HABITAT MANAGEMENT SERIES FOR UNIQUE OR ENDANGERED SPECIES

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Report No. 10
Spotted Owl
Strix occidentalis
FOREWORD

This Technical Note series on wildlife is designed to provide a literature review and summary of current knowledge pertaining to endangered and other wildlife species occurring on public lands. We in the Bureau of Land Management have recognized the need for basic wildlife information in order to do an effective job in land-use planning. Sound planning must identify the negative aspects as well as the positive benefits of any proposed land management decision or program. It is our hope, too, that this series will also prove useful to others—be they land managers, students, researchers or interested citizens.

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Introduction

The objective of this report is to provide BLM personnel with the latest and most up-to-date information on rare or endangered species occurring on the public domain. This will provide a tool for improved understanding of the interrelationships between the species and its environment and encourage an end product of enlightened land management which will fully consider the species' welfare in all management decisions.

1. Species Description

The spotted owl is a medium-large, non-migrating owl inhabiting dense coniferous forests and deeply shaded canyons in coastal and mountainous areas of western North America. Common names for subspecies are used in this report for purposes of clarification, although they are not accepted by the American Ornithologists' Union. Three subspecies have been named: *Strix occidentalis occidentalis*, the California spotted owl; *Strix occidentalis lucida*, the Mexican spotted owl; and *Strix occidentalis caurina*, the northern spotted owl. *S. o. occidentalis* is intermediate in coloration between the darker race *S. o. caurina* and the lighter race *S. o. lucida*. The spotted owl is the western counterpart of the barred owl (*Strix varia*) and resembles it closely, but is more spotted on the head and back (Reilly 1968). A photograph of the spotted owl is shown in Figure 1. Ground color consists of dark brown to chestnut brown, with round white spots on the head, neck and back. The wing primaries and tail appear barred with lighter brown and white. Distinct spotting with white and lighter brown occur on the underparts and breast, with no lengthwise streaking. The throat is white. The head is large and rounded with a grayish-brown facial disk. No ear tufts are present. The eyes are large and dark brown. In contrast, other owl species found within the range of the spotted owl (with the exception of the barn owl, *Tyto alba*) have yellowish eyes. The round head and face combined with the dark eyes should serve to differentiate this species from other western owls (Bent 1938, Sumner and Dixon 1953, Jewett et al 1953, Gabrielson and Jewett 1940, Bailey and Niedrach 1965, Ligon 1961).

Only incomplete descriptions exist for juveniles of the species, but immature spotted owls probably resemble young barred owls. Dawson (1923) described young spotted owls as "chiefly pale brownish buffy, broadly barred except on head and legs with light brown." Dickey (1914), in describing an active nest that he discovered at an approximate elevation of 5000 feet in Ventura County, California, stated that on June 6 the young appeared well grown but were still covered with soft grayish to buffy white down, with the exception of well-developed primary feathers.
Figure 1
Spotted Owl (*Strix occidentalis*)
Female spotted owls are larger than males, following the pattern of reversed size dimorphism exhibited in many birds of prey. Females weigh an average of 22.4 ounces with a range of 19.2 - 26.7 ounces. Males average 20.4 ounces with a range of 18.2 - 24.4 ounces. Wing length in females averages 12.2 inches (range 11.6 - 12.5 inches), and in males, 11.9 inches (range 11.6 - 12.2 inches) (Barhart and Johnson 1970). The body length of the spotted owl varies from 16 to 19 inches and the length of the tail is 8 to 9 inches (Reilly 1960, Summer and Dixon 1953, Gabrielson and Jewett 1940, Dawson 1923, Jewett et al 1953, Ligon 1961, Bailey and Niedrach 1965).

2. Distribution

Strix occidentalis occurs in the Pacific coast region from southern California north through Oregon and Washington to southern British Columbia in forested areas west of the crests of the Cascades and Sierra Nevada; and in the southern Rocky Mountains from central Colorado south through mountainous areas of New Mexico, eastern Arizona, and western Texas to Sonora, Michoacán, Guanajuato and Nuevo León in Mexico (American Ornithologists' Union 1957; Peters 1964). In addition there is a sight record of Strix occidentalis six miles south of Canada and ten miles west of Glacier National Park, Montana, in a heavily forested creek bottom at an elevation of 5100 feet (Weydemeyer 1927). Hoffmann et al (1959) reported sightings of two spotted owls at Anaconda Creek, Glacier National Park, once in July and twice in August, 1953. A photograph taken of the two birds on August 21, 1953, verified the identification. Neither account mentions subspecies. A distribution map for the three subspecies of spotted owl appears as Figure 2.

