Section II

Surveys and Studies

This section has two main parts, which are described briefly below. Part 1 begins after the "Background Information" box on the next page.

Part 1 — Northern Spotted Owl

This subsection includes a brief overview of existing literature on the northern spotted owl, a history of spotted owl surveys on the Elliott, and a summary of information gained through the surveys.

Part 2 — Marbled Murrelet

This subsection includes a brief overview of existing literature on the marbled murrelet, a short discussion of murrelet habitat on the Elliott and in the region, a history of murrelet surveys on the Elliott, and a summary of information gained through the surveys.

Background Information

Federal and state agencies make formal classifications of wildlife species, according to standards set by federal and state Endangered Species Acts. The various classifications are defined below. Federal designations are made by the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service. State of Oregon designations are made by the Oregon Department of Fish and Wildlife (ODFW).

Federal Classifications

Candidate species, category 1 — Species for which there is substantial information to support listing the species as threatened or endangered; listing proposals are either being prepared or are delayed by work on higher priority species.

Candidate species, category 2 — Species for which information indicates that listing is possibly appropriate, but conclusive data are not available; additional information is being collected.

Endangered species — A species determined to be in danger of extinction throughout all or a significant portion of its range.

Proposed threatened or endangered species — Species proposed by the USFWS for listing as threatened or endangered; not a final designation.

Threatened species — Species likely to become endangered species throughout all or a significant portion of their range within the foreseeable future.

State Classifications

Endangered species — Any native wildlife species determined by the State Fish and Wildlife Commission to be in danger of extinction throughout any significant portion of its range within Oregon; or any native wildlife species listed as endangered by the federal ESA.

Threatened species — Any native wildlife species that the State Fish and Wildlife Commission determines is likely to become endangered within the foreseeable future throughout any significant portion of its range within Oregon.

Sensitive species — Species that are likely to become threatened or endangered throughout all or a significant portion of their range in Oregon; functions as a state candidate species list.

Part 1. Northern Spotted Owl

Literature Review

Introduction

The northern spotted owl (*Strix occidentalis caurina*) is a medium-sized owl found in northwestern North America. It is chocolate brown with white spots or mottling on the head, nape, and body; and white bars on the tail. Markings of both sexes are similar, but females are larger and their voices are generally higher-pitched. Juveniles (less than 5 months) have visible down feathers, and subadults have white-tipped, pointed tail feathers. (Forsman et al. 1984; USDI Fish and Wildlife Service 1992a). Owls live an average of eight years in the wild (Thomas et al. 1990), although captive owls may live more than twenty years.

Historically the northern spotted owl existed over a vast expanse of natural forest. Owl pairs were sparsely distributed throughout the ecosystem and ranged over thousands of acres to find prey and nest sites (USDI Fish and Wildlife Service 1992b). Studies indicate that the owls tend to select mature or old growth forests, and are found less often in stands under 60 years old. Currently most older forests in the Pacific Northwest have been logged, and many of the remaining older forests are in fragments isolated from one another. These factors led to the listing of the northern spotted owl as a threatened species in 1990 by the U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service 1990b).

Owls in managed forests usually occupy areas with structural diversity and a high degree of canopy closure, containing large diameter or residual old trees, in stands more than 60 years old (USDI Fish and Wildlife Service 1992b). The Oregon Department of Forestry is currently sponsoring research to examine the relationship that spotted owls have with second growth forests as habitat, and the ability of young forests to provide for the needs of spotted owls.

Behavior

Spotted owls are nonmigratory, primarily nocturnal predators of medium-sized mammals in coniferous forests. Like other nocturnal owls, they have superb eyesight and hearing, and modified feathers to enable silent flight. For the most part, they use a sit-and-wait or perch-and-pounce foraging strategy, an effective strategy in dense forests. Oregon home range sizes vary from a median of more than 6,000 acres in some Douglas-fir/western hemlock forests, to slightly more than 1,000 acres in mixed conifer forest in the Klamath Mountains (summarized in USDI Fish and Wildlife Service 1992a).

The size of the home range may be related to availability of prey, including the number of prey and effectiveness of hunting (Carey et al. 1992, Forsman et al. 1984). On the Elliott State Forest, the spotted owl's primary prey species are northern flying squirrels and bushy-tailed woodrats. Northern flying squirrels are associated with interior forest habitat. High

densities of spotted owls and successful reproduction have been observed in a mosaic of wooded and clearcut areas in California, where woodrats are abundant (Simpson Timber Company 1992).

