DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

RIN 1018–AB 56

Endangered and Threatened Wildlife and Plants; Final Rule To List the Mexican Spotted Owl as a Threatened Species

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: The U.S. Fish and Wildlife Service (Service) determines the Mexican spotted owl (*Strix occidentalis lucida*) to be a threatened species under the authority of the Endangered Species Act of 1973, as amended (Act). This medium-sized bird is found from parts of central Colorado and Utah south through Arizona, New Mexico, and western Texas, then south through northwestern Mexico to the State of Michoacan. It commonly inhabits mountains and canyons containing dense, multi-storied forests with closed canopies. The Mexican spotted owl is threatened by destruction and modification of habitat caused by timber harvest and fires, increased predation associated with habitat fragmentation, and lack of adequate protective regulations. This rule implements the protection and recovery provisions afforded by the Act for this subspecies. Designation of critical habitat is prudent, but is not determinable at this time.

EFFECTIVE DATE: April 15, 1993.

ADDRESSES: The complete file for this rule is available for inspection, by appointment, during normal business hours at the U.S. Fish and Wildlife Service, Ecological Services Field Office, 3530 Pan American Highway NE., suite D, Albuquerque, New Mexico 87107.

FOR FURTHER INFORMATION CONTACT: Field Supervisor at the above address (505/883–7877).

SUPPLEMENTARY INFORMATION:

Background

The Mexican spotted owl is one of three spotted owl subspecies recognized by the American Ornithologists' Union (AOU) (1975:285; 1983:xiii). It was described from a specimen collected at Mount Tancitaro, Michoacan, Mexico, and named *Syrnium occidentale lucidum* (Nelson 1903). The spotted owl was later assigned to the genus *Strix* (Ridgway 1914). Specific and subspecific names were changed to conform to taxonomic standards and became *Strix occidentalis lucida*. Monson and Phillips (1981) regard spotted owls in Arizona as *Strix occidentalis hauchucae*, noting they are paler than *S. o. lucida* from Mexico; however, this taxonomic treatment is not followed by the AOU (1983).

The Mexican spotted owl (*S. o. lucida*) is distinguished from the California (*S. o. occidentalis*) and northern (*S. o. caurina*) subspecies chiefly by geographic distribution and plumage. Generally, the background coloration of the Mexican spotted owl is a darker brown than the California and northern subspecies. The plumage spots are larger, more numerous and whiter in *S. o. lucida*, giving it a lighter appearance overall.

Using starch-gel electrophoresis to examine genetic variability among the three spotted owl subspecies, Barrowclough and Gutierrez (1990) found *S. o. lucida* to be distinguishable from the two other subspecies by a significant difference in allelic frequency at one locus. They concluded that this genetic variation, which suggests prolonged geographic isolation of the Mexican subspecies, indicates that the Mexican spotted owl may represent a species distinct from the California and northern spotted owls.

The Mexican spotted owl has the largest geographic range of the three spotted owl subspecies. Its range extends from the southern Rocky Mountains in Colorado and the Colorado Plateau in southern Utah, southward through Arizona and New Mexico and, discontinuously, through the Sierra Madre Occidental and Oriental to the mountains at the southern end of the Mexican Plateau. There are no estimates of the owl's historic population size. Its historic range and present distribution are thought to be similar. Unless otherwise noted, the terms spotted owl, owl, owls and owlet in this document refer to the Mexican spotted owl.

Utah—The earliest spotted owl record in Utah was from Zion National Park (ZNP) in June 1928 (Hayward *et al.* 1976). The most northerly owl occurrence in the Southwest was recorded September 6, 1958, in the Book Cliffs of northeastern Utah (Behle 1981), where there were two additional unconfirmed reports in 1992 (S. Linner, Service, pers. comm., 1992). The most significant population of spotted owls in Utah occurs in ZNP. Surveys conducted between 1987 and 1990 recorded 6 pairs and 3 single birds (Gutierrez and Rinkevich 1991).

Spotted owls appear to be largely absent from higher elevations in Utah. Records include a 1958 sighting in an aspen grove (Behle 1981), a 1990 calling response at 10,000 feet elevation on the Manti-LaSal National Forest (U.S. Forest Service (Forest Service), *in litt.*, 1990), and a radio-tagged juvenile that moved from its natal territory in ZNP to mixed conifer in the Dixie National Forest 12–15 miles to the northeast (S. Linner, pers. comm., 1992).

Current spotted owl records (*i.e.*, those recorded since 1988) for Utah total 26 pairs and 19 single birds (S. Linner, *in litt.*, 1992).

Colorado—Twenty historic records of spotted owls exist for Colorado (Reynolds 1989); 13 have been accepted as valid by the Colorado Rare Birds Committee. These records were from the San Juan Mountains in southwestern Colorado and from the Front Range as far north as the vicinity of Denver.

Current spotted owl records for Colorado total 2 pairs and 10 single birds.

Arizona—Few early spotted owl records exist for Arizona. The earliest record is of a pair nesting in a cottonwood tree northwest of Tucson in 1872. A pair was found in the foothills of the Huachuca Mountains in 1890 (Bendire 1892).

The historic and current distribution of spotted owls in Arizona coincide, except for the current absence of owls from lower elevation riparian forests. Bendire (1892) found a pair of spotted owls nesting in cottonwoods northwest of Tucson in 1872, and Willit found them in lowland riparian areas in the vicinity of Roosevelt Lake (Salt River) in the 1910s (Phillips *et al.* 1964). These records suggest spotted owls may have formerly occurred in low elevation riparian habitats.

Spotted owls are known from the Colorado Plateau in northern Arizona, the basin and range mountains of the southeastern part of the state, and the rugged transition zone between these provinces in central and east central Arizona. The largest concentration of spotted owls in Arizona occurs in the central and east central forests along the Mogollon Rim, in the White Mountains, and on the volcanic peaks near Flagstaff. This region takes in all or part of five national forests and two Indian reservations. The number of owls reported by various agencies at the end of 1990 from the Mogollon Rim, the White Mountains and the volcanic peaks near Flagstaff totaled 124 pairs and 77 single birds.

Current spotted owl records for Arizona total 153 pairs and 108 single birds.

New Mexico—There are numerous early spotted owl records for New

Mexico. Prior to 1928, spotted owls were known from most of the major New Mexico mountain ranges including the Sangre de Cristo, Jemez, Manzano, Sacramento, Mogollon, Tularosa, San Francisco, San Mateo, and Black Range. Many records from southwest New Mexico were the result of the work of J.S. Ligon, who collected throughout New Mexico from about 1910 through 1930. Ligon observed spotted owls over an extensive range in New Mexico and Arizona, but found them most frequently in south central and southwest New Mexico and at similar latitudes in Arizona (Ligon 1926). Recent historic records documented spotted owls from most other mountain ranges in New Mexico (Ligon 1961, Hubbard 1978).

Current spotted owl records for New Mexico total 129 pairs and 85 single birds.

Texas—All Texas spotted owl records are from the Guadalupe Mountains near the New Mexico border. An owl was first reported in 1901 (Bailey 1928). A pair of owls was observed in the Guadalupe Mountains in 1988 (National Park Service (NPS), *in litt.*, 1990).

Current spotted owl records for Texas total 1 pair of birds.

Mexico—Information on spotted owl occurrence in Mexico is somewhat limited. Nevertheless, specimen and sight records obtained over the past 120 years provide a fair understanding of the owl's general distribution and at least an indirect assessment of relative abundance.

A survey of major museum collections found spotted owl specimens from Mexico collected from about 1870 through 1961, which represented 14 locations in 7 states, as follows: Sonora, 4 specimens from 4 sites; Chihuahua, 13 from 5 sites; Jalisco, 2 from 1 site; Michoacan, 1 from 1 site; Guanajuato, 1 from 1 site; San Luis Potosi, 2 from 1 site; and Nuevo Leon, 1 from 1 site. Sight records exist for an additional 4 localities in Sonora, 3 localities in Chihuahua, and 1 location each from Durango and Coahuila. No specimens were collected in the latter 2 states. A total of 23 owl locations in Mexico were known in 1991 (Service 1991a). The great majority of specimens and sight records were concentrated near the U.S. border in northeastern Sonora and northwestern Chihuahua, with large gaps in the known distribution and very few records south and east of there. Field notes from several trips to various mountain ranges in Mexico during the period 1952–1954 and 1983 (J. Marshall, Smithsonian Institution, *in litt.*, 1992) included observations of owls in 7 mountain ranges in Sonora, one mountain range in Chihuahua, and at one site each in Jalisco, Nuevo Leon, and Coahuila. The New Mexico Department of Game and Fish (NMDGF) is currently funding an owl study in the San Juanito-Creel area of west-central Chihuahua. One pair and four single birds have been found so far in that study. Although accurate numbers of owls in Mexico are not known, the available evidence suggests the species has always been uncommon in that country.

Current spotted owl records for Mexico total 1 pair and 4 additional single birds located in the NMDGF Study (R. Valdez, New Mexico State University, pers. comm., 1992), and 1 additional pair (J.A. Olivo-Martinez, Secretaria de Agricultura Y Recursos Hidraulicos, Subdelegacion Forestal, *in litt.*, 1990).

From 1988 to 1990, spotted owl records for the southwestern United States and Mexico totaled 294 pairs and 214 singles (802 birds). During 1991, 120 additional management territories were established on national forests in New Mexico and Arizona (Forest Service, *in litt.*, 1992).

An estimate of the total spotted owl population in the southwestern United States was derived primarily from data supplied by the Forest Service (Fletcher 1990) and data available in other Forest Service documents. Data considered in the calculations included total estimated timberland within national forests in Arizona and New Mexico, total estimated timberland outside national forests in Arizona and New Mexico, estimated suitable spotted owl habitat on national forests in Arizona and New Mexico, spotted owl sightings on national forests in Arizona and New Mexico, acres searched for spotted owls on national forests in Arizona and New Mexico, site pair occupancy rates reported from formal monitoring on three national forests in Arizona and New Mexico, and records of owl occurrences in Utah and Colorado. These data allowed the Service to estimate a 1990 population of Mexican spotted owls in the southwestern United States of 806 pairs and 548 singles. The total estimated population was 2,160 owls (Service 1991a). Data supplied in response to the proposed rule were too incomplete to produce a revised estimate of the total Mexican spotted owl population in the southwestern United States. Data are insufficient to make an estimate of the total Mexican spotted owl population in Mexico.

The Mexican spotted owl occupies a variety of vegetative habitats but these usually contain certain common characteristics (Ganey *et al.* 1988, Ganey and Balda 1989b, Fletcher 1990). These characteristics include high canopy closure, high stand density, and a multilayered canopy resulting from an uneven-aged stand. Other characteristics include downed logs, snags, and mistletoe infection that are indicative of an old grove and absence of active management. Much of the owl habitat is characterized by steep slopes and canyons with rocky cliffs.

The vegetative communities occupied by the Mexican spotted owl consist primarily of warm-temperate and cold-temperate forests, and, to a lesser extent, woodlands and riparian deciduous forest. The mixed-conifer community appears to be most frequently used.

Mixed-conifer forests contain several species of overstory trees. The most common are white fir (*Abies concolor*), Douglas fir (*Pseudotsuga menziesii*), and ponderosa pine (*Pinus ponderosa*). Less common species are southwestern white pine (*P. strobiformis*), limber pine (*P. Flexilis*), aspen (*Populus tremuloides*), and corkbark fir (*Abies lasiocarpa* var. *arizonica*).

The understory of mixed-conifer provides important roosting sites for Mexican spotted owls. The understory usually contains the same conifer species found in the overstory plus Gambel's oak (*Quercus gambelii*), maples (*Acer grandidentatum* and *A. glabrum*), and New Mexico locust (*Robinia neomexicana*). Montane riparian canyon bottoms used by owls in the mixed-conifer zone may contain box elder (*Acer negundo*), narrowleaf cottonwood (*Populus angustifolia*), maples (*Acer* spp.), and alders (*Alnus* spp.).

The vegetative communities used by the owl vary across its range. In southeastern Arizona, habitat use is approximately equally split between mixed-conifer and Madrean Evergreen Forest and Woodland (Ganey and Balda 1989b), which occurs below the mixed-conifer zone. There are two series of Madrean Evergreen Woodland: the upper oak-pine occurs at 5,500 to 7,200 feet, and the lower evergreen oak (encinal) occurs at 5,000 to 6,500 feet. Within these vegetative zones, and particularly at lower elevations, Mexican spotted owls are usually found in steep, forested canyons with rocky cliffs.

At the northern edge of their range in northeastern Arizona, southwestern Colorado, and Utah, Mexican spotted owls may occur year-round at 4,400 to 6,800 feet within the pinon-juniper zone (*Pinus edulis* and *Juniperus osteosperma*) below mixed-conifer forests. These habitats often include narrow, shady, cool canyons in

sandstone slickrock (Gutierrez and Rinkevich 1990; NPS, *in litt.*, 1990). Although no studies have been completed, most of the owl's activities during the breeding season are believed to occur within the canyons. Owls roost in riparian vegetation of canyon bottoms, on ledges, or cavities in the slickrock canyon walls (D.W. Willey, NPS, *in litt.*, 1990, Gutierrez and Rinkevich, 1991). Results of the first seasons of an ongoing telemetry study in canyon habitats in southern Utah and Colorado showed that during fall and winter 46 percent of owl locations occurred on mesa-tops, benches and warm slopes above the canyons. Movement out of the canyons indicates a shift during winter from summer-use areas inside the canyons and on cool slopes, to warmer areas (Willey 1992).

The habitat characteristics of high canopy closure, high stand density, a multi-layered canopy, uneven-aged stands, numerous snags, and downed woody matter are best expressed in old-growth mixed-conifer forests (usually more than 200 years old). These characteristics may also develop in younger stands that are unmanaged or minimally managed, especially when the stands contain remnant large trees or patches of large trees from earlier stands. Ganey and Balda (1988) found an average of 995 acres of old-growth forest within the 2,092-acre average home range for three pairs of radio-monitored owls in northern Arizona. Fletcher (1990) reported an average of 154 acres of old-growth forest within the management territories (MTs) of 359 spotted owls or owl pairs in Arizona and New Mexico. Management territories averaged 2,055 acres and were established around owl roost or nest sites based on Forest Service biologists' best judgment of suitable habitat.

Habitats suitable for owl nesting appear to be more restricted than those required for foraging or roosting. Areas with high canopy closure and at least a few old-growth trees are usually selected for nesting. Fletcher (1990) analyzed the characteristics of 22 nest sites in Arizona and New Mexico. Nesting occurred most frequently in the mixed-conifer community type (16) followed by the pine-oak community type (3). The remaining three nest sites occurred in riparian (2) and white fir (1) communities. The mixed-conifer and pine-oak community types were used significantly more than expected based on availability. No nests were found in the ponderosa pine community type in this study although it makes up 40 percent of Forest Service estimated suitable habitat in Arizona and New Mexico. Witches'-broom and tree stick platforms were the most frequently used nesting substrates (12); tree cavities, mostly in Gambel's oak, were also used frequently (8), and two nests were on cliff ledges. Tree species used were Douglas fir (9), Gambel's oak (6), white fir (3), and ponderosa pine (1). Except for the one ponderosa pine, the trees were of moderate to large diameter and height for their species. Most trees were on moderate to steep slopes at elevations ranging from 6,000 to 8,000 feet. Most nest trees occurred on northern or eastern facing slopes indicating a preference for the cooler portion of the habitat.

Limited information is available on the reproductive biology of the Mexican spotted owl. Owls most commonly lay eggs in April (Ligon 1926, Johnson and Johnson 1985, Skaggs 1988), but eggs have been found as early as March 2 (Skaggs 1988). Clutch size varies from 1 to 3 eggs (rarely 4) with most broods containing 1 or 2 owlets (Bendire 1892, Ganey and Balda 1988). However, broods of 3 occur occasionally in southern New Mexico where Skaggs (1988) reported 2 of 13 broods contained 3 owlets.

The incubation period is approximately 30 days and most eggs hatch by the end of May. Incubation is carried out solely by the female. Males provide food for the female and young until the owlets are about 2 weeks old. The female then assists in capturing food for the young (Johnson and Johnson 1985).

The female roosts at the nest until 3 to 6 days before the young fledge. Most owlets fledge in June, 34–36 days after hatching (Ganey and Balda 1988). Owlets are unable to fly when they first leave the nest. Owlets become increasingly proficient at flight throughout the summer and are "semi-independent" by late August or early September although juvenile begging calls have been heard as late as September 30 (Ganey and Balda 1988). Young are fully independent by early October.

