industry to mechanize to remain competitive, the loss of markets to other regions and, more recently, the reduction in timber supply from Federal lands. A significant increase in productivity occurred from 1975 to 1988, from the processing of 109,000 board feet per worker in 1975 to 146,000 board feet per worker in 1988 (Mead et al. 1991), resulting in a considerable reduction in employment. Offsetting these downward pressures on employment is the increasing percentage of recovery of products from logs. However, overall employment is predicted to further drop in all timber regions by the year 2040 (USDA 1990).

Much of the focus on employment losses in the Northwest has been on the limitation of log supplies from Federal lands, assuming that demand for these products would permit essentially unlimited harvest and production if

supplies were not limited. There is some evidence that the demand, at least in the short-term, is weak and that recessionary trends are partially to blame for employment cutbacks in the Northwest. For example, the State of Washington Office of Financial Management and Employment Security Department (1991) noted that, "the recession-induced downturn in housing construction across the nation put downward pressure on the demand for lumber and wood products during the third quarter 1990. A major real estate slump in the previously red-hot Asian (principally Japanese) market additionally cut into the demand for raw, unprocessed logs, a major export commodity in Washington. All of this depressed demand and contributed to both the over-the-quarter and over-the-year declines in statewide lumber and wood products."

The analysis goes on to state that final demand for lumber and wood products will not diminish, but reduced supply will lead to a "shaking out" of operators over the next decade. The volume of unprocessed raw log exports increased steadily from incidental levels in the 1950s. Exports now represent about 5 percent of total U.S. lumber production; in the Northwest, the 1989 log export volume of 3.7 bbf represented 25 percent of log volume but only 17 percent of timber product value (USDA 1990). Over 95 percent of these exports were softwood logs, 60 percent of which were exported to Japan. However, the U.S. is a net importer of wood products. Nationwide, in 1986 about 2.3 billion cubic feet (cu ft) were exported, whereas 4.6 billion cu ft were imported (U.S. Bureau of Census 1989).

The Forest Resources Conservation and Shortage Act of 1990 further restricted log exports. It is estimated that about 600 mmbf of logs that previously entered the export market will be available to local mills in 1991 and after, with 450 mmbf coming from State lands and the remainder from private lands (Backiel and Baldwin 1991). Log exports represent a potential 24,000 direct timber industry jobs in the Northwest, but nationwide a total export ban is expected to depress stumpage prices and result in a loss of 16,000 direct timber industry jobs (O'Toole *et al.* 1991) and negatively impact jobs in the shipping industry. With naturally decreasing availability of large logs, the export market is expected to decline in the mid-1990s with or without further protection of older forests.

Sustainable Harvest

The Forest Service and timber industry were aware in 1969 that the harvest rates planned in the Northwest at that time could not be sustained, given the planned levels of management intensity in place at that time; both harvest rates and employment were predicted to decrease over time (USDA 1969). The report predicted that the 1969 trends in harvest from private lands in western Oregon and southwestern Washington would lead to a 65 percent reduction in harvest over a 30 year period (to 1999). This situation has not improved since 1969 because an additional 22 years of high harvest has occurred in the region.

Inventory on westside forest industry lands in the Northwest has declined at a steady rate during the past 40 years. Inventory on industry lands was estimated at 33.7 billion cu ft in 1950, dropping to 19.5 billion cu ft in 1985 (Adams *et al.* 1988). Inventory on other private lands dropped by almost 2.5 billion cu ft during that same period. Declining inventory occurs as high-inventory, old growth forests are converted to managed stands or when harvest exceeds growth. Harvest from Federal lands in the westside nearly doubled during this period, from 1,800 mmbf in 1950 to almost 3,500 mmbf in 1985 (Adams *et al.* 1988).

The Forest Service (USDA 1990) reported that the removal of softwood growing stock in western states exceeded net annual growth, indicating that inventory continues to be depleted faster than it is replaced. This trend is expected to continue in the Northwest under current management plans. Projections show that total inventory of softwoods is expected to further decline from 33,607 million cu ft in 1986 to 28,993 million cu ft in the year 2000 and declining further to 25,133 million cu ft in the year 2040. Harvest is likewise expected to drop from 659 million cu ft in 1986 to 562 million cu ft in the year 2000. There is expected to be a continued transition in the Northwest that converts old growth forests to young managed stands (e.g., Sessions *et al.* 1990, USDA 1990). Planned harvest in the next 50 years is expected to reduce the average age of trees harvested to 80–90 years on Forest Service lands, to 50 years on Bureau lands, and to 45–65 years on private land (Sessions *et al.* 1990).

A further concern is that even the harvest levels predicted in forest plans may be too high and may overstate the amount of timber actually available for harvest. Johnson *et al.* (1991) in their report to Congress stated that Federal forest plans for the westside may have overestimated potential harvest by as much as 20 percent from some forests. Thus, harvest levels realized from Federal timberland may actually be below planned cuts because planning documents may reflect inventories higher than those that actually exist.

Costs of Critical Habitat Designation

The following sections summarize the results of the Service's analysis of economic data and identify the potential costs associated with the final designation of critical habitat.

Regional Effect on Federal Timber Harvest

The areas designated as critical habitat for the spotted owl include HCAs identified by the ISC Plan (Thomas *et al.* 1990). The Service used the most recent Forest Service and Bureau estimates to evaluate the economic effects of critical habitat designation on Federal timber sales. Some of their timber volume estimates were adjusted by the Service to account for differences between the critical habitat units on the Forest Service and Bureau lands in the August 13 proposal and the critical habitat units as defined in the final rule. The loss of timber-based revenue (economic rent) to the Federal government from Federal timber sales was the primary component of economic cost considered. Effects on timber-based employment and revenue sharing with counties also were examined.

Certain assumptions were necessary to estimate what may occur in the future, with and without designation of critical habitat. In conducting their analysis, the Forest Service and the Bureau considered a number of alternatives about timber supplies, price responses, and other regional and national factors which determine the economic effects of reducing Federal timber sales in the three-state region. Key assumptions used in this analysis include:

—Stumpage prices in the region will rise when Federal timber sales are reduced. Rising prices for timber sales that remain tend to offset reductions in Federal timber-based revenues, result in lower log exports from the region, and stimulate an increase in harvest from private lands, at least in the near-term; and

—The full effect of timber harvest reductions on regional economies will not be evident for several years because there are 4–6 bbf of timber on Forest Service and Bureau lands that have been sold and are available for

harvest. Thus, the Service assumes that 1995 is the first year the full impact of these regulations are likely to occur, as did the Forest Service and Bureau in their analyses. Some impacts may have already occurred as a result of the critical habitat proposal, but the full impact should not occur for several years.

The Forest Service 1995 planned a harvest level of 3,024 mmbf is considerably below the average annual sale in the late 1980s, whereas the Bureau 1995 planned sale of 1,193 mmbf is slightly higher than the 1985–1989 average. Four estimates of Forest Service and Bureau timber volume available for sale in 1995 were considered in the analysis. The sequence began with planned sales (Final Plans) and shows decreasing timber volumes available for sale, first with reductions from planned sale levels made prior to listing (With-ISC), then from the potential effects of listing the owl as threatened (With-Listing), and finally with the potential effects due to adverse modification of critical habitat (With-Critical Habitat).

In deriving their estimates, the Forest Service and Bureau made somewhat different assumptions for their With-ISC timber sales. Both assumed no timber sales in the HCAs. The Forest Service assumed that the 50–11–40 rule would apply to areas outside the HCAs. The Bureau assumed only partial implementation of the 50–11–40 rule, and attributes owl protection measures on their lands to the Act, including listing and critical habitat designation. The number of acres in the critical habitat units in the final rule also differs from the August 13, 1991, proposal. Thus, the estimates provided by the Forest Service and the Bureau from the previous proposals are not used directly in this analysis.

Based upon Service experience in section 7 consultations to date regarding the owl, the Service assumed that of the total reduction in sales, 70 percent would be due to listing impacts (application of the jeopardy standards and take prohibitions) and the remaining 30 percent would be due to critical habitat (application of the adverse modification standard). The Service believes that most restrictions or changes to harvest activities in critical habitat would result from efforts to avoid section 7 jeopardy opinions. The percent harvest assumed allowable in this analysis ranged from 5 percent to 25 percent of planned harvest and varied by physiographic province.

Using the assumptions as outlined in the economic analysis, the designation of critical habitat represents a potential reduction of regional harvest volume by 102 mmbf, which is 2 percent of the planned timber harvest volume (Table 4). This follows a With-ISC reduction of 1,682 mmbf annually, as a result of prior owl protection measures, representing 40 percent of the Final Plan volume. Listing may result in an additional reduction of 236 mmbf, or 8 percent of the Final Plan volume. Impacts on regional timber-based revenue, employment, and revenue sharing for affected counties are derived directly from these changes in timber volume.

TABLE 4.—SUMMARY OF INCREMENTAL EFFECTS OF THE DESIGNATION OF CRITICAL HABITAT

Area of reduction	Reduction caused by			
	Final plans	Implementation of ISC plan	Listing the spotted owl	Critical habitat
Timber volume (mmbf):				
Washington	718	−408	−32	−14
Oregon	2,998	−1,008	−186	−80
California	500	−266	−18	−8
Three-State Total	4,217 mmbf	−1,682 mmbf	−236 mmbf	−102 mmbf
Timber value (million 1990 dollars):				
Washington	174	−89	−11	−5
Oregon	1,111	−207	−96	−42
California	152	−82	−6	−3
Three-State Total	1,437	−378	−113	−50
Timber employment (total jobs):				
Washington	10,342	−5,935	−415	−178
Oregon	48,300	−17,676	−2,739	−1,174
California	7,753	−4,094	−157	−68
Three-State Total	66,395	−27,705	−3,311	−1,420
Payments to counties (million 1990 dollars):				
Washington	39.4	−20	−2.7	−1.1
Oregon	401.1	−69	−37.2	−16.5
California	38.2	−21	−1.6	−0.7
Three-State Total	478.7	−110	−41.5	−18.4

Regional Effects on Timber-based Revenue

The price and revenue estimates in this section are gross measures. Net revenues are discussed in the following section. The estimates of timber-based revenue incorporate the rising price assumption used by the Forest Service in their analysis. The effects of the business cycle on the demand for lumber, and other factors influencing the timber economy both regionally and nationally, are incorporated in the Timber Assessment Market Model (TAMM) developed by the Forest Service and used to estimate the market effects of owl protection measures.

The Forest Service estimates that timber and lumber prices will rise significantly by 1995, a projected "boom" year for the national economy, with corresponding effects on total timber-based revenues (USDA 1991b). For example, softwood stumpage prices in western Oregon and Washington are estimated to increase 14 percent between 1988 and 1995 under the Final Plan sale volumes. When the With-ISC, With-Listing, and With-Critical Habitat effects are added, the price increase is even greater (the With-ISC stumpage price is estimated to be 30 percent higher than the Final Plans price by 1995). The data indicate that carrying out the mandates of the Endangered Species Act would result in an approximately 3 percent increase to the 1995 stumpage price, 2 percent for listing impacts and 1 percent for critical habitat, based on the assumptions used in this analysis. From a national

perspective, stumpage prices should not increase significantly because of the relatively small reduction that will occur in national timber harvest. The approximately 102 mmbf reduction in westside supply from critical habitat compares to a national harvest of 36.5 bbf (USDA 1990), or less than 0.26 percent of the 1986 national harvest. The Forest Service concluded that the designation of critical habitat would have little effect on forest product prices in other regions of the country (USDA 1991b).

The revenue loss estimates incorporate those price changes discussed above. The critical habitat estimate represents $50 million, or 3 percent of the Final Plan total. The difference in total revenues between Final Plans and With-ISC is $378 million, or 26 percent of the Final Plan revenue total, and the listing impact is an additional $113 million.

Reductions in County Revenue

Federal timber-based revenues are shared with the states and counties where the timber is harvested (25 percent of gross revenues for the Forest Service and 50 percent for the Bureau). Those payments are expected to be reduced by $18 million due to critical habitat designation. The With-ISC sale level may reduce payments to counties by $110 million, or 23 percent of the Final Plans total, and listing impacts may represent an additional loss of $41 million.

The revenue sharing payments were calculated for each county to determine the potential differences in county payments between the Final Plans, With-ISC Plan, With-Listing, and With-Critical Habitat after each reduction in available timber harvest volume. The percent reduction for With-Critical Habitat varies substantially between counties with the largest potential decreases generally occurring in Washington. Oregon faces the greatest potential reduction in Federal timber revenue, losing over $16 million dollars annually. However, on a county-by-county basis, more substantial reductions would be evident in Washington. It is estimated that eight counties in Washington may lose in excess of 10 percent of their county timber revenues over and above the payments estimated after listing the owl as threatened. Overall, the three-State area may face a reduction of 5 percent in Federal revenue sharing payments, although the distribution of the losses is not uniform.

Net Economic Loss to the U.S. Treasury

The estimated gross dollar loss to the U.S. Treasury from a harvest reduction of 102 mmbf is approximately $50 million. There are two offsetting balances that are deductible from the gross loss in order to get the net loss of economic efficiency attributable to the designation of critical habitat. The administrative cost of conducting timber sales is a cost that will not have to be borne for the reduced volume, and road credits associated with the reduced volume will not have to be deducted from the sales value of the timber. Both offsetting balances have been estimated for each of the national forests. Only the administrative costs have been estimated for the Bureau districts since road credits are not applicable to their sales. After deducting the appropriate administrative costs and road credits, there is a net loss to the U.S. Treasury attributable to the critical habitat designation of nearly $44 million annually.

The estimated net loss to the U.S. Treasury may be overstated. The Government Accounting Office reported in recent testimony that government costs exceeded revenue for approximately 9 percent of timber sales in Forest Service Regions 5 and 6 (Pacific Coast States) in 1990 (GAO 1991). Three different estimates of the government cost of timber sales were calculated for comparison with revenues: (1) Average sale and administrative costs, (2) average operating cost per thousand board feet multiplied by the board feet of sales, and (3) average total operating cost as in (2) above plus regional office and Washington office overhead and payments to states. Costs calculated under alternative (1) appear closest to counting only marginal economic costs, which are required in this analysis. Thus, the net revenue loss to the U.S. Treasury presented above was estimated with conservative assumptions and is a worst case estimate.

Employment Effects

Projected reductions in the volume of timber offered for sale by the Forest Service and the Bureau as a result of designating critical habitat for the spotted owl are expected to affect levels of employment in the region's timber and related industries. At a national level, employment is not expected to be significantly impacted as a result of the critical habitat designation.

Estimates of timber-based employment effects caused by critical habitat designation were derived using empirical data on the timber industry in the Pacific Northwest and IMPLAN input-output models of the regional economies in the three states. The IMPLAN modeling system was developed by the Forest Service to assess the regional economic effects of changes in the availability of timber.

IMPLAN models were used to estimate job response coefficients (jobs per mmbf) for each of the affected counties. The coefficients were applied to the board foot reductions expected to result from designating as critical habitat a specific number of Forest Service or Bureau acres in each county. The resulting estimates of job loss by county were aggregated to the forest or district level and subtracted from the Final Plans and employment estimates provided by the Forest Service to estimate listing and critical habitat employment effects by forest and district.

The IMPLAN models constructed for this analysis focused on county level timber harvest reductions, based on the location of individual critical habitat units. Special attention was paid to intercounty log flows in order to take into account the processing of timber in counties other than those in which it is cut. Also, to improve county level analyses, the effects of large metropolitan areas on timber-based economies were extracted from five counties in Oregon and five counties in Washington. County level analysis was instrumental in balancing benefits and costs of critical habitat designation as required by the Act.

The Final Plans and With-ISC employment levels for the Forest Service were provided in its most recent comments (USDA 1991c). The employment levels were derived using the job response coefficients derived for this analysis and the estimates of timber volume. They include direct, indirect, and induced employment. The county job response coefficients used in the analysis range from 8.01 to 17.11, with an overall weighted average of 13.9. The coefficients projected direct jobs and indirect/induced jobs separately.

Critical habitat designation potentially represents a regional loss of 1,420 total jobs, 847 direct plus 573 indirect and induced jobs. The With-ISC and Listing timber sales represent a lower number of timber-based jobs in 1995, as compared to employment that would be supported by the Final Plans volume. The With-ISC level may reduce employment by 27,705 compared to Final Plans. The total decrease attributable to the Act may be an additional 4,731 jobs. Of those, an estimated 3,311 would

result from listing impacts on the critical habitat in the areas outside the HCAs.