Spotted owls usually occupy the same general home range and use the same core area year after year. Pairs tend to remain together. Annual home ranges often overlap to some degree with other pairs or single owls (Forsman et al. 1984). Resident spotted owls have regular contacts with their neighbors (Carey et al. 1992). Owls use a variety of hoots, barks, and whistles to communicate with mates, neighbors, and rivals (Forsman et al. 1984, USDI Fish and Wildlife Service 1992a).

Breeding season begins in March. Spotted owls often nest in cavities (Forsman et al.1984, Thomas et al. 1990a). Owls have also been observed using platforms such as abandoned goshawk nests or mistletoe brooms (Buchanan et al. 1993, USDI Fish and Wildlife Service 1992a). One to four eggs (usually two) are laid and incubated by the female for about 30 days. The female leaves the nest only for short periods and is dependent on the male for food. By two to three weeks after hatching, the female forages further from the nest site. The owlets fledge at 34-36 days (May-June) and make short flights two weeks after fledging. The adults continue to provide food for them until fall (Forsman et al. 1984), when the juvenile owls disperse.

Reproductive success among spotted owls is variable. In some years, most pairs attempt to breed, and in other years few pairs attempt breeding (USDI Fish and Wildlife Service 1990b). Preliminary data from the Elliott gives a fecundity rate (the number of female young produced per year per female) of 0.16, which is low compared to other areas in Oregon.

Habitat Characteristics

Stand structure suitable for nesting is a crucial habitat requirement for the spotted owl (Tappeiner, et al. 1992). Forest stands used by owls for nesting are typically those with diverse structures (Spies and Franklin 1991). The stands have been found to be multi-storied with many small trees and fewer large trees per acre. They often have mixed species, with two or more age classes resulting from disturbances such as fire, windthrow, and root diseases. Overstory species may include redwood, ponderosa pine, sugar pine, western hemlock, and Douglas-fir. There are usually large snags and downed logs.

Some studies have found spotted owl detection rates, abundance, and reproduction to be positively correlated with increasing amounts of older forest (Bart and Forsman 1992, Postovit 1979, Thomas et al. 1990). Bart and Forsman (1992) defined older forest as stands 80 or more years old. They found that landscapes with more than 60% older forest had 7 times the density of owl pairs and 40 times the number of young fledged per square kilometer, than landscapes that had 20% or less older forest.

Distribution of Species and Habitat

The current range of the northern spotted owl is approximately the same as its historic range, extending from southwestern British Columbia to the San Francisco Bay Area, and from the Pacific Ocean east into the Cascades (USDI Fish and Wildlife Service 1992a). Suitable owl habitat is described as old growth or structurally diverse coniferous forest, especially at low and mid-elevations. By this definition, an estimated 95% of remaining owl habitat in Oregon is on federal lands (USDI Fish and Wildlife Service 1992a).

Recent estimates of northern spotted owl numbers show the population in Washington, Oregon, and California as 3500-3600 pairs, with about 2000 in Oregon (Thomas et al. 1993, USDI Fish and Wildlife Service 1992a). The northern spotted owl is now rare in Canada (Thomas et al. 1993). The majority of the spotted owls in Oregon are located in the Cascades and the Klamath province in southwest Oregon.

Factors Causing Decline of Species

Thomas and others describe loss and fragmentation of habitat due to timber harvest and other disturbance, as the greatest threat to the northern spotted owl (Thomas et al. 1990a, 1993, USDI Fish and Wildlife Service 1992a). Habitat loss was estimated at 1-5% per year using Landsat and timber harvesting data (Thomas et al. 1993).

In addition to general habitat loss, potential future isolation of remaining habitat and owl populations is a concern. The isolation of small populations of a species has been observed to lead to local declines or extinctions from random genetic changes or environmental disturbances such as fire, windthrow, drought, or disease (Lamberson et al. 1992, Shaffer 1987, Thomas et al. 1990a). In addition, juveniles dispersing from isolated habitat are not as likely to find viable territories.