A wide range of reproductive rates has been observed between years. Reproductive success on the Coconino, Lincoln, and Santa Fe National Forests was determined by formal monitoring in 1989 and 1990 (Fletcher 1990), and during 1991 on the Gila and Coconino National Forests (Olson *et al.* 1991). In 1989, 39 monitored pairs had an average fecundity (female offspring per pair) of 0.67. In 1990, 18 monitored pairs had an average fecundity of 0.06 female young per pair. In 1991, on the Coconino National Forest, the mean fecundity of 18 paired females was 0.75, and on the Gila National Forest, mean fecundity of 19 paired females was 0.74. The low reproductive rate in 1990 was likely attributable to drought conditions affecting prey availability. Conversely, 1991 was an abnormally wet year which may have resulted in exceptionally favorable conditions for the owls. These disparate data identify the magnitude of variation in productivity through time. Ganey and Balda (1988), in a non-systematic study of nesting success in Arizona from 1984 through 1987 found a reproductive rate of 0.32 female young per pair. Skaggs and Raitt (1988) found a reproductive rate of 0.20 female young per pair during one nesting season on the Lincoln National Forest. No data are available on dispersal and age specific survival of the Mexican spotted owl. During 1991, 3 of 18 paired females on the Coconino National Forest, and 3 of 19 on the Gila National Forest were subadults (Olson *et al.* 1991). No other demographic data are available for the Mexican spotted owl.

The initial information on Mexican spotted owl home range characteristics, size, and use resulted from a telemetry study conducted in northern Arizona on 8 radio-tagged spotted owls (Ganey and Balda 1989a). Home range size for single owls varied from 702 to 2,386 acres, with an average size of 1,601 acres. The combined home ranges occupied by pairs averaged 2,092 acres. An average of 66 percent of a pair's home range was used by both owls. The areas of overlap were the nest area, the primary roost, and the foraging areas. Within the home range, owls appear to have core areas that are consistently used. Core areas of individuals (*i.e.*, where 60 percent of radio responses occurred) averaged 336 acres, and core areas for pairs averaged 398 acres. High use areas tended to correspond to steep slopes (Ganey and Balda 1988). Although seasonal movements varied between owls, most remained within their summer home ranges throughout the year. On the Lincoln National Forest, the mean home range size of 4 pairs was 2,909 acres during winter and spring 1990–1991 (Kroel and Zwank 1991). In Utah, Willey (1992) telemetered 5 male owls from ZNP, Canyonlands National Park, and Capitol Reef National Monument. The mean home range size for the 3 owls from ZNP was 598 acres compared with 1,544 for the other 2 owls.

The diet of the Mexican spotted owl includes a variety of mammals, birds, reptiles, and insects with mammals making up the bulk of the diet throughout the owl's range. Woodrats (*Neotoma spp.*) are the most important prey, especially in rock canyon country (Johnson and Johnson 1985, Ganey and

Balda 1988, Gutierrez and Rinkevich 1991, Ganey 1992).

Ganey and Balda (1988) observed that Mexican spotted owls hunted mainly by moving from tree to tree, spending from a few seconds to several hours watching and listening for prey. Because spotted owls launch their attack at relatively short distances from their prey, a multistoried forest with many potential perches is advantageous to owls seeking food.

Spotted owls have plumage similar to boreal-zone owls, apparently as an adaptation for periods of winter temperatures. They are inefficient at dissipating body heat. Apparently to compensate for this inefficiency, they roost and nest in areas of mature forest with a dense multilayered canopy, often on a north slope, near water, or in a canyon that receives cold air drainage. Such sites are 1 to 6 degrees Celsius cooler than other nearby habitat (Barrows and Barrows 1978, Barrows 1981).

Hawks and great horned owls (*Bubo virginianus*) prey on Mexican spotted owls. Great horned owls were the suspected predators of 3 radio-tagged Mexican spotted owls (Ganey and Balda 1988, Skaggs 1990). There is some habitat overlap between the 2 species, but great horned owls occur most often in areas of low relief in selectively logged forest or along meadow edges, whereas spotted owls occur mainly on steep slopes containing dense forest. Johnson and Johnson (1985, 1990) and Phillips *et al.* (1964) reported circumstantial evidence indicating that Mexican spotted owls abandon habitat invaded by great horned owls.

Young *Strix* owls suffer from avian predation (Southern 1970, Gutierrez *et al.* 1985). Young northern spotted owls are especially vulnerable during development, following fledging, and during early dispersal (Forsman *et al.* 1984, Gutierrez *et al.* 1985, Miller and Meslow 1985). Skaggs (1988) observed a red-tailed hawk (*Buteo jamaicensis*) almost succeed in capturing a Mexican spotted owl. A red-tailed hawk was the suspected predator of a Mexican spotted owl in a radio-monitoring study (Skaggs 1990).

Federal, State, Indian, and private lands contain habitat for the Mexican spotted owl. The Forest Service, Bureau of Indian Affairs (BIA), NPS, and Bureau of Land Management (BLM) are the Federal land managing agencies. Efforts to estimate suitable habitat and survey for owls have varied between agencies with the most intensive work being done by the Forest Service.

In 1990, the Forest Service estimated that it managed 4,698,807 acres of suitable owl habitat (Fletcher 1990; Forest Service, Pike and San Isabel National Forest, *in litt.*, 1990; Forest Service, Intermountain Region, *in litt.*, 1990) on 18 national forests. Along with presently suitable habitat, the Forest Service estimated another 1,040,000 acres of Arizona and New Mexico national forest lands were capable of becoming suitable in the next 10 to 100 years (Fletcher 1990). These lands were suitable in the past but became unsuitable due to timber harvest or natural causes. Timber harvest accounted for the loss of 816,000 acres and natural causes accounted for the loss of 221,000 acres. The Forest Service estimated 79 percent of these lands will require 50+ years to return to suitable owl habitat.

The Forest Service began Mexican spotted owl inventories in New Mexico and Arizona in 1988. Inventories in Colorado and Utah began in 1990. As of 1990, just over 2,000,000 acres had been inventoried (Fletcher 1990; Forest Service, Pike and San Isabel National Forest, *in litt.*, 1990; Forest Service, Intermountain Region, *in litt.*, 1990). Approximately 70 percent of the surveys were on lands available for timber harvest.

Forest Service inventories through 1990 resulted in the establishment of 517 owl MTs in Arizona and New Mexico with each MT representing the occurrence of either a single owl or pair of owls. Approximately half the MTs were established from confirmed nest or roost localities; the other half were established only from night calling responses. On lands unavailable for timber harvest, only 30 percent of the MTs were established from confirmed nest or roost localities. There were 318 MTs (61 percent) on lands available for timber harvest and 199 MTs (39 percent) on lands not available for timber harvest. Among the MTs on lands not available for timber harvest, 102 were on lands unsuitable for timber harvest, 39 were on lands withdrawn from timber harvest, and 58 were on lands such as wilderness areas (Fletcher 1990). The Forest Service reported 620 MTs for Arizona and New Mexico national forests as of 1992, but provided no new information about the area inventoried or distribution of owl MTs by types of land use.

There are potentially up to 878,000 acres of spotted owl habitat on Indian reservations. However, the actual amount of habitat is likely much lower because estimates supplied by the BIA Forestry Divison were developed mostly from timber-type maps containing little information about understory conditions or slope. Also, habitat estimates for the Mescalero Apache, Jicarilla Apache, Southern Ute, and Zuni reservations represent the total commercial forest land for those reservations; no potential habitat estimates were supplied.

Formal owl surveys were conducted on 71,200 acres on four Indian reservations in 1990 and 15 owls were located. In 1990 a total of 5 pairs and 22 single owls were known to occur on Indian reservations. (BIA, Albuquerque Area Office, *in litt.*, 1990; BIA, Navajo Area Office, *in litt.*, 1990; BIA, Phoenix Area Office, *in litt.*, 1990).

A total of 734,000 acres of potential owl habitat occurs on BLM lands in Colorado, Utah, Arizona, and New Mexico (BLM, Colorado State Office, *in litt.*, 1990; BLM, Utah State Office, *in litt.*, 1990; BLM, New Mexico State Office, *in litt.*, 1990; Ted Cordery, Arizona BLM, pers. comm., 1992).

In 1992, a total of 1 pair and 5 single owls were known from BLM lands in Colorado, Utah, Arizona, and New Mexico. There were 6 pairs and 4 singles in Utah, 1 pair and 3 singles in Colorado, and no owls in New Mexico or Arizona.

Most owl habitat on national parks and monuments consists of steep shaded canyons in the northern part of the owl's range. It is difficult to estimate acreage for this type of habitat. The NPS estimated that 23 parks and monuments in the Southwest contained between 238,000 and 438,000 acres of owl habitat (NPS, Southwest Region, *in litt.*, 1990; NPS, Rocky Mountain Region, *in litt.*, 1990; J. Ray, NPS, Grand Canyon National Park, pers. comm., 1990).

In 1990, a total of 8 pairs and 16 single owls were known from NPS lands (NPS, Southwest Region, *in litt.*, 1990; NPS, Rocky Mountain Region, *in litt.*, 1990; J. Ray, NPS, pers. comm., 1990).

Between 177,400 and 202,400 acres of New Mexico State lands contain forests and canyons that could be suitable owl habitat. However, no owl surveys had been conducted as of 1992 (Greg Fitch, New Mexico Forestry Division, pers. comm., 1992). In Arizona, no suitable owl habitat is known to occur on State lands controlled by the Arizona Game and Fish Department (AGFD). No present or historic owl localities are known from State lands in New Mexico or Arizona. No information was obtained on suitable owl habitat on State lands in Utah and Colorado. However, 1 pair was recorded on Utah state lands during 1992.

Ganey and Balda (1988) surveyed throughout Arizona for spotted owls from 1984 through 1987. They reported 3 of 146 owl sites were on private lands, but provided no locations or habitat

information. Skaggs (1988) reported that 7 owl records from southern New Mexico during the period 1900 to 1987 were from private lands. These records from Hidalgo County in southwest New Mexico were from the Animas Mountains, which are on private land. Spotted owls are reported currently present in the Animas Mountains (P. Melhop, Nature Conservancy, pers. comm., 1992).

Suitable spotted owl habitat reported by Federal and State agencies in 1990 totalled about 6,815,557 acres. The Forest Service reported 4,698,807 acres (69 percent), BIA 878,000 acres (13 percent), BLM 711,000 acres (10 percent), NPS between 238,100 and 437,600 acres (about 5 percent), and the State of New Mexico between 177,400 and 202,400 acres (about 3 percent). An estimate of 5,000 acres of suitable owl habitat on private lands is much less than 1 percent of the total.

The proportion of total habitat for each agency is probably fairly accurate. However, the total acreage of suitable habitat is likely overestimated. The error is a consequence of inadequate information on land status and disagreement about the types of communities that provide suitable habitat. For instance, the Forest Service included many acres of the ponderosa pine community type in its estimate of suitable habitat. These acres were excluded from the Service estimate. Several agencies expressed uncertainty about the accuracy of their habitat estimates.

From the data provided by various agencies, it is impossible to develop an accurate estimate of total suitable owl habitat. The Service's best estimate excludes most of the ponderosa pine community type for New Mexico and Arizona national forests because this community type was found to be used insignificantly by nesting and roosting owls. However, it may constitute important wintering or foraging habitat. The Forest Service does consider ponderosa pine forest to be suitable habitat when it has the correct structural attributes (K.W. Fletcher, Forest Service, pers. comm., 1992), but the forest stand maps and inventory databases do not separate suitable from unsuitable stands in ponderosa pine. Forest Service owl inventory data place approximately 50 management territories in ponderosa pine habitat which would add 100,000 acres to the suitable habitat base in Arizona and New Mexico (Forest Service, *in litt.*, 1992). Although the ponderosa pine community type might also be excluded for Colorado national forests and Indian reservations, this was not done because figures from those sources did not report habitat by community type. The Service estimate of total suitable Mexican spotted owl habitat in the United States is 5,489,734 to 5,714,734 acres.

Ninety-one percent of Mexican spotted owls known at the end of 1990 occurred on national forests, 4 percent occurred on Indian reservations, 4 percent occurred on national parks, and 1 percent occurred on BLM lands. Because the Service has received only incomplete 1991 and 1992 survey data, it is not possible to identify exact percentages since 1990.

Management direction for lands with owl habitat varies by agency. A management emphasis for timber production is in force on much of Forest Service and BIA managed land. Much BLM owl habitat is managed primarily for wildlife and recreation but is still available for natural resource extraction, including oil, gas, minerals, and timber. NPS lands are managed for recreation and preservation of natural values. State lands in blocks large enough to support owl populations are usually game management areas. Management of private lands providing owl habitat is unknown.

Forest Service management plans call for suitable timber land in the Southwest to be managed as even-aged stands using a system called shelterwood management. The shelterwood management system begins in a timber stand 100 or more years old with a series of commercial harvests culminating in a regeneration cut. This cut removes most of the timber but leaves some trees to provide shade and a seed source for the newly developing stand. After a new stand of young trees is established in 10 to 40 years, a commercial harvest called a removal cut removes the sheltering overstory trees. Young stands receive pre-commercial thinning to maintain tree spacing for maximum growth. When trees reach commercial size, stands are periodically thinned with commercial harvests called intermediate cuts. There are usually 1 to 3 intermediate cuts prior to the next regeneration cut.

About 95 percent of the Forest Service commercial timber in the Southwest is planned for management under the shelterwood system. Commercial forests on the Navajo Indian Reservation are being converted to shelterwood management (James Carter, BIA, pers. comm., 1990). Other commercial forests on Indian lands in the Southwest are managed as uneven-aged stands by use of selective logging.

Previous Service Actions

On December 22, 1989, the Service received a petition submitted by Dr. Robin D. Silver requesting the listing of the Mexican spotted owl as an endangered or threatened species under the Act. On February 27, 1990, the Service found that the petition presented substantial information indicating that listing might be warranted and initiated a status review.

Section 4(b)(3) of the Act requires the Secretary of the Interior to reach a final decision on any petition accepted for review within 12 months of its receipt. In conducting its review, the Service published a notice in the **Federal Register** (55 FR 11413) on March 28, 1990, requesting public comments and biological data on the status of the Mexican spotted owl. In addition, a status review team of 5 Service biologists and 1 biologist each from the AGFD and the New Mexico Department of Game and Fish (NMDGF) was established. This team organized all comments and information received in response to the March 28 notice as well as other information gathered or in the Service's files.

On December 6, 1990, the team completed a draft status review report on the Mexican spotted owl. On February 20, 1991, the Service made a finding, based on the contents of the report, that listing the Mexican spotted owl, pursuant to section 4(b)(3)(B)(i) of the Act, was warranted. Notice of this finding was published in the **Federal Register** on April 11, 1991.

The entire spotted owl species (*Strix occidentalis*) was listed on the Service's Animal Notice of Review (54 FR 554; January 6, 1989) as a Category 2 species. A Category 2 species is one for which listing may be appropriate but additional biological information is needed to support a proposed rule. The information gathered in the status review for the Mexican spotted owl contributed to the information needed for a decision to propose this subspecies for listing. A proposed rule to list the Mexican spotted owl as threatened without critical habitat was published in the **Federal Register** on November 4, 1991 (56 FR 56344).

Summary of Comments and Recommendations

In the November 4, 1991, proposed rule (56 FR 56344) and associated notifications, all interested parties were requested to submit factual reports or information that might bear on whether the owl should be listed. The comment period originally closed on March 3, 1992, but was reopened from May 11,

1992 to September 1, 1992 (57 FR 20073; May 11, 1992) to allow submission of additional comments. Appropriate State agencies, county governments, Federal agencies, scientific organizations, and other interested parties were contacted and requested to comment. Newspaper notices inviting public comment were published in Arizona in the Mesa Tribune, Scottsdale Progress, Tucson Citizen, Navajo-Hopi Observer, Eastern Arizona Courier, Lake Powell Chronicle, Kingman Booster-Spirit, Sierra Vista Daily Herald Dispatch, Copper County News, Verde Independent Bugle, Red Rock News, Williams News, Prescott Sun, Holbrook Tribune News & Snowflake Herald, Round Valley Paper, Silver Creek Dispatch, White Mountain Independent, Arizona Daily Sun, Arizona Republic, Arizona Daily Star, in New Mexico in the Albuquerque Journal, Silver City Daily Record, Santa Fe New Mexican, Carlsbad Current Argus, Alamogordo News, in Utah in The Daily Spectrum, Reaper, Salt Lake Tribune, and in Colorado in the Durango Herald, and Rocky Mountain News. The inclusive dates of publication were January 15, 1992 to February 11, 1992 for the initial comment period and hearings and from June 17, 1992 to July 1, 1992 for the second comment period.

Because of anticipated widespread public interest, the Service held 6 public hearings which were announced in the proposed rule. Interested parties were contacted and notified of the hearings. A notice of the hearing dates and locations was published in the Federal Register on January 2, 1992 (57 FR 35). Approximately 883 people attended the hearings. About 68 people attended the hearing in Santa Fe, New Mexico; 42 in Alamogordo, New Mexico; 71 in Silver City, New Mexico; 60 in Tucson, Arizona; 545 in Flagstaff, Arizona; and 97 in Cedar City, Utah. Transcripts of these hearings are available for inspection (see ADDRESSES).

A total of 1,541 written comments were received at the Service's Ecological Services Field Office in Albuquerque, New Mexico: 149 supported the proposed listing; 1,384 opposed the proposed listing; and 8 either commented on information in the proposed rule but expressed neither support nor opposition, provided additional information only, or were non-substantive or irrelevant to the proposed listing.

Oral or written comments were received from 142 parties at the hearings: 33 supported the proposed listing, and 109 opposed the proposed listing.