Critical habitat impacts affect less than one half of one percent of Regional timber industry employment, and total spotted owl protection will affect about 21 percent of regional timber employment. At a national level, the potential loss of 847 direct jobs represents a very small percent of the 607,000 workers in the primary timber processing industries (1986 data). Direct job losses from owl protection measures on Federal lands (18,155 jobs) represents 3 percent of the direct timber processing employment nationwide. It should be noted that some of the regional employment adjustments associated with the spotted owl conservation measures have already occurred as a result of court injunctions, the listing of the species, and the proposals to designate critical habitat. The degree to which this adjustment had been made is difficult to ascertain. Offsetting circumstances could significantly reduce the affect of supply restrictions in the Northwest.

The percent of timber industry jobs that may be lost varies by county; however, most counties will experience a loss less than 1 percent of their direct timber industry jobs. Oregon may be the most heavily impacted state, losing 707 direct jobs of the total 847 for the three states. This could represents as much as 1.4 percent of Oregon's total timber jobs, after adjustment for employment losses due to the ISC Plan and listing of the owl. On a county basis, the potential loss of jobs as a result of projected timber volume reductions on the Forest Service and Bureau lands may be 1 percent or more of total industry jobs in 12 counties, with Douglas County, Oregon, experiencing the largest total job loss, at 267 jobs (7.6 percent).

County economic diversity is one factor that can lessen the impact of the projected loss of timber industry jobs. Not only does it provide more reemployment opportunities for affected industry employees, but it also provides a broader base of employment in those jobs indirectly supported by timber harvest. When job losses occur in isolated areas where there are relatively few employment alternatives, the impacts are usually longer lasting.

Wage Loss

Wage and salary losses associated with job losses are a national economic efficiency loss measured as lost wages for the time of unemployment and the difference in workers earnings after reemployment. The assumptions used in this study are similar to Mead *et al.* (1991) where 92 percent of displaced workers remained unemployed for up to 1 year and the remaining 8 percent became reemployed at the end of the second year. After the second year, the difference between average timber industry wages and average manufacturing wages is used to assess the value of economic loss.

The estimates that Mead *et al.* (1991) used for average timber industry wage rates were adjusted to 1990 dollars to reflect the earnings losses of displaced workers. Similarly, the average of all industry wage rates was adjusted to 1990 dollars. The duration of time for the impacts is 20 years after which most, if not all, currently affected workers will be either out of the workforce or will have achieved a wage rate comparable to the wage rate they would have received in the timber industry. The discount rate used in the calculation of the present value of earnings lost is 10 percent (the Office of Management and Budget approved rate for government projects). The discounted present value of wages lost may be nearly $65 million, with an annualized value of $7.6 million. The national economic efficiency loss attributed to unemployment effects is calculated under the conservative assumption that reduced harvest levels will remain constant for the period of analysis, which is not expected to be the case.

An estimate of the net change in capital asset value that may result from the designation of critical habitat is not possible with existing data. The estimates of mill closures and home asset value losses that were presented in public comment (Lippke *et al.* 1990, Mead *et al.* 1991) considered the total losses attributable to all preservation efforts for the northern spotted owl. The home asset losses are a pecuniary effect and reflect a transfer payment from sellers to buyers of homes. Home asset losses are a regional distribution impact and not a national economic efficiency cost. Similarly, asset value gains to private landowners both in the Northwest and elsewhere are transfer payments and not national economic efficiency costs.

Mill closures potentially attributable to critical habitat designation would be a reduction in national productive capacity and would be valued at the opportunity cost of capital (salvage value if the capital has no other uses). It may be argued that investment in a plant and equipment is a sunk cost of doing business and, therefore, there is no asset value loss.

The analysis of critical habitat designation is far more limited in scope and focuses only on the portion of the total preservation effort that is associated with the critical habitat for the spotted owl. There are insufficient data to isolate the portion of any asset value loss estimates that are attributable solely to critical habitat.

Social Costs

The social implications of protecting the northern spotted owl throughout Washington, Oregon, and northern California are significant and widespread, yet difficult to isolate from changes occurring in the forest products industry that are unrelated to the proposed action. Public comment on the proposed rule received from many timber-dependent communities emphasized the potential severity of social impacts. Historically, timber-dependent communities and the wood products industry have experienced volatility of markets and cycles of prosperity and recession. A major source of change in the timber industry has been the technological advances over time that have caused and continue to cause job losses. Mechanization and computerization has greatly reduced the manual work involved in the industry. A study by Lee *et al.* (1991) examined the social impacts of harvest reductions in Washington. Critical habitat adds an incremental impact to the effects of other owl protection measures and to other market factors depressing the timber industry, which have cumulatively been severe in some locations.

Non-timber Effects

Non-timber harvest activities on Federal lands are subject to the consultation process under section 7 of the Act. When a listed species or its habitat is involved, the impact on projects may come about because projects are modified to minimize the impact on the listed species and/or its habitat. In the case of the northern spotted owl, several projects have been proposed in critical habitat. Determining which of these projects would be modified as a result of a section 7 consultation or any costs associated with modification of project plans is the first step necessary to estimating the impact of these projects. The second step consists of estimating the net consumer surplus lost to society as a result of the restricted supply of an activity caused by critical habitat designation. The fact that a proposed expansion to a ski area, for example, may result in more visitor days does not necessarily result in increased societal welfare. The potential loss of visitor days at competing ski areas would have to be considered before a final

determination is reached about the net change in consumer surplus.

Given the relatively small number of areas and acres of critical habitat involved in the proposed list of projects, it is doubtful that a significant impact would result from non-timber activities. However, the Service cannot prejudge the results of the section 7 consultation process for any of the proposed projects. While the Service is aware of the proposed non-timber activities, they cannot be quantifiable. The Service will assist project sponsors through the section 7 consultation process.

Effect on Private Lands

Although it is expected to be minimal or nonexistent, effects of critical habitat designation may occur for activities on private lands where there is a Federal nexus (e.g., restricted access to areas through critical habitat on Federal lands). Areas in checkerboard ownership may be particularly sensitive since access may be limited to existing roads on Federal land. Activities on private lands that require use of Federal lands or authorization (e.g., constructing new roads in critical habitat on Federal lands) would have to go through the section 7 process which may result in added project costs. The Service is not able to determine actual impacts on lands adjacent to critical habitat at this time, but the impacts are expected to be minimal.

Public comments received during the proposal stages of critical habitat designation did not identify specific examples of private lands affected by proposed critical habitat. However, the Service is aware that such situations may exist and will work with other Federal agencies through the section 7 process to minimize effects on private landowners.

Summary of Potential Impacts

The primary economic cost of the designation is to restrict timber harvest on Federal land. The incremental cost is an estimated annual reduction in timber harvest of 102 mmbf, with secondary effects on regional employment and revenue sharing with county governments. The employment effect is a projected loss of 847 direct plus 573 indirect and induced jobs for a total of 1,420 jobs in the three state area. Lost payments to counties represents an estimated $18.4 million loss annually. Some of these effects have already started to occur, and are expected to be in full effect by 1995. There may be offsetting effects in the timber industry that may partially mitigate some of these effects, at least in the short term, in the form of replacement logs from a private sector response, decreased log exports, and the availability of 4–6 bbf of sold but uncut timber. Benefits include improved watershed protection, decreased stream sedimentation, increased anadromous fish habitat, protection of regional biodiversity, and existence values to the American public.

Offsetting or Mitigating Factors

Increased timber harvest on private lands in response to higher stumpage prices and new restrictions on log exports may both result in additional logs being available to regional sawmills and processing plants to replace, in part, the reduction of timber available from Federal lands as a result of the designation of critical habitat for the spotted owl. The effect of these replacement logs will be to lessen the employment impacts discussed above. Key factors determining the size of both mitigating effects are the size of the response and the location of the newly available timber. Further, there are 4–6 bbf of sold but not harvested logs in the region, and much of this would be expected to enter the market, which may help reduce short-term impacts of log reductions. Increases in stumpage price are expected to induce private timber owners to increase their harvest, at least in the near-term, by harvesting timber sooner than originally planned. Although the amount of the private sector response is uncertain, available data suggest that it may produce a significant source of replacement timber. The Forest Service estimated that implementing the ISC Plan would result in a 30 percent increase in regional stumpage price, and that private timber owners would respond by increasing their annual harvest in the region by 445 mmbf by 1995, a 4.2 percent increase in timber supply (USDA/USDI 1990). (The response indicates a supply elasticity of 0.14. Mead *et al.* (1991) report a similarly small supply elasticity of 0.13.)

The timber harvest reductions attributable to the Endangered Species Act are estimated to result in an additional stumpage price increase of 3 percent (USDA 1991b). Assuming the same supply response for that relatively small additional price rise may result in an additional 47 mmbf of private harvest. The location of the additional private harvest and how available it may be to the logging operations and processors dependent on Federal log supplies cannot be determined. However, using the average job response coefficient of 13.9 jobs/mmbf, the private sector response may produce 6,186 jobs when Federal supplies are reduced from Final Plans to With-ISC sale levels, and an additional 654 jobs With-Listing and With-Critical Habitat effects. The private sector response is expected to be relatively short lived, however, with private harvest falling below the baseline level by the year 2000, with a subsequent reduction of timber-based employment.

The export of unprocessed logs from the Pacific Northwest has represented a significant proportion of total harvest in recent years. In 1988 to 1989, 3.7 bbf of logs were exported from the region, 25 percent of total harvest. Export of unprocessed logs continues to be controversial. Opponents of exports argue that processing jobs and value added that could benefit the regional economy are exported as well. Proponents of exports claim that exports allow owners of timber to obtain the premium prices foreign markets offer for Pacific Northwest timber, and that restrictions on exports would impose a social welfare loss on the domestic economy.

Exports of logs from Federal lands have been prohibited since the early 1970s. Federal legislation in 1990, aimed in part at offsetting the employment effects of owl protection efforts, restricted log exports from State-owned lands and stiffened restrictions on the use of Federal logs as substitutes for private logs that are exported. Restrictions on exports from State-owned land are expected to make 450 mmbf available for domestic processing, primarily in Washington (Stevens 1991). Tighter monitoring of log substitution is expected to make an additional 150 mmbf available for domestic mills. Using the 2.8 jobs/mmbf involved with logging and export operations reported by Northwest Forest Resource Council (1989) and the average job response coefficient of 13.9 jobs/mmbf developed for this analysis, reducing exports may produce a net increase of 11.1 jobs/mmbf. Thus, the 600 mmbf may result in a net increase of 6,660 timber-based jobs in the region when the new export restrictions are in full effect.

The rise in domestic stumpage price as a result of reduced Federal timber sales is expected to have the further effect of reducing log exports from private lands as log exports from the region become less competitive in international timber markets. The Forest Service estimated a 21 percent decrease in exports from the region as a result of higher prices caused by reducing timber sales from Final Plans to the With-ISC Plan (USDA 1991b). Critical habitat designation may reduce exports somewhat more as prices rise. It cannot be determined what proportion of logs no longer exported from private lands

would become available for local processing.

Benefits of Critical Habitat Designation

Designation of critical habitat for the spotted owl is expected to provide a wide range of economic benefits to society. These economic benefits are whenever possible defined in monetary terms. They include use values as well as intrinsic or preservation values. Benefits provided by preservation of the owl's habitat include the same types of direct and indirect use values of old growth forest ecosystems. Habitat preservation also provides water quality protection, scenic and air quality, biological diversity, and other environmental services.

Benefits of critical habitat designation are in addition to those provided by listing of the owl as threatened or those derived from other actions taken by land management agencies to provide protection to the owl and its habitat. Only the incremental protection provided by critical habitat designation, and the ancillary benefits attributable to that action, are compared with the incremental costs of restricting timber harvest and other economic effects of designating critical habitat. When areas of proposed critical habitat were considered for possible exclusion, the incremental effects of exclusion on both benefits and costs were compared.

A number of non-timber related service flows currently provided by critical habitat would have continued without critical habitat designation, but most would be different. Including an area in the critical habitat designation has allowed the values the area now provides to be maintained or develop over time. In most cases those values would have been changed if the area had been excluded from critical habitat because higher levels of timber harvest or other actions might have been carried out. From a "with" and "without" perspective, the net benefit of critical habitat designation is the difference between total values when an area is part of critical habitat (with) and their value when the area is not included in critical habitat (without).

Many of the benefits provided by protection of the spotted owl and its habitat are not marketed. The lack of market prices makes it difficult to value them in dollar terms, as compared to timber harvest and other commercial activities. No comprehensive dollar estimate of the benefits of designating critical habitat is feasible with available data. Rather, the analysis provided here references data from several sources in order to identify some of the benefits expected to result from the designation of critical habitat, with empirical examples when available.

Recreational Use Benefits

Direct recreational uses of a threatened species often are limited because there may be too few animals to supply observation or other recreational opportunities. However, even though the spotted owl population may be too few in number to provide widespread direct recreation to wildlife watchers, its habitat provides other kinds of enhanced recreational opportunities. Forest land harvested for timber invites certain recreation activities, such as deer hunting and off-road vehicle use. Older forests invite hiking, camping, and primitive and semi-primitive recreation. Without considerable analysis, it cannot be determined whether the net change in older forest recreation values would be positive or negative with timber harvest.

However, data from the Oregon State Parks and Recreation Department (USDI 1991c) and a review of current forest plans for Washington and Oregon indicate that the acreage of roaded recreation areas exceed the demand for recreational opportunities of that type while the demand for recreation on primitive and semi-primitive recreation areas is not satisfied. If annual recreational use of the proposed 1.69 million acres of critical habitat added to the HCAs were to average one person per acre with average consumer surplus of $30 per visitor day, direct use recreation benefits would total $50.7 million per year.

Aesthetic Benefits

Psychological studies of human perceptions toward scenic beauty provide evidence of a strong link between perceived aesthetic quality and objective measures of changes in the appearance of a forest, such as the retention of visual corridors along roads. Scenic beauty ratings of forest quality are often an important determinant of willingness to pay for a forest recreation experience (Brown *et al.* 1989). According to 95 percent of users, scenic quality is important to the recreational experience in national forests (Walsh and Olienyk 1981, Walsh *et al.* 1989). The effects of harvesting older forests in the Pacific Northwest on scenic quality have not been studied, but they can be inferred from work in other regions. Studies have found that harvesting mixed age stands of second growth forest with some older specimen trees would reduce average consumer surplus per visit and total visitation by approximately 70 percent (Walsh and Olienyk 1981, Walsh *et al.* 1989). Reductions are reported for all recreational activities studied except hunting and driving off-road vehicles, for which harvest often increases opportunities. As the available supply of older forests becomes increasingly scarce, the opportunity to use older forest recreation areas will diminish and scenic quality of the remaining areas will become increasingly valued.

Biodiversity Benefits

The designation of critical habitat for the spotted owl contributes to the protection of regional biodiversity in the Northwest. The habitat of the northern spotted owl represents a unique ecosystem of diverse plant and animal species. Most attention has been directed toward protection of the spotted owl, but this is only one of several hundred vertebrate species occurring in the Pacific Northwest (Bruce *et al.* 1985, Ruggerio *et al.* 1991). This species richness and abundance depends to a large extent on the presence of mature and older forests (Ruggerio *et al.* 1991).

Northwest forests accumulate more biomass than tropical forests (Franklin 1988), and also provide protection to the soils, particularly on steeper slopes, and maintain higher water quality with lower sediment yields. Management strategies designed to provide 50 to 90 year old trees for harvest on public lands in the Northwest are not likely to provide the same benefits to regional biodiversity as would stands managed at longer rotation lengths, nor will they provide the same benefits that are found in areas protected from clearcut harvest techniques.

The recent discovery of a cancer-fighting chemical in the Pacific yew further demonstrates the potential economic importance of maintaining biological diversity in Northwest forests. In addition, protection of spotted owl habitat may obviate the listing of other species dependent on that same habitat type, thereby reducing future economic costs of listing species and critical habitat (e.g., the marbled murrelet). Other plant and animal species, including stocks of anadromous fish, are being considered for listing in the Northwest. If their habitat is adequately protected as a result of designating spotted owl critical habitat, the need for future listings may be reduced. Thus, the conservation of the owl promotes the ecosystem level conservation needed to protect other plant and animal species and is a benefit to society.