The northern spotted owl, Strix occidentalis caurina, occurs in heavily forested areas on the western slope of the Cascade Mountains in British Columbia, Washington and Oregon, and the Coast Ranges of California, from southern British Columbia south to the region north of San Francisco Bay (Peters 1964, Alcorn 1947, Jewett et al 1953, Gabrielson and Jewett 1940). It is rare in Marin County, California (Maillard 1927) but becomes more numerous farther north along the coast. Its most northerly extension is probably Bella Coola, British Columbia (Laing 1942). In Washington it occurs as far eastward as Cle Elum, Kittitas County (Slipp 1946).

Strix occidentalis occidentalis, the California spotted owl, occurs on the west slope of the Sierra Nevada in forests at elevations of 2500 - 6600 feet, from Tehama County south to Tulare County. It also ranges onto the east slope of the Sierras in the mountains north of Lake Tahoe near the California-Nevada border (Dawson 1923, Johnson and Russell 1962).
Figure 2 DISTRIBUTION OF THE SPOTTED OWL IN THE UNITED STATES

- California spotted owl, Strix occidentalis occidentalis
- Mexican spotted owl, Strix occidentalis lucida
- Northern spotted owl, Strix occidentalis caurina
A disjunct population occurs on the coastal slope of the mountains in southern California from Santa Barbara County to San Diego County (American Ornithologists' Union 1957. Grinnell and Miller 1914).

The Mexican spotted owl, Strix occidentalis lucida, ranges as far north as central Colorado, extending south along the foothills and adjacent areas east of the Front Range, through the mountainous central and southern part of the state (Bailey and Niedrach 1965, American Ornithologists' Union 1957) and into eastern Arizona and New Mexico. It occurs in all the high forested areas of New Mexico from the Sangre de Cristo Range near Taos and the mountains around Santa Fe south through the San Mateo, Black, Mogollon and Animas Ranges. The Guadalupe Mountains of southern New Mexico and western Texas represent the farthest southeastern extension of its range in the United States (American Ornithologists' Union 1957, Ligon 1961). In Arizona it resides mainly in the heavily forested mountains and high mesas (Phillips et al 1964). Specimens have also been described from the San Francisco Mountains and Grand Canyon National Park in northern Arizona (McKee 1933). In Utah, Behle (1947) sighted one at Navajo Mountain, San Juan County, and Wauer and Carter (1965) list it as a permanent resident of Zion National Park.

3. Status and Population Trend

The spotted owl is not on the official U. S. list of endangered species. However, destruction of suitable habitat coupled with an almost total lack of ecological and population data throughout its range gives cause for serious concern about the future of the species.

In southwest Oregon five spotted owl groves were located in 1972, and eleven in 1973. Prior to 1972 reports of spotted owl sightings numbered only two in a six-year period. Eric Forsman of Oregon State University, Corvallis, presently has seventy-four spotted owl sighting locations throughout Oregon. Nineteen sighting locations exist in the southwest part of the state. Although observers have noted many pairs of owls, only two nesting pairs were seen in southwest Oregon in 1973. Only one of the nests was successful, fledging two young (Nietro 1974a).

In northwest California, thirty-nine pairs of spotted owls have been located in a survey still being conducted by the California Department of Fish and Game. Four to six pairs occur in the corridor of Redwood National Park along Redwood Creek. A significant concentration of spotted owls has been found in the South Fork of the Trinity River drainage along the east slope of South Fork Mountain in Trinity County. Sixteen pairs of
Spotted owls live in an area of about 125 square miles, thirty miles long and two to six miles wide. Spacing between owls located ranges from 1.2 to 5.2 miles; most of the spotted owls occur at intervals of 1.5 to 2 miles. Investigators have not yet determined the full extent of this concentration. Spotted owls rarely occur in isolated pairs; rather, pairs of spotted owls are usually no more than five or six miles from each other. Such spacing provides replacement individuals for pair maintenance in the populations of this species (Gould 1973).

No population data exist for other parts of the spotted owl's range.

A significant behavioral trait of the spotted owl is its extremely sedentary and docile nature. Numerous reports appear in the literature of observers approaching even nesting spotted owls very closely, without the owls showing evidence of fear or alarm (Bent 1938, Dickey 1914, Steele 1927, Ligon 1961, Dawson 1923). Nietro (1974a) cites one instance where the breast of a spotted owl was stroked with a four-foot stick. This characteristic is a useful one for field identification and observation, but may be detrimental to the owl by causing increased exposure to humans and retarding movements of spotted owls away from areas where their habitat is being destroyed through the various activities of man. Because areas of suitable spotted owl habitat are isolated and widely scattered throughout its range, these factors in combination may be causing serious declines in spotted owl numbers.