In total, oral or written comments were received from 12 Federal and State agencies and officials, 25 local officials, and 1,670 private organizations, companies, and individuals. All comments, both oral and written, received during the comment period are addressed in the following summary. Comments of a similar nature are grouped into a number of general issues. These issues and the Service's response to each are discussed below.

Issue 1: The Service does not have adequate population trend data to support the conclusion that the Mexican spotted owl is threatened and should be listed under the Act.

Response: The Service concludes, as detailed in the "Summary of Factors" section, that there is sufficient evidence that the status of the Mexican spotted owl meets the standards required for it to receive protection under the Act. The Service studied the trends in habitat loss to determine the effects to the population of the Mexican spotted owl. Approximately 20 percent of owl habitat has been rendered no longer suitable, with one-half of this habitat loss occurring within the last decade, representing a habitat loss rate close to 1 percent year. Forest plans for the next decade for the 11 national forests in New Mexico and Arizona call for continued conversion of habitat to a non-suitable condition at a rate of 0.4 percent per year. The habitat lost under a shelterwood harvest system is permanently maintained in a condition not suitable as owl habitat. This loss of habitat will, in time, result in the endangerment of the owl. Forest plans govern forest practices, and as long as they are in effect, the Service cannot ignore their content.

Issue 2: The habitat requirements of the owl are not adequately understood to justify the Service contention that shelterwood timber management makes habitat unsuitable for owl use. Owls occur in a variety of habitat types across a broad elevational range. Owls require open stands and second-growth, and are not old-growth dependent.

Response: The owl uses a variety of forest types ranging from deciduous riparian woodlands, through pinon-juniper, pine-oak, mixed conifer, and spruce fir. Elevations used usually range from 6,500 to 9,500 feet. Most surveys have been associated with timber sales, and when evaluated with surveys in wilderness areas, other reserved lands, and non-Forest Service land, they present adequate data to characterize habitat. There are common characteristics of almost all occupied forested habitat (Ganey and Balda 1988, Ganey and Balda 1989a, Ganey and balda 1989b, Kroel and Zwank 1991). The characteristics include a significant component of mature trees, high canopy closure, multiple storied forest structure, and abundant dead and down woody material. Single-storied, even-aged stands produced under shelterwood management do not retain the habitat characteristics found in occupied owl habitat. Surveys have not determined occupancy in habitat following significant stand modifying timber harvest. Favorable roost and nest sites are seldom found in significantly altered stands.

Issue 3: Habitat definition is biased because surveys are driven by timber sales. Conversely, old-growth has not been surveyed.

Response: Owl survey efforts have been prioritized to proposed activity sites primarily to determine absence or presence of owls and "clear" those areas. However, a significant and increasing amount of survey effort is directed at reserved lands such as wilderness, stands allocated for old-growth management, and non-activity areas including steep slopes, canyon environments and other areas minimally or not suited for timber harvest. Surveys have examined mature and old-growth habitat on all of the national forests in the Southwest Region.

Issue 4: Ponderosa pine forests are utilized as habitat, and should be adequately protected. Conversely, ponderosa pine forests are not owl habitat, and need not be protected.

Response: The Forest Service estimates the ponderosa pine community type provides 40 percent of habitat in Arizona and New Mexico national forests. Of 22 nest sites for which sufficient data were available to analyze, none occurred in the ponderosa pine type. Of 83 day roost sites with sufficient data to analyze, only one occurred in the ponderosa pine type (Fletcher 1990). The pine-oak community type, which provides only 8 percent of the estimated owl habitat, had 18 percent of the nest sites and 19 percent of the roost trees. Therefore, the pure ponderosa pine type appears to provide only marginal conditions for nest and roost sites. However, where this habitat intergrades with other habitats such as mixed conifer and canyons, it may be used for foraging. Additionally, the habitat may be important for seasonal elevational movements and winter habitat.

Issue 5: Data are inadequate to determine how the Mexican spotted owl uses habitat in southern Utah.

Southwestern Colorado does not include any owl habitat.

Response: Studies in canyon habitats in southern Utah have provided some of the best data available on habitat use and movements by the Mexican spotted owl. Gutierrez and Rinkevich (1991) and Rinkevich (1991a, 1991b) examined distribution, density and food habits of Mexican spotted owls at Zion National Park and on surrounding BLM lands during the period May 1989–August 1990. They found owls at nine different locations within Zion National Park. Their analysis of habitat characteristics identified high humidity, multiple vegetative strata, narrow canyons and high quantities of ground litter as habitat correlates with the presence of Mexican spotted owls. In contrast to forested habitats, canyon habitats frequently contain relatively little or no forest stands other than riparian stringers. Mammals comprised 99 percent of the owl's diet, and bushy-tailed woodrats (*Neotoma cinerea*) comprised 67 percent of the biomass identified at Zion National Park. The bushy-tailed woodrat and the desert woodrat (*N. lepida*) comprised 98 percent of the biomass in the owl's diet on NPS and BLM lands in southern Utah. Surveys in Colorado indicate that owls use canyon habitat types similar to those in Utah. The known range extends from Mesa Verde and the San Juan Mountains northward along the Front Range of central Colorado (Reynolds 1990, Willey 1992).

Issue 6: Data on demography, dispersal and other life history characters are inadequate to allow the development of a population viability model. The presence of single birds on territories should be seen as a warning that the population is in decline because it shows that birds are not able to acquire mates.

Response: There are not adequate data to develop a population viability analysis. Demography studies and other studies to acquire the data necessary to complete a population viability analysis require several years, depending on the longevity of the species. Studies designed to obtain these data are being conducted on the Coconino, Gila and Lincoln National Forests. It will be several years before they produce the necessary data. Single birds on territories may be a cause for concern where singletons reside alone on territories for multiple years as they do at some sites in northern New Mexico. In the southern mountain ranges, where owls are more abundant, additional surveys frequently find that pairs are present, or the unmated birds are subadults. The presence of subadults on territories probably indicates an expanding population. When population data are available, the stability of the populations will be analyzed.

Issue 7: Data on prey base or prey habitat relationships are not available. Spotted owl occurrence is limited by prey availability, not forest environment.

Response: The Service believes that, as with other species, owl populations are limited by prey availability, environment, stochastic events, and other factors. There have been several prey analyses completed at this time including studies on the Coconino National Forest (Ganey 1992), several national forests in New Mexico and Arizona (Duncan 1992), Capitol Reef National Park (Wagner *et. al.* 1982), Zion National Park (Kertell 1977, Rinkevich 1991a) and Bureau of Land Management lands surrounding Zion National Park (Rinkevich 1991b). These studies all have shown that Mexican spotted owls feed on mammals, birds, reptiles and insects. Mammals, woodrats (*Neotoma* spp.) in particular, account for most of the biomass consumed. Another study in progress on the Lincoln National Forest (Pat Ward, Forest Service, pers. comm., 1992) has identified *Peromyscus maniculatus* and *Microtus* spp. as important prey on that forest.

The spotted owl is described as a "perch and dive" predator. Hunting behavior consists of moving from tree to tree, spending a few seconds to several hours watching and listening for prey (Ganey and Balda 1988). Owls have been observed to launch attacks from perches less than 5 meters in height. Because spotted owls dive relatively short distances to their prey, a multi-storied forest with many potential perches is essential to successful foraging. Spotted owls infrequently forage in shrub-sapling habitats, probably due to difficulty in hunting effectively in dense ground cover. California spotted owls also avoid meadows or large open expanses, despite potentially large numbers of prey available (Barrows 1980). The occurrence of spotted owls in canyon habitat with a minimal forest component suggests that the topographical and physical structure of canyons may substitute for the multi-storied structural characteristics of forested habitat (Gutierrez and Rinkevich 1991, Willey 1992).

Issue 8: The Service did not consider the range and population size of the Mexican spotted owl in Mexico.

Response: The proposed rule did consider the range in Mexico, but as pointed out, there is very little information about the owl in Mexico. Sightings in Mexico have been rare despite the fact that many of the observers were explicitly looking for unusual birds, including owls, to collect. The rarity of the sightings suggest that the birds are uncommon in Mexico. The Service is also concerned about the potential for the development of large-scale timber operations in Mexican spotted owl habitat in Mexico. For example, a project proposed by the World Bank would extract four billion board feet from the Barranca del Cobre area of the Sierra Madre Occidental in southern Chihuahua. In 1992, the Service began a cooperative Mexican spotted owl research project with Mexican biologists in this area.

Issue 9: No data are available on owl populations on Indian reservations.

Response: Limited data are available on owls on Native American lands. Until recently, surveys for owls were infrequent on these lands. However, in many cases, that situation has changed and surveys are being conducted. Currently, an estimated 13 percent of owl habitat, and 5 percent of known owls occur on Native American lands. These figures were included in the Service estimate of the total Mexican spotted owl population throughout the southwest.

Issue 10: Loss of riparian habitat has not impacted owls at higher elevations.

Response: Riparian woodlands in the Southwest prior to the twentieth century may have satisfied many of the structural and thermal requirements of owl nest and roost sites. Dense cottonwood canopies and willow/mesquite understories may provide the necessary multi-storied structure and cool microclimate. High diversity and abundance of prey items in these habitats may have made them suitable breeding sites. Loss of riparian habitat has been most extensive at low and middle elevations. In the last century, Arizona has lost 90 percent of its low elevation riparian habitat (Bulmer and Thornburg 1988), and New Mexico has lost 33 percent of its wetlands, including low elevation riparian habitat (Dahl 1990, State of Arizona 1990). The importance of low and mid-elevation riparian woodlands to the owl is unknown. Less high elevation, montane riparian habitat has been lost than lower elevation habitat, with correspondingly lower impacts to owls.

Winter use of low elevation riparian habitat has been documented (Bendire 1892, Phillips *et al.* 1964). Its importance as a seasonal portion of the home range is unclear. Riparian habitat also may provide significant dispersal

corridors between the semi-isolated montane habitat regions. Current studies of dispersal and winter elevational movements will identify the extent and importance of riparian habitat for the owl.

Issue 11: Landscape fragmentation in the southwestern United States is natural and should not adversely affect a species that has evolved in that environment.

Response: Landscapes in the southwestern United States are naturally heterogenous. The natural heterogeneity often leads to isolation of small populations that are individually at greater risk of extinction than larger populations with similar rates of immigration and emigration. Fragmentation of contiguous blocks of habitat further reduces effective population sizes with attendant increases in extinction risk. Because fragmentation results in smaller local populations, even species that are adapted to fragmented landscapes may be jeopardized by additional man-caused fragmentation. Carey *et al.* (1992) demonstrated that northern spotted owls required and traversed significantly more terrain in heavily fragmented ares than in lightly fragmented areas. The consequent expansion of territories in heavily fragmented habitat appeared to adversely impact social structure, as evidenced by the proportion of adult-subadult pairs, degree of adult nomadism, and overlap among home ranges of pairs. Gutierrez and Pritchard (1992), in a study on the insular ecology of the California spotted owl, a subspecies occurring in small populations on isolated mountain ranges, also found that owls in isolated populations experienced lower survival rates and had a greater proportion of subadults. There are no studies on the effects of habitat fragmentation on the Mexican spotted owl.

Issue 12: Disjunct sub-populations on "sky islands" (montane environments) demonstrate that genetic isolation is apparently not a limiting factor to the Mexican spotted owl, and suggests at least minimal dispersion between mountain ranges.

Response: Genetic isolation may not be a limiting factor, but its importance is not known at this time. Currently, one study is investigating the extent of dispersal and the phylogenetic and population affinities of spotted owls. Additional research is needed in other portions of the sub-species range.

Issue 13: The Service states that the populations of great horned owls and red-tailed hawks in New Mexico and Arizona have increased by more than 2 percent annually for the last 22 years. The actual data reported in breeding birds surveys show that great horned owls have increased 2.6 percent annually in Arizona and decreased 4.1 percent annually in New Mexico. In the last ten years red-tailed hawks had an insignificant annual increase of 0.2 percent in Arizona. Furthermore, there is no evidence that these population changes are related to forest fragmentation as suggested in the proposed rule.

Response: The trend data reported in the proposed rule were from a summary of Breeding Bird Survey (BBS) routes in Region 2 (New Mexico, Arizona, Texas, Oklahoma) of the Service, not New Mexico and Arizona. The figures for the 1966–1992 BBS summary are as follows: in New Mexico, great horned owls (*Bubo virginianus*) had a statistically non-significant decline of 2.2 percent per year, and red-tailed hawks (*Buteo Jamaicensis*) had a significant increase of 5.6 percent per year; in Arizona, great horned owls had a non-significant increase of 1.1 percent per year, and red-tailed hawks had a significant increase of 4.3 percent. During the ten-year period of 1982-1991, red-tailed hawks in Arizona showed a non-significant 0.6 percent annual decrease, and in New Mexico, a non-significant 3.3 percent annual increase. During the same period, great horned owls in Arizona showed a non-significant decrease of 2.6 percent per year, and in New Mexico, a significant annual decrease of 11.3 percent. Looking only at the mountainous physiographic unit that includes the upper portion of the Mogollon Rim in Arizona, the Mogollon Mountains and Sacramento Mountains in New Mexico, for the 1982-1991 period, great horned owls showed a significant 4.2 percent annual decline, and red-tailed hawks increased significantly at a rate of 8.6 percent annually. A non-significant rate of change is the same as no change at all. In fact, breeding bird surveys are not a good way to estimate populations of large hawks and owls, because they infrequently nest near roads, and in the case of owls, are nocturnal.

Issue 14: The consequences of human impacts on the environment are impossible to predict and we should not be too eager to interfere with the evolutionary process.

Response: There are frequently unanticipated effects on the environment from human activities, but unfortunately they are not often beneficial to rare species. In most cases these effects result in declining populations and even extinctions. In the case of the Mexican Spotted owl, reduction of habitat is most likely to be harmful to the species because of direct reductions in population size with attendant increase in the probability of extinction. In promulgating the Endangered Species Act, Congress sought to prevent extinction as a consequence of economic growth and development untempered by adequate concern and conservation. Such human activities are additive to and beyond normal ecological processes that may result in extinction.

Issue 15: Increased spotted owl roadkills and use of marginal habitat indicated abundance.

Response: There is no information on trends of spotted owl roadkills as no systematic sampling method has been devised for translating the roadkill reports into relative abundance. The habitat in question may not provide for nesting and roosting, but may be important for foraging and wintering. Research is underway to address the uses of habitats considered atypical for the owl.

Issue 16: The Service neglected the Mexican spotted owl study by Dames and Moore (1990).

Response: The Service evaluated the study and found that it did not contain any information contrary to that in other owl habitat research. The study was inconclusive regarding habitat selection between core and outside-core areas. The second conclusion reached in the study, concerning differences between habitats utilized, supported the accepted view that there is considerable variation in habitat attributes within owls' home ranges. The experimental design sampled only habitat considered suitable and was inadequate to show differences between suitable and unsuitable owl habitat.

Issue 17: The Service has not considered the habitat reserved in areas such as wilderness and old growth allocations.

Response: The Service evaluated the relative threats to the portion of the population subject to past and future habitat loss, and concluded that habitat loss affected a significant part (59 percent of the total owl population.

Issue 18: The listing proposal was based on Ganey's flawed data.

Response: Ganey has conducted some of the most extensive research on the Mexican spotted owl, and is considered an authority on the species. His published studies, which the Service has cited, are available for public and peer review. The Service has not found Ganey's experimental design or conclusions to be flawed.

Issue 19: The Service should submit its findings to peer review.

Response: The data and information that were used to evaluate the petition, compile the status review, and determine the threats detailed in the proposed rule, are all referenced in the status review and proposed rule. The proposed rule, which was published in the Federal Register on November 4, 1991, is similar to a draft document. The extensive comment periods provided opportunities for peer review by both the scientific community and the interested public. The comments addressed here summarize that review. Where information was presented in error in the proposed rule, or where new information was provided, the comment information has been incorporated into this final rule.

Issue 20: Service biologists who wrote the status review and proposed rule are not trained in silviculture or forestry, and therefore have no business analyzing silvicultural practices.

Response: The Service biologists who wrote the status review and proposed rule are primarily trained in ecology and wildlife biology; however, some do have training in silviculture. The purpose of the review was to evaluate the effects of habitat change on the Mexican spotted owl, not to evaluate the assumptions of the silviculture treatments and whether the treatments would result in the foresters' desired future conditions. The Service assumed that those conditions would be met. A threat to the owl was identified based on the incompatibility of the desired conditions with maintenance of owl habitat.

Issue 21: The Mexican spotted owl is a subspecies, not a species, so it cannot be listed.

Response: Section 3(15) of the Act defines species to include "any subspecies of fish or wildlife or plants", and the criterion of a listable population as "any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature". The Mexican subspecies of the spotted owl does not overlap the ranges of either of the other two subspecies. Furthermore, Barrowclough and Gutierrez (1990) conducted a genetic analysis of the three subspecies and found no variation between the coastal subspecies. However, their data do indicate that the Mexican spotted owl is distinct and has been genetically isolated from the other two subspecies for a long period of time. That study provided information supporting the determination that the Mexican spotted owl meets the taxonomic criteria for listing under the Act.