Aquatic Benefits

Research has demonstrated that many declining fish populations are found in or downstream from areas where logging and road building are the primary causes of stream habitat degradation (Hartman and Scrivener 1990). The designation of critical habitat is expected to reduce the amount of logging and. thereby, provide benefits in the form of reduced soil erosion, decreased sedimentation in streams, and improved habitat for salmon and other stream fauna. Increased productivity of streams and increased numbers of anadromous and other stream fish have direct economic as well as non-market benefits to society.

The watersheds of the Pacific Northwest protect fisheries resources that are valuable to both commercial and recreational use (Frissell 1991). Numerous coastal cities and small communities in the rural areas are dependent on tourists as well as sport and commercial fisheries. Several studies have found a positive relationship between fish populations, the fishing catch rate, and the consumer surplus value of fishing for salmon in the Columbia River Basin, trout in Colorado, and salmon in Idaho. For example, Loomis (1988) predicted that catchable salmon numbers from streams in the Siuslaw National Forest could double if current timber management practices were terminated. Economic losses to salmon and steelhead fisheries from future timber harvest on 86,700 acres in the Siuslaw National Forest were estimated to be $1.7 million over a 30 year period (Loomis 1988).

Intrinsic Values

Estimates of recreation user demand, benefits of scenic beauty, and benefits of water quality represent only a partial estimate of the total value society places on the spotted owl and its habitat. The public also is willing to pay for the increased probability of owl survival that may result from the improved information that becomes available when harvesting old growth forests is delayed, the knowledge that the natural ecosystem exists and is protected, and the satisfaction from its bequest to future generations.

Rubin *et al.* (1991) reported adjusted values of $35 per household for residents of Washington State, with 249 responding to an open-ended question in a mail survey. The authors estimated spotted owl preservation values of $37 per household for Oregon, $21 for California, and $15 for the rest of the U.S., aggregating to about $1.5 billion per year (1987 dollars). Hagen *et al.* (1991) reported a threshold value estimate ranging from a low of approximately $3 to a high of $8 per household in the U.S.

In a study based on a national mail survey of nearly 400 households, Hagen *et al.* (1991) reported that 81 percent favored protection of old growth forests and northern spotted owls. The average willingness to pay higher taxes and wood product prices reported in a referendum contingent valuation format was $190 per year. The lower limit of the 98 percent confidence range around the mean value was $117 per household. A study by Olsen *et al.* (1991) reported the average willingness to pay for increasing runs of salmon and steelhead. Nonusers who reported no probability of future participation in the sport of fishing valued the resource at $27 per year, while nonusers who stated some probability of future participation valued it at $59 per year.

Long Term Effects of Critical Habitat Designation

To determine how the effects of critical habitat designation will change over time requires projections of many parameters that may themselves change in uncertain ways in the future. The dynamic interactions within regional and national economies are hard to predict and, at best, some indication of the direction and order of magnitude of change is the best estimate that can be provided. Many factors are expected to influence the level of impact critical habitat designation will have on national and regional supply of wood and wood products. For example, construction and new housing starts with their derived demand for wood and wood products will interact with the available timber supply to determine future stumpage prices. Changes in stumpage prices will, in turn, affect economic decisions about the timing of timber harvesting. Also, the relative competitive position of the Northwest timber industry sector in the National market will have a substantial affect on the timber communities in the three State area.

The development of a new projection model was not within the scope of the economic analysis of designating critical habitat for the spotted owl. However, existing projection efforts were examined and their findings interpreted within the context of critical habitat designation.

One factor of primary interest is the harvest rate allowed in critical habitat as the forest condition improves in habitat quality for owl populations. Most of the costs delineated in the economic analysis stem from reduced timber harvest levels on the critical habitat acreage above the areas identified by the ISC.

The designation of portions of the three State area as critical habitat does not produce a regimen of permanent, restrictive management practices. That is not the intent of the Act or the section 7 consultation process. In the economic analysis it was assumed that national forests will have some portion (5 to 25 percent) of the sustainable yield within the critical habitat areas, outside of the ISC areas and above 50–11–40, available for timber harvest. It is expected that the percent of allowable timber harvests will increase over time as the condition of the forests improves and the owl population recovers in areas identified for protection through implementation of a final recovery plan and/or agency management plans.

Once owl recovery goals are reached, it is assumed that multiple use management practices also may be employed within the ISC areas. The determination of long-term, sustainable yield within the context of multiple use of the forest resource may result, however, in harvest rates below the 1990 plans level. As more information becomes available about species requirements for survival, and that information is incorporated into future management plans, it is expected that future timber harvest levels can be determined that stabilize the supply of timber from Federal lands at some level compatible with the nation's need for timber as well as survival of forest based species. This new equilibrium level of harvest, although perhaps lower than historic rates, will help avoid the dramatic timber community expansions and contractions typical of past cycles.

The rate at which timber harvests within critical habitat will be allowed to increase over time is difficult to determine and can only be approximated. As the owl population recovers, an increase in the allowable harvest within critical habitat units is expected. The rate at which this would occur is dependent on the type of owl management or conservation plan (e.g., recovery plan) that the agencies develop and implement, and the timing of implementation and its effects on owl recovery.

The rate of increase in allowable harvest is projected at approximately 10 percent per decade beginning in the year 2010. The time required for developing and testing new silvicultural practices on Federal land, as well as the time for the recovery of the existing forests, makes it unlikely that significantly increased harvest levels will be possible

on critical habitat before the year 2010. The implications for the Northwest of renewed availability of federal lands for timber harvesting are a downward effect on timber prices, renewed employment opportunities, and an increase in timber supply for local mills. However, jobs lost during the early 1990s will not be replaced on a one for one basis. Even at modest, annual labor productivity increases, future job creation will be lower per million board feet of timber harvested.

The Forest Service (USDA 1990) discuss simulated effects of several future scenarios of timber demand, supply and prices. The analysis uses trends in key variables that affect the timber industry to formulate baseline projections to the year 2040. Some of these underlying trends have implications for the way that economic effects stemming from the designation of critical habitat will affect the economy of the Northwest in the future. In particular, the share of U.S. softwood production coming from the Northwest is projected to decrease. During the interval from 1986 to 2040, nationwide softwood production is projected to increase from 33.9 bbf to 49.2 bbf, but the Northwest share is expected to only increase from 20.3 bbf to 22.9 bbf, a loss of 13.3 percent of the nationwide share.

A second factor is the projected employment in the softwood industries. While the base scenario projects only modest increases in Northwest softwood lumber production, labor requirements per mmbf continue to decrease. Technological innovations are projected to reduce labor requirements for all timber based industries. The average productivity rate increase is approximately 1.2 percent per year. The comparable rate reported by Anderson and Olson (1991) is 1.4 percent annually. The productivity gain in the timber industry of the Northwest was addressed in Greber (1991) who stated that the large productivity gains of the past decade that came about when mills modernized their equipment will not be sustained into the future because of two factors: First, most of the inefficient timber mills are already out of business or have retooled; and second, that increased use of timber residuals and specialized products will create additional employment, thus compensating in part for some of the productivity gains. A modest productivity gain of 1.2 percent annually was assumed to adequately reflect the changes in labor requirements in the future.

Increasing the volume of timber production on critical habitat will affect timber based employment and the net loss to the Treasury in the future. Using constant dollars (USDA 1990), the timber revenue loss associated with reduced volumes of timber harvested was estimated to the year 2040. The associated employment reductions and dollar loss to the Treasury were also calculated. In constant dollars, the net loss to the Treasury is not significantly different in the year 2040 than it is in 1995. The annual equivalent value for the time period is $49 million. However, the total job loss diminishes from 1,420 in 1995 to 541 total jobs attributable to critical habitat designation.

The Northwest economy will be affected by the implications of both the trend in production shifts to other parts of the U.S., and the capital for labor substitutions. As the demand for wood and wood products increases in the future, more pressure will be put on the Northwest to become more competitive by keeping its costs of production down. The substitution of capital for labor is a basic economic technique for minimizing production costs. The resulting higher labor productivity means that fewer jobs would be in place in the future than were lost when critical habitat was initially designated. As these economic conditions evolve, the timber industry will play a lesser role in the regional economy of the Northwest.

Available Conservation Measures

The purpose of the Act, as stated in section 2(b), is to provide a means to conserve the ecosystems upon which endangered and threatened species depend and to provide a program for the conservation of listed species. Section 2(c)(1) of the Act declares that "* * * all Federal departments and agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of this Act."

The Act mandates the conservation of listed species through different mechanisms, such as: Section 7 (requiring Federal agencies to further the purposes of the Act by carrying out conservation programs and insuring that Federal actions will not likely jeopardize the continued existence of the listed species or result in the destruction or adverse modification of critical habitat); section 9 (prohibition of taking of listed species); section 10 (wildlife research permits and habitat conservation planning on non-Federal lands); section 6 (cooperative State and Federal grants); land acquisition; and research. Other Federal laws also require conservation of endangered and threatened species, such as the National Forest Management Act, the Federal Land and Policy Management Act, the National Environmental Policy Act, and various other State and Federal laws and regulations.

Critical habitat is not intended as a management or conservation plan. In the case of critical habitat for the northern spotted owl, association with the ISC Plan leaves the perception that the critical habitat is a form of that plan. The ISC Plan, critical habitat, recovery plan, the Scientific Panel report, and other conservation processes are working with the same land base containing specific locations of older forests. Although these are different processes, because of the limited habitat base remaining, it is inevitable that they overlap. Emphasizing large blocks of suitable habitat has been a common theme in all recovery and management processes for the northern spotted owl because it is essential to local population stability (although without connectivity among them, the blocks themselves will probably not maintain long-term ecosystem stability or long-term viability of owl populations).

The ISC analysis clearly identifies the near-term risk associated with the implementation of the ISC Plan, especially if all parts of that plan are not implemented fully or in a timely manner. The HCA strategy is based on long-term habitat development objectives to support projected owl pair targets. The near-term loss of owl habitat and owl pairs outside of HCAs prior to full habitat recovery within HCAs could lead to a significant decline in the owl population which may increase the amount of time it will take to achieve owl recovery. Over the past 2 years, the Service's section 7 analyses have begun to demonstrate the effects of continued timber harvest that, in the near-term, may increase the risk associated with the ISC Plan (USFWS 1991a, b, and c).

The Service has not done a risk analysis for critical habitat because there are no numerical goals upon which to evaluate the effectiveness of the designation. Population goals (in terms both of total numbers of owls and distribution), upon which a risk analysis would depend, were not developed for this rule but are instead part of the recovery plan process. Risk analysis is not the intended purpose of critical habitat designation. Critical habitat is primarily intended to identify the habitat that meets the criteria for the primary constituent elements. However, there are benefits that result from designation. Designation will help retain recovery options and reduce the near-term risk until a long-term conservation plan is implemented. Critical habitat

does not replace the HCA network and management recommendations of the ISC for the intervening forest matrix.

Designation of critical habitat may provide a mechanism for regulatory protection for HCAs, protection in key areas outside of HCAs (e.g., in areas designated where habitat or pair deficiencies exist or areas of high risk as identified by the ISC), linkage throughout the current range, an ecological buffer to HCAs, and/or protection of areas currently in need of special management (e.g., areas of concern or areas where linkage problems occur) through section 7 of the Act.

Designation of critical habitat does not offer specific direction for managing owl habitat. That type of direction, as well as any change in direction, will come through the administration of other facets of the Act (e.g., section 7, section 10 HCP process, and recovery planning) or through the development of land management plans that address management of the owl.

Recovery Planning

Recovery planning under section 4(f) of the Act is the "umbrella" that eventually guides all of the Act's activities and promotes a species' conservation and eventual delisting. Recovery plans provide guidance, which may include population goals and identification of areas in need of protection or special management. Recovery plans usually include management recommendations for areas proposed or designated as critical habitat.

The Northern Spotted Owl Recovery Team is evaluating critical habitat, the ISC Plan, and other current planning efforts to determine the relationship between them and to help clarify their role in conserving the owl. The Recovery Team is expected to produce a recovery plan for the northern spotted owl that will address the steps needed to recover the owl on all landownerships throughout its range and provide an acceptable mechanism for implementation. Although a recovery plan is not a regulatory document, the plan should identify requirements for managing or modifying designated critical habitat on Federal lands, as well as considerations for critical habitat on other landownerships.

Critical habitat should be compatible with the recovery effort. Although the Recovery Team may recommend changes to the ISC network (for management purposes), there should not be any conflict with critical habitat. Valid recommendations or management prescriptions developed by the Recovery Team can be applied to critical habitat regardless of whether there are different management prescriptions prescribed for HCA-type areas or other areas within critical habitat where timber harvest may be more compatible with owl conservation.

The Service has worked closely with the Recovery Team and other efforts to ensure consistency and will reevaluate the need for critical habitat after completion and implementation of the recovery plan or at any time that new information indicates that changes may be warranted. The Service may also reassess critical habitat designation if other land management plans or conservation strategies, which may reduce the need for the additional protection provided by critical habitat designation, are developed and fully implemented.

The Service expects that, consistent with section 7(a)(1) of the Act, Federal and non-Federal agencies will produce biologically sound, long-term land management plans that contribute to the conservation of spotted owls, as well as other listed and nonlisted species. Biologically credible plans such as the ISC Plan offer opportunities for resolving conflicts between timber management and owl conservation and offer a basis for present and future land management decisions. Valid and acceptable management prescriptions contained in such plans can help guide the Service and other agencies in managing critical habitat.

Section 7 Consultation

Section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to destroy or adversely modify critical habitat. This Federal responsibility accompanies, and is in addition to, the requirement in section 7(a)(2) of the Act that Federal agencies ensure that their actions do not jeopardize the continued existence of any listed species.

Jeopardy is defined at 50 CFR 402.02 as any action that would be expected to appreciably reduce the likelihood of both the survival and recovery of a species. Destruction or adverse modification of critical habitat is defined at 50 CFR 402.02 as a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. The regulations also clearly state that such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.

Survival and recovery, mentioned in both the definition of adverse modification and jeopardy, are directly related. Survival may be viewed as a linear continuum between recovery and extinction of the species. The closer one is to recovery, the greater the certainty in the species continued survival. The terms "survival and recovery" are, thus, related by the degree of certainty that the species will persist over a given period of time. Survival relates to viability. Factors that influence a species' viability include population numbers, distribution throughout the range, stochasticity, expected duration, and reproductive success. A species may be considered recovered when there is a high degree of certainty for the species' continued viability.

The Act's definition of critical habitat indicates that the purpose of critical habitat is to contribute to a species' conservation, which by definition equates to recovery. Section 7 prohibitions against the destruction or adverse modification of critical habitat apply to actions that would impair survival and recovery of the listed species, thus providing a regulatory means of ensuring that Federal actions within critical habitat are considered in relation to the goals and recommendations of a recovery plan. As a result of the link between critical habitat and recovery, the prohibition against destruction or adverse modification of the critical habitat should provide for the protection of the critical habitat's ability to contribute fully to a species' recovery. Thus, the adverse modification standard may be reached closer to the recovery end of the survival continuum, whereas, the jeopardy standard traditionally has been applied nearer to the extinction end of the continuum.

Basis for Analysis

Designation of critical habitat focuses on the primary constituent elements within the defined units and their contribution to the species' recovery, based on consideration of the species' biological needs and factors that contribute to recovery (e.g., distribution, numbers, reproduction, and viability). The evaluation of actions that may affect critical habitat for the spotted owl should consider the effects of the action on any of the factors that were the basis for determining the habitat to be critical, including the primary constituent elements of nesting, roosting, foraging, and dispersal, as well as the contribution of the local and provincial area to recovery. The desired outcome of section 7 should be to avoid actions

that further reduce the ability of the habitat to support owls (e.g., the type of activities that led to the owls' listing, such as conversion of habitat to younger forest, short rotation rates, fragmentation, and isolation).

The range of the owl is subdivided into a number of provincial areas as previously discussed (Thomas *et al.* 1990, USDI 1990a). These subdivisions are not based upon identification of separate populations of owls, but rather on geographical habitat differences. The provinces and local populations of owls are for the most part interrelated and interconnected. Provinces, subprovinces, and individual critical habitat units are all part of a habitat network important to maintaining a stable and well-distributed population over the range of the owl. Section 7 analysis of activities affecting owl critical habitat should consider provinces, subprovinces, and individual critical habitat units, as well as the entire range of the subspecies. The basis for an adverse modification opinion should be on the provincial areas identified in this rule (see PRIMARY CONSTITUENT ELEMENTS section) and further explained in the narratives that describe the role, values, and relationships of critical habitat units (USFWS 1991e). Should the Recovery Team identify a more appropriate set of areas, they will form the basis for analysis under section 7.