Predation by larger birds, particularly the great horned owl, is reported to be an important cause of mortality for both adult and juvenile spotted owls (Miller 1989). However, some observers have reported encounters in northwestern California that appeared to be competitive rather than predator-prey interactions (Marcot and Gardetto 1980, Simpson Timber Company 1992). Other possible predators are the goshawk, red-tailed hawk, and raven (on juveniles).

Barred owls are expanding into northern spotted owl territories, and may displace or occasionally hybridize with spotted owls (Thomas et al. 1993, USDA Forest Service 1988, USDI Fish and Wildlife Service 1992a). It is not clear if this could become a significant threat to the species.

Measuring population trends of spotted owls is difficult, partly because the species is comparatively long-lived. Analysis of five discrete populations for 5-8 years indicated that those spotted owl populations are declining an average of 7.5% each year in northern California and southern Oregon (Anderson and Burnham 1992, updated in Thomas et al. 1993, USDI Fish and Wildlife Service 1990b).

History of Surveys on the Elliott State Forest

As of September 16, 1993, there were 35 known sites with resident spotted owls on or within 1.5 miles of the Elliott State Forest. Of these 35 sites, 29 are occupied by pairs, 5 by resident single owls, and 1 site by 2 birds, pair status unknown. The activity centers for 24 sites are on state land, 8 are on private lands, and 3 on BLM lands. In addition, there are 4 sites where owls are present but residency is not yet determined, one of these with 2 birds ("status unknown"). There are also 4 locations where non-territorial "floater" owls have been recorded. Thus, based on data collected in 1991-1993, 69 individual spotted owls have been recorded on or within 1.5 miles of the Elliott.

Surveys Before 1991

An informal survey for spotted owls was done on the Elliott in 1982, with daytime observations of owls at 10 sites. No surveys were conducted from 1983-1985. From 1986-1989, Bureau of Land Management and ODFW personnel conducted surveys that were limited to a few areas, such as the Lower Mill Creek and Upper Mill Creek owl sites.

In 1990, the Department of Forestry conducted a slightly broader survey of the Elliott, focused on areas within and immediately adjacent to timber sales. Also in 1990, ODFW hired a consultant who conducted supplemental surveys for a number of sites on the Elliott. Owls were detected in 10 areas during the 1990 surveys.

1991 Survey

The first broad, intensive survey of the Elliott was conducted in 1991. The survey was done by ODFW with additional support provided by the Department of Forestry. The 1991 survey documented 39 owl sites. Survey methodology used U.S. Fish and Wildlife Service survey guidelines.

1992 Survey

Owl surveys in 1992 were done primarily through a contract between the Department of Forestry and the Cooperative Wildlife Research Unit at Oregon State University. ODFW provided 3 people to complement the survey crew members from Oregon State University. The survey methodology used was the U.S. Fish and Wildlife Service revised survey protocol. The 1992 survey documented 33 pairs and resident single owls, and 9 "status unknown" owl sites on or within 1.5 miles of Elliott State Forest.

1993 Survey and Research

The owl surveys in 1993 were again contracted to the Cooperative Wildlife Research Unit at Oregon State University. Survey methodology used the more rigorous density study area protocol. Survey results indicated 29 owl pairs, 7 resident singles, 4 status unknown sites, and 4 areas containing non-territorial "floater" owls.

The Elliott State Forest was designated as a "Density Study Area" in 1993, in order to examine aspects of demographic performance and habitat relationships. The research goals are to further our understanding of how spotted owls are influenced by changes to their original old forest habitat, and how forestry practices may be used to improve owl habitat or minimize the impact of timber harvest. Methods used will include surveys, identification of

occupied sites, and capture and banding techniques. During the next four or five years, researchers will be determining owl densities in young forests, adult survival, number of young fledged compared with various parameters, and population rate of change.

Owl surveys have also been conducted in 1994, but results were not analyzed in time to include in this Habitat Conservation Plan.

Banding and Radio Telemetry

During 1991, 1992, and 1993, 39 adult/subadult and 18 juvenile owls were banded on or adjacent to the Elliott. This number represents approximately 61% of the resident owls. To date, 7 banded owls have been observed in locations different from their original banding location. Also, 3 owls that were banded outside the Elliott have been observed within the Elliott.

Although no radio-transmitters have been placed on owls within the Elliott, 2 radio-marked owls from outside the Elliott have relocated within the Elliott.

