

1-1-1986

Spotted Owls In Harvested Areas

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SPOTTED OWLS IN HARVESTED AREAS

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SPOTTED OWLS IN HARVESTED AREAS

(TITLE)

BY

Kathleen R. Nickell

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Master of Science

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1986

YEAR

I HEREBY RECOMMEND THIS THESIS BE ACCEPTED AS FULFILLING
THIS PART OF THE GRADUATE DEGREE CITED ABOVE

20 May '86
DATE

20 May '86
DATE

Richard Andrews
ADVISER

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ABSTRACT

The northern spotted owl (Strix occidentalis caurina) typically inhabits old-growth forests. Typical habitat is altered to varying degrees through timber harvesting practices which remove old-growth forests. On the Bureau of Land Management-Medford District, Oregon, spotted owls have nested successfully in areas previously entered, to some degree, by logging. The objectives of this study were to locate nesting spotted owls in areas managed extensively for timber harvest, evaluate the available habitat, and determine the owl's habitat use. Five sites were selected for study based on pair occupancy and logging impact.

At each site, habitat around the nest site or activity center was structurally typical of mature or old-growth stands. Canopy closure ranged from 87% to 96% and although the stands were uneven-aged, average age was generally less than 100 years. Outside the nest stand, each of the sites was a mosaic of habitat types. Average canopy closure values varied greatest within mixed conifer/hardwood stands. Excluding the Porcupine Mountain study site, canopy closure averaged at least 82% in partial cuts. Slope values were not comparable. The basal area of live trees was highest in closed sapling-pole stands.

Eight adult owls were radio-tagged. Home range was calculated for three pairs and four individuals. Based on 100% of the samples, home range averaged 1969.0 ac (796.8 ha) for an individual and 1898.9 ac (768.5 ha) for a pair. Except for the Rush Creek birds, all of the owls were

utilizing some partial cut stands for roosting and foraging.

A total of 161 prey items were identified from regurgitated owl pellets. Woodrats and northern flying squirrels were the predominant prey species taken.

The northern spotted owl (Strix occidentalis caurina) ranges from southwestern British Columbia south through Washington, Oregon, and California. In Oregon, it is found from the coast east to the crest of the Cascade Mountains. It is currently listed as threatened by the Oregon Department of Fish and Wildlife (U.S. Fish and Wildlife Service 1982). Within its range in southwestern Oregon, typical habitat is old-growth forests of Douglas fir (Pseudotsuga menziesii), incense cedar (Libocedrus decurrens), white fir (Abies concolor), and other tree species with uneven-aged, multilayered canopies (U.S. Fish and Wildlife Service 1982). These old-growth forests, characterized by snags, fallen trees, trees with broken tops, and trees with fungal or dwarf mistletoe (Arceuthobium spp.) infections, provide typical nesting, foraging, and roosting habitat (Forsman 1976, U.S. Fish and Wildlife Service 1982). Home range in these forests averaged 2,907 ac (1,177 ha) (Forsman 1980). Nests are commonly found in large cavities or in clumps of deformed limbs and are often traditional (Forsman et al. 1982, U.S. Fish and Wildlife Service 1982).

Typical old-growth habitat is altered to varying degrees through timber harvesting practices which remove old-growth timber. On the Bureau of Land Management-Medford District, Oregon (BLM), spotted owls have nested successfully in areas previously entered, to some degree, for logging (Gayle Sitter and Jim Harper per. comm.). Data, however, are limited on the characteristics of these habitats, that is, its diversity, the amount and distribution of old-growth, and the degree of the forest disturbance. The objectives of the study, therefore, were to locate nesting spotted owls in these areas managed extensively for timber harvest, evaluate the available habitat, and to determine

the owl's habitat use.

STUDY AREA

This study was conducted in the Klamath and Cascade Mountains of southwestern Oregon on lands administered by the BLM-Medford District from 1 April - 31 November 1985. The five study sites were in three BLM resource areas and were within a 40 mile (64.4 km) radius of Medford, Oregon (Figure 1). The sites were selected based on the findings of a pilot study conducted 1 May - 15 August 1984.

The topography is rugged with steep slopes and narrow river canyons. Mountain peaks generally rise to 5,000 feet (1,524 m) (McKee 1972). Summers are characteristically hot and dry and the winters are cool and dry with snow occurring at higher elevations (Baldwin 1973).