The loss of one or more provinces, or even a major part of a province, could lead to genetic and demographic isolation of parts of the owls' range. Potential isolation could have a greater near-term effect on some areas (e.g., Olympic Peninsula, Washington Cascades, Oregon Coast Ranges, Shasta/McCloud area within the Klamath Mountains) because of the present status of owl numbers and owl habitat within those areas, than on other areas (e.g., north-central Klamath Mountains, westside Oregon Cascades). In the long-term, however, the concern over population stability would be similar in all areas. Population stability for the owl may depend on the relative location of large stable population reserves that act as sources for areas where mortality exceeds recruitment (sinks), that are subject to population fluctuations, or exhibit low reproductive success (Thomas *et al.* 1990).

For a wide-ranging species such as the spotted owl, where multiple critical habitat units are designated, each unit has both a local role and a rangewide role in contributing to the conservation of the species. The loss of a single unit may not jeopardize the continued existence of the species, but may significantly reduce the ability of critical habitat to contribute to recovery. In some cases the loss of a critical habitat unit could result in local instability, affecting dispersal and connectivity and, thus, reducing local population levels. This could have a detrimental effect on the stability of the province or at the least on that portion of the province where the loss occurred. That, in turn, would also have an effect on linkage to other provinces potentially leading to isolation and instability. This could preclude recovery or reduce the likelihood of survival of the species.

Each critical habitat unit is related to and dependent upon each adjacent unit, just as each province is dependent on each adjacent province. In some cases, gradual degradation of one critical habitat unit to the point where it no longer fulfills the overall function for which it was designated could also preclude the survival and recovery of the species. Over time the resulting effect could lead to greater problems at the province level and ultimately at the species level.

Present conditions vary throughout the range of the owl with the result that some areas may be less able to sustain continuing impacts than others at any given time (e.g., the Olympic Peninsula and Oregon Coast Ranges). The level of disturbance a critical habitat unit could withstand and still fulfill its intended purpose is variable throughout the owls' range and will need to be reviewed in the context of its current status, condition, and location. Because of the interrelationships between units, local areas, and provinces, it is difficult to separate out the effects on one area or level of analysis.

Each project will need review as to its impacts at all levels. When determining whether any particular action would appreciably diminish the value of the habitat for the survival and recovery of the owl, the baseline condition and expected roles for both the individual critical habitat unit and the surrounding units must be considered. Among the factors to be considered are: The extent of the proposed action; the present condition of the habitat (e.g., percent of the area suitable for nesting, roosting, foraging, and dispersal; degree of fragmentation); the current number of pairs in the project area; the reproductive success of breeding pairs; the expected time to regenerate sufficient habitat to support an effective population in a particular area; consistency of the action with the intent of the ISC Plan, recovery plan, or other conservation plans; geographic considerations; and local and regional problems. The analysis should also consider the affect of the action on habitat that was not included in critical habitat, as well as the affects on critical habitat from actions planned outside the designated area.

Analysis of impacts to individual units must consider the effects to the local area (both the unit and surrounding units), any definable sub-area (e.g., province), and the overall range of the species. The Service has developed biological narratives describing the role, condition, and value of each individual unit, as well as the conditions and problems associated with provinces and subprovinces (USFWS 1991e). To help in consideration of how actions affect local and provincial stability, these narratives contain an explanation of the interrelationships among units, local areas, and provinces.

Consultation Process

Section 7 consultation for critical habitat will focus on the effects of actions on owl habitat whether or not it is currently occupied. The presence or absence of individual spotted owls or pairs of spotted owls will not factor into the determination of actions that trigger section 7. Any action that may affect critical habitat will trigger section 7 consultation.

The requirement to consider adverse modification of critical habitat is an incremental section 7 consideration above and beyond section 7 review necessary to evaluate jeopardy and incidental take. As required by 50 CFR 402.14, a Federal agency must consult with the Service if it determines an action may affect a listed species or its critical habitat. Federal agencies are responsible for determining whether or not to consult with the Service and should consider a number of factors when determining whether any proposed action may affect critical habitat. The Service will review the action agency's determination on a case-by-case basis and will or will not concur whether the action may adversely affect critical habitat, as appropriate. To the extent possible, agencies should consult on a programmatic basis (especially for multiple actions such as timber sales).

The Service will consider the effect of the proposed action on the primary constituent elements along with the reasons why that particular area was determined to be critical habitat. The trigger to initiate section 7 consultation (under adverse modification) is any action that may affect any of the four primary constituent elements of critical habitat or reduce the potential of critical

habitat to develop these elements; this is independent from any action that would affect known individuals. The evaluation should also take into consideration what happens outside of critical habitat since projects outside of critical habitat may also impact habitat within critical habitat. It should also consider what effects the action may have on other adjacent critical habitat units, the local area as defined by the Service, and the province or subprovince.

A number of Federal agencies or departments fund, authorize, or carry out actions that may affect lands the Service is designating as critical habitat. Among these agencies are the Bureau, Forest Service, Department of Defense, Bureau of Mines, Corps of Engineers, Bureau of Reclamation, Federal Energy Regulatory Commission, and Federal Highway Administration. The Service has identified numerous activities proposed within the range of the northern spotted owl that are currently the subject of formal or informal section 7 consultations. These include the Forest Service's and Bureau's land management plans (e.g., the Forest Service's spotted owl environmental impact statement), annual timber sale operations, and other more localized projects, such as hydroelectric developments; road, trail, and powerline construction; land exchanges; resort development; and a number of smaller actions (e.g., campground construction). A more complete list is contained in the Service's administrative record.

Examples of Proposed Actions

For any final regulation that designates critical habitat, section 4(b)(8) of the Act requires a brief description and evaluation of those activities (public or private) that may adversely modify such habitat or may be affected by such designation. Destruction or adverse modification of critical habitat is defined as a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.

Activities that disturb or remove the primary constituent elements within designated critical habitat units might adversely modify the owl's critical habitat. These activities may include actions that would reduce the canopy closure of a timber stand, reduce the average dbh of the trees in the stand, appreciably modify the multi-layered stand structure, reduce the availability of nesting structures and sites, reduce the suitability of the landscape to provide for safe movement, or reduce the abundance or availability of prey species.

In contrast, activities that would have no effect on the critical habitat's primary constituent elements almost certainly would not adversely modify the critical habitat. However, even though an action may not adversely modify critical habitat, it may still affect spotted owls (e.g., through disturbance) and, therefore, be subject to consultation under the jeopardy standard of Section 7 of the Act, as determined after consideration of the aforementioned factors.

Areas designated as critical habitat for the spotted owl support a number of existing and proposed commercial and noncommercial activities. Some of the commercial activities that may affect spotted owl critical habitat include timber harvest, salvage activities, sand and gravel extraction, mining (e.g., open pit), land disturbance activities associated with oil and gas leases, snag creation/removal, construction of hydroelectric facilities, geothermal development, and construction of alpine ski areas and associated resort facilities.

Commercial activities not likely to destroy or adversely modify critical habitat include limited livestock grazing and various site-specific activities such as scenic tours and cavern exploration. Conducting owl surveys would not be likely to destroy or adversely modify critical habitat.

Non-commercial activities are largely associated with recreation and are not considered likely to adversely affect critical habitat. Such activities include hiking, camping, fishing, hunting, cross-country skiing, off-road vehicle use, and various activities associated with nature appreciation. Additional activities include "personal use" commodity production, such as mushroom and plant gathering, Christmas tree cutting, and rock collecting. These activities are also foreseen as not having any adverse effect on critical habitat.

Expected Impacts of Designation

The Service will use management guidelines when finalized by the Recovery Team during consultation to evaluate proposed actions in critical habitat. Until formal recovery goals and management guidelines are developed by the Recovery Team, the Service anticipates using the ISC Plan and other factors described in this document as a basis for determining the level of allowable timber harvest or other activities that affect owl habitat within critical habitat.

At this time the Service assumes that the Forest Service and Bureau will continue to manage the HCAs as recommended by the ISC. The Service expects that many proposed activities within HCAs that are also designated as critical habitat would be inconsistent with the long-term development of large suitable habitat blocks and would, therefore, likely result in destruction or adverse modification of critical habitat. Proposed actions that are consistent with the ISC recommendations for activities within HCAs would not likely destroy or adversely modify critical habitat. All such determinations will be made on a case-by-case basis during section 7 consultation.

Timber harvest or other actions proposed in critical habitat units, but outside HCAs, may or may not adversely modify critical habitat, depending on the current condition of the area and the degree of impact anticipated from implementation of the project. The potential level of allowable harvest or habitat reduction in the non-HCA portions of critical habitat units will vary over time for each unit, depending on local and provincial owl populations and habitat conditions and will be determined on a case-by-case basis during section 7 consultation, although meeting the intent of the 50–11–40 rule would be insufficient in most cases.

To avoid or reduce conflicts, the Service recommends that timber harvest or other actions be considered for the forest matrix outside critical habitat before consideration is given to placement of sales within the HCA or non-HCA portions of critical habitat. Variations within and among provinces (e.g., existing habitat quality and quantity, distribution of existing habitat, etc.) may lead to differences in near- or long-term protection strategies and may affect the focus of planning and section 7 review. Changes to HCA boundaries as a result of implementation of a recovery plan or other similar plan may affect how actions are treated in section 7.

Under this scenario, the net effect of the designation of critical habitat will be a reduction in harvest that falls somewhere between the effects of no harvest (as recommended for HCAs) and the application of the 50–11–40 rule. This impact will vary over the range of the owl. The potential impact of section 7 may also vary depending on the effect of the results of the exclusion of acres due to high economic costs. In some cases these areas may have been

reduced to the point where further timber harvest or habitat reduction would likely result in destruction or adverse modification of critical habitat.

Given this approach, the Service envisions that, as habitat within critical habitat begins to recover or the need for near-term protection of suitable habitat adjacent to HCAs decreases, increasing levels of harvest will be allowed within critical habitat. Eventually, few if any restrictions above 50–11–40 may be necessary in critical habitat outside of HCAs, once habitat within the HCAs has fully recovered and become occupied by owls. The Service expects that these assumptions may change as the recovery plan is completed and implemented. Restrictions on the levels of activities within HCAs may decrease as well as more is learned about maintaining owls in managed forests.

Reasonable and Prudent Alternatives

In cases where it is concluded that an action would likely result in the destruction or adverse modification of critical habitat, to the extent possible, the Service is required to provide reasonable and prudent alternatives to the proposed action in its biological opinion. By definition, reasonable and prudent alternatives allow the intended purpose of the proposed action to go forward, and remove the conditions that would adversely modify critical habitat; alternatives may vary according to local conditions, project size, or other factors. To reduce the potential for identifying such alternatives, the Service recommends that the agencies initiate discussions early enough in the planning process so that plans are not to the point where current alternatives may not be feasible and a greater number of options to reduce impacts may be available. Reviewing such actions as timber sales on a programmatic basis would facilitate this process.

Under this scenario, if adverse modification was anticipated, examples of possible reasonable and prudent alternatives that may be provided in a biological opinion include:

—Shift the planned action to another agreed-upon location outside or inside of the critical habitat unit;

—Maintain the quality of the habitat by minimizing fragmentation (e.g., through changes in sale layout);

—Leave sufficient habitat to support known (or an identified number of) pairs in a configuration that does not diminish the quality of the habitat for successful reproduction; and/or

—Implement forest management practices that are known to be compatible with spotted owls (e.g., those that retain certain habitat components or characteristics and those known to speed the development of habitat in young, even-age stands).

For actions that result in more moderate impacts, the Service may recommend minor modifications to the project's configuration. In the case of a proposed upgrade of a powerline right-of-way corridor, for example, the Service may recommend modified construction practices or that the corridor be expanded on one side of the existing corridor versus the other side to avoid impacts to habitat where the primary constituent elements are of higher quality. For projects that may result in more severe impacts, more substantial project changes may be necessary. For example, in the case of a multiple-unit timber sale, the Service may recommend that certain units be reduced in size, reconfigured, relocated, or dropped altogether to avoid impacts to primary constituent elements. The Service may recommend alternate timber harvest prescriptions in certain forest types.

No reasonable and prudent alternatives may be feasible for some proposed actions. For example, due to a lack of existing habitat or high levels of fragmentation, no level of harvest may be possible without resulting in the destruction or adverse modification of critical habitat. In this situation, the Service may issue an adverse modification biological opinion with no reasonable and prudent alternatives. The Service recommends that agencies initiate discussions, especially for timber sales, at the earliest opportunity to help avoid this type of situation.

Some activities could be considered a benefit to spotted owl habitat and, therefore, would not be expected to destroy or adversely modify critical habitat. Examples of activities that could benefit critical habitat in some cases include protective measures such as wildfire suppression or forest-pest eradication (e.g., eastside forests), as well as silvicultural treatments that may improve spotted owl habitat. At this time, they should be evaluated on a case-by-case basis.

Research on silviculture or other types of forest management practices may negatively affect critical habitat. However, the information that may result from such research may offset the perceived impacts of the action. Wherever possible, research should be conducted outside of critical habitat units, coordinated throughout the subspecies' range, and based upon an approved long-term strategy. In some cases, existing experimental or research forests are included in critical habitat. Although the effects of timber harvest in these areas would also be of concern, it is expected that the conservation value to be gained from permitted research activities may offer mitigating circumstances.

In general, those activities that do not remove components of habitat for spotted owls or their prey species are not likely to destroy or adversely modify critical habitat. Each proposed action would be examined under section 7 in relation to its site-specific impacts. The involved Federal agencies can assist the Service in its evaluation of proposed actions by providing detailed information on the habitat configuration of a project area, habitat conditions of surrounding areas, and information on known locations of spotted owls.

Lands both inside and outside of critical habitat are still subject to section 7 consultation on the jeopardy standard and to section 9 take prohibitions for their effects on owls. The Service envisions that the role of all landownerships in the conservation of the owl outside of critical habitat units will be addressed through section 7, the HCP process, the recovery planning process, and other appropriate State and Federal laws.

Conservation Measures on Non-Federal Lands

All non-Federal lands have been excluded from the designation of critical habitat. If an action that is committed by a non-Federal entity affects spotted owls, that action would be subject to review under Section 9 of the Act. Section 9 prohibits intentional and non-intentional "take" of listed species and applies regardless of whether or not the lands are within critical habitat.

There may be some instances where activities outside of critical habitat on non-Federal lands may affect critical habitat. For example, a private party may require a right-of-way permit through critical habitat for an action on private lands. In this type of case a section 7 consultation may be required on the right-of-way permit because the action requires Federal involvement. The Service does not expect that there will be many of these type of situations. However, if a biological opinion is required, recommendations will be provided to help avoid impacts to critical habitat consistent with those examples identified in the previous section.

Examples of Forest Practices

Recent data gathered through research on privately-owned industrial

timberlands in California have suggested that, in some cases, certain silvicultural practices may be compatible with maintenance of viable spotted owl populations and may contribute to delisting. Although there may be significant benefits to be gained from changing current forest management practices, several concerns exist that need to be addressed. First, there are no long-term data on reproductive rates. Therefore, it is possible that the rates observed in the past few years may be a result of high points in prey cycles, or other factors that may vary considerably over time. Another concern that urges caution is that, while the selectively-harvested areas may show adequate owl densities, those densities could be a result of owls being displaced by clearcutting and being forced into the best remaining habitat (those areas with residual trees). While those owls may continue to live, and some may reproduce, there are no data to conclude that a spotted owl population can be sustained in such habitats in the long-term. In addition, other factors, such as rates of fledging success, juvenile dispersal success, and longevity of breeding adult pairs, need to be researched to determine the impact of changes in forest management practices on them.

Although scientists familiar with spotted owl ecology cite several reasons that the high densities reported on selectively-harvested timberlands should be viewed with caution, the Service believes that opportunities may exist for forest management that is compatible with maintenance of owl habitat and owl populations. For example, forest management practices could provide forest stands of different ages that exhibit appropriate habitat characteristics for the owl. These practices should ensure that sufficient younger-aged stands mature at an adequate rate to provide replacement habitat for older stands lost due to logging or natural causes and could provide an adequate quantity and distribution of large contiguous blocks of older forest needed for spotted owls.