Demographics

Fecundity is one factor of demographic performance. Fecundity is defined as the number of female young produced per adult/subadult female owl per year, in the population of interest. Based on an assumed 50:50 sex ratio, the fecundity rate for owls on the Elliott was 0.089 in 1991; 0.241 in 1992; and 0.100 in 1993. In general, the fecundity rate on the Elliott is lower than from the majority of study areas elsewhere in Oregon. As the table on the next page shows, 7 out of 10 study areas in Oregon recorded a higher fecundity rate than the Elliott in 1991 and 1992 (ODFW, unpublished data).

Another measure of demographic performance is the observed “turnover” rates of resident owls. In most situations, observed turnover of banded birds is the result of the death of the previous resident owl, and its replacement with a new owl. As spotted owls are generally long-lived, turnover rates are relatively low compared to other avian species. Turnover rates for spotted owls are determined through observations of banded owls. As the majority of owls on the Elliott have only recently been banded, no determination of turnover rates is possible.

Age and Sex Characteristics

The surveyors were able to determine the age of 29 owls (besides the juveniles) of the owls banded in 1991-1993. Of these 29 owls, 28 were classified as adults (at least in their third calendar year of life), and 1 was classified as a subadult (in its second calendar year of life). Of the 29 owls, 14 were males and 15 were females.

Home Range Sizes

Home range sizes for 19 pairs of radio-marked spotted owls in the Oregon coast range have been examined. The mean (average) annual home range size for the 19 pairs of owls was 5,722 acres, or about the size of a circle with a radius of 1.7 miles. The average amount of mature and old growth forest within these home ranges was 2,353 acres (Johnson 1993, Thomas, et al. 1990). This study is the best available information on owl home ranges in the Oregon coast range, and the results are applicable to the Elliott.

Table II-1. Fecundity Rates for Northern Spotted Owls in Ten Areas in Oregon

This summary reflects 1991 and 1992 fecundity data combined. Fecundity is defined as the number of female young produced per adult/subadult female owl per year, in the population of interest. A 50:50 sex ratio is assumed for young owls. State lands in northwestern Oregon include the Clatsop and Tillamook State Forests.

Study Area	Fecundity Rate
H.J. Andrews	0.484
Medford	0.425
Coos Bay (BLM)	0.361
Roseburg	0.349
Siskiyou	0.346
Eugene — West	0.325
Siuslaw	0.208
Elliott State Forest	**0.164**
Eugene — East	0.121
Northwest Oregon (state lands)	0.100

Habitat Characteristics

As a working description for the Elliott, suitable spotted owl habitat includes conifer stands 80 years of age and older. These stands normally include trees 18 inches DBH (diameter breast height) and larger. As a result of timber harvest during the past 15 years, suitable spotted owl habitat on the Coos District state forests has declined by approximately 24%, as shown in the table on the next page.

Through the spotted owl surveys, observations have been made of spotted owls' use of habitat on the Elliott. These observations indicate that owls are using conifer and hardwood stands in a manner similar to that reported in other areas of the state.

Nest sites on the Elliott have been similar to those reported elsewhere. An assessment has been done of 289 spotted owl nest trees in the Oregon coast range (Johnson 1993). Eighty-two percent of nests were in cavities, with the average nest tree being 57 inches in diameter at breast height (DBH), and 131 feet tall. Nests were located at an average height of 87 feet above the ground.

Table II-2. Trend in Stands 80 Years or Older on Coos District State Lands

(1978-1993)

Acreages are from Oregon Department of Forestry OSCUR inventory data.

Total area	98,391 acres
Acres of stands age 80+ in 1978	64,606 acres
Acres of stands age 80+ harvested 1978-1993	22,052 acres
Acres of stands age 80+ in 1993 [1]	49,418 acres
Percent change in acres of stands age 80+	-23.51%
Average annual decrease in stands age 80+	1.57%

1. This acreage includes acres that have grown into the 80+ age class since 1978.

During the 1950s-1970s, a significant portion of the Elliott was partial cut to remove dead trees and trees likely to die before clearcut harvest (referred to as mortality-salvage). These operations took place mostly in the central and southeastern portion of the Elliott. An analysis of the spotted owl sites on the Elliott found that there were significantly fewer mortality-salvaged stands within 1.5 mile circles around owl sites, than there were within 1.5 mile circles centered on random points. Owl survey information indicates that few or no resident owls are associated with areas containing mortality-salvaged stands. A possible explanation for why owls are not found in these areas may be that the mortality salvage operations removed structural components that are important to owls from the stands, such as snags and down logs.