4. Life History

Very little literature exists on the life history and ecology of the spotted owl. Intensive studies of this species were not undertaken until 1972 when the U. S. Forest Service funded a research project on the northern spotted owl with the Oregon Cooperative Wildlife Research Unit. Information gained from this project is not yet available for publication.

The spotted owl prefers mammals, but also preys on birds, amphibians, and insects (Earhart and Johnson 1970, Bent 1938). Twenty-three pellets of the California spotted owl, S. o. occidentalis, collected by Marshall (1942) from a densely wooded portion of Whitaker's Forest, Tulare County, California, contained the following remains:

1 mole (Scapanus latimanus)
1 shrew (Sorex spp.)
1 little California bat (Myotis californicus)
1 hoary bat (Lasiurus cinereus)
11 flying squirrels (Glaucomys sabrinus) (present in all but 2 of the pellets)
2 deer mice (Peromyscus spp.)
1 screech owl (Otus asio)
1 saw-whet owl (Cryptoglauca acadica)
1 Steller jay (Cyanocitta stelleri)
1 red-breasted nuthatch (Sitta canadensis)
1 evening grosbeak (Hesperiphona vespertina)
At least one other small passerine bird
1 June beetle (Pleocoma hoppingsi)

Two adult male owls were also collected from the same general area. The stomach of one contained three bats (Myotis spp.), and one deer mouse (Peromyscus spp.). The other contained one long-eared bat (Myotis evotis), and four crickets, probably Gryllus spp. (Marshall 1942). The variety of food items taken by the spotted owl parallels Bent's (1938) list for the barred owl. Dickey (1914) found the remains of a freshly killed wood rat (Neotoma spp.), a dried Peromyscus skull, and a dried pellet containing mouse bones in the nest of a California spotted owl from Ventura County. Two records exist of S. o. occidentalis consuming pigmy owls (Glaucidium gnoma) (Richardson 1906, Daggett 1913). Marshall (1939) believed that spotted owls may also prey on flammulated screech owls (Otus flammuleolus) since he claimed that no flammulated screech owls had territories within an area occupied by spotted owls. An adult California spotted owl fed its offspring a small bird by pulling off strips of flesh for them (Bryant 1940).

Food habits of the other two subspecies resemble those of the California spotted owl. Nearly every spotted owl stomach examined by Ligon (1961) in New Mexico contained woodrat (Neotoma) remains. The stomach of a specimen collected from the Huachucha Mountains, Arizona, was completely filled with the parts from seventeen noctuid moths (Agrotis spp.) (Huey 1932). Three northern spotted owls were collected in a coast hemlock forest at an elevation of 3400 feet in Linn County, Oregon. The stomach of one male contained four crickets (Cyphoderris monstrosa). Another male contained the remains of one flying squirrel (Glaucomys sabrinus), one jumping mouse (Zapus trinitatus), several limb bones of a frog or toad, and five crickets (Cyphoderris monstrosa). The third specimen, a female, contained eighteen crickets (C. monstrosa) (Marshall 1942). Food items determined from pellets found in southwest Oregon include: dusky-footed woodrat (Neotoma fuscipes) (50-60% by occurrence), bushy-tailed woodrat (N. cinerea), flying squirrel (Glaucomys sabrinus), brush rabbit (Sylvilagus bachmani), and various small birds and insects. Cicadas also appeared in several pellets (Nietro 1971a). Smith (1963) found pellets in a nesting area in southern British Columbia containing remains of the following species:

5 flying squirrels (Glaucomys sabrinus)
5 deer mice (Peromyscus spp.)
2 jumping mice (Zapus spp.)
2 pikas (Ochotona princeps)
1 mountain Phenacomys (Phenacomys intermedius)
1 crossbill (Loxia spp.)

No investigators have recorded observations of spotted owl hunting methods. The owls probably take diurnal birds from their roosts at night and may capture bats, especially slow-flying species such as Lasiurus cinereus, on the wing (Marshall 1942).

Since no accurate population estimates exist, spotted owl densities are largely conjectural. Because only a limited area of the range offers suitable habitat, even relatively undisturbed populations probably occur in low densities. Smith (1963) stated that a pair of spotted owls nesting in British Columbia "occupied" an area of about one acre. But Marshall (1942) believed that in suitable habitat pairs might occur at intervals of one to two miles, with a hunting territory covering about two square miles. One continuous survey conducted in California located four pairs of spotted owls in ten miles (Gould 1973). Recent studies in Oregon and California seem to indicate that a pair of owls requires 300 to 600 acres of suitable habitat (Nieto 1971a, Gould 1973).

Knowledge of the reproductive biology of the spotted owl is fragmentary. Courtship behavior, length of incubation, parental and juvenile behavior, and age at fledging are almost completely unknown.