Issue 22: Current protection guidelines under Forest Service Interim Directive No. 2 are excessive/adequate/inadequate. Unoccupied habitat is important.

Response: The Service is concerned that management of national forests to protect individual owls or pairs of owls, by designating individual management territories, does not provide adequate protection for the species. The Service is concerned that forest fragmentation between management territories may increase rates of predation, reduce the amount of habitat available for recruitment of owls into new territories, and reduce the ability of dispersing owls to move across the forests. Because the size of the management territories is based on the mean of a small sample of home ranges, adequate habitat may not be provided by current management guidelines. At this time, it is not known to what extent owls move from their management territories during winter. If habitat surrounding management territories is not maintained, and owls require it, even seasonally, the birds may not survive. In telemetry studies in Arizona and Utah, 2 of 5, and 1 of 5 Mexican spotted owls, respectively, moved off their territories during winter and returned prior to breeding in the spring (Ganey and Balda 1989b, Willey 1992). Management for the northern spotted owl is developed around large blocks of habitat, referred to in the northern spotted owl draft recovery plan as Designated Conservation Areas. The management plan for the California spotted owl calls for management of high quality and low quality habitat on a forest-wide basis (Verner *et al.* 1992). The Service believes that either of these strategies are preferable to the single territory management under the current Region 3 (Arizona and New Mexico) Forest Service Interim Directive No. 2.

Issue 23: The sizes of management territories and core areas established by the Forest Service are excessive/inadequate.

Response: The Forest Service derived its estimate of management territories and cores based on Ganey and Balda's (1988) study, which at the time, was the only study that provided information on home range size for the Mexican spotted owl. The study sampled mixed conifer forest habitat use by radio-monitored owl pairs. Additional sampling in mixed conifer forest has been done by Kroel and Zwank (1991) with similar results. The Forest Service use of the average rather than maximum size, or the mean size plus two standard deviations for the establishment of management territory size, resulted in management territories that meet size and habitat requirements for only about 50 percent of owl pairs. Core area size was determined by delineating an activity area in which 60 percent of radio signals occurred, and centering the area around the known roost, nest or detection locations. The use of averages probably underestimates the size of activity areas for a significant portion of the population.

Issue 24: Owl habitat on BLM and State land is inadequately protected.

Response: The timber programs on BLM and State lands in the southwest are small and are not considered a threat to the owl. Most owl habitat on BLM lands is mixed-conifer and hardwood riparian stringers in canyons, so it is unlikely to be used for commercial timber production. Proposed actions on BLM lands follow a clearance and impact analysis conducted in accordance with the Endangered Species Act and the National Environmental Policy Act (BLM, *in litt.*, 1992). Any activity that may affect a listed species triggers consultation with the Service. Additional policies for each state BLM office further limit activities. However, the policies are too general to ensure adequate spotted owl protection on BLM lands.

The State of Arizona lists the Mexican spotted owl as threatened (AGFD 1988). The State of New Mexico is considering adding the owl to its endangered species list. However, protection by both states is limited to the capture, handling, transportation, and take of the owl as regulated by game laws and special licenses for live wildlife, and only affects recreation, hunting, and scientific investigation. The owl has no endangered species status or special protection in Colorado, Texas, or Utah.

Issue 25: The Endangered Species Act requires management of single species. What happens when there is a conflict with other sensitive or listed species? For example, northern goshawk and Mexican spotted owl management needs conflict.

Response: The Endangered Species Act does not stipulate single species management. The Act states section 2(b): "The purposes of this act are to provide a means whereby the ecosystems upon which endangered species and threatened species may be conserved * * *" However, because the northern goshawk (*Accipiter gentilis*) is not a listed species and the owl will be listed as threatened, if a conflict arises, the owl's needs will take precedence. The Service believes that if the national forests are managed as natural ecosystems, a variety of habitats will be maintained that will provide for both of these as well as other species.

Issue 26: The Mexican spotted owl should be listed as endangered. Emergency listing is needed.

Response: The Act defines an endangered species as one that is in danger of extinction. A threatened species is one that is likely to become endangered in the foreseeable future. At this time there is no indication that the owl is presently in danger of extinction. However, because of conversion of habitat identified in the proposed rule, it is likely to become endangered in the foreseeable future unless habitat management changes are implemented. Thus, the species fits the category of threatened, but not endangered. Emergency listing is not justified unless the threats to the species create an emergency posing a significant risk to the well-being of the species, such as large population losses or extinction.

Issue 27: The Service illegally delayed the Mexican spotted owl listing process.

Response: The Service regrets the delay in completing the listing process for this species.

Issue 28: Critical habitat is mandated by the Endangered Species Act, and it should be added in the final rule listing the owl.

Response: At the time of publication of the proposed rule the Service believed that the designation of critical habitat was not prudent because it appeared that consultation under the jeopardy standard in section 7 of the Act would provide the same level of protection for the species as would be derived from the designation of critical habitat. Because consultation would apply forest-wide, and would not be limited to areas within critical habitat boundaries, the Service concluded that designating critical habitat would not provide any additional benefit to the species. Subsequently, however, the Service's experience in informal conferences with the Forest Service under section 7(a)(4) has demonstrated this conclusion was mistaken and that section 7 consultation under the jeopardy standard is not adequate as the sole means to protect the owl and its habitat. Therefore, this final rule calls for designation of critical habitat. However, critical habitat is not determinable at this time.

Issue 29: Conferences on forest activities should be initiated immediately.

Response: Under section 7(a)(4) of the Act, the action agency, in this case the Forest Service, is responsible for determining whether a proposed action is likely to jeopardize a species proposed for listing and, if so, for initiating an informal conference with the Service on the proposed action. The Forest Service has decided that no proposed actions in National Forests in New Mexico and Arizona meet this standard and so has not requested conferences. However, now that the owl is listed, the Forest Service is required, under section 7(a)(2) to request formal consultation on any action that may affect the owl. The Service expects such consultations to be initiated in the immediate future.

Issue 30: Economic considerations should be given more weight when communities may be affected. The Service did not follow legal procedures in the listing process. It failed to consult with county governments as required by Executive Order 12291.

Response: The Act identifies 5 factors which are considered to determine whether a species should be listed as threatened or endangered. These are: the present or threatened destruction, modification or curtailment of its habitat or range; over-utilization for commercial, recreational scientific or educational purposes; disease or predation; inadequacy of existing regulatory mechanisms, and other natural or man-made factors affecting the species continued existence. The Act requires that only scientific and commercial data may be used to make that determination, and prohibits the Service from considering economic factors. As a result, Executive Order 12291 does not apply to rulemakings to list species under the Act. However, because economics are considered in the designation of critical habitat, the Service will comply with Executive Order 12291 in designating critical habitat for the owl.

Issue 31: The Service needs to ensure public input before listing the Mexican spotted owl. The Service is required to notify counties and other affected parties to solicit their input prior to listing a species under the Act. The Service failed to meet this obligation.

Response: The Service has fully met or surpassed the requirements of the Administrative Procedure Act and the Endangered Species Act for public notification. On December 22, 1989, the Service received a petition to list the Mexican spotted owl as threatened or endangered under the Endangered Species Act of 1973, as amended. The Service evaluated the information in the petition and other materials in making a finding that the petition may be warranted. An announcement of the 90-day finding was published in the **Federal Register** on March 28, 1990 (55 FR 11413). That same announcement also stated that the Service was initiating the status review of the species. The **Federal Register** is the instrument that must be used by all Federal agencies for such notices. Additionally, the Service sent notices of the petition finding and the status review initiation on April 9, 1990, to newspapers in New Mexico, Arizona, Utah and Colorado. Following the completion of the status review and the 12-month finding by the Service that the petitioned action was warranted, the Service provided public notice in the **Federal Register** on April 11, 1991 (56 FR 14678). The Service published the proposal to list the owl as threatened in the **Federal Register** on November 4, 1991 (56 FR 56344) with a 120-day public comment period open until March 3, 1992. The notice of six proposed public hearings was published in the **Federal Register** on January 2, 1992 (57 FR 35). Legal notices of the proposed public hearings were again sent to newspapers throughout the southwest and to all agencies and individuals who had previously expressed interest in the owl at the time of the proposal to list. In addition to the notices, regional news releases dated October 21, 1991, and January 7, 1992, were released. The Service held six public hearings to solicit information from the public on the proposal to list the owl. The hearings were held in Santa Fe, Alamogordo and Silver City, New Mexico, on January 21–23, 1992; in Tucson and Flagstaff, Arizona, and Cedar City, Utah, on February 4–6, 1992, respectively. Notices of the proposed rule and solicitation for comments were sent to affected counties and government agencies in February. The notice for a second public comment period open from May 11 to September 1, 1992, was published in the **Federal Register** on May 11, 1992 (57 FR 20073). More than 1,500 letters addressing the listing of the owl were received during the comment periods. The correspondence and comments received at the public hearings have been evaluated in the decision whether to list the owl.

Issue 32: Those who are advocating listing the Mexican spotted owl as a threatened species are a vocal minority with an agenda to remove the human species from public lands. Mexican spotted owl protection under the Act is an environmentalist trick to destroy local rural economies.

Response: The Service cannot speak for the motivation of those individuals who petitioned or who advocate listing the Mexican spotted owl as a threatened species under the Endangered Species Act. Advocate motivation was not considered when the Service proposed to list the owl, and is not considered when a final determination is made on whether or not to list. As stated above, the Service considers only scientific and commercial information relating to the

five factors for listing in making its determination.

Issue 33: The covert purpose of listing the Mexican spotted owl is to force the Forest Service to alter its silvicultural practices. Listing is an excuse for the Service to take over management of public lands managed by other agencies.

Response: The Service has determined that listing of the Mexican spotted owl is warranted based on the available scientific and commercial information relating to the five factors for listing. Even-aged management applied extensively on public lands has been identified as the major threat to the species. Removal of this threat will entail modification of these silviculture practices. However, the land management agencies—Forest Service, Bureau of Land Management, Bureau of Indian Affairs and National Park Service—will continue to be managers of land under their respective jurisdictions.

Issue 34: Habitat loss rates are negligible.

Response: The Forest Service estimates 40 percent of the habitat that has been lost was lost since 1980 (Fletcher 1990). This represents a loss of habitat at a rate of 0.98 percent per year over the last decade. The Service estimate of habitat loss in the next decade, based on forest plan schedules, is 0.4 percent per year. This rate of habitat loss is of great concern because continued shelterwood management will prevent its return to suitability.

Issue 35: Harvest rates are declining, and thus, are not a threat to the owl.

Response: Timber harvest rates remain a controversial issue. The Service is concerned about the current level and intensity of timber harvest. Forest plans on five national forests in Arizona and New Mexico are presently being reviewed by the Forest Service because of concern the allowable sale quantity (ASQ) can not be sustained while meeting other forest plan standards and guidelines. The timber volume sold gradually increased from 334 million board feet (MMBF) in 1971 to 447 MMBF in 1986 and slowly decreased to 282 MMBF in 1991. The reductions in harvest in 1991 and 1992 reflected difficulties met in adjusting to new management practices, including conservation of owl habitat. The future short-term projected sale volume is about 300 MMBF annually (L. Henson, Forest Service, *in litt.*, 1992). Mexican spotted owl habitat faces destruction and modification at a rate close to that of the past decade. Based on information in forest plans, the Forest Service predicts timber demand will increase 30 percent over the next 50 years and that national forests will attempt to meet the demand. If this increase is realized, future harvest entry and corresponding owl habitat loss will be greater than the estimates derived from projected even-age treatments and harvest volume.

Issue 36: Forest management practices have improved the quality and increased the acreage of Mexican spotted owl habitat.

Response: In some areas, railroad logging removed vast quantities of timber at the beginning of the twentieth century. The quality of those sites for Mexican spotted owls prior to treatment probably varied, but the pre-treatment situation is unclear and subject to debate (White 1985, Covington and Moore 1992). Following treatment, most of these areas did not provide suitable conditions for Mexican spotted owls. On some forests, most notably the Lincoln National Forest in New Mexico, some of these sites do provide suitable habitat for owls today. In these instances, the habitat has improved. These sites have had little or no management other than fire suppression since they were railroad logged. The trees were mostly too small to harvest until recently. Although these forest stands primarily consist of young trees, there are small groups of older trees in most stands of owl habitat. These older trees provide an important component of owl habitat because most summer day roost and nest trees are found in such older groups. The Service is concerned that timber harvest programs which focus on forest health usually target older trees for removal, despite their value to wildlife such as the Mexican spotted owl.

Issue 37: The national forests are in a healthy condition because of sound forestry practices.

Response: The national forests of the southwest are generally in good health. However, many old-growth stands have been removed, and many stands now date from this century. With the notable exception of the Lincoln National Forest, the majority of Mexican spotted owls are clearly associated with mature to old-growth stands of pine-oak or mixed conifer. Those stands contain the largest, oldest and most valuable trees for the timber industry. They are also often infected with dwarf mistletoe, which is perceived as a threat to forest health. This combination has resulted in great pressure to remove the oldest remaining stands in the name of forest health. However, these stands are extremely valuable to the Mexican spotted owl and other wildlife species, and are in short supply. The Service believes that, until there are more mature stands that provide high quality habitat, the remaining mature and old-growth stands should be retained in their present condition. Development of management techniques to remove serious infection foci, to thin, and to prevent the threat of habitat destroying wildfires while retaining habitat suitability is possible.

Issue 38: Forest resource mismanagement has impacted ecosystem health.

Response: Ecosystem health means different things to different people. Management during the previous century has had a variety of effects on forest ecosystems. Stands of old-growth have been removed and replaced with young trees which are sometimes of different species. Some wildlife species now have less habitat available than before, and their populations have declined, while other species are more abundant. Fire suppression during the past 80 years has resulted in many stands exhibiting high tree density and competition that suppresses tree growth. Fire suppression has also resulted in extensive tracts of small trees at high density that are now dangerously susceptible to stand destroying wildfires. Some of these consequences are beneficial to the Mexican spotted owl, and others are, or may be, harmful. Given the paucity of information on the needs of the Mexican spotted owl, the Service encourages research which will identify management that will benefit the owl and other species.

Issue 39: Timber management and fire suppression are needed to maintain forest health.

Response: As stated in the previous comment, forest health means different things to different people. Forest Service management has attempted to limit the spread of parasites and disease through silvicultural treatments with varying degrees of success. According to the Forest Service, and in accord with epidemiological theory, stands that have higher tree densities are most susceptible to parasites, disease and stand destroying wildfires. Fire suppression has been widely practiced by the Forest Service resulting in an important suite of problems in forest health, timber productivity, and fire danger. The present condition of forest ecosystems will, in many cases, require management to restore natural processes. The Service encourages the Forest Service to continue research and development of management techniques that will mimic natural forest ecosystem processes. The Service also believes that new ideas and techniques should be tested for unexpected adverse effects prior to wholesale adoption.

Issue 40: The Service incorrectly interprets that habitat made "capable" (temporarily not suitable) is lost habitat.

Response: The Service considers habitat made "capable" by even-age timber harvest methods to be habitat lost indefinitely. The shelterwood system is the even-age harvest method primarily used by the Forest Service in Region 3. For example, a regenerating, middle-aged stand of "capable" habitat might be within 50 years of recovering to a condition suitable as owl habitat. Under the shelterwood system, the stand will receive intermediate cuts before then, which will prevent its return to suitable condition. Ultimately, the stand will receive another regeneration cut where all but a few of the overstory trees are removed. Thus, after the critical attributes of owl habitat have been lost, shelterwood acres are held in even-age conditions perpetually unless silvicultural management is altered or deferred. Suitability as owl habitat is never recovered or, at best, is recovered only briefly before the forest is re-entered and returned to "capable" status.

Issue 41: More than one half of shelterwood timber management is in ponderosa pine forest that is not suitable for Mexican spotted owls. Shelterwood management is in decline in Region 3 and does not threaten owl habitat.

Response: The conversion of complex structured forest stands to even-aged stands was identified by the Service (1991a, 1991b) as the greatest threat facing the Mexican spotted owl. Half of all shelterwood management is occurring in unsuitable forest (primarily pure ponderosa pine) habitat, and the other half in suitable forest habitat. The Service has determined habitat loss trends from current forest plans which provide the only available data on timber harvest trends into the future. An estimated 0.4 percent of Mexican spotted owl habitat will be made unsuitable each year in the future. Because timber harvest will occur in stands that are most valuable to owls, a serious threat exists to Mexican spotted owl persistence. The Forest Service considers that pure ponderosa pine habitat is suitable habitat when it has multi-storied structure. Thus, even-age management in this forest type may also pose a threat to the owl. The capability of most ponderosa pine stands to meet owl habitat needs is limited by young stand age and possibly other limitations, such as low prey densities and inappropriate thermal conditions. However, pure ponderosa pine stands may be capable of developing complex structure, and thus represent important potential habitat for the future. Shelterwood management will prevent pure ponderosa pine from attaining its potential as owl habitat.

Issue 42: The Mexican spotted owl can be found in selectively harvested areas. Uneven-aged timber harvest management is needed to protect owl habitat.