Spotted Owl Prey

Tables II-3 and II-4 on the next page show spotted owl prey species information on the Elliott, based on samples taken in 1992 and 1993. These tables show that the primary prey species for the owl are northern flying squirrels and bushy-tailed woodrats. The woodrats reflect 13.5% of the individual prey animals taken, but due to the body weight of the woodrat, make up 28.8% of the biomass consumed. The northern flying squirrels reflect 37.8% of the individual prey animals taken, and make up 34.7% of the biomass consumed. The sample size of 37 prey animals is quite small. The ongoing research is being conducted by the Oregon Cooperative Wildlife Research Unit. Results have not been published yet.

Table II-3. Composition of Spotted Owl Prey Species on the Elliott [1]			
Prey Species	**1992** **7 prey animals**	**1993** **30 prey animals**	**Total** **37 prey animals**
Northern flying squirrel	28.6%	40%	37.8%
Unidentified small mammal	14.3%	10%	10.8%
Bushy-tailed woodrat	0%	16.7%	13.5%
Vole species	28.6%	3.3%	8.1%
Mouse species	0%	16.7%	13.5%
Leporid species (Hare and rabbit family)	14.3%	0%	2.7%
Bird species	14.3%	10%	10.8%
Insect species	0%	3.3%	2.7%

1. Source: Oregon Cooperative Wildlife Research Unit.

Table II-4. Biomass of Spotted Owl Prey Species on the Elliott [1]			
Prey Species	**1992** **1125 grams**	**1993** **3514 grams**	**Total** **4639 grams**
Northern flying squirrel	20.4%	39.3%	34.7%
Unidentified small mammal	2.2%	11.6%	9.3%
Bushy-tailed woodrat	0%	38%	28.8%
Vole species	4.4%	0.7%	1.6%
Mouse species	0%	3.6%	2.7%
Leporid species (Hare and rabbit family)	66.7%	0%	16.2%
Bird species	6.2%	6.8%	6.7%
Insect species	0%	0.1%	0.1%

1. Source: Oregon Cooperative Wildlife Research Unit.

Part 2. Marbled Murrelet

Literature Review

Introduction

The marbled murrelet (*Brachyramphus marmoratus*) is a robin-sized seabird of the Alcid family, which also includes puffins, auks, and guillemots. Breeding adults are sooty-brown with dark bars and rufous brown flecks, and are light, mottled brown underneath. Juveniles appear similar, with faint brownish mottling. Winter plumage is brownish-gray with white underneath (Marshall 1989). The North American subspecies of the murrelet has a range that extends from the Aleutian Archipelago in Alaska south to central California (USDA Forest Service et al. 1993).

The U.S. Fish and Wildlife Service listed the marbled murrelet as a threatened species in Washington, Oregon, and California in 1992, due to loss of nesting habitat, and threats from gill net fishing and oil spills (USDI Fish and Wildlife Service 1992). The U.S. Fish and Wildlife Service is currently developing a recovery plan for marbled murrelets.

Behavior

Murrelets feed on fish and invertebrates in near-coastal waters, although some have also been observed on rivers and inland lakes (Carter and Sealy 1986). Unlike other alcids, marbled murrelets nest inland in mature and old growth coniferous forests as far as 52 miles from the ocean (Marshall 1988). In Washington, Oregon, and California, murrelet nests have been found in trees. As of the 1993 breeding season, 64 tree nests have been located, 23 in Oregon (Nelson 1993a, 1993b). Marbled murrelets have been observed to nest near each other (Hamer and Cummins 1990,Marshall 1988). However, the degree of colonial nesting in this species is unknown. Most nests have been located only in the last few years, and nesting behavior is still being researched.

Murrelets lay a single egg in April or later — some chicks may fledge as late as September. They may not nest every year. The egg is incubated by both male and female in alternating 24 hour shifts. The chick hatches after approximately 28 days and is then fed by both adults once or twice a day, usually at dusk. After 30-35 days, the fledgling flies directly to the ocean (Marshall 1989).