Spotted owl nests have been found on bare ground (Reilly 1968, Bent 1938) but are more often situated in trees, tree hollows and natural cliffside cavities. One nest in Ventura County, California, which owls used repeatedly, was discovered in a roomy cavity about fifteen feet from the base of a 200-foot, north-facing granite cliff in the narrow gorge of a steep canyon. The cavity, approximately three feet deep, contained two eggs on a bed of rubbish, owl feathers, pellets, and bones of small mammals. The adult birds used a tall cottonwood tree near the nest as a perch. A steep rocky slope faced the nest cliff on the north side (Bent 1938). Another nest in Ventura County resembled an old raven's nest near the entrance of a three-to-four-foot-deep cavity located about sixty-five feet from the ground in a high shaded cliff of red conglomerate at an elevation of about 5000 feet. One of the adult birds perched in a small oak near the nest and in a tall fir tree standing near the cliff opposite the nest (Dickey 1914b). Bryant (1940) reported two young owls in juvenile plumage perched on the roots of a large fallen log in the General Grant Grove, King's Canyon National Park. The owls had evidently used a hollow in the log about two feet in diameter as a nesting site. When one of the young owls was returned to the site about two weeks later, after having been captured by a camper, the other juvenile was found in the cavity. In Riverside, California, owls laid one set of eggs on the floor of a small cave in a clay bank; another set was found at the base of a large rock on the bare ground. Apparently
the owls had not attempted nest construction. Eggs have also been found in oak and sycamore stubs and in holes in trees in southern California. Spotted owls used an old hawk's nest thirty-five feet up in an oak tree at the edge of a steep canyon in San Luis Obispo County, California; two others nested in Cooper's hawks' nests which had been occupied by hawks the previous year (Bent 1938).

The nest of a Mexican spotted owl in Arizona was described by Bent (1938) from a communication by C. E. Bendire. The owls had recently constructed the nest in a fork close to the trunk of a large cottonwood tree in the middle of a dense grove of smaller trees of the same species. The nest was about the size of those of the larger hawks, built from sticks, twigs, and the dry inner bark of the cottonwood and lined with a few feathers and dry grasses. The inner cavity was two inches deep. The foliage of the tree hid the nest effectively, except from below.

In New Mexico, spotted owls used a reconstructed eagle's or raven's nest in the north-facing cave of a steep canyon at an elevation of about 7000 feet in a pine-fir association. Pine limbs, twigs and dead pine needles comprised a nest about 3 feet in diameter with an unlined cavity three inches deep and ten inches in diameter. It was located on a four-foot-wide shelf thirty feet from the floor of the cave. Owls reconstructed another nest at an elevation of 7000 feet in the shaded fissure of a narrow box canyon. A dense growth of fifty to seventy-five foot tall fir trees covered the north-facing slope. This nest occurred in a cavity twenty-five feet from the ground with dimensions of three feet by three feet. The third nest was also remodeled from an old nest in a heavily forested grove of Douglas-fir (Pseudotsuga menziesii) trees infested with "witch's broom," a pathologic condition generating an anomalous, dense growth of branches about the trunk. Owls built the nest in this abnormal growth fifteen feet from the ground in a tree with a basal diameter of sixteen inches (Ligon 1926).

The northern spotted owl nests primarily in the Tsuga heterophylla (western hemlock) Zone, as described by Franklin and Dyrness (1973). Subclimax forests of Douglas-fir (Pseudotsuga menziesii) dominate large areas of this community. These areas comprise the major nesting territories of the northern spotted owl. Typically the nest tree is an old growth tree with a broken top, infested with mistletoe, and capable of supporting a nest 100 feet or more from the ground. A lateral limb grows upward to form a new top, creating a protected nesting platform (Luman 1971, Nieto 1974a). A nest site described from British Columbia occurred in a mature mixed stand of western hemlock (Tsuga heterophylla), western redcedar (Thuja plicata), Douglas-fir (Pseudotsuga menziesii), Englemann spruce (Picea englemannii) and Pacific silver fir (Abies amabilis) (Smith 1963).
Spotted owls may use the same nest site repeatedly. Bent (1938) describes a nest site in southern California which owls used in 1908, 1909, and 1910, when the parent birds were taken. It was not visited for fifteen years but was also in use in 1925, 1926, and 1929.

The spotted owl generally remains docile during human investigation of its nest, eggs or young. An adult owl perched within eighteen inches of one investigator's hands as he examined the juvenile owls displayed little more than mild interest in his activities. Its strongest threat was a slight parting of the bill as it moved from his touch (Dickey 1914). Peyton (1910) lifted females from the nest by hand to collect their eggs. In New Mexico, spotted owls displayed alertness and uneasiness when their nests were investigated. Females on the nest did not leave until closely approached, then snapped their bills and flew off, but remained nearby calling softly. Males answered the calls from a distance, but never appeared (Ligon 1926). However, Smith (1963) reported that a nesting northern spotted owl struck him a glancing blow on the shoulders with its talons.