There are a number of practices associated with selective timber harvests that may maintain suitable habitat conditions while yielding forest products, or at least minimize the time a stand takes after harvest to regain the attributes of suitable spotted owl habitat. Not all of the following practices can be applied in all conditions.

(1) Maintain conditions:

—Attempt to maintain a multi-layered, closed canopy by retaining pockets of scattered dominant and codominant trees in the overstory, and retaining enough hardwoods and smaller conifers to maintain an understory.

(2) Minimize impacts to habitat:

—Retain large snags and standing culls to provide the decadent component important to prey species and to provide nest sites;

—Retain and/or create large dead and down material to provide food and cover for spotted owl prey species;

—When preparing a site for planting, minimize hot burns that destroy soil structure through elimination of organic matter from the upper soil horizons and that remove most or all of the duff layer above the soil; and

—When regenerating a harvested area, plant a mixture of species that most closely approximates the original stand composition; avoid monotypic stands. Minimize control of hardwoods or, if hardwoods must be suppressed to allow seedling establishment, allow hardwoods to continue growing as soon as seedlings are established.

Several long-term demographic studies are underway on agency and managed industrial timberlands. It is hoped that many of the uncertainties described above will be resolved if the studies can continue for 5 to 7 years. At that time, the Service can re-evaluate what, if any, harvest practices are compatible with long-term maintenance of a viable spotted owl population.

Examples of areas where conservation efforts may prove successful include some private lands (primarily in the redwood-dominated forests of the coastal region) in California. In this region owls have been observed nesting in stands that had acquired characteristics associated with owl presence in as little as 40 to 60 years (Pious 1989). Redwood-dominated forests develop habitat characteristics more quickly following harvest because redwoods exhibit fast growth (redwoods are a stump sprouting species); this region of California receives high precipitation levels augmented by coastal fog, during a long growing season; and the habitat often possesses an understory of other conifers and hardwoods.

These forest growing conditions and an abundant prey base in that part of the subspecies' range lead to the development of suitable nesting, roosting, and foraging habitat in a much shorter time following harvest than in the remaining portion of the owl's range. Although the stability and reproductive success of these owls over time is not well understood, the Service believes that an owl population can be maintained throughout the Redwoods region. In this portion of California, several timber companies are working with the Service in the section 10 HCP process. Two efforts have been completed that the Service believes will be successful in avoiding future conflict.

In other parts of the owls' range in California, some selective harvest techniques on non-Federal lands may be compatible with spotted owls. To address these areas, the State of California and a number of private companies have initiated the HCP process to develop timber harvest plans that are more compatible with owl conservation. The Service believes that the plans developed through this process may provide a basis for maintaining owls on private lands.

The Yakima Indian Nation in Washington practices predominately selective harvest methods. Similar to the methods in some parts of northern California, these methods may also be compatible with maintenance of an owl population. The Yakima Nation is in the process of conducting research on the effect of timber harvest practices on spotted owls to refine an owl management plan for their lands. The Service expects the Bureau of Indian Affairs and Indian Nations to continue to work towards the development of forest management plans on tribal lands that are compatible with spotted owls.

However, more data are needed to ascertain the compatibility between types of forest management and long-term spotted owl reproductive success, particularly if timber harvest is to be considered for designated areas such as HCAs (this should be done outside of HCAs until further data are available and supportive). Agencies should work with industry to continue to study the affects of different harvest techniques on owl presence and reproductive success to determine if (1) new harvest methods would shorten the time needed to produce suitable habitat, (2) if there are timber harvest prescriptions that would be more compatible with northern spotted owls, (3) whether the high owl densities reported by researchers on industrial timberlands can be sustained for the long-term, and (4) whether reproductive rates of spotted owls on managed forests are at a level that can be expected to sustain a viable owl population.

Biodiversity and Ecosystem Protection

The habitat of the northern spotted owl represents a unique ecosystem of diverse plant and animal species. Most attention has been directed toward

protection of the spotted owl, but this is only one of several hundred vertebrate species occurring in the Pacific Northwest (Bruce *et al.* 1985, Ruggierio *et al.* 1991). Among ecosystems in North America, the Pacific Northwest has one of the highest number of bird species, the most bird families (Harris 1984), the second highest number of mammal species (Raphael 1990), and many endemic or relic amphibian species (Bury 1988, Welsh 1990). This species richness and abundance depends to a large extent on the presence of mature and older forests (Ruggierio *et al.* 1991).

These forests play a major role in our environment (see Schamberger *et al.* 1991 for summary). Redwood and Douglas-fir forests accumulate more biomass than tropical rainforests (Franklin 1988). Reduced rotation rates and conversion to younger forests will lead to forests with closed single-layered canopies, smaller trees of similar size, less ground litter and snags, and a more simplified ecological system (Hansen *et al.* 1991). Research indicates that managed stands have fewer species and lower abundance of wildlife than older forests (e.g., Bury 1983; Raphael 1984, 1988; Corn and Bury 1989).

The forests provide protection to the soils, particularly on steep slopes, and maintain higher water quality with lower sediment yield. For example, prescribed burning of slash and cull logs reduces available cover by up to 95 percent (Bartles *et al.* 1985, Hartman and Scrivener 1990). The loss of cover exposes the soil to erosion and reduces or eliminates cover for terrestrial and aquatic species.

Rotation length also impacts the amount of soil loss. The more an area is logged, the more frequently the soil is exposed to erosive elements. For example, Frissell (1991) stated that increased erosion occurs for 15 years following logging. Thus a 100-year rotation exposes the soil 15 years out of 100 (15 percent), whereas a 60-year rotation exposes the soil to erosion 15 years out of 60 (25 percent of the time). Construction of logging roads increases the frequency of land mass failures and diminishes ecosystem stability, as evidenced by temporal fluctuations in abundance of aquatic fauna (Lamberti *et al.* 1991). For example, Amaranthus *et al.* (1985) reported that almost 1.5 million cubic yards of debris slide erosion occurred over a 20-year period on only 14 percent of Siskiyou National Forest, with an erosion rate of approximately ½ cubic yard per acre per year across the entire watershed; roads occupied 2 percent of the area inventoried, yet represented 60 percent of the slide volume. They reported that logging on Federal lands was associated with a 6-fold increase in slide volume, whereas adjacent private logging was associated with a 45-fold increase. Increased soil erosion has been reported in other studies as well (Furniss *et al.* 1991, Rice *et al.* 1979).

Huppert *et al.* (1985) note that environmental manipulations that simplify habitat have a direct, negative impact on fish population structure and abundance. Increased erosion rates and sedimentation decreases the productivity of aquatic systems, which in turn reduces fish populations, and results in smaller numbers of fish. Timber harvest also increases water temperature and may reduce dissolved oxygen levels when excessive organic litter enters streams (Hartman and Scrivener 1990, Hicks *et al.* 1991, Sedell and Swanson 1984).

Unlogged forests provide protection to soils, particularly on steeper slopes, and maintain higher water quality with lower sediment yield than logged sites. Anderson and Olson (1991) note that more than 50 percent of the large pool habitat for anadromous fish in the Northwest outside wilderness areas has been lost over the past 50 years. This has resulted in decreased survival in salmon and steelhead trout fry and results cumulatively in decreased populations of these fish (Phillips *et al.* 1975, Hicks *et al.* 1991, Hartman and Scrivener 1990).

Fish stocks have dramatically declined in the Northwest (Nehlsen *et al.* 1991); at least 106 populations of salmon and steelhead have already been extirpated on the West Coast. Many declining fish populations are found in or downstream from areas where logging and road building are evident (Hartman and Scrivener 1990). The river systems draining Northwest watersheds contain an abundance of salmon species as well as other instream fauna and flora. The designation of critical habitat is expected to reduce the amount of logging and thereby provide benefits in the form of reduced soil erosion, decreased sedimentation in streams, and increased habitat for these species.

Critical habitat designation may also help maintain important nesting habitat for migratory birds (e.g., neotropical migrants), many of which are seriously declining in numbers. Current international efforts to maintain tropical forest habitat in Central and South America may be enhanced by complementary efforts to maintain suitable habitat for species that nest in forests of the Northwest.

Designation of critical habitat for the northern spotted owl may benefit these and other forest species, particularly those that depend upon large blocks of older forest and occur within the designated areas. In 1990, the Service identified species that were candidates for listing as endangered or threatened and were found within the HCAs delineated by the ISC. The Service has updated that list to include those species that may benefit from designation of critical habitat for the spotted owl (a list is maintained in the administrative record). About 60 listed, proposed, and candidate species have been observed within areas designated as critical habitat. Although not all of the known locations of these species are found within critical habitat units, review of Federal actions under Section 7 of the Act may be of benefit to these species. Designation may be most beneficial to the marbled murrelet and salmon stocks that inhabit or depend on these areas, thus helping to reduce conflicts associated with these species.

The Scientific Panel has also identified areas that are important to maintaining such an ecosystem network within the range of the owl (Johnson *et al.* 1991). This effort addressed the owl and numerous other forest species and processes, and includes more acreage to accommodate these components of the ecosystem. For example, they concluded that current forest plans were inadequate to protect streams and salmon stocks in the Northwest. The Service has not had the opportunity to thoroughly review the product of this effort to determine its relationship to other potentially listed species; initial comparison would equate this critical habitat rule with alternative 6 to 8 out of the list of 14 alternatives (with number 14 being the most protective for all species).

Designation of critical habitat will contribute to the conservation and management of the Northwest's forests as one component in the management and maintenance of characteristic species and processes. Research is beginning to identify the importance of maintaining ecosystem processes upon which the stability of the system depends. In turn, the species and populations depend on that stability. Such functions as hydrology, bank stability, nutrient cycling, predator/prey cycles, fisheries restoration (e.g., salmon), and local microclimates are all interdependent. They can benefit from conservation approaches that focus on unity of the ecosystem as opposed to a piecemeal approach that does not take

into account the interrelationships of all processes.

Preservation of separate blocks of habitat, however, will not by itself contribute to ecosystem stability. Linkage among the blocks of habitat is a necessary component. Critical habitat designation may contribute to regional biodiversity by protecting natural ecosystems of sufficient size and quality to support native species, as well as protecting listed, proposed, and candidate species. Critical habitat may also help in retaining ecosystem values through a combination of preservation, conservation, and compatible management of forest habitat with emphasis given to older forest values and characteristics.

However, these are dynamic and complex issues that include both spatial and temporal components that are not addressed by the designation of critical habitat alone. Further research and evaluation of data will be necessary to understand the interrelationships of these species to older forests and whether management for the spotted owl will adequately provide for their conservation, perhaps reducing the need for listing of proposed and candidate species.

Summary of Comments and Recommendations

In the August 13, 1991, proposed rule and associated notifications, the Service requested all interested parties to submit factual reports or information that might contribute to the development of this final rule. On October 8, 1991, the Service published a notice (56 FR 50701) to correct errors in the legal descriptions contained in the August 13 proposal; on November 12, 1991, the Service published a notice (56 FR 57503) correcting two editorial errors on references contained in the August 13 proposal.

The public comment period was open from August 13, 1991, through October 15, 1991. During that period the Service conducted four public hearings on this issue at the following locations: Redding, California on September 9, 1991; Medford, Oregon on September 11, 1991; Olympia, Washington on September 17, 1991; and Portland, Oregon on September 19, 1991. The Service accepted testimony from the public from 1 to 4 p.m. and from 6 to 9 p.m. on each of those days. The Service announced the dates, times, and locations of the public hearings in the August 13, 1991 proposed rule (56 FR 40001). Appropriate State agencies, county governments, Federal agencies, scientific organizations, and other interested parties were contacted and asked to comment. In addition, on August 21, 1991, the Service published notices in the Olympia Olympian, the Oregonian, the Medford Mail Tribune, and the Redding Record Searchlight newspapers announcing the publication of the proposed rule, and the dates, times, and locations of the public hearings. All meetings were attended by at least one member of the Regional Directorate.

During the 60-day comment period, the Service received approximately 5,800 written comments. In addition, 286 people testified at the 4 public hearings. The Service received comments from the Forest Service, Bureau of Land Management, National Park Service, other Federal agencies, several elected officials, State agencies, environmental organizations, and representatives of the timber industry. About 56 percent of the comments were supportive of the proposal.

In addition, following the close of the public comment period on the May 6, 1991, proposed rule, the Service received nearly 10,000 letters and postcards. The Service did not consider these comments because the additional comment period began with the publication of the August 13, 1991, proposal, and the comments received between June 5, 1991, and August 13, 1991, pertained to a proposed rule that was out of date. The majority of the comments were from the general public. The Service appreciates the interest and concern expressed in these letters, however, very little biological or commercial data was provided during this or earlier comment periods.

Most of the letters and oral testimony received repeated issues raised in response to the May 6, 1991, proposal. The Service is not repeating those issues here, except where we have received new information that adds to or changes our earlier response. Members of the public interested in those issues previously raised should examine the "Summary of Comments and Recommendations" section, beginning on page 40020 in the August 13, 1991, proposal (56 FR 40001). The new issues raised during the public comment period announced in the August 13, 1991, proposal, whether written or oral are discussed below.

Landownership Issues

Issue 1: Several members of the public objected to the exclusion of the private lands from the August 13, 1991, proposal. They indicated that there was no legal basis for such a decision, that removal of the private lands limited recovery team options, and suggested that these lands be included in the final rule. Some members of the public saw the exclusion of private lands and inclusion of additional Federal lands in some areas as deceitful.

Service response: The Endangered Species Act requires that the designation of critical habitat take into consideration "* * * the economic impact, and any other relevant impact * * *," and make a determination as to whether the benefits of excluding those areas outweigh the benefits of including them so long as the action will not result in the extinction of the listed species. The Service made the decision to exclude non-Federal lands because it felt that the conservation benefits attributable to those lands did not outweigh the costs of their inclusion.

The information that the Service has indicates that many of these lands (primarily private) do not contain owl habitat and have very few spotted owls, although these lands may be important to the long-term recovery of the owl. In other areas, such as northern California where there is a fairly large amount of owl habitat on private lands, the State and private entities are currently involved in regulatory processes that will result in the development of HCPs for owls that will be of greater benefit than could be derived through critical habitat.

It is important to remember that excluding these areas from critical habitat does not exclude them from compliance under other legal requirements of the Act. They are still fully subject to section 7 consultation (jeopardy) and section 9 (take prohibition) requirements regardless of whether an area is critical habitat.

Issue 2: Many individuals still felt that the Service had designated too much habitat and indicated that the removal of 3 million acres indicated that the Service had erred in its first proposal and probably erred in its second.

Service response: The Service proposed designation of critical habitat for those areas that met certain criteria. Since critical habitat is not a plan to manage the owl or any species, the concept of "too much land" does not directly apply. The northern spotted owl has already lost a significant portion of its habitat, such that remaining habitat that meets the criteria should be identified and provided with additional protection to offset threats to extinction. As stated in the response to the above issue on excluding private lands, the Act also requires that consideration be given to economic or other factors that may influence the decision to include areas in critical habitat. The Service made this difficult decision and excluded over 4

million acres of lands from the designation. Although these lands are not part of the critical habitat proposal, they still are important in owl conservation.

Issue 3: The Service should specifically exclude private lands by legal description. Such areas that are subsequently acquired by a Federal agency, would not become automatically designated as critical habitat. Excluding private lands generically is ambiguous, in that such lands when acquired by a Federal agency should not be thought of as designated critical habitat unless the Service follows the appropriate regulations to designate these areas.

Service response: It is mechanically impossible for the Service to specifically exclude all private lands by legal description, particularly since many of these areas are intermingled with Federal lands and are less than 40 acre parcels. To accomplish this the Service has on file in its administrative record the U.S. Geological Survey topographic quadrangle maps. These show the actual boundaries of each critical habitat unit. If land exchanges are initiated, the activity would need to be reviewed under section 7; future decisions on including these areas in critical habitat would have to be weighed at that time.

Issue 4: The Service should withdraw the State-owned lands, particularly in southwest Washington. The commenters generally indicated that there is no biological difference between the habitat on these lands and adjacent private lands, and concluded that the Service's decision to exclude private lands but retain State lands was arbitrary. The State of Washington asked why private lands in these areas were not included. Some individuals also questioned the Service's belief that the States should have more responsibility with respect to carrying out the purposes of the Endangered Species Act than private entities, referring to a lack of any legal basis for such an opinion.