Habitat Characteristics

Marbled murrelets feed mostly in near-shore marine waters and in inland saltwater bays and sounds, and occasionally inland freshwater lakes (Marshall 1989). They often gather at the mouths of rivers.

Nesting habitat is crucial to murrelets and, south of the Alaskan tundra, occurs within mature or old growth coniferous forests within 50 miles of the ocean (Carter and Erickson 1988; Hamer and Cummins 1990, 1991, Nelson 1989, 1990a, Paton and Ralph 1990; Sealy and Carter 1984). A mature stand is usually defined as from 80 to 200 years old; old growth characteristics are found in stands over 200 years old (Franklin and Spies 1984, Marshall 1988).

Murrelet nests have been found on platforms or broad surfaces that are formed by large limbs, moss, branches deformed by diseases such as mistletoe, or damaged branches. Suitable nesting platforms are found most commonly on older trees. Most nests are directly under overhanging branches, which may provide protection from harsh weather and predators. The Pacific Seabird Group defines potential nesting habitat as (1) mature (with or without an old growth component) and old growth coniferous forests; and (2) younger coniferous forests that have deformation or structures suitable for nesting (Ralph et al. 1993). Preferred tree species are Douglas-fir, coast redwood, western hemlock, Sitka spruce or western redcedar. Because murrelets are seabirds, their nesting habitat must be within flight distance of a marine environment (USDA Forest Service et al., 1993b). For the purposes of surveys, potential nesting habitat is being defined as stands within 50 miles of the ocean, containing trees greater than 18 inches DBH, with some site-specific review for potential nest platforms.

There is no clear relationship between stand size and use by marbled murrelets (Ralph 1993). One study found high numbers of murrelets only when the amount of old growth or mature forest within a 1.25 mile radius was greater than 31% (Hamer and Cummins 1990). It has been suggested that small stands are more likely to be used when large occupied stands are nearby. All 76 known occupied sites in Oregon between 1986-1990 (Interagency Marbled Murrelet Committee 1991) were larger than 25 acres, although recent detections have occurred in smaller stands, including 1 occupied stand of 5 acres (Grenier and Nelson 1993).

Stand buffers are highly recommended by biologists, to a) minimize mortality and windthrow from wind along an edge; b) minimize microclimate and biological changes (productivity, decomposition, tree mortality) related to increased light, temperature and drying; and c) minimize nest predation from corvids (ravens, crows and jays) (Nelson 1993c, Washington State Forest Practices Board 1993).

Distribution of Species and Habitat

Marbled murrelets range along the Pacific coast of North America, from Alaska south to central California. Wintering birds have occasionally been found in southern California. Historical populations are thought to have been much larger — perhaps 60,000 murrelets in California, where the murrelet population was recently estimated at 2,000-3,000 birds (Carter and Erickson 1992, Larsen 1991). Alaska has the most murrelets at present, with estimates as high as 250,000 birds (McAllister 1993, personal communication). Other recent estimates of population sizes are 5,000 in Washington (Speich et al. 1992) and 2,000-5,780 in Oregon (Nelson et al. 1992, Strong et al. 1993, Sustainable Ecosystems Institute 1993). The current distribution of murrelets correlates with the presence of older forests on shore (Nelson 1990b, Speich et al. 1992), with the exception of the area between Florence and

Coos Bay, which has high densities of murrelets, though there are no nearby large forest stands (Strong et al. 1993).

Factors Causing Decline of Species

The U.S. Fish and Wildlife Service cited loss of nesting habitat as the primary reason for the decline in marbled murrelet populations. Other causes include gill net mortality and oil spills (USDI Fish and Wildlife Service 1992). Feeding murrelets are very vulnerable to being killed in gill nets — an estimated 600-800 per year were being killed in Prince William Sound, Alaska, before the Exxon Valdez oil spill (Sealy and Carter 1984). Large numbers of murrelets killed by oil contamination were found after the spill. Estimates of the total number killed ranged up to 1,000-3,000 (Mendenhall 1992).

Some biologists regard fragmentation of nesting habitat as a threat because it may lead to increased predation. Unpublished data in Oregon show that approximately 70% of murrelet nests fail, and of these, nearly half fail because of predation (Nelson 1993c). Predators include the common crow, Steller's jay, common raven, and great horned owl (Nelson 1991, 1992, 1993c, Naslund et al. in press). These species commonly use forest edges.