Spotted owls usually lay only two eggs: clutch sizes of three eggs are also common but four eggs are only rarely found in a nest (Bent 1938, Gabrielson and Jewett 1940). Eggs are rounded to ovate in shape, colored pure white to dull white with faint tinges of buff; have no apparent glaze and possess a slightly roughened texture. The lack of gloss is especially apparent in comparison with eggs of the barred owl (Bent 1938, Ligon 1926). Twenty-three eggs from California measured by Bent averaged 49.9 x 41.3 mm; the largest egg measured 53.9 x 43.2 mm. Three eggs from New Mexico averaged 49.3 x 40.9 mm (Ligon 1926).

Length of incubation and age at fledging are unknown for spotted owls, but may resemble those for the barred owl. Incubation in barred owls lasts from twenty-one to twenty-eight days; both parents may participate (Reilly 1968, Bent 1938). Fifteen records of eggs in California fall between March 1 and May 10; eight of these are between March 27 and April 1, roughly indicating the height of the nesting season in this state. In New Mexico four records are given from April 4-17 (Bent 1938). Ligon (1926) found two females incubating fresh eggs at an elevation of 7000 feet in New Mexico on April 4 and 6, 1924; a female found at a nest at 7500 feet on April 10, 1924 had not yet laid eggs.

Juvenile spotted owls may leave the nest at an early age, though they are still cared for by the parents. Dickey (1914) saw two young in a cliff nest sixty-five feet above the ground.
in Ventura County, California, on May 31. When he returned to the site on June 6 the young were perched with the adult in an oak tree fifteen feet above the ground and 100 yards from the nest. They were still largely covered with down and unable to fly. Northern spotted owls in Oregon leave the nest as early as about one week after hatching, move overland and perch eight to ten feet off the ground in a nearby understory tree until fledging. The exact timing, mechanics, and reasons for this maneuver are unknown (Nietro 1974b). The parent birds probably share incubation and juvenile care since they have both been observed near nests on numerous occasions (Bent 1938, Dickey 1914, Peyton 1910, Ligon 1926). Fledging in spotted owls takes place sometime after the sixth week (Reilly 1968).

Spotted owls are non-migratory. Investigators have noted them at the same elevations both winter and summer (Sumner and Dixon 1953, Ligon 1961, Bent 1938, Nietro 1974a), although they may occur in lowlands near mountains in Arizona more frequently in winter (Phillips et al 1961). Intra-range movements also seem to be limited, for spotted owls frequent the same localities year after year (Bent 1938, Peyton 1910, Ligon 1926). The only record of localized spotted owl movements is by Marshall (1956), who stated that a pair was attracted to his camp from their roosting area more than two miles away. He did not say how this was accomplished.

Several investigators have stated that spotted owls do not occur with great horned owls (Bubo virginianus). Marshall (1942) felt that heavily timbered areas favored the spotted owl. The year after a forest fire swept through spotted owl habitat in the Hualapai Mountains, Arizona, horned owls were heard for the first time and spotted owls could not be found (Phillips et al 1964). Spotted owls feed on smaller owl species including the pigmy owl (Glaucidium gnoma), screech owl (Otus asio), and saw-whet owl (Cryptoglaux acadica) (Daggett 1913, Dawson 1923, Bent 1938, Marshall 1942). No flammulated screech owls (Otus flammeolus) lived in an area occupied by a pair of spotted owls; hoots of the spotted owl silenced male flammulated screech owls, and females responded to real and simulated spotted owl hoots with alarm calls (Marshall 1939).

In 1973 a pair of goshawks (Accipiter gentilis) moved into a traditional spotted owl nesting area in Oregon and nested within 400 feet of the owl nest site. Although the goshawks vocalized frequently, no observed interspecific incidences of predation occurred (Luman 1974, Nietro 1974b).
Bent (1938) reported an incident of harrassment of a spotted owl by a group of birds including nineteen Steller's jays (Cyanistes stelleri spp.), five or six Scrub jays (Aphelocoma coerulescens), six acorn woodpeckers (Melanerpes formicivorus), one brown creeper (Certhia familiaris), many vireos (Vireo spp.), black-throated gray warblers (Dendroica nigrescens), and western flycatchers (Empidonax difficilis).