Service response: Although State laws provide for wildlife protection, some State lands were retained in the August 13 revised proposal because they have particularly high value for the conservation of the owl. Most were identified in the ISC Plan as recommended HCAs since these lands provide essential "stepping stones" for maintaining nesting habitat in a well-distributed manner throughout the range of the owl. Other State lands, contiguous with Federal lands, were included because they have some of the only remaining habitat outside of Federal lands in key areas, such as the Olympic Peninsula.

However, the Service, in further reviewing this issue, decided to exclude State lands because the economic and other relevant impacts exceed the benefits of designation. Most regulatory protection for critical habitat is provided through section 7 of the Act, which has little, if any, applicability to State lands. Further, since the majority of owls and owl habitat are found on Federal lands, the Service concluded that exclusion of these lands will not result in the extinction of the owl.

Issue 5: The Service failed to justify the exclusion of the tribal lands.

Service response: The situation on tribal lands is similar to that on other non-Federal lands. The Service used the same logic applied to private and State lands in determining to exclude tribal lands in the designation.

Issue 6: The Service should have recognized the sovereignty of the Indian nations when it excluded tribal lands.

Service response: The Service expects that all landowners, regardless of their status, will comply with the Act and will contribute to the conservation of the northern spotted owl.

Issue 7: The Service should exclude the Oregon and California lands, and should return the management of these lands to the counties.

Service response: The Service does not have the authority to transfer the management of any lands managed or owned by Federal or non-Federal entities to other entities. On the other hand, the Endangered Species Act applies to all landownerships and the Service carefully reviewed the biological situation before making a decision on the areas of habitat that should be included in critical habitat.

The majority of owls and owl habitat (about 85 percent) are currently found on Federal lands. These lands are particularly important in the State of Oregon because very little owl habitat remains on non-Federal lands in that state. The Oregon and California lands, managed by the Bureau, are more crucial to owl conservation than many other lands. The areas selected for inclusion in critical habitat fully met the Service's criteria for inclusion and help form the basis for owl conservation in Oregon. As a result of the exclusion process previously discussed, the Service made the decision to reduce the amount of lands in critical habitat for some Oregon counties that were affected the most by the designation. This was consistent with the mandates of the Act.

Issue 8: The Service received two petitions requesting that the counties of Douglas and Jackson, Oregon, be exempted from the mandates of the Endangered Species Act.

Service response: The Service has considered the portion of these petitions that refer to critical habitat and, as requested in the petitions, has considered the economic costs of designating critical habitat in those areas. As a result of this process and in addition to the earlier decision to remove private lands from the proposal, the Service reduced an additional amount of acres from Forest Service and Bureau lands in these counties. That has reduced the expected economic impacts from designating critical habitat in those two counties (similar decisions were also made in other affected counties).

The Service does not have the authority to exclude anyone from compliance with Federal laws. Further, the exclusion of areas from critical habitat does not exclude these areas from consideration under other legal obligations of the Act, such as sections 7 and 9. The Recovery Team is considering the roles of the different landownerships in its deliberations and will describe these in its draft plan.

Issue 9: The Service should clearly exclude all activities that were approved prior to the designation of critical habitat.

Service response: In carrying out the requirements of the Act to consider the economic and other relevant factors, the Service made the decision to exclude from critical habitat all sold and awarded timber sales (as of the date of the August 13 proposal) and to exclude all existing projects that are either in place or that have thoroughly completed all their Federal and State permitting processes as of the publication date of this final rule. The Service made the decision to exclude these activities because it felt that the conservation benefits gained by regulating these activities did not outweigh the costs. An example of such an exclusion is sold and awarded timber sales where the costs for the Federal government to buy back these sales outweighs the benefits of designating these areas as critical habitat. However, any changes in these activities are not excluded and would require Service review. In addition, excluding these activities from critical habitat does not imply that they are no longer subject to sections 7 or 9 of the Act. They must still undergo review and be in compliance with the Act.

Issue 10: A number of commenters requested either site-specific additions to or deletions from critical habitat. A

number of suggestions for more effectively designating critical habitat in certain areas, such as specific ranger districts, were provided to the Service by persons familiar with site-specific conditions.

Service response: These cases generally involved rather major changes in critical habitat units. The Service has evaluated each of these specific requests and has included, within its administrative record, written explanations of whether or not the recommendation was accepted and recommendations for the future treatment of some of the requested major changes. In order to make such major adjustments, the Service would need to publish another revised proposal to allow for the greatest possible public input. The Service can revise critical habitat at any time in the future, by following the standard procedures used to designate critical habitat. In addition, the Service will reevaluate its designation following the completion of a recovery plan for the owl, and at that time will very likely consider some of these recommendations.

The Service intends to work with land management agencies and the Recovery Team, through section 7 consultation, to refine the management direction for critical habitat. Publication of this final rule does not eliminate flexibility in managing areas for spotted owls.

General Issues

Issue 11: The Service did not consider the comments received on the May 6, 1991, proposal. Many members of the public seemed to be frustrated and questioned the worth or value in providing comments again. Many people pointed out that 88 percent of the commenters on the May 6 proposal opposed the designation and reminded the Service that in a democracy such overwhelming opposition should be sufficient to stop an action, yet the Service has issued a second proposal. Some indicated that they did not want to be told that the Service must adhere to the provisions of the Endangered Species Act and other regulations.

Service response: The Service has considered input from the public and appreciates the effort required to write letters and present oral testimony. All of the information presented was considered in the development of both the August 13, 1991, proposal and this final rule. The Service's intent has been to publish a final rule that is as accurate and effective as possible. The Service is bound by laws and regulations and cannot violate these mandates because some members of the public object. Furthermore, individuals who submit comments on an issue very likely have rather strong feelings on that issue and sometimes submit more than one letter or testify at more than one hearing. The Service does not regard the relative proportions of various comments received as being indicative of the views of the public as a whole, nor is this a relevant factor under either the Endangered Species Act or the Administrative Procedures Act. The comments received on the August 13, 1991, proposal that were in favor of the proposed action slightly outnumbered those against.

Issue 12: The Service should not have used the ISC Plan to designate critical habitat because that plan did not use the best available scientific information. The individuals involved in the ISC Plan merely used their personal judgment when developing the plan. The ISC accepted the plan as valid because they could not disprove it as a hypothesis. Some commenters challenged specific critical habitat units and unit spacing patterns, indicating that the Service had violated the basic rules established by the ISC (e.g. critical habitat units in Douglas County).

Service response: The ISC was comprised of the most knowledgeable owl experts in the Pacific Northwest. Their plan was thoroughly peer reviewed by nationally respected scientists and is considered a scientifically credible and authoritative document that will play a major role in spotted owl conservation. The HCAs were considered to be the cornerstone of the ISC Plan and they are presently being adhered to by the Federal land management agencies. As a result, the Service accepted the HCAs because they represent the best scientific efforts available and are essential to the conservation of the species.

However, the ISC Plan contains a second important component that is an integral part of the ISC strategy, the 50–11–40 rule to govern forest management in the forest matrix outside of the HCAs. Critical habitat is not a plan and does not contain this second component. The Service's intent in not violating ISC rules on spacing was to ensure that to the extent possible critical habitat units would not be spaced further apart than the distances recommended by the ISC. Although the Service assumes that 50–11–40 or some other credible rule will be applied to these lands, reducing distances between critical habitat units would improve short-term linkage.

Issue 13: The Service's approval of Sierra Pacific's management plan suggests that critical habitat is unnecessary.

Service response: Sierra Pacific submitted a forest management plan that was intended to show how their forest practices would not result in "take" (under section 9) of spotted owls. The Service concurred that activities conducted in accordance with that plan will not result in take of owls. This does not imply that this is a plan for managing viable populations of owls. However, critical habitat is not a management plan, and a plan of this nature does not factor into the biological consideration of critical habitat. The Service did, however, take this type of activity into account when it made the decision to exclude private lands from critical habitat due to economic and other considerations.

Issue 14: The Service should consider the Industry's plan for conserving spotted owls in lieu of designating critical habitat.

Service response: The Recovery Team for the Northern Spotted Owl, designated by the Secretary of the Interior, is reviewing that plan (Wildlife Committee 1991) to determine its relevance to the recovery of the owl. The Service believes that this is a more appropriate forum for review of this type of document at this time since it focused on owl management; the plan generally focused on reserved areas which are already protected. The ideas and concepts in the document were brief and had not been peer-reviewed, and the type of information useful to consideration of critical habitat was not provided. Until the recovery planning process is complete and the Recovery Team has had a thorough opportunity to review the Industry's plan, the usefulness of that or other documents in owl conservation is inconclusive.

Issue 15: The Service should more carefully describe the primary constituent elements and should describe the elements contained in each critical habitat unit.

Service response: The Service concurs with this request and the final rule has more clearly stated the criteria and their application. Information on the elements contained in each individual critical habitat unit are included in the individual unit narratives (USFWS 1991e and contained in the Service's administrative record for this decision).

Issue 16: The Service should only designate currently occupied areas as critical habitat.

Service response: The Service focused on existing and currently occupied habitat in developing this rule. However, the Act clearly states that areas in need of special management (inside or outside of the current range of the listed

species) can be included in a designation of critical habitat. In reviewing the situation surrounding the northern spotted owl, the Service made the decision that in some areas (e.g., areas of concern) there was a need to include habitat that was not currently occupied or was not of similar quality to other habitat included. Recovery of the owl is dependent upon improvement in the quantity, quality, and/or arrangement of habitat. Thus, currently unoccupied habitat must be allowed to achieve suitability for owls.

Issue 17: Critical habitat is not legally determinable, because the agencies have not agreed upon a consistent definition of suitable habitat. The expansion of the definitions of what constitutes habitat for the owl calls the decision to list the owl into question, since habitat loss was the basis for that decision.

Service response: Forests naturally vary due to a number of factors, such as site productivity, microclimate, soil condition, rainfall, fire, and disease. They further vary as a result of forest practices. As a result, the use of the term suitable to adequately describe one set of consistent parameters throughout the species range would be impossible and incorrect. However, the term can be used generically to describe owl habitat in terms of general characteristics. Habitat that currently contains known pairs of reproducing owls can be clearly identified on existing maps. This is what the Service concentrated on in developing its proposal to designate critical habitat.

There has always been considerable confusion over what constitutes owl habitat from old growth to second growth. Those terms are probably more misleading and misused than the term suitable. Suitable generally refers to nesting and roosting habitat which is typically older forest stands or mixed age stands with remnant older trees. Regardless of the age of the forest in which owls are found, the problem of habitat loss, habitat modification and fragmentation, and rapid and continual conversion to younger stands to a condition that does not support owls has been determined by the Service, the ISC, and other groups to constitute a threat to the survival of the spotted owl.

Issue 18: Modern road building and logging methods are less environmentally damaging now that they were in past decades, and the Service fails to take this into account in describing effects of logging and roads on regional water quality, fisheries, and biodiversity. You have not considered the beneficial effects of new forestry and alternative means of harvesting timber.

Service response: Frissell (1991) notes that, although it is anticipated that newer techniques will reduce impacts, these techniques are untested. He further states that (1) the newer techniques will still be environmentally damaging, and will be applied over a larger geographic area, resulting in continued degradation of watersheds and receiving streams; and (2) the remaining old growth is often located in steeper terrain so the risk of soil movement from road construction and tree removal is greater. Although newer techniques exist, they may not be applied in a widespread or uniform manner.

Issue 19: There is still an inadequate description in the rule as to what constitutes allowable activities in critical habitat. For example, timber harvest that is consistent with owl habitat protection should be permitted. The public is entitled to a more specific description about restrictions, and exactly what constitutes adverse modification of critical habitat.

Service Response: The Service agrees with this comment and attempted to provide more specific information. However, it is difficult for the Service to identify every type of action and not prejudge the outcome of section 7 consultation. As the land managing agencies work with the Service, together they can identify courses-of-action that will benefit the owl and maintain certainty within the timber communities.

Economic Issues

Issue 20: The Service is underestimating impacts by separating impacts from the listing process and from the designation of critical habitat.

Service response: The Endangered Species Act specifies that the listing of species should occur without consideration of economic costs, whereas the Act specifies that the designation of critical habitat should consider economic and other costs. Listing a species provides protection to that species under the jeopardy standard and incidental take whereas designating critical habitat provides additional protection through the adverse modification standard. These are intended to be separate standards to be addressed through section 7 consultation. The economic analysis clearly identifies the costs and benefits of these independent and incremental actions, and is not an effort to underestimate costs. The total cost of conserving the spotted owl is greater than the cost of designating critical habitat alone, and includes the costs of prior owl protection measures under other laws and costs resulting from listing under the Act, as well as the cost of designating critical habitat.

Issue 21: The Service uses an improper baseline from which to assess economic impacts. The Service should use the 1983–1987 period as the baseline. It is inappropriate for the Service to use the "Actual or Projected Final Plans Plus ISC Plan" as the baseline for analysis. This minimizes the effects of designating critical habitat.

Service response: This issue is further addressed in the Economic Analysis Report (USDI 1991a) and summarized in the final rule. The historically high harvest rates of the 1983–1987 period were not sustainable, and this is recognized in the Final Plans of the agencies. The structure of the economic analysis is to look at the expected effects in the future both "with" and "without" critical habitat designation. In the "without" scenario, timber harvest levels would be reflected in the agencies' final plans adjusted for the ISC which is the basis used by the Service to determine the level of impact when critical habitat is designated. The Federal agencies do not intend to continue harvesting at the higher 1983–1987 rates, and to use this as a baseline would be misleading.

Issue 22: The Service improperly assumes the implementation of all or part of the ISC report as a pre-existing condition.

Service response: The ISC was established primarily in response to existing and ongoing lawsuits that began before the listing of the owl; the ISC was not chartered to respond to the Act. Subsequent to the listing of the owl, the Forest Service stated that it would follow the intent of the ISC recommendations in their management plans, and the Bureau in the Jamison strategy agreed to implement, to the extent possible, recommendations of the ISC. Although the Bureau has recently changed its approach to owl management, it has not completed its planning activities. The ISC is correctly identified as a pre-existing condition that should be identified as a separate impact from the designation of critical habitat.

Issue 23: In reporting the costs of critical habitat designation only the "incremental" costs over and above the Final Plans plus ISC are mentioned as being attributable to critical habitat designation, but in using examples of recreational benefits the report uses all of the acres. If the ISC Plan was "in effect" for determining costs then it should also have been "in effect" for

determining benefits. If the Service uses an incremental analysis to address costs, then the same increment must be used to assign benefits.

Service response: The Service agrees with this comment and has revised the final economic analysis to reflect a discussion of incremental cost and benefit analysis. Costs and benefits should both be on the same basis to provide a correct comparison.

Issue 24: The Service should show the total impacts of not harvesting critical habitat areas. That is the most likely result of designation and it will effect management plans for the next 100 years, not just through 1995. The critical habitat proposal is just another set-aside that locks up land from human use.

Service response: The final economic analysis presents a realistic scenario of the future and assumes that some short-term harvesting will occur in the critical habitat areas outside the HCAs. The designation of critical habitat is intended to be a temporary measure to provide protection to the habitat so it can recover, and anticipates a reduced rate of harvest of older forests in the short-term. The option to harvest timber in these areas is not foregone, but rather is available in the future. Conversely, the option to harvest now is essentially an irreversible commitment of resources (at least a 100-year commitment) which precludes recovery of owl habitat. Effects will continue beyond 1995; this year was used as a point in time when full effects of the action would occur it was not intended to imply that effects would stop at that time.

Issue 25: The economic studies cited by the Service in its discussion of benefits have major flaws. They rely heavily on a controversial economic methodology called the "contingent valuation method," as well as the concept of nonuse values. These methods and concepts use no market data on which to base the estimation of benefits, instead relying on responses by individuals confronted with hypothetical situations who know they will never have to pay in any event.

Service Response: Though empirical applications of the contingent valuation method continue to be controversial, there is a growing body of evidence that supports the practical usefulness of resulting value estimates. In the past decade, an extensive body of literature has developed assessing the accuracy of the contingent valuation method (CVM) of estimating individual willingness to pay for the recreational use of environmental resources. Initial results were challenged on the grounds that what people say they are willing to pay, contingent on the availability of an environmental resource, represent behavioral intentions rather than a directly observable action or historical fact. More recently, the relationship between intentions and actual behavior has been submitted to systematic empirical investigation. Despite some continuing controversies and unsettled points, CVM studies of the recreational benefits of environmental resources have performed reasonably well when compared to the available empirical evidence from travel behavior, actual cash transactions, and controlled laboratory experiments. Levels of accuracy have been reasonable and consistent with levels obtained in other areas of economics and in other disciplines. Contingent valuation can be applied with confidence to estimate use value of nonmarket consumption, and the initial studies of nonuse preservation values held by the general population also are encouraging, i.e. not significantly different from psychological measures of preferences for forest quality. CVM and psychological studies of values and preference patterns yield scientific data that are testable by replication and other methods.