Response: The overall effects of selective harvest methods on the owl are currently unknown. Selective harvest methods probably have lesser impacts on habitat than do large-scale even-aged techniques. The Service understands that Indian reservations (with the exception of the Navajo Reservation) primarily use individual tree selection harvest methods. Owls do occur on these Native American lands, but systematic surveys have only recently been initiated. Historically, the Lincoln National Forest has been harvested in a manner that retained some of the structural components of owl habitat and allowed for a relatively rapid return to a suitable condition. Selective harvest techniques and their attendant effects on owl habitat should be examined as alternatives to current harvest techniques. However, the use of selective harvest must be experimentally implemented and closely monitored to determine appropriate intensities of harvest prior to wholesale application.

Issue 43: The Service overestimated the amount of steep slope logging in the southwest. Steep slope logging is insignificant at this time, and because of economic considerations, will never be important.

Response: The Service utilized forest plans to identify the extent and likely impact of steep-slope logging in owl habitat. At the beginning of this century most of the gentle topography was intensively logged. Forests that remained intact were largely on steep slopes which probably served as refugia while the railroad-logged forests regrew. Today, much of the best owl habitat, which consists of mature and old-growth forest, occurs on steep slopes. Additionally, analyses of nest sites in New Mexico and Arizona indicate that steep slopes are preferentially selected by owls for nest and roost sites. Because steep slopes were minimally logged, the largest and most desirable trees occur in these areas. Forest plans on 5 of 11 Arizona and New Mexico forests allow cable or skyline logging of steep slopes. The Service considers steep slope logging to constitute a serious threat to the owl.

Issue 44: Forests should be managed on a longer harvest rotation cycle.

Response: The Service agrees. At this time, most of the timber produced in New Mexico and Arizona comes from forests that are managed under an even-aged system and harvested with a rotation cycle of 120 years or less. This cycle may maximize timber production but will not provide enough time for stands to reach the mature to old-growth conditions characteristic of forested spotted owl habitat. Region 3 of the Forest Service has recognized that a 120-year cycle is too short in its management guidelines for the northern goshawk (Reynolds *et al.* 1991), and, in discussions with the Service, has stated its intention to adopt longer rotation cycles across the Region.

Issue 45: The Service states that diminishing yields of ponderosa pine are causing the Forest Service to increase harvest rates in mixed conifer in order to maintain timber output at present levels. No data or references are cited to support this allegation.

Response: The Forest Service has estimated that approximately 50 percent of current timber yields could be obtained from harvest in unsuitable owl habitat. Therefore, any additional volume must come from other forest types, including mixed conifer, which compose owl habitat. The proportions vary among forests.

Issue 46: The Service implies that timber yields in ponderosa pine are diminishing. There are no data to support this allegation. In Arizona there is considerable effort to harvest smaller diameter ponderosa pine. This has made large volumes of ponderosa pine available and resulted in improvements in forest health and reduced fire risk.

Response: The Service recognizes that a tremendous production of small diameter ponderosa pine exists in Arizona and New Mexico. Forest Service silviculturalists have informed Service biologists that they consider increasing densities of small ponderosa pine a serious threat to forest health as well as a fire hazard. They report that they have had difficulty finding a market for these small products, and because most mills are not tooled to handle small logs, harvest is concentrated on larger trees. Forest Service data (Flowers, *in litt.*, 1992) show decreased availability of large trees. Therefore, yields of ponderosa pine are expected to decrease unless greater use is made of small diameter trees.

Issue 47: The timber industry needs to retool its mills to handle smaller, second growth trees. Large trees in the Southwest are not a renewable resource.

Response: According to Forest Service data, the growing stock level (GSL) on

national forests in New Mexico and Arizona currently exceeds 700 MMBF per year, and the planned 1992 harvest will be less than 300 MMBF. Part of the reason for the difference is that much of the growth occurs in young dense stands that cannot be efficiently harvested or marketed at this time. The decrease of late successional forests has reduced the availability of large trees, and the GSL is almost entirely concentrated in the young tree size classes. If the timber industry could develop a market for small trees, a tremendous resource would be available. As more mills are retooled to handle small trees the need to remove large trees from Mexican spotted owl habitat will diminish. The Service encourages this change in harvest emphasis.

Issue 48: The decline of the timber industry is related/unrelated to Mexican spotted owl habitat protection.

Response: The Forest Service estimated (Fletcher 1990) 59 percent (1,977,226 acres) of owl habitat is available for timber harvest. Protection of occupied owl territories has precluded the harvest of some of this suitable timber acreage, particularly in forests with a high density of territories such as the Lincoln National Forest. However, as suggested by communication from the AGFD (*in litt.*, 1990) and Forest Service memos (Forest Service, *in litt.*, 1989, *in litt.*, 1989, *in litt.*, 1989, *in litt.*, 1990, *in litt.*, 1990), ASQ levels are not sustainable. The Region 3 Forest Service ASQ is based on suitable timber acreage, rather than viable timber acreage. Accelerated harvest, accelerated stand reentries, inappropriate harvest methods, and a harvest rotation cycle of 120 years or less promoted forest ecosystem health problems which resulted in jeopardy to species dependent on late successional forest habitat.

The timber extraction industry in the Southwest has declined and experienced reductions in jobs over the long term. The decline is unrelated to the Mexican spotted owl or other threatened, endangered and sensitive species issues. Employment in the timber industry in New Mexico and Arizona has declined since the mid-1950s in real numbers as well as in percentage of the labor force. In 1956, timber harvest and sawmills employed about 3,672 people. Between 1956 and 1978 employment rose and fell between 2,500 and 4,000 people. In the late 1970s, employment in the timber industry peaked at 4,281. The numbers then dropped in the early 1980s as the lumber market fell. The level of employment reached a low of 2,009 employees in 1985 (several years prior to the adoption by the Forest Service of Interim Directive No. 1 in 1989 and No. 2 in 1990). By 1986, the market had recovered, and the New Mexico timber industry began to produce lumber at the same volumes it had in the late 1970s, but employment never recovered. By 1988, the employment figure stood at 2,400 people. Restructuring and automation in the industry had permanently eliminated more than 1,000 jobs (L. Krahl, Forest Trust, Santa Fe, New Mexico, *in litt.*, 1991).

Issue 49: Listing the owl and protecting its habitat will limit recreational access.

Response: The owl is being listed primarily due to the threat of loss of suitable habitat as a result of even-age timber harvest systems. Recreational use of national forests and other public lands would not be limited to any great extent as a result of the listing action. As with protection of other sensitive species, a small number of conflicts between needs of the owl and human recreation may be expected. These conflicts would be site-specific and would not affect any comprehensive recreational programs.

Issue 50: The national forests should be managed for multiple-use. The forest should be managed for all animals, not simply a single species.

Response: The Service agrees.

Issue 51: Forest Service inventories now indicate 620 Mexican spotted owl territories. This is an increase of 103 over the 517 indicated in the listing proposal. The Forest Service attributes the increase to new inventories conducted primarily in proposed timber sale areas. About 25–30 percent of the Forest Service inventory has been done in wilderness or other areas withdrawn from timber production.

Response: This new information is incorporated into the final rule.

Issue 52: The listing proposal stated that the forest plan management emphasis is timber production. In fact most analysis areas in Forest Service forest plans have management emphases other than timber and none are entirely timber oriented. When carrying out projects within a given management emphasis, decisions result from site specific environmental analysis required for timber sales. In these decisions, high timber emphasis is almost never selected for implementation on the ground.

Response: Although timber production *per se* may not be the management emphasis for many of the Forest Service's timber sales, timber harvest is the result, and treatments that result in even-aged stands destroy habitat for owls regardless of the emphasis.

Issue 53: The Forest Service forest plans not make irreversible and irretrievable commitments of resources.

Response: The Service understands this.

Issue 54: Forest plans provide guidelines, not hard rules for management.

Response: The Forest Service has been discussing alternative silviculture practices for use in Mexican spotted owl habitat, but, at this time, there is no binding direction to eliminate even-aged management. Forest Service timber sales during 1992 on the Apache-Sitgreaves, Carson, and Lincoln National Forests and the Environmental Analysis for the Region 3 1992 timber program continue to call for even-aged management in terms of shelterwood seed cuts and overstory removal cuts. The forests continue to manage for a 120-year harvest rotation cycle, as called for in forest plans. The forest plans for the Lincoln and Santa Fe National Forests call for harvest on steep slopes with cable logging techniques. All of these practices were identified by the Service (1991a, 1991b) as likely to jeopardize the continued existence of the Mexican spotted owl. Until policy changes are made formally, the Service believes that guidance provided in forest plans will continue to be followed.

Issue 55: Forest plans have a limited lifetime and cannot be extrapolated 50 to 100 years into the future.

Response: Forest plans set the policy for management on the national forests for the duration for which they are written, usually 10 to 15 years. The Forest Service is not committed to following forest plan guidelines beyond the lifetime of the plan. Conversely, the Forest Service is also not obligated to reverse its policy in subsequent plans. The management of forests with average tree lifetimes in excess of 200 years demands long-term management planning. Such long term planning is implied in the shelterwood silviculture method recommended in Region 3 forest plans. Because no other direction for management is proposed for the future, and until formal policies change, the Service believes that it must assume that practices recommended in forest plans will continue.

Issue 56: Estimates are made in the proposal on the changing of suitable owl habitat to capable and the length of time needed to regain suitability. These are in need of modification based on what the Forest Service has learned about the stand conditions where many of the owls live, analysis of stand growth patterns and the recognition that multi-

storied stand structure does not always mean wide differences in tree age. Projections of 100 years and upward for regaining suitability of modified owl habitat appear to be a large part of the rationale for the listing proposal.

Response: Two aspects of the recovery from "capable" to suitable habitat were considered in the proposed rule. If shelterwood management is continued, management will be directed at retaining the even-aged structure through pre-commercial and commercial thinning and other intermediate cuts followed by partial overstory and final removal cuts. These management treatments will result in maintaining stands in even-aged, simple structured condition as long as management continues. Time is required for even-aged stands to attain the complex canopy structure that is most used by Mexican spotted owls. If trees are left after regeneration cuts, complex structure will occur more rapidly than with complete overstory removal. In addition, if those trees left are the oldest and largest, complexity will be restored at an accelerated rate.

Issue 57: The estimates of time of recovery in the Forest Service data cited in the listing proposal (Fletcher 1990) were extremely conservative and made when views tended towards a need for "old growth conditions". However, Ganey and Balda (1988) found that, when owls had various foraging habitats available, only 2 of 6 owls used old growth more than in proportion to availability. Additionally, estimates in the report by Fletcher were made by a variety of individuals on the various national forests without review of experts in forest growth and silviculture. Forest Service timber stand data evaluated since the report by Fletcher shows that much occupied suitable owl habitat is relatively young, multi-storied stands. Detailed examination of stand data on the Lincoln National Forest shows owl territories comprised of many stands that meet criteria for suitability as habitat but are immature, dating from the extensive logging that took place in the 1920s and 1930s.

The Lincoln National Forest was almost completely logged over in the first 40 years of this century. Based on the historical record, most of this forest would have been considered unsuitable for spotted owls (under today's standards) by 1940. The harvest was made with cuts equivalent to clearcuts, seed tree cuts, or shelterwood seed cuts. Some logging has continued ever since. The record is also clear that the spotted owl was abundant to the point of near saturation of the forested area by the late 1900's. Although we do not have good records of when Mexican spotted owls appeared in number (or for that matter that they ever were scarce) it is certain that suitability was regained in substantially less than 60 years following timber cutting that was much more extensive than modern management predicts for the future.

Response: Ganey and Balda (1988) identified non-random use of old-growth stands for two pairs of owls. The remaining owls had mature and old-growth stands available, and they used those stands in proportion to their abundance on their territories. In the Lincoln, Gila, Coconino, Apache-Sitgreaves and Tonto National Forest, owls are found most consistently where mature and old-growth stands of mixed conifer or pine-oak are present. Based on the inventory figures that are summarized in Appendix 8 of the Forest Service comments, significant numbers of trees were left after cutting on the Lincoln National Forest. Appendix 8 shows approximately 15 percent of the stand density index in Mexican spotted owl cores is made up of trees greater than 18 inch diameter at breast height. Even on the Lincoln National Forest with its high site index, these trees date from prior to 1900. The assertion is made that suitable habitat has returned to areas that were heavily harvested as late as 1940. Most of the heavy logging on the Lincoln occurred early in the century. Thus, most stands have had more than 80 years to recover. Eighty years is a period consistent with Fletcher (1990) and the Service (1991a, 1991b) expectation for the time required for habitat to recover to suitable condition after being made "capable."

Issue 58: The proposal implies that all the steep slopes on five national forests are fully subject to logging. It also states that these slopes have not been logged in the past. Neither assertion is correct. The amount of steep slope logging is now limited to a very small fraction of the steep slopes on the national forests in question. Further, the best population of spotted owls known to exist occurs on the Lincoln National Forest where most steep slopes were logged using steam powered cable yarders and crawler tractors in the first 40 years of this century. Many timbered, steep slopes elsewhere in the Southwest were logged in the early part of this century and to a much lesser degree since then. The photographic records indicate that the methods of harvest on steep slopes were most nearly like shelterwood seed cuts, seed tree cuts, and clearcuts.

Response: The Service has not stated that all steep slopes on five national forests are fully subject to logging. What the Service did assert (Service 1991b, pp 56340) was "Forest plans for 5 of the 11 New Mexico and Arizona national forests now contain provisions to allow cable or skyline logging on slopes greater than 40 percent. The Gila National Forest Plan (Forest Service 1986a) suggests total timber harvest for that forest could be maintained at the present 30 MMBF per year ASQ by entering steep slopes, with as much as 50 percent of the forest's total timber volume coming from this habitat in five decades." The population of owls on the Cloudcroft and Mayhill Districts of the Lincoln National Forest is high. Steep slopes in these districts were harvested during the early decades of this century, but enough habitat probably remained on steep slopes to sustain the species while the trees on the gentler slopes grew back. Large, old trees that date from before 1900 remain today on most spotted owl territories on the Lincoln National Forest. The presence of these large old trees leads to the conclusion that the forest was not harvested as completely as is generally believed. On the Gila, Coconino, Tonto, and Apache-Sitgreaves National Forests the greatest Mexican spotted owl concentrations occur in canyons and on steep slopes which have experienced less intensive harvests than the flatter surrounding terrain (Forest Service, *in litt.*, 1992).

Issue 59: The proposal states that Mexican spotted owl habitat faces destruction at a rate equal to or exceeding that of recent decades. The assertion is without merit. The record clearly shows that Mexican Spotted owl habitat is not facing destruction, but is improving with each passing year.

The current amount of timber harvested and programmed for harvest is not increasing but rather is considerably less than that of recent decades. The timber sold in each of the 3 years since 1989 was less than any of the preceding 20 years. Timber sales are projected to be about 300 MMBF which is less than the levels of more than 400 MMBF in the late 1980s.

Response: The Service is not concerned with the rate of harvest; it is concerned about the rate of conversion of suitable habitat to a condition that will not support Mexican spotted owls. Even-aged management, as identified in Region 3 forest plans, has only been in widespread use since about the mid-1970s, so harvests prior to that time are not an issue. As stated in the Mexican spotted owl status review (Service 1991a) and the proposed rule (Service 1991b), past and projected management under the shelterwood system is identified as leading to increased rates of habitat conversion into the

foreseeable future. Furthermore, there is no documentation of future direction that obligates or directs the forests to reverse that trend. Figures provided by the Forest Service show an increase in harvest, region-wide, from 334 MMBF in 1971 to 447 MMBF in 1986, followed by a decrease to 282 MMBF in 1991. The reductions in harvest in 1991 and 1992 reflect difficulties met in adjusting to new management practices.

Issue 60: Habitat conditions are much improved over that recorded in early descriptions and surveys. In the mixed conifer type, they indicate that it was variously thinned by fire and/or that fire had swept enormous areas, killing nearly all the trees in the burned areas. Many of these burns supported good cover of aspen or young conifers. Pearson in 1931 noted some aspen stands and prairies within the mixed conifer zone without young conifers and questioned if they really would succeed to mixed conifer. Today, little evidence of such conditions remain due primarily to control of fire losses and ecological succession. Enormous areas of aspen stands no longer exist and young conifer stands have matured substantially. Forest Service forest inventories indicate that most aspen stands remaining in the southwest have an understory of conifers that will eventually replace them. Meadow conditions persist within the mixed conifer type, but these too are being replaced by conifers and none remain so extensive in area that could be described as prairies. Almost all meadows in the mixed conifer zone show evidence of conifer invasion at their margins.