The spotted owl displays a wide range of vocalizations. Dickey (1914) stated that whenever owls hooted they used a standard pattern of two long and two short notes, "who, whoo, who, who." Other observers concur that the principal call note consists of four syllables, but describe the pattern as an initial short note followed by a pause, with two more short notes ensuing in more rapid succession. There follows another, longer pause with the final note drawn out in a falling inflection, "coo--coo-coo-----coo-o-o." The total duration of this call is 2½-3 seconds. Owls generally give this call at intervals of a minute or longer (Ligon 1926, Maillard 1927, Gould 1973). Spotted owls also use a three-syllable call. The first two notes are short and alike in tone and volume, followed by a pause and a longer final note, also with a falling inflection, "hoo-hoo--hoo-o-o" (Bent 1938, Nietro 1971b). Spotted owls also utter a shrill whistle of about 1½ seconds duration, starting at a low pitch with a sharp, siren-like rising inflection, "whee-e-e-?" This may be a disturbance call and is more often uttered by the female (Ligon 1926, Dickey 1914, Bent 1938, Reilly 1968, Nietro 1971b, Gould 1973). A third vocalization is a harsh, repeated call resembling the call of a crow (Nietro 1971b). Other observers describe a call which sounds like the barking of a small dog (Sumner and Dixon 1953, Phillips et al 1964). The spotted owl has a generally higher-pitched call than either the horned owl or the barred owl. All of its vocalizations may vary in tone, pitch, and volume (Bent 1938, Ligon 1926, Reilly 1968).

5. Habitat Requirements

The spotted owl is sedentary, heat intolerant, and almost totally nocturnal. Its habitat requirements reflect these characteristics.

The northern spotted owl prefers dense coniferous forests where deeply shaded ravines are available for daytime roosts (Marshall 1942). Timber developed to the density and height of spotted owl requirements occurs in the Mixed Conifer (Pinus-Pseudotsuga - Libocedrus - Abies) Zone (Franklin and Dyrness 1973) of the Cascade Ranges of southwest Oregon, and in the Tsuga heterophylla Zone (Franklin and Dyrness 1973) of the Coast and Cascade Ranges of western Oregon and Washington. This zone also extends across the Puget Trough and Olympic Peninsula.
of Washington and into southern British Columbia. The intrusion of the Willamette and other dry interior valleys separate its occurrence along the Coast Ranges and Western and High Cascade physiographic provinces in Oregon.

The Mixed Conifer Zone occurs at mid-elevations (2100-4500 feet) on the western slope of the Cascade Range in southwest Oregon and is typified by mixed forests of Douglas-fir, sugar pine (Pinus lambertiana), ponderosa pine (Pinus ponderosa), incense-cedar (Libocedrus decurrens) and white fir (Abies concolor) or grand fir (Abies grandis). It is an extension of the lower montane forests of the Sierra Nevada.

The Tsuga heterophylla Zone is the most extensive in western Oregon and Washington. It is also the most economically important in terms of timber production. In the Cascades this zone ranges in elevation from essentially sea level to about 2500 feet at 49 degrees north latitude and from 500 to 3200 feet at 45 degrees north latitude. It is characterized by a climax formation of western hemlock (Tsuga heterophylla) and western redcedar (Thuja plicata). Douglas-fir is usually a dominant and sometimes the sole dominant in subclimax seral stands which have developed in the large areas of this zone that have been logged or burned in the last 150 years (Franklin and Dyrness 1973).

Spotted owls do not occur in the subalpine forest communities, probably because these forests are too thin to provide the dense cover spotted owls prefer. Spotted owls were never attracted to calls in these forests in California, although they occurred at lower elevations in the same localities (Marshall 1942). In southwest Oregon, spotted owls have not been sighted above elevations of 5400 feet (Nietro 1974a). Gould (1973) found spotted owls at elevations ranging from 65 to 4700 feet in northwest California. Marshall (1942) collected specimens of S. o. occidentalis in dense stands of ponderosa pine at elevations of 5000 to 5500 feet in Tulare County, California. He found three specimens of S. o. caurina in a ravine wooded with western hemlock at an elevation of 3400 feet in Linn County, Oregon.

Spotted owls usually occur in densely wooded areas with crown closures of at least eighty percent. Of particular importance is the development of forest density and tree height in the vicinity of the nest. Spotted owls select particular types of nest trees; factors important in nest tree selection have been discussed on page 9. These owls are not species-specific in choosing nest trees as long as other requirements are satisfied. In many areas of the northern spotted owl's range
only Douglas-fir trees provide the necessary characteristics, but ponderosa or other pine species may also be utilized in more xeric habitats (Luman 1974, Nietro 1974a, 1974b).