Murrelet Habitat on the Elliott and Adjacent Lands

The entire Elliott State Forest is within the breeding range of the murrelet. In 1993, 39,367 acres (42%) of the potentially forested lands within the Elliott were in stands in the 100 year age class or older. Most of the mature stands are between 100 and 130 years old, with less than 1% over 155 years. Remnant old growth that escaped the 1868 fire is scattered throughout the forest.

Potential murrelet nesting habitat contains trees greater than 18 inches DBH, with suitable nest platforms. A preliminary analysis of stand inventory data from the Elliott showed 126 stands out of a total of 1,986 stands (using inventory polygons) containing trees greater than or equal to 32 inches diameter breast height (DBH). Forty-three of the 126 stands contain trees greater than or equal to 48 inches DBH. Because stand inventories do not specifically record larger trees in all cases, additional stands with these large trees are known to be present throughout the forest. Stands with larger trees are considered to be desirable murrelet habitat. Of 15 known nest sites in Oregon and Washington, all included trees (2 to 47 trees per acre) with DBH greater than 32 inches (Nelson, Hamer and Holtrop, in prep.).

Analysis of murrelet-occupied stands in the Elliott State Forest, compared with random stands (murrelet activity not known), showed occupied stands to be older (average age of 116 years; range 98-145 years) and with more remnant, large trees (an average of 19.2 trees per acre over 26 inches DBH) (Grenier and Nelson 1993). A stand structure that includes a variety of tree species; less uniform tree sizes; random spacing of trees; and large, remnant overstory trees, is an important component of murrelet-occupied sites. High quality murrelet nesting habitat contains an abundance of nest platforms, mistletoe, and moss.

Regionally, potentially suitable nesting habitat exists in several areas adjacent to the Elliott State Forest. To the north, Mapleton Ranger District of the Siuslaw National Forest provides potential habitat. Two Bureau of Land Management districts near the Elliott also provide suitable habitat. They are the Umpqua Resource Area (Coos Bay District) to the northeast, and the Tyee Resource Area (Roseburg District) to the east. Occupied survey sites have been located in some of these areas, especially on Forest Service-administered lands due to more survey work there. Statewide, between 1986 and 1992, 508 potentially occupied survey sites were documented, primarily on federal lands. Since the coast range has not been fully surveyed, it is likely that considerably more occupied sites will be found in the future.

History of Surveys on the Elliott State Forest

In 1989 the first general surveys on the Elliott were conducted by the Oregon State University Cooperative Wildlife Research Unit as part of a larger coast range sampling effort (Nelson 1990a, 1990b). Seven murrelet detections were recorded. Detections are defined below, in the "Key Terms" box.

Based on 1992-1994 survey data, there are 31 known murrelet occupied sites. No nests have been discovered. Nest site surveys have not yet been conducted on the Elliott, and the reproductive status of the murrelet population is unknown.

1992 and 1993 Surveys

In 1992 the Department of Forestry conducted preliminary surveys of 33 sales (76 survey sites). Potential occupied behavior was observed at 3 survey areas and detections were recorded at 15 other sites (Platt and Goggans 1992).

Intensive surveys were conducted around 49 proposed sale areas in 1993. "Occupied behaviors" were observed at 18 sale survey areas.

Surveys continued in 1994, and preliminary results are available. Based on 1992-1994 data, there are a total of 31 sites where occupied behavior was observed.

Key Terms

The following definitions are from the Pacific Seabird Group (Ralph et al. 1993).

Detection — The unit of measure for murrelet surveys; the sighting or hearing of one or more birds acting in a similar manner.

Occupied site — A portion of a survey area where at least one of the following occurs, indicating potential occupying of the site by murrelets: 1) discovery of an active nest or a recent nest site as evidenced by a fecal ring or eggshell fragments; 2) discovery of a chick or eggshell fragments on the forest floor; 3) birds flying below, through, into, or out of the forest canopy within or adjacent to a stand; 4) birds perching, landing, or attempting to land on branches; 5) birds calling from a stationary location within the stand; 6) birds flying in small or large radius circles above the forest canopy.

Potential habitat — For marbled murrelets, potential habitat is coniferous forests within 50 miles of the coast, (1) mature (with or without an old growth component) and old growth coniferous forests; and (2) younger (70-80 years) coniferous forests that have deformations or structures suitable for nesting.