The listing proposal presents no evidence to show that there has been a recent decline in Mexican spotted owl habitat. While it is true that every year some suitable habitat has been changed to capable, there is also a substantial regrowth of areas into suitability. Information from forest inventories indicates that a net gain in suitable habitat for Mexican spotted owl is occurring. It is certain that this has occurred on the Lincoln National Forest and the ecological changes reflected in forest inventories make it clear that such changes have occurred throughout the Region. The table in Appendix 7 of the Forest Service Region 3 comment letter summaries forest inventory information showing how rapidly change is occurring. Comparing inventories from 1962 and 1987–1988, it shows that in Arizona and New Mexico the acreage of mixed conifer (generally considered suitable habitat) has increased by [not included] acres or 81 percent. This equates to approximately 40 thousand acres per year. Proportioned at the ratio of commercial forest land ownership, about 24,006 acres would be attributable to Forest Service lands and exceeds the area of suitable habitat annually impacted by Forest Service timber sale programs. This is a strong indication that suitable habitat for the Mexican Spotted Owl is increasing rather than decreasing.

Response: Appendix 7, provided by the Forest Service, shows an increase in mixed conifer habitat at the expense of aspen and ponderosa pine stands. However, it does not demonstrate increases in suitable habitat. Much of the increase in mixed conifer is a result of invasion of ponderosa pine by young white fir. These stands will not have attributes of suitable Mexican spotted owl habitat for many years. If fire suppression is relaxed, many of these stands will revert back to pure ponderosa pine, or aspen, forest types that are not generally suitable for Mexican spotted owls. The assertion that the Service has not presented any evidence of Mexican spotted owl habitat loss is in error. In the status review and in the proposed rule (Service 1991a, 1991b) the Service cites Forest Service data which show a loss of 10 percent of suitable Mexican spotted owl habitat between 1980 and 1990.

Issue 61: Forest Service inventory comparisons show an increase of 1,920,000 acres (210 percent) in forested area classified as wilderness or other areas permanently reserved from timber cutting on the national forests in Arizona and New Mexico. These forested areas are not subject to logging. In a more specific example, a recent comparison of inventory information on the Apache-Sitgreaves National Forest for a mid-1970's inventory and a 1988 inventory shows the following information. Timber lands increased from 812,000 acres to 823,000 acres (+1 percent). Total live stems per acre increased from 650 to 854 (31 percent) and cubic foot volume increased from 800 million cubic feet to 1.3 billion cubic feet (64 percent). In contrast, the description of this forest in 1904 contained the following: "throughout the area in which yellow pine predominated the amount of litter and underbrush is very small, the forest floor being very clean, with a scanty covering of humus".

Response: The Service recognized the withdrawal of timberlands in its analysis of impacts to the owl. The increase in stem density, mentioned above, does not identify an increase in suitable habitat. It indicates an increase in the acreage in seedling/sapling size trees on the forest, which result from removal of mature and old-growth overstory. Contrary to the implication that this increased density is indicative of improved conditions, it indicates that suitable habitat is being converted to unsuitable.

Issue 62: Like the mixed conifer forests, ponderosa pine forest were much less dense in the past than they are today.

Response: This comment is difficult to respond to because no evidence has been presented to indicate that mature and old-growth mixed conifer stands are more dense today than they were previous to timber management. As indicated in the preceding comment, the increase in average stem density is a result of replacing old stands with regenerating stands of seedlings and saplings. Young stands composed of small trees can sustain considerably higher densities than stands composed of large old trees.

Issue 63: Early descriptions characterize ponderosa pine forests as open forests. Such descriptions indicate the average condition had always been unsuitable as owl habitat and less dense than the ponderosa pine forest we have today. This is additional evidence that the modern, denser ponderosa pine forests on capable habitat are progressing towards suitable habitat rather than away from it.

Response: The assertion that forests were open has been supported for ponderosa pine, not mixed conifer. Open stands of pure ponderosa pine do not have the attributes of suitable Mexican spotted owl habitat, and dense even-aged stands of ponderosa pine usually lack those characteristics.

Issue 64: The long history of partial cutting, extensive areas of forests reserved from cutting and successful fire control in Region 3 has allowed ecological succession to increase the conifer cover. It has increased the proportion of mixed conifer species such as white fir at the expense of successional tree species such as aspen and ponderosa pine. The experience is in accordance with expectations developed from ecological studies where mixed conifers and aspen occur. Neither aspen nor ponderosa pine are well suited to regenerating under shaded conditions. Ponderosa pine in the Southwest has tended to increase in extent and density at its ecotone with grasslands and oak due to grazing and fire. Both of these trends continue to increase the potential suitability for owl habitat in part because the current and projected timber sale program is too small in amount and the disturbances associated with the timber harvests are not severe enough to mimic the wild

fires that had historically maintained the early successional cover types in the southwestern forest ecosystems.

Response: The Service agrees with the Forest Service that widespread fire suppression has caused many changes in forest community types. The Service also is in general agreement with the Forest Service efforts to identify management practices which emulate and will return the forests to natural ecological processes. Pure aspen and pure ponderosa pine stands may have been more widespread in the past than they are today because of the factors identified above. However, mixed conifer and pine oak are also community types that occur naturally, usually on wetter sites than those occupied by pure ponderosa pine. Because mixed conifer and pine oak occur on wetter sites they experienced less frequent fires, with resultant higher density stands. As noted above in the Forest Service comments, when fires occurred naturally in mixed conifer they were often stand destroying and succeeded by aspen. Current and historical fire suppression efforts are largely responsible for the demise of aspen in southwestern forests but may be of little importance in controlling tree density *per se* in mixed conifer.

Issue 65: The listing proposal fails to consider that the net annual growth of sawtimber (gross growth minus mortality and defect) on national forests in Region 3 is 701 million board feet. This growth does not include wood products such as posts and cordwood. However, the timber sale program does include such convertible products. The total sale program is projected to be 310 million board feet in 1993 and to remain at this low level until the needs of sensitive species such as the Mexican spotted owl indicate otherwise. It includes about 60 million board feet equivalent of other wood products, mostly pinyon-juniper firewood and posts cut from non-suitable owl habitat and pulpwood less than 9 inches in diameter sold by the cord. The current annual increase in timber volume in the forests is approximately the difference between the 701 million board feet of growth in sawtimber and the sale of about 250 (310 minus 60 other wood products) million board feet of sawtimber. This difference is the excess over and above depletion from logging, fire, and pathogens and has produced a net increase in volume in the forest for each or the last five decades. Because the timber sale program has been significantly reduced beginning between (date not provided) and 1990. The increase in inventory is expected to be by even greater margins in the future. The excess of timber growth can only manifest itself as an increase in tree size, an increase in stand density or both, all of which favors spotted owl habitat. About half of the sawtimber sold is expected to come from potentially suitable owl habitat and about half of the growth as well. If so, the net effect in suitable owl habitat will be improvement not worsened habitat for Mexican spotted owls.

Response: The Service does not disagree with the Forest Service that there is timber available on national forests for harvest. The concern for the owl is that the Forest Service harvests are focused, not on small sawtimber that is found in stands of unsuitable habitat, but rather on the oldest stands that are most important to the owl. In addition, the harvest techniques proposed in suitable Mexican spotted owl habitat by the Forest Service are not benign to the owl. They have essentially the same effect as stand destroying fires. They convert mature, complexly structured forests into young stands with simple structure that are no longer suitable for Mexican spotted owls. The acreage of mature and old-growth forests on suitable timberlands were not presented in this comment letter, but in the Service's reviews of the 1992 timber sale programs on the Apache-Sitgreaves, Carson, Santa Fe, Lincoln and Tonto National Forests it was clear that such stands are under-represented across the landscape. The Service encourages the Forest Service to increase its stand allocations to maintain old-growth and mature forests.

Issue 66: The listing proposal cited estimates of timber offered and sold in the report by Fletcher (1990). This report did not include the substantial reductions in sales offered and sold that were subsequently modified to eliminate cutting that would adversely affect owls or goshawks. When owls or goshawks are found, the Forest Service continues to cancel portions of timber sales that were included in past statistics of offered or sold timber. Based on interpretation of forest plans, the listing proposal projects an annual rate of loss of suitable habitat of 0.4 percent. However, the proposal ignores the record of actual practice which has been and will continue to be substantially less than the upper limits set forth in the forest plans. The proposal dwells exclusively on erroneously projected potential habitat losses and ignores the record of growth and ecological changes which, as shown above, indicates a net improvement in spotted owl habitat is occurring rather than destruction or an increased rate of loss.

Response: The Service acknowledges that the Forest Service has eliminated, reduced, or modified many timber sale activities in Region 3, particularly in 1992. However, the Environmental Assessment for the Region 3 1992 timber program (Forest Service, *in litt.*, 1992) still contains activities that will convert suitable habitat to even-age, and that will maintain even-age conditions in stands that were formerly converted from suitable habitat. Final environmental impact statements on individual timber sales on the Carson and Lincoln National Forests (Forest Service 1992a, 1992b) also retain even age treatments in suitable habitats. Furthermore, the Forest Service does not have any formal published policy direction that will prevent it from continuing or resuming these practices in the future.

Issue 67: The proposal states that allowable sale quantities (ASQ) were not scientifically derived. The allowable sale quantities were based on models of timber growth derived from scientific studies (Edminster 1978). The projections match experienced growth and growth on research plots much more closely than could reasonably be attributed to chance. As noted in the background discussion, the variance with planning criteria is related to evolving standards and criteria that can change rapidly in today's world. Standards for spotted owls and goshawks are two recent examples that continue to develop. Further, ASQ functions as an upper limit on timber sales not as a minimum to be achieved. The record indicates that Region 3 has operated its timber program at a level substantially less than the allowable sale quantity and will continue to do so.

Response: Whether the ASQ amounts were scientifically derived or not, they were sufficiently incorrect on five forests to require review and modification (D. Jolly, Forest Service, *in litt.*, 1990) by the Forest Service. Furthermore, at a meeting with the Forest Service (August 14, 1992), the Service was told that Region 3 of the Forest Service has a goal for 1993 and beyond of 300 MMBF per year.

These ASQ levels are primarily from growth estimates on suitable timberland. They do not account for the extent of acreage set aside for such allocations as old-growth management or threatened, endangered or sensitive species habitat protection. Forest Service data indicate the remaining suitable timberland (viable timberland) is currently estimated to be about two-thirds of the figure used to calculate ASQ. The viable timber growth is estimated as less than one-half the

growth used to calculate the ASQ levels identified in current forest plans. In other words, the current ASQ level is allowing harvests at twice the viable level, and thus is biologically unsound and unsustainable. In addition to negative impacts to the owl from even-aged management, the Service considers the excessive ASQ levels to constitute a serious threat to sustainability of owl habitat.

Issue 68: The proposal speculates that demand projections show an increase in future decades and that means future habitat loss at even greater rates than the proposal projects. Aside from the data that indicated that habitat can be expected to increase rather than decrease, an increase in timber demand does not mean an increase in supply from the national forests. The record clearly indicates a willingness of the Forest Service to limit the availability of timber supply from its land in the face of high demand for it. The concept of sensitive species and development of guidelines to meet their needs were initiated by means of the forest plans prior to petitions for listing to the Fish and Wildlife Service. The effects of identifying sensitive species in the forest plans and applying management guidelines contained in the Forest Service manual was overlooked in the way the listing proposal portrayed the content and probable effects of the forest plan guidance.

Response: The Service understands that forest plans provide management guidance to the forests. Service interpretations of forest plans is based upon their content, not on how they may be altered at some time in the future.

Issue 69: Fragmentation was stated as a problem but appears to be a declared one without a clear statement of reasons of how the proposed activities would do this. Projections of perceived effects of shelterwood cutting are simply declared to have this effect. There is no statement that this has indeed occurred and our view is that the fabric of the whole forest is largely intact. Although there are openings in the forest canopy, they are not dominant, not substantially out of scale with the landscape and probably less abundant than before the era of fire control. The photographic record of early day scenes from the Lincoln National Forest and elsewhere in the Southwest indicate this to be true (Glover 1964, Glover 1990, Glover and Hereford 1990). The small amount of and timing control of timber harvests that are likely to occur will not result in habitat fragmentation.

Response: When trees are removed from a forest, the canopy is opened up. This results in a change or discontinuity in the forest. If enough trees are removed, the habitat may change so that it becomes suitable for species that would not otherwise have occurred there. These new species may be plants, animals, fungi, protists, or procaryotes. When changes in habitat result in new conditions which allow invasion by species that would not normally occur there, the formerly homogeneous habitat is fragmented. When the forest receives a shelterwood regeneration cut or a final removal cut the overstory changes in a manner that is visible to humans. There are also correlated changes in the fauna from which biologists may infer that a habitat change has occurred. This is a form of fragmentation. When large areas of mature and old growth, or young dense forest habitat, like that which is identified as suitable on the Lincoln National Forest, are fragmented, the incidence of red tailed hawks and great horned owls may increase, and both of those species are implicated predators of Mexican spotted owls. Fragmentation may also remove acreage that can be used by the owls, resulting in lower density. This has been demonstrated for the northern spotted owl (Carey *et al.* 1992).

Issue 70: The listing proposal makes some assumptions about present and future conditions in Mexico. Forest Service experience indicates the listing proposal misrepresents the situation there. Much of the forest is inaccessible, isolated economically, and likely to remain so. There are many steep canyons and the people there do not have ready access to technology needed to conduct steep slope logging. The lands are not suitable for agriculture and not subject to conversion to other uses. Where forestry is practiced, most logging is done with horses and mules with partial cutting methods and natural regeneration is abundant. There is little waste. Fire control has improved. They also manage their young stands at higher stand densities than is the usual practice in the United States. Widespread deforestation is not a reasonable expectation. The listing proposal essentially writes off the Mexican spotted owl and its habitat in Mexico on the basis of assumptions that are incorrect, inadequately supported by data, or are misrepresentative of the situation there. The listing proposal misrepresents both the speed of change and perhaps the direction in which the habitat is changing.

Response: The Service reviewed available literature and notes taken by biologists on Mexican spotted owls in Mexico, and solicited information from the Mexican Government. The available information all indicated that the Mexican spotted owl is rare throughout its range in Mexico. In addition, other species which are dependent on the same kinds of forest habitat, the imperial woodpecker, the thick-billed parrot and the maroon-fronted parrot are either extinct or in decline, largely because of habitat alteration and pressures from increased human populations. The Secretaria de Desarrollo Urbano y Ecologia, Mexico, stated that the species is considered rare and imperilled by the Mexican government (Graciela de la Garza Garcia, Secretaria de Desarrollo Urbano y Ecologia *in litt.*, 1990)

Issue 71: As noted in the listing proposal, under the threat category of over-utilization for commercial, recreational, scientific or educational purposes, the major effect appears to be scientific research. Research, not conducted by the Forest Service, is permitted by special use permits issued by the national forests in which the research occurs. Forest Service permits cover any stand disturbing activities, camp sites, or other exclusive uses of national forest resources necessary in conducting the research. In addition permits from state and federal wildlife agencies may be required depending on how the work affects the birds themselves. We have not noted major changes in educational or recreational uses of the spotted owl although it may occur in the future. We are aware of two pairs of owls and their fledglings that have been subject to many "show me" trips throughout the 1992 breeding season and appear to have suffered no ill effects. Young were successfully raised by both pairs this year.

Response: The Service does not disagree with this comment. This issue is of minor consequence for the Mexican spotted owl and did not influence the listing decision.

Issue 72: The proposal cites upward great horned owl population trends over the last 22 years as a concern. The Forest Service shares the concern about predation. However, it disagrees with the proposal which flatly declares that this is evidence that the stands are opening up. This is conjecture, not evidence. The evidence based on records and measurements of timber stands themselves indicates the opposite to be true (Covington and Moore 1992).

Response: Covington and Moore's work was in ponderosa pine, and the Service acknowledges that tree density in ponderosa pine has increased as a result of fire suppression. The increased closure within mixed conifer stands is a result of tree growth and is not an

issue. The Service concern is that imposition of management which might be appropriate for pure ponderosa pine stands, generally not suitable habitat, with removal of forest overstory in suitable Mexican spotted owl habitat may expose the owls to increased rates of predation by creating conditions that are suitable for great horned owls and red-tailed hawks. The Service is also concerned that these openings may increase exposure to parasites and or diseases, which the owls would not otherwise encounter. See Service responses to Issue 11 and 13 above.

Issue 73: Thirty years ago the great horned owl and hawks in general were commonly considered as varmints and it was not uncommon for hunters and other rural residents to shoot them at every opportunity. Both are now protected species. Chlorinated hydrocarbon pesticides were found to have adverse effects on reproduction on birds of prey and these are no longer in use. Such factors could have a bearing on long term upward population trends for both the red-tailed hawk and great horned owls cited as predators of spotted owls. Even if they do not, such assertions are no more speculative than those cited in the listing proposal and illustrate that there are certainly many factors involved in populations of predator species. The conclusions reached in the proposal about open stand conditions are incorrect and inconsistent with the historical record.

Response: The causes of increased populations of red-tailed hawks and great horned owls are not an issue. The Service's concern is that when the Forest Service opens gaps in the forest canopy in suitable Mexican spotted owl habitat it creates opportunities for increased contact between these species and Mexican spotted owls. The result of increased contact is likely to be increased predation on the Mexican spotted owls. Juvenile Mexican spotted owls are particularly vulnerable to predation when their exposure increases.