A well-developed understory is also important near the nest site to provide the young birds with suitable perches when they leave the nest (Luman 1974). Nietro (1974a) states that although Forsman maintains that spotted owls require 600 acres of old-growth habitat, he feels, based on his observations of the birds in southwest Oregon, that spotted owls will utilize an area comprised of second-growth evergreen species, if a closed forest canopy exists with interspersed old-growth trees for nesting. Gould (1973) has found that large, old-growth trees and the degree of crown closure are important components of spotted owl habitat in northwest California. Spotted owls often occur in areas of old-growth Douglas-fir forests exhibiting crown closures of less than forty percent. This tends to give the impression that crown closure is not an important factor in habitat selection. But almost all of these areas have sections where the understory canopy is greater than forty percent. Such places furnish suitable nesting and roosting areas, and possibly higher prey densities, for spotted owls.

In Oregon, water has been found within 200 feet of every roosting and nesting site located. Ninety-eight percent of the spotted owls located in northwestern California were found within four-tenths of a mile of permanent water. Approximately twenty percent were found within 200 feet of water. On warm days the owls frequent the bottoms of the darkest streambeds and spring areas. Heat intolerance may also partly explain the owls' preference for deeply shaded forests and canyon as well as their greater selection of north-, west-, or east-facing slopes for roosting and nesting sites (Luman 1974, Nietro 1974a, Gould 1973).

The presence of roads and logged areas does not seem to affect the occurrence of northern spotted owls. Ninety-four percent of the spotted owls sighted in the California Department of Fish and Game survey occurred within one mile of roads, and thirty-nine percent of the sightings were within 500 feet of roads. Of the thirty-eight spotted owl sightings where the nearest logging activity was known, twenty-six percent occurred more than one mile from logged areas, but thirteen percent were located immediately adjacent to clearcut blocks and five percent occurred in partially cut areas.

The fact that spotted owls were found near roads and logged areas does not indicate that populations of this species are being maintained in such areas, or even that the owls commonly use them. The California survey employed tape-recorded spotted

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owl calls played from easily accessible areas, and owls probably moved toward the source of these calls. In addition these sedentary birds may remain near recently logged areas. The effects of nest site destruction and logging disturbances on the reproductive success of spotted owls is not yet known (Gould 1973).

The vegetational requirements of the California spotted owl are met in the lower montane forests of the western slope of the Sierra Nevada, where the major dominant species include ponderosa pine, Douglas-fir, and white fir. Lodgepole pine (Pinus contorta) is a subdominant in burned areas (Shelford 1963). Spotted owls live on the western slope of the Sierra Nevada at elevations from 2500 to 6600 feet (Johnson and Russell 1962). In southern California S. o. occidentalis has been reported to occur in the steep gorge of a canyon well timbered with oak (Quercus), cottonwood (Populus), willow (Salix), sycamore (Platanus) and alder (Alnus) trees (Bent 1938).

In Arizona and New Mexico S. o. lucida prefers deep, narrow, timbered canyons at elevations from 6500 to 9000 feet. They usually occur in spruce (Picea) or Douglas-fir forests, and are not often found away from such vegetational associations. Douglas-fir trees exhibiting witch's broom, a condition previously described, have been noted where these owls occur. In the mountains of southeastern Arizona they also frequent groves of quaking aspen (Populus tremuloides) and dense stands of maples (Acer) in streambeds (Ligon 1926, 1961, Phillips et al 1964, Bent 1938).

California and Mexican spotted owls make greater use of tree hollows and cliffside cavities for roosting and nesting than do northern spotted owls. Ligon (1926) states that cliffs and caves are one of the habitat requirements of the spotted owl in New Mexico. Virtually all cliff nesting sites portrayed in the literature are protected from the sun either by north-facing exposures or by their location in an otherwise shaded area of the cliff. An adjacent source of water, while not always directly described, is at least strongly suggested by accompanying physiographic and vegetative descriptions (Ligon 1926, Bent 1938, Dickey 1914, Peyton 1910).

Territorial requirements for S. o. occidentalis and S. o. lucida are probably similar to the 300 to 600 acre figure given earlier for the northern spotted owl.
6. **Limiting Factors**

Destruction of habitat through lumbering of old-growth forests poses the most immediate threat to spotted owl populations in the northwestern United States. Although field observations in southwest Oregon seem to indicate that spotted owls may use second-growth evergreen forests if all other habitat requirements are met, it should not be assumed that factors other than forest composition influencing spotted owl populations will not be altered by logging activity. Nietro (1974a) believes that logging near areas occupied by spotted owls alters the number and variety of available prey species to the extent that the owls leave. Reproductive success of spotted owls may be diminished by nearby logging (Gould 1973). Lumbering in other mountainous areas of the owl's range also destroys suitable habitat.