Contingent valuation is particularly appropriate for comparing benefits and costs of a proposed wildlife preservation program. The reason is that the decision is made in the present based on expectations about the future. CVM is *ex ante*, i.e., before the fact, in the sense that willingness to pay (WTP) responses represent behavioral intentions rather than *ex post*, i.e., after the fact, actions, which are less relevant to benefit-cost analysis of proposed programs.

Issue 26: Jobs are being lost because of a lack of a predictable Federal timber supply.

Service response: The unpredictable nature of Federal timber sales in the Northwest is an unfortunate effect of several Federal actions, including historic overharvest and the designation of critical habitat for the owl and recent court decisions. Once the critical habitat designation is complete, a recovery plan for the spotted owl adopted, and the court actions are resolved, Federal land management agencies will be able to determine a more predictable supply of timber from Federal lands.

Issue 27: There was inadequate discussion about social impacts.

Service response: The Service has added a section in the final Economic Analysis Report that reviewed existing studies as well as comments submitted by the public. A summary section was added to the final rule.

Issue 28: The Service is attempting to shift blame from owl conservation to mechanization and log exports; the effect of mechanization is misleading and automation will not continue to be a major cause of job loss in the future.

Service response: The Service recognizes that the economic impacts due to critical habitat designation are in addition to the impacts due to other factors, including mechanization and log exports. Mechanization has and will continue to result in job losses in the industry, but this is necessary if the timber industry of the Northwest is to remain competitive with other industry sectors. In the recent past, jobs have been lost at a rate of 1.8 percent per year, but this rate is expected to decline because many of the recent innovations have now been implemented in local mills. However, industry experts believe that job losses due to mechanization will continue at about 1.2 percent per year over the next several decades. Exporting logs from local communities also exports associated secondary processing opportunities (value added). However, in a free trade economy, there is a welfare gain when exporters receive a higher premium for their logs in the export market, thereby providing higher profit levels for domestic firms.

Issue 29: Reducing log exports will do little to help loggers. In 1990, the US imported into the United States more wood products than it exported, so it is clear that we are a net importer of wood products in this country.

Service response: Reducing exports will not increase logging and hauling jobs, which amount to about 1.1 jobs per million board feet of timber. However, reducing log exports could increase the number of secondary processing jobs in the northwest, which amount to about direct 11–13 jobs per million board feet. Each billion board feet of exported timber represents about 11,000–13,000 timber industry jobs.

Issue 30: The owl will have a significant impact on small businesses.

Service response: The Service has determined that the critical habitat designation will not have a significant impact on small business in an analysis required by the Regulatory Flexibility Act. The total impact of all owl protection measures may have a significant impact on small businesses, but the incremental effect of designating critical habitat will impact only 848 direct industry jobs, and has been determined to not, by itself, be a significant impact to small businesses over the three-State area.

Issue 31: Access corridors to private lands are included in critical habitat, therefore, critical habitat will effect private landowners. Timber values on

private lands requiring access through Federal lands would be reduced if Section 7 consultations restrict access. Impacts to private lands should be addressed in the report.

Service response: The Service anticipates being able to work with other Federal agencies to minimize effects on private landowners. The Service recognizes that consultation may, in some limited cases, result in modified access to private lands, but cannot quantify the economic effects.

Issue 32: A quantitative (but non-dollar) assessment is also necessary to assure that the proposed critical habitat is cost-effective. Cost-effectiveness requires that the desired level of owl protection be achieved at the lowest possible cost in terms of other lost resource values, principally lost timber values.

Service response: Cost-effectiveness as defined by the commenter and the benefit-cost analysis required by the Endangered Species Act are two different things. The Act requires that benefits be compared to costs so long as species extinction is not the result. The designation of critical habitat is economically viable when the benefits are greater than the costs. The designation of critical habitat is not economically viable when the costs are greater than the benefits. In the economic analysis, the Service must weigh the conservation and other benefits of habitat protection against the economic and social costs of reduced timber harvest. The commenter's cost-effectiveness definition is more restrictive than the benefit-cost test; the Service has not measured the appropriateness of critical habitat designation using the commenter's definition of cost-effectiveness.

Issue 33: The exclusion process needs to explicitly take account of the value of timber foregone, which is clearly the largest cost of the designation.

Service response: The value of timber foregone is defined as the value of the economic rent of the timber and has been included in the Service's economic analysis. The economic rent is the amount of Federal revenue that comes from the sale of timber from public lands. This measure of the value of timber foregone is a major component of the total cost estimate.

Issue 34: The Service failed to quantify opportunity costs of timber set-asides.

Service response: The opportunity costs of timber set-asides is the loss of Federal revenue due to the restriction of logging on Federal land. This loss estimate is included in the economic analysis.

Issue 35: The assumption that stumpage prices are expected to rise significantly by 1995 because of the shortage of stumpage volume brought about by the listing and critical habitat designation is at variance with the Forest Service land management planning assumptions that Forest Service timber supplies will exhibit a horizontal demand curve.

Service response: The Forest Service land management planning assumption that the demand curve for timber will be horizontal has no bearing on the assumption that stumpage prices will rise significantly by 1995. The economic factors that determine consumer demand do not influence industry supply, i.e., the factors that propel upward stumpage prices. The assumptions of increased stumpage prices are based on industry and Forest Service data that support this determination.

Issue 36: The American people have the right to know the true costs of these proposals in lost taxes, lost wages, and increased costs in housing and paper products.

Service response: The effect on lost taxes and increased housing costs are not estimated in the Economic Analysis Report because they are transfer costs and not measures of economic efficiency. Many of these effects are regional in nature, and are mitigated by compensating mechanisms in the industry in other production areas. An estimate of lost wages is included in the final economic analysis.

Issue 37: The use of county-based assessments underestimates job losses and associated impacts on adjacent counties.

Service response: The focus of part of the economic analysis at the county level may have appeared to underestimate job losses, but modifications to the IMPLAN model, job response coefficients, and indirect multipliers used by the Service were intended to fully display all job losses in the Region. Expansion of the IMPLAN model to a sub-region level further provided a mechanism to fully address all job losses. However, by focusing at the county level, some jobs may have been assigned to one county that were lost in an adjacent county, but this effect is expected to be minimal, and the total job loss in the region should be estimated properly.

Issue 38: The Service used an indirect multiplier of about 1.6; this seems low, since others use multipliers of up to 2.2 to arrive at both direct and indirect jobs.

Service response: The Service's use of a lower multiplier was counterbalanced by the use of a higher estimate of direct job coefficients. The Service's economic analysis defined the size of the "direct" timber industry to be greater than the definitions used in some of the other analyses. The higher job coefficients, when combined with the lower multiplier, arrived at job impact estimates within the ranges of those reported in other studies.

National Environmental Policy Act

The 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 Act. A notice outlining the Service's reasons for this determination was published in the **Federal Register** on October 25, 1983 (48 FR 49244).

Regulatory Flexibility Act and Executive Order 12291

The Department of the Interior has determined that designation of critical habitat for this species will not constitute a major rule under Executive Order 12291 and certifies that this designation will not have a significant economic effect on a substantial number of small entities under the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*). Based on the information discussed in this rule concerning public projects and private activities within critical habitat units, it is not clear whether significant economic impacts will result from the critical habitat designation. Also, no direct costs, enforcement costs, information collection, or recordkeeping requirements are imposed on small entities by this designation. Further, the rule contains no recordkeeping requirements as defined by the Paperwork Reduction Act of 1980.

Takings Implications Assessment

The Service has analyzed the potential takings implications of designating critical habitat for the owl in a Takings Implications Assessment prepared pursuant to requirements of Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights." The Takings Implications Assessment concludes that the designation does not pose significant takings implications.

References Cited

A complete list of all references cited herein is available upon request from the Portland Regional Office (see ADDRESSES above).

Authors

The primary authors of this rule are Barry S. Mulder and Karla J. Kramer, U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement (see ADDRESSES section); Steve Spaıgle, U.S. Fish and Wildlife Service, Sacramento Field Station; Michael Tehan, U.S. Fish and Wildlife Service, Olympia Field Station; and Randy G. Tweten, U.S. Fish and Wildlife Service, Portland Field Station.

The economic summary was prepared by Mel Schamberger, U.S. Fish and Wildlife Service (see ADDRESSES section); John Charbonneau and Michael Hay, U.S. Fish and Wildlife Service, Office of Policy, Budget, and Administration, Washington, DC; and Richard Johnson, U.S. Fish and Wildlife Service, National Ecology Research Center, Fort Collins, Colorado.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, and Transportation.

Regulations Promulgation

Accordingly part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations is hereby amended as set forth below:

PART 17—[AMENDED]

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 16 U.S.C. 1531–1544; 16 U.S.C. 4201–4245; Pub. L. 99–625, 100 Stat. 3500, unless otherwise noted.

§ 17.11 [Amended]

2. § 17.11(h) is amended by revising the "Critical habitat" entry for "Owl, northern spotted", under BIRDS, to read "17.95(b)".

3. § 17.95(b) is amended by adding critical habitat for the northern spotted owl (*Strix occidentalis caurina*) in the same alphabetical order as the species occurs in § 17.11(h).

§ 17.95 Critical habitat—fish and wildlife.

* * * * *

(b) * * *

NORTHERN SPOTTED OWL (*Strix occidentalis caurina*)

For the States of California, Oregon, and Washington, critical habitat units under Federal jurisdiction are depicted on maps maintained on file at the U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement, 911 Northeast 11th Avenue, Portland, Oregon 97232–4181 (503/231–6131). Copies of these maps are available upon request at the requester's expense.

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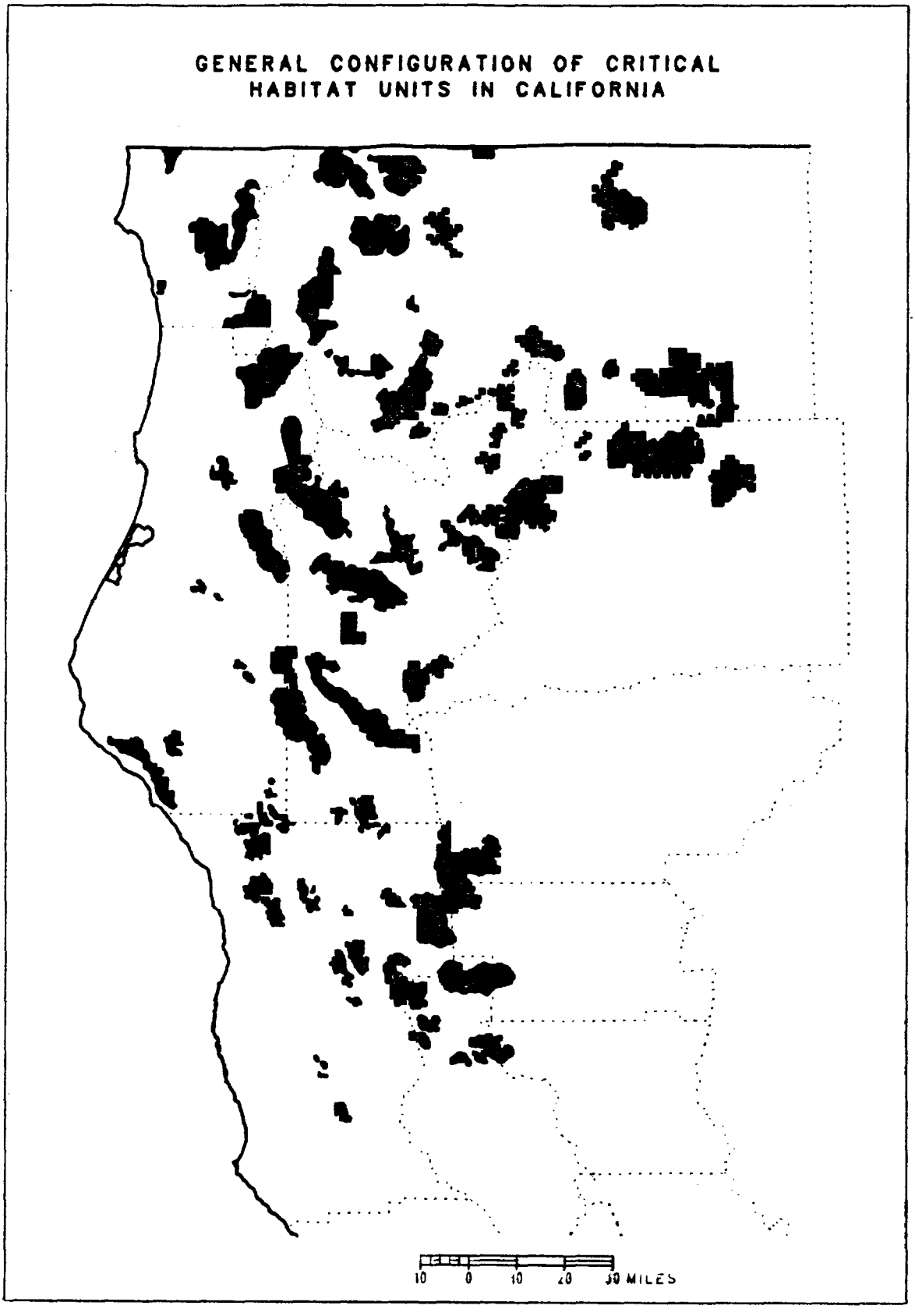
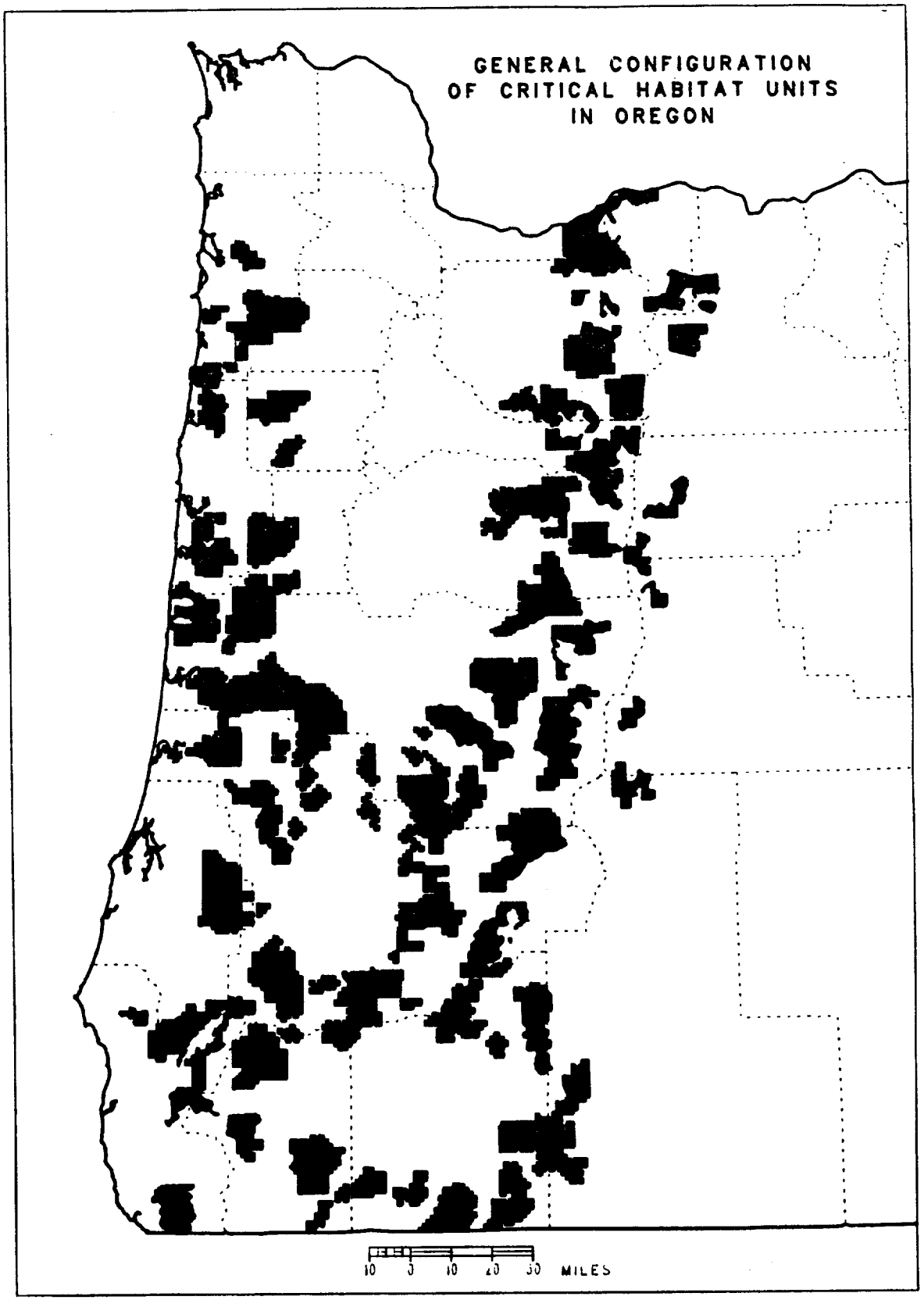
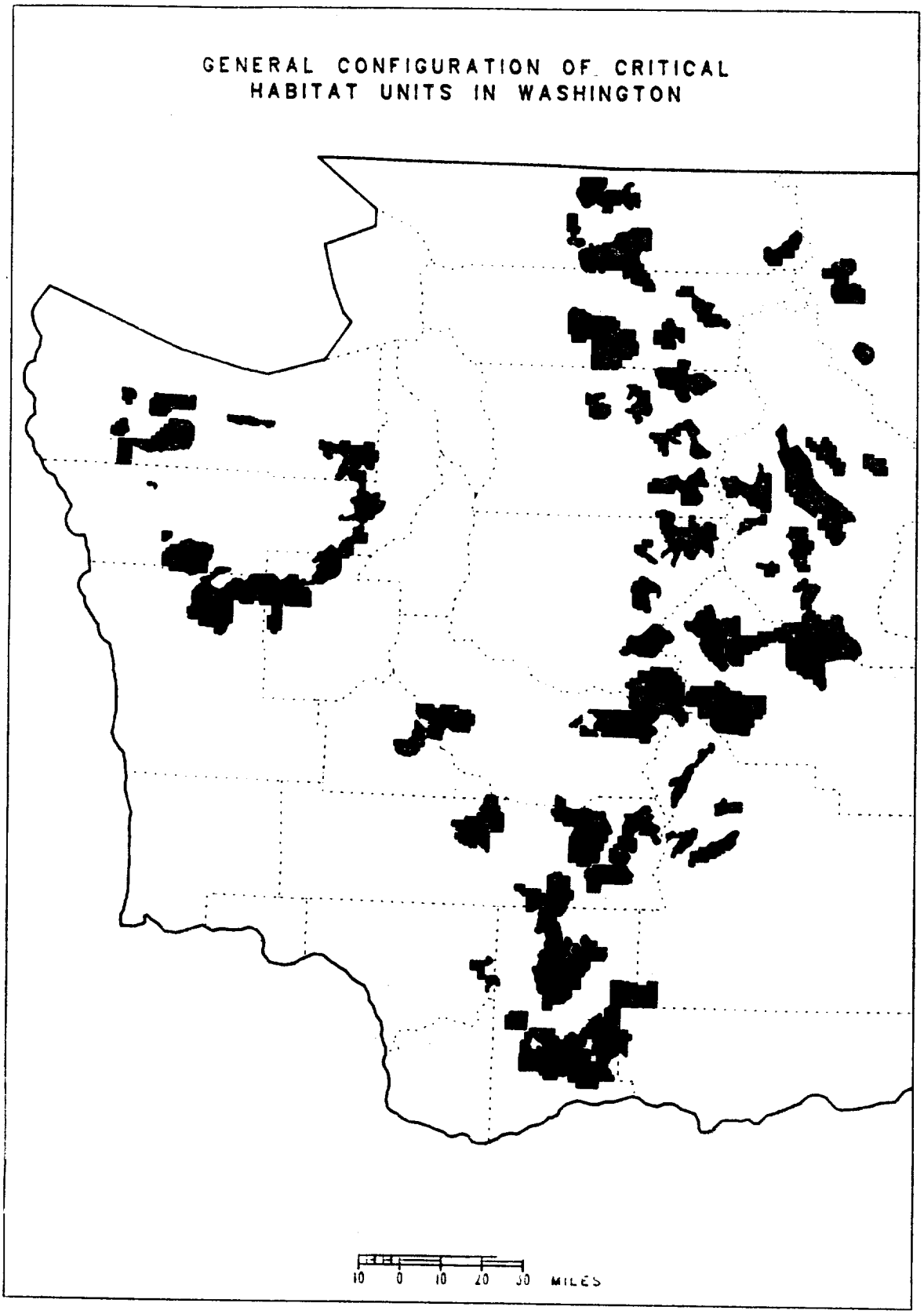
The general configuration of the California areas are illustrated on the map which follows:



The general configuration of the Oregon areas are illustrated on the map which follows:



The general configuration of the Washington areas are illustrated on the map which follows:



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Primary constituent elements: forested lands that are used or potentially used by the northern spotted owl for nesting, roosting, foraging, or dispersing.

Dated: January 8, 1992.

John F. Turner,

Director, Fish and Wildlife Service.

[FR Doc. 92-874 Filed 1-14-92; 8:45 am]

BILLING CODE 4310-55-M

may also contribute to the habitat base that supports foraging and dispersal needs. This inconsistency has affected the definitions used by the various land managing entities.

Presently, many definitions of "suitable" spotted owl habitat are used throughout the species' range. As a result, existing estimates of the amount of spotted owl habitat may be misleading. Current estimates of suitable habitat (i.e., for nesting, roosting, and foraging) do not contain estimates of the additional amount of forested acres that may meet only the dispersal needs of the owl.

Forests in the northwestern United States exhibit natural variation in terms of species composition, stand age, climatic and soil conditions, slope steepness and aspect, and other factors. Forest structure varies in several measurable ways: Canopy closure varies from closed to relatively open, as a function of tree size, stocking density, and species composition; canopy layering ranges from multi-layered stands composed of two or more tree heights to single-layered stands; average tree diameter varies with tree age, species, and soil and climatic conditions; and the amount of decadence (deformed, broken, and rotting trees, standing and down dead material, etc.) varies with factors such as stand age, and fire, wind, and forest pest influence. Factors such as rainfall, elevation, slope, and aspect influence microclimatic conditions.

Forest characteristics associated with spotted owls usually develop with increasing forest age, but their occurrence may vary by location, past forest practices, and stand type, history, and condition. Although spotted owl habitat is variable over its range, some general attributes are common to the subspecies' life-history requirements throughout its range. The attributes of nesting and roosting habitat typically include a moderate to high canopy closure (60 to 80 percent); a multi-layered, multi-species canopy with large (> 30 inches diameter at breast height (dbh)) overstory trees; a high incidence of large trees with various deformities (e.g., large cavities, broken tops, mistletoe infections, and other evidence of decadence); large snags; large accumulations of fallen trees and other woody debris on the ground; and sufficient open space below the canopy for owls to fly (Thomas *et al.* 1990).

Spotted owls use a wider array of forest types for foraging and dispersal, including more open and fragmented habitat, although less is known about the characteristics of foraging and dispersal habitat. Habitat that meets the species' needs for nesting and roosting also provides for foraging and dispersal. However, habitat that supports dispersal or foraging does not always support the other constituent elements and is not considered adequate for other purposes.

Although the term "dispersal" frequently refers to post fledgling movements of juveniles, for the purposes of this rule the Service is using the term to include all movement and to encompass important concepts of linkage and connectivity among owl subpopulations. Although habitat that allows for dispersal may currently be marginal or unsuitable for nesting, roosting, or foraging, it provides an important linkage function among blocks of nesting habitat both locally and over the owl's range that is essential to the owl's conservation. Dispersal habitat, at a minimum, consists of stands with adequate tree size and canopy closure to provide protection from avian predators and at least minimal foraging opportunities; there may be variations over the owl's range (e.g., drier sites in the east Cascades or northern California).

Foraging habitat is more difficult to describe, but may exist in a continuum between the dispersal habitat and nesting or roosting habitats described above. Foraging habitat varies across the range of the owl depending upon forest structure and prey availability. It is currently thought to consist mainly of attributes similar to those in nesting and roosting habitat for most of the owl's range, but may not always support successfully nesting pairs.

The age of a forest is not as important in determining habitat suitability for owls as are vegetational and structural elements. Northern interior forests typically require 150 to 200 years to attain the attributes of nesting and roosting habitat; however, characteristics of nesting and roosting habitat are sometimes found in younger forests, usually those with significant old-age remnant trees from earlier stands. These remnant attributes are products of fire, wind storms, or previous logging operations that removed only some of the trees. As one moves to lower elevations or south and toward the coast in the species range, these attributes tend to be attained at younger ages due to changes in site productivity, microclimate, and other factors. However, differences in growth rates exist between wet and dry-site conditions which may affect how quickly these attributes develop.

In the coastal redwoods of California, spotted owls have been observed nesting in stands that had acquired characteristics associated with owl presence in as little as 40 to 60 years (Pious 1989). They develop these habitat characteristics in a shorter time following harvest than other timber-types because of unique characteristics and conditions, such as fast-growth, good soil, high precipitation levels, a long growing season, an understory of other conifers and hardwoods, and an abundant prey base (Thomas *et al.* 1990). Although the forests in this area are younger in age than in other parts of the owl's range, structural habitat characteristics associated with owl presence are similar to those observed elsewhere.

Nearly all nest and roost sites are located in the portions of forest stands containing the oldest trees (Thomas *et al.* 1990). Owl survey data indicate that northern spotted owls are disproportionately found in association with older forests (Thomas *et al.* 1990, USDI 1990a). Although owls are occasionally found in younger forests, densities are significantly higher in older forests or forest stands having the characteristics of older forests, usually due to remnant older trees or other factors. Owls having an array of habitat types within their home ranges select for older forest (> 200 years), use mature forest (100–200 years) in proportion to its availability, and tend to avoid younger forest (< 100 years) or use it in relation to its availability (USDI 1989). Different studies over the owl's range demonstrate that owls select older forests for foraging (USDI 1990a); roost sites are also strongly associated with older forests.

Northern spotted owls have large home ranges and utilize large tracts of land containing significant acreage of older forest to meet their biological needs (USDI 1990a). As the quality and quantity of habitat declines, annual home range sizes increase. Therefore, home range sizes are not uniform across the range of the owl and vary among and within provinces. Thomas *et al.* (1990) indicated median annual pair home range sizes varied from a high of over 9,000 acres for the Olympic Peninsula to a low of about 3,000 acres for the Oregon Cascades. Individual annual pair home range sizes varied from as small as 1,000 acres in the Klamath Province to nearly 30,000 acres in the Washington Cascades (USDI 1990a).

Northern spotted owls have been observed over a wide range of elevations, but avoid high elevation, subalpine forests. The range of elevation in which spotted owls have been observed extends from 70 feet above sea

outside of critical habitat), nor does it have a direct effect on areas not designated as critical habitat. Recovery planning and critical habitat designation are different processes. Specific management recommendations for critical habitat are more appropriately addressed in recovery plans, management plans, and through section 7 consultation.

In addition to considering biological information in designating critical habitat, the Service also considers economic and other relevant impacts of designating critical habitat. The Service may exclude areas from critical habitat when the benefits of such exclusion outweigh the benefits of including the areas within critical habitat, provided that the exclusion will not result in the extinction of a species.

Critical habitat identifies specific areas essential to the conservation of a species. Areas not currently containing all of the essential features, but with the capability to do so in the future, may also be essential for the long-term recovery of the species, particularly in certain portions of its range, and may be designated as critical habitat. However, not all areas containing the features of a listed species' habitat are necessarily essential to species' survival. Areas not included in critical habitat that contain one or more of the essential elements are still important to a species' conservation and may be addressed under other facets of the Act and other conservation laws and regulations. Some areas containing the requisite features may have been excluded for economic reasons. All designated areas may also be of considerable value in maintaining ecosystem integrity and supporting other species, although that is not a consideration in designating critical habitat.

The process of designating critical habitat for the northern spotted owl consisted of three steps that are explained in this document. The first step was to determine the elements and areas essential to the owls' conservation. This step was completed in the proposal process and is summarized in the sections on Primary Constituent Elements, Criteria for Identifying Critical Habitat, and the Results of the Applying the Selection Criteria. The second step was to determine the potential costs of the proposed designation, which was completed in the proposal process and is only briefly noted here in the Economic Summary of the August 13 Proposal. The final step was to decide which areas should be excluded based upon economic and other relevant impacts, and to determine the costs associated with the final designation. This step is discussed in the Summary of the Exclusion Process, the Effects of the Designation, the Economic Impacts of the Final Designation, and Available Conservation Measures sections. A section on biodiversity is included to highlight the importance of that issue and its relationship to the northern spotted owl.

Primary Constituent Elements

In determining which areas to designate as critical habitat, the Service considers those physical and biological attributes that are essential to a species' conservation. In addition the Act stipulates that the areas containing these elements may require special management considerations or protection. Such physical and biological features, as stated in 50 CFR 424.12, include, but are not limited to, the following:

—Space for individual and population growth, and for normal behavior;
—Food, water, or other nutritional or physiological requirements;
—Cover or shelter;
—Sites for breeding, reproduction, rearing of offspring; and
—Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The Service is required to base critical habitat designations upon the best scientific and commercial data available (50 CFR 424.12). In designating critical habitat for the northern spotted owl, the Service has reviewed its overall approach to the conservation of the spotted owl undertaken since the proposed listing of the owl in 1989. This process has resulted in the most thorough study of owl habitat currently available.

The Service has also reviewed all available information that pertains to the habitat requirements of this subspecies, including material received during the public comment period from State and Federal agencies and other entities. The Service has met and discussed various aspects of critical habitat for the owl and related issues with representatives of the Interagency Scientific Committee (ISC), the Northern Spotted Owl Recovery Team (Recovery Team), the Forest Service's Environmental Impact Statement (EIS) planning team, the Scientific Panel on Late-Successional Forest Ecosystems (Scientific Panel), and State and Federal agencies. The purpose was to gather and discuss information useful in the designation. The Service had access to and shared information with these efforts. The Service's cumulative administrative records for the northern spotted owl contain more specific and definitive scientific information than the records for most other listed species.

For a thorough discussion of the ecology and life history of this subspecies, see the ISC's A Conservation Strategy for the Northern Spotted Owl (hereafter referred to as the ISC Plan) (Thomas *et al.* 1990), the Service's three status reviews (USDI 1987, 1989, 1990), and the June 26, 1990, final rule listing the northern spotted owl as a threatened species (55 FR 26114). These documents incorporate the majority of current biological information on the subspecies used to develop this rule. The Service also reviewed biological data from owl studies made available since the summer of 1990 (e.g., Buchanan 1991, Irwin *et al.* 1991, Lehmkuhl 1991, Snetsinger *et al.* 1991, Zabel et al. 1991).

There were very few new references that provided additional information on characteristics of owl habitat. None of the new biological data contradicted previous studies on the ecology of the subspecies summarized in the above-referenced documents. The following information summarizes the key elements of the spotted owl's habitat that are pertinent to the designation of critical habitat.

Habitat Characteristics

The Service has determined that the physical and biological habitat features, referred to as the primary constituent elements, that support nesting, roosting, foraging, and dispersal are essential to the conservation of the northern spotted owl. These elements were determined from studies on owl habitat preferences, including habitat structure and use and prey preferences, throughout the range of the owl.

Spotted owl habitat consists of four components: (1) Nesting, (2) roosting, (3) foraging, and (4) dispersal. Currently, the land managing agencies characterize spotted owl habitat under the term "suitable." However, suitable is a term that generally refers only to the nesting, roosting, and occasionally the foraging portion of the habitat used by northern spotted owls, and has not historically been used to characterize all four types of spotted owl habitat.

Therefore, under that definition most areas where spotted owls are found contain both "suitable" and "unsuitable" habitat. In addition to the "suitable" habitat that supports all facets of the owl's life history, habitat that is currently labeled as "unsuitable"