Issue 74: The listing proposal also takes issue with existing Forest Service regulatory mechanisms. The Forest Service has issued a Notice of Intent to prepare an environmental impact statement and decision which will amend forest plans to include guidelines that will be developed in a conservation strategy for the Mexican spotted owl. This will close the loop and all of our control mechanisms will include consistent information. Management has been responsive to a rapidly changing and growing body of information. All Forest Service units are consistently applying the latest guidelines. The net result has been a dramatic shift in the way timber sales are designed. This further supports the Forest Service's earlier discussion about why decisions on owl habitat cannot be made based on assumptions about forest plan implementation. Actual practice reflects an extraordinary commitment to owl habitat protection that has been responsive to new information as it develops. The regulatory mechanism implemented within the Forest Service through its guidelines and directives assures the continued existence of the spotted owl throughout its range in Region 3. This is certainly true within the relatively short time needed to develop and implement a conservation strategy. There is also a strong record of Forest Service effort to develop new information, sponsor research and to spend millions of dollars on spotted owl inventories prior to project implementation. The information will be used to further develop direction for the management of the spotted owl and its habitat. This is a very reasonable approach in light of the long term ecological changes that are improving owl habitat, especially when combined with the over-estimation of the amount and nature of disturbance to habitat that was outlined in the listing proposal.

Response: The Service recognizes and appreciates the efforts that the Forest Service has taken to reduce the impacts of its management on the Mexican spotted owl. However, the Service does not believe that the Forest Service's interim directives provide adequate protection to guarantee the long-term existence of the owl across its range. The Forest Service has not yet been able to develop and adopt a conservation strategy that the Service believes will adequately protect the owl.

Issue 75: The proposal cites the effect of forest fires as a concern in loss of habitat. The Forest Service shares this concern and acknowledges that fire can be expected to destroy habitat for the Mexican Spotted owl more completely, in large areas, for longer periods of time than do any of the management practices it proposes to implement as discussed in preceding sections. Unlike timber management and other activities, the Forest Service cannot control where fires occur and therefore cannot avoid owl habitat or nesting areas. Wildfires and the activities needed to suppress them cannot be scheduled to avoid the breeding season for the bird and almost always occur during this time. Of particular concern is that fires in steep, dense, or multi-storied stands of mixed species are difficult to fight and tend to be large and stand consuming. Forest Service recent experience with the Dude fire on the Tonto National Forest certainly bears out this observation with the total loss of five owl territories for the foreseeable future.

Response: The Service has identified wildfires as the cause of some loss of suitable habitat in New Mexico and Arizona. The Service disagrees with the Forest Service assertion that the losses will be of longer duration than the forestry practices promulgated in the forest plans. As stated previously (Service 1991a, 1991b), as long as shelterwood management is maintained it will prevent habitat from returning to suitability. Additionally, the Forest Service noted that 221,000 acres (5 percent) of suitable habitat has been converted to unsuitable condition by fires in recent years (Fletcher 1990). If recent years means the past 20 years, then suitable habitat has been converted at the rate of 0.25 percent per year. If the period was longer than 20 years (some of these acres were burned 50 years ago), the annual burn would be smaller and the rotation length longer. A burn rate of 0.25 percent per year translates to a rotation cycle of approximately 400 years which is close to many estimates of the age of virgin old-growth mixed conifer stands in the southwest. This rate of burning would also result in approximately 20 percent of mixed conifer habitat being in aspen at any given time.

Issue 76: In mixed conifer, the predominant tree species is white fir, easily killed by fire, as is white pine and blue spruce. The fire resistance of Douglas-fir is not high enough to survive fire in a dense multi-storied stand. Forest lands also have experienced long term loss of site occupancy by trees in shrub fields on the Lincoln National Forest and elsewhere created by high intensity fire in mixed conifer stands that had shrubs or oak in the understory. Even the fire resistant ponderosa pine often suffers stand destroying fire intensities when grown in dense, multi-storied stands. Experience and scientific information also indicates that extensive tree mortality due to bark beetles can be expected if stand density is uncontrolled. Loss of significant amounts of habitat to bark beetles such as Ipps, mountain pine beetle, western pine beetle, roundheaded pine beetle, Douglas-fir beetle, and Scolytus beetles is certain and these losses are likely to be associated with drought periods when soil moisture is not adequate to support a high density of trees. Numerous researchers have reported an increasing risk of bark beetle epidemics with increasing stand density, increasing tree diameter and high

moisture stress. It is also expected that defoliation by spruce budworm will be a chronic problem. This insect is strongly associated with multi-storied stand of white fir and Douglas-fir throughout the southwest. Management toward dense, multi-storied stand conditions in ponderosa pine and Douglas-fir has and will continue to increase the intensity of dwarf mistletoe infection.

This parasitic plant spreads by expelling seed that fall on nearby and understory trees. This parasite reduces growth eventually killing the tree and preventing the small trees from ever reaching large sizes and greatly reducing stand density. High levels of infection eventually eliminate high stand densities and large trees and this makes the stand unsuitable as spotted owl habitat. Open stands of small infected trees can be expected to persist indefinitely until replaced by means of a stand destroying event such as fire or clearcutting. If timber and prescribed fire activities are completely foregone in owl habitat, dwarf mistletoe infestation can be expected to intensify over time. Two region-wide surveys for dwarf mistletoe conducted thirty years apart indicate that this has happened in recent history as modern forests have become more dense and have been managed through harvest methods that emphasize partial cutting. In 1950's surveys, 30 percent of the commercial forest acres were found to be infected, and in the 1980's it was 39 percent.

The listing proposal underestimates the vulnerability of extensive areas of dense, multi-storied stands to sudden and catastrophic losses of habitat to fire, insects or disease. Likewise it overlooks the beneficial effect of a diversity of stand conditions and cover type mixes that are essential to stable ecosystems needed by the Mexican spotted owl and other wildlife species. The listing proposal ignores the consequences of allowing an excess of timber growth over removal to persist indefinitely. Short term and uncertain improvement in spotted owl habitat is being proposed that assures extensive, catastrophic losses of habitat in the longer term.

Response: The Service has not underestimated the vulnerability of the forests to fire, pests and disease. The Service recognizes the importance of fire ecology in forested habitats. Moreover, the Service appreciates that the function of fires differs among different forest community types. The Service analysis of fire in mixed conifer is that it will result in longer lived forests with greater structural and species diversity than what will be attained under current Forest Service management guidelines. Under current guidelines, mixed conifer stands will be destroyed 3.3 times as frequently (every 120 years as opposed to every 400 years) by regeneration cuts as they would be if natural fire is permitted to determine stand longevity. Parasites and diseases are also an integral part of forest ecosystems and contribute to the maintenance of species diversity and structural diversity in forests. The increases in parasite and diseases intensity is compared to younger stands, not naturally occurring old-growth forests. If mixed conifer stands are composed of multiple species, the close juxtaposition of many tree species will impede the transmission of parasites and diseases which are species specific. The Service reiterates, it is not advocating that management of forests and timber harvests must stop. There is a tremendous resource increment available for harvest, but that resource does not reside in the already over-harvested mature and old-growth stands that are needed by the Mexican spotted owl. It is in the young forest stands often identified as vegetation structural stage three. If the Forest Service adapted its sale program to harvest small saw-timber which is over-abundant, and to retain mature and old-growth stands until they are adequately represented across the landscape, a significant threat to owl habitat would be removed.

Issue 77: The predominant reason for proposing listing of the Mexican spotted owl by the Service was the perceived current and projected future loss of suitable habitat. The Forest Service has shown clearly that: (a) Changes from suitable to capable habitat have been minimized with a net gain in suitable habitat being much more probable than a net loss of habitat; (b) there is no present or projected over-utilization of the bird for recreational, scientific or educational purposes; (c) Forest Service actions have not had and will continue to have no measurable effect on diseases and predation of the owls; (d) Regulatory mechanisms are in place to assure that habitat for the owl will be protected; (e) emphasis on short term gains in habitat will assure substantial and uncontrolled future losses of spotted owl habitat.

Response: The Service does not agree that suitable habitat is being gained faster than lost. Service analysis of Forest Service data indicate that the forest increment is occurring mostly in stands that are not yet suitable for owls and that harvest is aimed at the very limited mature and old-growth stands. When combined with even-aged management practices identified in the forest plans, there is a steady loss of suitable habitat into the foreseeable future.

Summary of Factors Affecting the Species

After a thorough review and consideration of all information available, the Service has determined that the Mexican spotted owl should be classified as a threatened species. Procedures found at section 4(a)(1) of the Endangered Species Act (16 U.S.C. 1531 *et seq.*), and regulations (50 CFR Part 424) promulgated to implement the listing provisions of the Act were followed. A species may be determined to be an endangered or threatened species due to 1 or more of the 5 factors described in section 4(a)(1). These factors and their application to the Mexican spotted owl (*Strix occidentalis lucida*) are as follows:

A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Recent surveys have shown Mexican spotted owls occur most frequently in forests with distinct "mature forest" characteristics. Owls are usually associated with forested mountains and canyons containing dense uneven-aged stands with a closed canopy, as is typically found in the mixed-conifer community type. Although these characteristics are mostly found in mixed-conifer forests, ponderosa pine/Gambel's oak forests are also used if they are old enough to exhibit a high incidence of large cavity trees; broken tops, numerous snags, and a heavy accumulation of downed woody material.

Significant portions of Mexican spotted owl habitat have been lost or modified. Several factors are responsible and represent continually increasing pressures from local and regional human populations. Cumulatively, they have reduced spotted owl habitat significantly throughout its range.

Fletcher (1990) provided an estimate of spotted owl habitat loss on Forest Service lands in Arizona and New Mexico, expressing it as habitat "made capable." He defined "capable habitat" as habitat that was "* * * suitable at some time in the past and became unsuitable due to natural or man-caused events * * * and it is capable of becoming suitable Mexican spotted owl habitat at some time in the future." An estimated 1,037,000 acres of owl habitat have been converted from suitable to capable. Of this, 816,000 acres (78.7 percent) were due to human activities (primarily timber harvest) and 221,000 acres (21.3 percent) were due to natural causes (primarily fire).

Fletcher (1990) also provided an analysis of the length of time required for capable habitat to return to suitable. However, recovery periods for the habitat "made capable" due to timber harvest (78.7 percent) are irrelevant because any acreage placed under the even-aged shelterwood management system used on Forest Service timberlands in the Southwest must be considered indefinitely unsuitable as spotted owl habitat. For example, a regenerating, middle-aged stand of "capable" habitat might be within 50 years of returning to suitable status. Under the shelterwood system, the stand will receive intermediate cuts before then, which sets back the time to return to suitable conditions. Ultimately, the stand will be re-entered with another regeneration cut where all but a few trees are removed. Thus, after the critical attributes of owl habitat have been lost, shelterwood acres are held perpetually as "capable habitat" unless silvicultural management is altered. Suitability as owl habitat is never recovered or, at best, is recovered only briefly before the forest is re-entered and returned "capable" status. Therefore, all past and projected acres of owl habitat placed under shelterwood management are considered lost indefinitely as owl habitat. According to current forest plans, and assuming that present management direction continues, about 95 percent of Forest Service commercial timberland in the Southwest is projected for management using the shelterwood system. Commercial timberland on the Navajo Indian Reservation is being converted to shelterwood management. Commercial timberland on other Indian reservations in the Southwest is managed predominately through selective logging to produce uneven-aged stands (S. Haglund, BIA, pers. comm., 1992).

Fletcher (1990) reported 3,365,000 acres of currently suitable habitat exist in New Mexico and Arizona national forests. Conversion of 1,667,000 acres from suitable to capable represents a 23.5 percent loss of suitable habitat over an unspecified, but recent, number of years. Forty percent of the loss occurred since 1980 (Fletcher 1990), which represents a rate of habitat loss of approximately 10 percent in the last decade on Arizona and New Mexico national forests.

Data are not available on owl habitat loss from lands other than Arizona and New Mexico national forests. National forests in Arizona and New Mexico account for approximately 90 percent of known owl locations.

There are some indications that the spotted owl historically ranged into middle and low elevations in well developed riparian woodland communities. Bendire's (1892) location for nesting owls northwest of Tucson was in the extensive historical riparian gallery forests of the Santa Cruz River and its major tributaries. His sighting near the confluence of the Santa Cruz River, Rillito Creek, and Canada del Oro was also at the base of the Santa Catalina Mountains which contain typical conifer forest habitat currently occupied by owls.

Riparian woodlands in the Southwest prior to the twentieth century may have satisfied many of the structural and thermal requirements of owl nest and roost sites. Dense cottonwood canopies and willow/mesquite understories could have provided a multistoried structure and cool microclimate. The historical presence of surface water below these gallery forests probably ameliorated the surrounding desert thermal regime. The high diversity and abundance of potential prey items may have made these middle and low elevation riparian habitats suitable breeding locations.

Duncan (1990) documented a recent breeding season owl location in a mid-elevation riparian area, also in southeastern Arizona. Single owls have been observed in winter in mid-elevation riparian areas in central Arizona (J. Ganey, Nothern Arizona University, pers. comm., 1990; T. Lister, AGFD, pers. comm., 1989). Winter locations at low elevations have also been recorded in New Mexico (Skaggs, New Mexico State University, pers. comm., 1990). These contemporary records suggest riparian habitats could indeed have provided suitable owl habitat in the past.

Southwestern national forests primarily use the shelterwood harvest technique, which manages for even-aged stands. Thus, the uneven-aged, multistoried stands comprising primary owl roost and nest sites will be converted to unsuitable even-aged stands with reduced structural diversity if management practices remain unchanged.

Forest plans for 5 of the 11 New Mexico and Arizona national forests now contain provisions to allow cable or skyline logging on slopes greater than 40 percent. The Gila National Forest Plan (Forest Service 1986a) suggests total timber harvest for the forest could be maintained at the present 30 MMBF per year ASQ by entering steep slopes, with as much as 50 percent of the forest's total timber volume coming from steep slope habitats in 5 decades. The Lincoln National Forest Plan (Forest Service 1986b) specifies 5,054 acres of steep-slope logging during the 10 years covered by the plan, and the Santa Fe National Forest Plan (Forest Service 1987) calls for harvest of 1.5 MMBF annually by skyline logging. The Apache-Sitgreaves and Tonto National Forests do not identify specific plans for cable logging, but the practice is not precluded in the forest plans.

Most steep slopes have not been harvested to any significant degree in the Southwest in the past. Steep slopes typically provide superior spotted owl habitat by virtue of the owl's preference for the topography, rock outcrops and/or cliffs, and the generally cooler microclimates often supporting multilayered mixed-conifer forest. Steep slopes may be particularly important in maintaining owl populations where they occur at the lower elevational limits of the owl's range. Steep slopes and deep canyons often provide pockets of mixed-conifer within wider areas dominated by vegetation considered inferior as spotted owl habitat (e.g. ponderosa pine or pinyon-juniper). Thus, harvest of steep slopes could impact habitat that is very limited and critical to maintaining spotted owls in an area.

Entering steeper slopes will result in a larger proportion of harvest in mixed-conifer, the primary owl habitat. Historically, timber harvest in the Southwest was concentrated in the high value, easily accessed ponderosa pine forests on relatively flat or rolling terrain on plateaus or mesa tops. With continued timber demands and decreased availability of that resource in large tree sizes, harvest is now moving increasingly into mixed-conifer and steep terrain.

According to current forest plans, in the 10-year planning period from 1987 through 1996, Arizona and New Mexico national forests will enter 7.48 percent of harvest-suitable land with regeneration cuts (this is the cut in the shelterwood management system that removes the largest volume of wood per acre and initiates regeneration of a new stand from tree seedlings). At this harvest rate, in 100 years 74.8 percent of harvest-suitable acres will be placed under the even-aged shelterwood system and many of these acres will receive subsequent intermediate cuts to thin the stands for maintenance of maximum timber productivity. Of the estimated suitable owl habitat on Arizona and New Mexico national forests, 59 percent (1,987,000 acres) is available for harvest (Fletcher 1990). Assuming equal distribution across forest types, 74 percent of this figure represents a 44 percent loss of total suitable owl habitat (1,468,267 of 3,365,000 acres) on national forest lands

in Arizona and New Mexico. Based on information in forest plans, the Forest Service predicts forest timber demand will increase 30 percent in 50 years. If this increase is realized, future harvest entry and corresponding owl habitat loss will be considerably greater than these figures indicate.

Timber harvest rates remain controversial in southwestern forests. While the Forest Service (Fletcher 1990) reported yearly decreases in total numbers of acres entered from 1980 through 1990 in New Mexico and Arizona national forests, average board feet harvested per acre has increased each year from approximately 2,750 board feet per acre to almost 4,000 board feet per arce. Forest plans are being reviewed by the Forest Service on 5 national forests in Arizona and New Mexico because of concern the ASQ can not be maintained while meeting other forest plan standards and guidelines. The Coconino, Apache-Sitgreaves, and Kaibab National Forests reduced the volume of timber offered for sale by about 15 percent while conducting these reviews (D. Jolly, *in litt.*, 1990). It is unknown how forest management recommendations from the reviews will affect rates of spotted owl habitat loss.