Other forms of human activity may also exert influences on spotted owl populations. Construction of new outlying communities and mountain retreats around urban centers may destroy habitat through encroachment of civilization. Recreational activities in mountainous areas have increased tremendously in recent years. Although human disturbance factors appear to be low for the spotted owl, this has not yet been adequately determined. Greater accessibility of remote mountainous areas through backpacking and the use of trail machines and snowmobiles will increase human contact with spotted owls in their habitat and may introduce stress factors in excess of tolerable limits.

7. **Protective Measures Instituted**

The state of Oregon has given the northern spotted owl (*S. o. caurina*) official status as an endangered species.

8. **Species and Habitat Management Recommendations**

1. Give full protection to known nesting sites occurring on public land (Nietro 1974a).

2. Encourage private land owners to protect spotted owl habitat and nesting sites.

3. Establish maximum protective zones around all sightings, as feasible, until spotted owl habitat requirements are better known (Nietro 1974a).

4. Retain wide buffer strips along all streams in preferred spotted owl habitat (Nietro 1974a).
5. Defer planned timber sales where owls have been sighted until:
   a. the nest site is located
   b. additional guidelines are developed (Nietro 1974a).

6. Continue to locate and survey suitable spotted owl habitat far in advance of any timber sale planning (Nietro 1974a).

7. Review past timber harvest effects on spotted owl habitat (Nietro 1974a).

8. Whenever land is transferred from federal to state or private ownership, attempt to provide protection for spotted owls, habitat or nest sites that may occur on the lands (Snow 1973).

9. Conduct a breeding study to determine if spotted owls occurring in or near areas where logging is taking place are reproducing as effectively as spotted owls in areas not affected by logging or other disturbances (Gould 1973).

10. Monitor the existence of known pairs of spotted owls at least every four years to determine population-trends (Gould 1973).

11. If areas where spotted owls occur are to be set aside the following guidelines for establishing spotted owl management areas are suggested:
   a. The nest site or grove should be included.
   b. The permanent watercourse closest to the nest area should be included.
   c. The protected area should include the entire hillside from drainage area to ridge top.
   d. The area should exceed 300 acres in size.
   e. The area should include groves of large old-growth trees and groves of trees with d.b.h. (diameter breast high) greater than eleven inches and with a canopy cover greater than 40% (Gould 1973).
9. **Current Research**

1. The California Department of Fish and Game is conducting a statewide inventory of spotted owl populations. Tape-recorded spotted owl calls are played at night in areas of suitable habitat to elicit responses by spotted owls. In addition, volunteers will be asked to provide the Department with information on other spotted owl sightings. An accurate estimate of the spotted owl population in California should be available by the end of 1974. Gordon Gould is the biologist conducting this survey for the state (Mallette 1974).

2. Eric Forsman, Cooperative Wildlife Research Unit, Oregon State University, Corvallis, Oregon, is conducting research into the food habits, territory, breeding biology and habitat of the northern spotted owl in Oregon. His findings should be published as a Master's Thesis about June, 1974.

10. **Summary**

The spotted owl resides primarily in heavily forested mountain slopes or deeply shaded canyons in the western United States. Regional and overall population numbers are currently unknown.

Spotted owls are large owls. Body length varies from sixteen to nineteen inches; the tail is eight to nine inches long. Females are slightly larger than males and weigh an average of 22.4 ounces as adults; males average 20.4 ounces.

Food habit studies indicate that spotted owls prefer mammalian prey. Small rodents comprise the majority of food items taken. Birds, amphibians and insects are also preyed upon. A wide variety of prey species are utilized.

Female spotted owls lay from two to three eggs in late March or early April. Courtship behavior is unknown, but both parents probably participate in incubation, which may last from twenty-one to twenty-eight days. Juvenile owls leave the nest while still too young to fly and perch on the limb of an understory tree near the nest.

Reproductive success in spotted owls is not known. Many pairs of owls are sighted by observers, but in southwest Oregon in 1973 only one of two known nesting sites was successful. Two young were fledged.
Spotted owls nest primarily in cliffside cavities or in old-growth timber. Nesting sites are located in cool, shaded areas. Water is present nearby. The owls may use the same nest site repeatedly.

Adult birds show little inclination to defend their nests, eggs, or young from human investigators. In fact, docility is a consistent behavioral trait of the spotted owl.

Investigations in Oregon show that a pair of northern spotted owls requires about 600 acres of old-growth habitat. Similar figures probably apply to the other subspecies. Although population densities for spotted owls are not known, they are probably quite low even in undisturbed areas due to the relative isolation of areas of suitable habitat.

Loss of habitat through lumbering is the most serious threat to the existence of spotted owls. In addition, increasing use of public lands for outdoor recreation may introduce other intolerable stress factors into the spotted owl's environment. Proper planning and wise management of public lands can help to avert these problems.

11. Authorities

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