The Service (1991a, 1991b) and the AGFD have repeatedly expressed concern that current ASQs are not biologically realistic figures, as have Forest Service District Rangers and others (Forest Service, *in litt.*, 1989a, 1989b, 1989c, 1990a, 1990b). The concerns are that biological diversity, timber yield and other values are not being sustained as required by the National Forest Management Act. If harvests are too intensive in owl habitat, the habitat will be opened too much and become degraded. At a meeting with the Forest Service on August 14, 1992, the Service was told that the Forest Service intends to meet a region-wide timber harvest of 300 MMBF in 1993 and future years.

Forest plans indicate recreational use of most national forests will increase significantly in future decades. This use will increase various activities that often occur in owl habitat. The severity of impact will vary with the type of activity (e.g. road and trail building, camping, picnicking, shooting, hiking, hunting, skiing, and ORV-riding). Cumulatively, these activities may affect local owl populations and their habitat near public access areas.

Specific data on habitat loss in Mexico are not available. The few owls recorded were, as in the United States, closely associated with relatively undisturbed, forested mountains and canyons. The protection once afforded the species in Mexico by the remote rugged habitat is disappearing due to a rapidly growing human population, expanding road system, and increased mechanization of harvest techniques.

An estimated 2,191,000 acres of habitat, or 39 percent of the total currently suitable Mexican spotted owl habitat in the United States, is not available for timber harvest. However, these lands are often scattered small units incapable by themselves of supporting a viable spotted owl population. Within Forest Service lands in Arizona and New Mexico, Fletcher (1990) reported 1,378,000 acres of suitable owl habitat is not available for harvest. Fifty-three percent of this land is on 2 forests (Gila National Forest, 453,000 acres; Santa Fe National Forest, 288,000 acres). There are about 550,000 acres of spotted owl habitat in national forest wilderness areas in New Mexico and Arizona. No information is available regarding the amount of owl habitat in wilderness areas in Utah and Colorado..

Except for Forest Service wilderness areas, NPS lands are the only other contiguous units of habitat excluded from timber harvest. The NPS reported that an estimated 238,000 to 438,000 acres of spotted owl habitat is managed to preserve natural values. The wide range in the estimate reflects NPS uncertainty about which habitats are actually suitable for owls. This is partly because known NPS owl habitat is predominantly in canyonlands, which are often at the northern limits of the Mexican spotted owl's range where owl occurrence is more difficult to predict.

Bureau of Land Management lands have been harvested minimally, if at all, in the past. Pressure to harvest timber on BLM lands could increase if available timber in national forests decreases.

Habitat fragmentation is often the result of conversion of forest habitat from large contiguous tracts into smaller parcels through the creation of openings. Fragmentation may isolate stands from one another. Most Forest Service timber harvest in the Southwest is done in relatively small cutting units using even-aged management under the shelterwood system (Fletcher 1990). The spotted owl is an interior forest bird largely dependent on uneven-aged forests. By modifying and fragmenting uneven-aged forests, timber harvest as currently practiced in the Southwest will likely decrease habitat suitability for supporting self-sustaining and well distributed populations of the spotted owl (Green 1988, Harris 1984, Harris *et al.* 1982, Meslow *et al.* 1981, Thomas *et al.* 1988).

At a large scale, fragmentation may isolate larger contiguous populations into increasingly smaller and more isolated clusters of breeding pairs by reducing the overall quality of available suitable nesting, roosting, and foraging habitat. In addition to reducing total owl numbers, this isolation may create genetic problems that result from inbreeding as well as dispersal problems. A portion of the overall Mexican spotted owl population already exists in relatively isolated clusters of birds in the Colorado Plateau canyonlands of the north and the basin-and-range mountains of the south. These sections of the owl's range fall outside the relatively contiguous and more densely populated habitat of south-central Arizona and New Mexico. Habitat fragmentation for this core population in central Arizona and New Mexico could have serious implications for the stability of the spotted owl population as a whole.

Small-scale fragmentation will erode the quality of home range habitat for individual owls (Carey *et al.* 1992). Fragmentation on a cutting-unit level can degrade habitat for spotted owls by affecting prey availability, interfering with the owl's primary hunting technique, and destroying the crucial microclimate attributes of the nest/roost sites. Simultaneously, this level of fragmentation will likely enhance habitat quality for spotted owl predators such as great horned owls and red-tailed hawks. Increased predation may combine with decreased nesting success (due to habitat degradation and reduced prey availability, especially in the first weeks after owlets have hatched) to severely impact the Mexican spotted owl.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

The greatest potential for overutilization of the Mexican spotted owl is through scientific activities that will likely increase with increasing interest and funds available for owl studies. In one instance, the NMDGF (*in litt.*, 1990) withdrew a permit to capture and radio-tag several owls because simultaneous Forest Service owl surveys documented their scarcity. The permit was revoked after it became apparent that the owl population was too small to support the research activities. These situations may become more common for the spotted owl, which sometimes exists in small populations on isolated mountain ranges.

Recreational (bird watching), educational (classroom field trips), and

public relations (agency "show me" trips for public and press) activities are also likely to increase as this owl becomes better known. The owl is relatively easy to observe from close distances. Numerous authors have noted the bird's affinity for secluded old-growth habitat infrequently visited by man. Except for a few individuals, the owls' tolerance of frequent human disturbance is unknown (Johnson and Johnson 1990).

C. Disease or Predation

Great horned owls are a suspected major cause of mortality in Mexican spotted owls (Ganey and Balda 1988, Skaggs 1990). The two species are sympatric, but habitat use has probably separated them ecologically. However, present forest management is changing traditional spotted owl habitat to resemble the "open" forest typically used by great horned owls. Such management usually results in patches distributed throughout the forest (fragmentation), which creates edge (ecotone) suitable to the great horned owl and increases the likelihood of contact between the two species. Spotted owls appear to avoid areas used by great horned owls (Johnson and Johnson 1985, 1990).

D. The Inadequacy of Existing Regulatory Mechanisms

Under the Migratory Bird Treaty Act (MBTA) it is unlawful to pursue, hunt, take, capture, or kill in any manner any migratory bird. Although the Mexican spotted owl remains in its summer range throughout the year, it is included on the list of birds protected under the MBTA.

An interagency agreement with the purpose of ensuring population viability of the spotted owl (*Strix occidentalis*), including the Mexican spotted owl, was signed by the Service, BLM, NPS, and Forest Service on August 12, 1988 (U.S. Department of Interior 1988). Under this agreement, each agency agreed to manage its land to provide owl habitat, to carry out habitat and population inventories sufficient to indicate long term trends, and to carry out research activities sufficient to provide empirical information on the validity of planning assumptions. The degree to which this agreement has been implemented has varied among agencies. Coordination among agencies under the agreement has been minimal.

Only the State of Arizona recognizes the owl as a threatened species (AGFD 1988). Capture, handling, transportation, and take of the owl are regulated by game laws and special licenses for live wildlife. Thus, Arizona only regulates hunting, recreation, and scientific investigation. New Mexico is considering placing the owl on its list of endangered species at this time.

Most Federal agencies have policies to protect state threatened or endangered species and some agencies also protect species that are candidates for Federal listing. The National Park Service Organic Act protects all wildlife on national parks and monuments. However, these general policies lack standards and guidelines that can be used to measure policy success. Until agencies develop specific protection guidelines, evaluate them for adequacy, and test them through implementation, it is uncertain whether any general agency policies will adequately protect the Mexican spotted owl.

Specific management policies for the spotted owl have been developed by BLM in Colorado and New Mexico. The policy in Colorado states, "* * * In areas with a confirmed nest or roost site, surface management activities will be limited and will be determined on a case by case basis to allow as much flexibility as possible outside of the core area." Management policy in New Mexico states that habitat-core areas and territories of appropriate size will be established and preserved wherever owls are found. These policies are too general to ensure the spotted owl will be adequately protected on BLM lands.

Spotted owl protection guidelines have been developed by only one Indian nation. The guidelines for the Mescalero Apache Reservation establish a 72-acre buffer zone around owl roost or nest sites. No management activities can occur within the buffer zone during the reproductive season. After the reproductive season, the buffer is reduced to a 150-foot radius (5.1 acres) around significant roost areas and a 200-foot radius (8 acres) around nests. It is unclear these guidelines provide significant protection for spotted owl pairs, which have an average home range of more than 2,000 acres.

Detailed guidelines for spotted owl management have been developed by the Forest Service Southwest Region. The guidelines were first issued as Mexican spotted owl Interim Directive No. 1 (ID No. 1) in June, 1990, and reissued as Mexican spotted owl Interim Directive No. 2 (ID No. 2) in June, 1990. The guidelines expired December 26, 1991, but the Forest Service is continuing to manage under ID No. 2. The IDs apply only to national forests in New Mexico and Arizona. No spotted owl management guidelines have been developed for Colorado or Utah national forests. The IDs require establishment of a Mexican Spotted Owl Management Territory (MT) around each spotted owl nest or roost site. Each MT (except those on the Gila and Lincoln National Forests) has a core area of 450 acres and an overall size of 2,000 acres. Activities within the core area are limited to road construction. Within the MT, activities, including timber harvest, are limited to a maximum of 775 acres. The intent of the guidelines is to retain at least 1,000 acres of suitable habitat within the MT after proposed management activities are identified and located. Forest Service estimates indicate suitable habitat within MTs currently averages 1,150 acres.

The MT size and entry limitations were based on average home range values found by Ganey and Balda (1988) for radio-monitored birds. Ganey and Balda's work was the only study of its type for the Mexican spotted owl when ID No. 2 was adopted. The Forest Service uses average rather than maximum values for MT size, thereby establishing MTs that are expected to meet size and habitat requirements for only about 50 percent of spotted owls.

Application of the IDs has not been uniform on all forests. Guidelines on two forests were modified. ID No. 1 reduced the core area size to 300 acres for the Lincoln National Forest. ID No. 2 established a core area size of 450 acres for all forests but reduced the overall territory size to 1,500 acres for the Lincoln and Gila National Forests. Both forests have significant owl populations which have resulted in severe conflicts with planned timber harvest volumes. The IDs provide no protection for unoccupied suitable owl habitat.

E. Other Natural or Manmade Factors Affecting the Owl's Continued Existence

Forest fires have destroyed approximately 221,900 acres of suitable spotted owl habitat in New Mexico and Arizona national forests in recent years (Fletcher 1990). This acreage represents a loss of approximately 5 percent of the 4,402,000 acres Fletcher (1990) considered spotted owl habitat, and approximately 21 percent of the owl habitat recently made unsuitable. Fletcher estimated that 79 percent of the lost acres would require more than 50 years to return to suitable habitat. The future incidence of fire can be expected to remain fairly constant.

Malicious and accidental harm to spotted owls has rarely been documented. Several road-killed owls have been found in Arizona and New Mexico, perhaps reflecting increasing human activities in owl habitat. No reports of accidental shooting are known. Malicious harm to owls has not

been documented. However, as conflicts over spotted owls and forest management increase, and the methods for locating owls become widely known, the potential for malicious harm will increase.

The barred owl has undergone rapid range expansion over the past 20 years into the range of the northern spotted owl (Hamer 1988) and has replaced the northern spotted owl in some areas (Forsman *et al.* 1984). The barred owl has taken advantage of habitat modifications, such as those resulting from present forest management (fragmentation), to expand its range into areas where it may compete with the spotted owl. There are no records of barred owls in the U.S. range of the Mexican spotted owl, but the range and numerical expansion of the great horned owl and red-tailed hawk in the Southwest suggest that the barred owl could do the same. The Mexican subspecies of the barred owl (*Strix varia sartorii*) is known from much of the Mexican spotted owl's historic range in central Mexico (AOU 1983); the ecological relationship between the two there is unknown. The potential for interbreeding between Mexican spotted owls and barred owls merits concern and monitoring where the two species overlap. Such interbreeding is reported with the northern spotted owl (K. Fletcher, Forest Service, pers. comm., 1990).

The Service has carefully assessed the best scientific information available regarding the past, present, and future threats faced by this species in determining to make this rule final. Based on this evaluation, the preferred action is to list the Mexican spotted owl (*Strix occidentalis lucida*) as threatened throughout its range. Suitable habitat for this subspecies has been reduced by timber harvest and fires. Habitat fragmentation as a consequence of forest management practices increases the threat of predation and inhibits dispersal. An estimated 2,160 Mexican spotted owls exist. Endangered status would no be appropriate because the available data do not indicate that extinction throughout all or a significant portion of the range is an imminent possibility.

Critical Habitat

Section 4(a)(3) of the Act, as amended, requires that the Secretary of Interior designate critical habitat at the time a species is determined to be endangered or threatened, to the maximum extent prudent and determinable. In the proposed rule for this listing, the Service stated that designating critical habitat for the Mexican spotted owl was not prudent. This decision was based on the conclusion that because habitat destruction was the principal threat to the owl, the jeopardy standard for the species under section 7 of the Act would be as stringent as the adverse modification of critical habitat would be if critical habitat were designated. The Service thus found it would not be prudent to designate critical habitat, because this would provide no additional conservation benefit to the species. The Service has since concluded that designation of critical habitat for the Mexican spotted owl will indeed provide benefits to the species greater than those provided by listing alone. Primarily, the designation of critical habitat will facilitate management and recovery planning by the Forest Service and other agencies in a way that could not be accomplished solely through listing.

Although the Service has concluded that designation of critical habitat is prudent, it also finds that critical habitat is not presently determinable. The Service's regulations (50 CFR 424.12(a)(2)) state that critical habitat is not determinable if information sufficient to perform required analyses of the impacts of the designation is lacking or if the biological needs of the species are not sufficiently well known to permit identification of the area as critical habitat. Although considerable knowledge of Mexican spotted owl habitat needs has been gathered in recent years, maps in sufficient detail to accurately delineate these areas on the ground are not presently available. The Service has initiated the studies needed to ascertain critical habitat areas and will publish, in the **Federal Register**, a final rule to designate critical habitat for the Mexican spotted owl by November 4, 1993.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Endangered Species Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing encourages and results in conservation actions by Federal, state, and private agencies, groups, and individuals. The Endangered Species Act provides for possible land acquisition and cooperation with the States and authorizes recovery plans for all listed species. The protection required of Federal agencies and the prohibitions against taking and harm are discussed, in part, below.

Section 7(a) of the Act, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR Part 402. Section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or destroy or adversely modify its critical habitat. If a Federal action may adversely affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

The U.S. Forest Service and some Indian nations have active timber sale programs in the Southwest. The BLM also participates in timber sale programs to a lesser degree. Because habitat loss and modification resulting from timber harvesting activities represent primary threats to the Mexican spotted owl, most timber sales administered by Federal agencies will be subject to section 7 consultation. Other actions that may affect the Mexican spotted owl such as road building, trail building, pipeline construction, powerline construction, mining, or construction of recreation facilities will likely require section 7 consultation between the Service and the appropriate Federal agency.

The Act and implementing regulations found at 50 CFR 17.21 and 17.31 set forth a series of general prohibitions and exceptions that apply to all threatened wildlife. These prohibitions, in part, make it illegal for any person subject to the jurisdiction of the United States to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, or collect; or to attempt any of these), import or export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. It also is illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

Permits may be issued to carry out otherwise prohibited activities involving threatened wildlife species under certain circumstances. Regulations governing permits are at 50 CFR 17.22, 17.23, and 17.32. Such permits are available for scientific purposes, to enhance the propagation or survival of the species, and/or for incidental take in connection with otherwise lawful activities. For

threatened species, there are also permits for zoological exhibition, educational purposes, or special purposes consistent with the intent of the Act.

On June 28, 1979, the order Strigiformes, which includes all owls, was included in appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The effect of this listing is that export permits are generally required before international shipment may occur. Such shipment is strictly regulated by CITES party nations to prevent effects that may be detrimental to the species' survival. Generally, the export cannot be allowed if it is primarily for commercial purposes.

National Environmental Policy Act

The Fish and Wildlife Service has determined that an Environmental Assessment, as defined under the authority of the National Environmental Policy Act of 1969, need not be prepared in connection with regulations adopted pursuant to section 4(a) of the Endangered Species Act of 1973, as amended. A notice outlining the Service's reasons for this determination was published in the Federal Register on October 25, 1983 (48 FR 49244).

References Cited

A complete list of all references cited herein is available upon request from the Field Supervisor, New Mexico Ecological Services Field Office, (see ADDRESSES section).

Authors

The primary authors of this final rule are Dr. Jack Cully (see ADDRESSES section) and Dr. William Austin, U.S. Fish and Wildlife Service, Ecological Services Field Office, 3616 West Thomas Road, suite 6, Phoenix, Arizona 58019 (602/379–4720).

List of Subjects in 50 CFR Part 17

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

Proposed Regulation Promulgation

PART 17—[AMENDED]

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

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

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

2. Amend § 17.11(h) by adding the following, in alphabetical order under "Birds", to the List of Endangered and Threatened Wildlife:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
BIRDS							
•	•	•	•	•	•	•	•
Mexican spotted owl	*Strix occidentalis lucida*	U.S.A. (NM, AZ, TX, CO, UT), Mexico.	NA	T	494	NA	NA
•	•	•	•	•	•	•	•

Dated: January 6, 1993.

John F. Turner,

Director, Fish and Wildlife Service.

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