Mixed conifer forest is the predominant vegetation type, but cedar-hemlock-Douglas fir forest, silver fir-Douglas fir forest, and the Oregon oakwoods vegetation types also occur (Hall et al. 1985). Mixed conifer forests are unique to southwestern Oregon and are usually comprised of several conifer species: Douglas fir, ponderosa pine (Pinus ponderosa), incense cedar, sugar pine (Pinus lambertiana), and white fir (Hall et al. 1985). Timber harvesting continues to alter large blocks of forest and has augmented the natural mosaic of habitat types.

METHODS

Calling surveys (Forsman 1983) were conducted in areas with a history of use by owls and where logging had occurred. Nest sites of owls located in the calling survey were found using the procedures

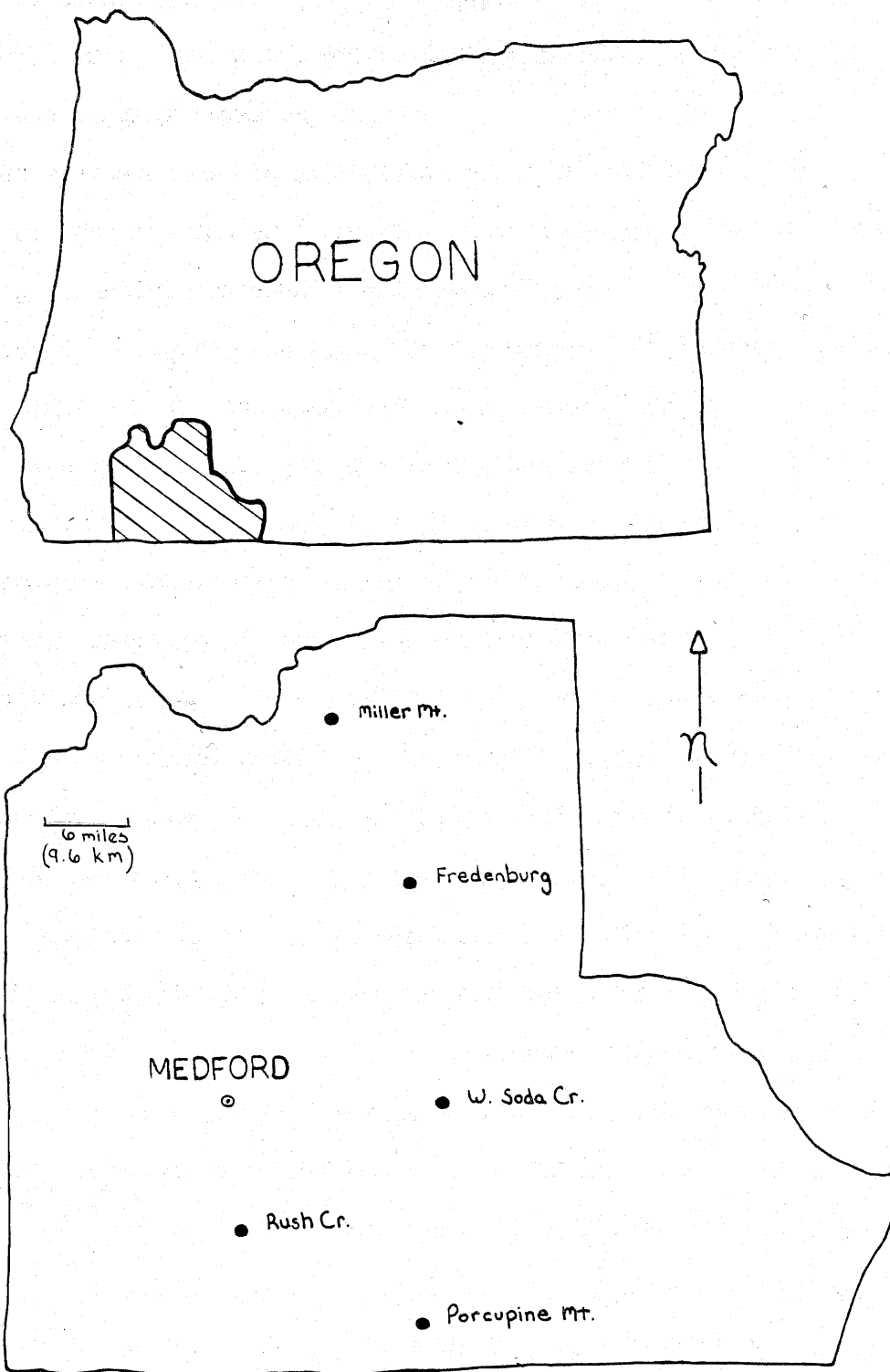


Figure 1. Spotted owl study area (top) and location of five study sites on the BLM-Medford District, Oregon, 1985.

described by Forsman (1980). If a nest was not found, a center of activity was established where owl sign, i.e., pellets, feathers, and droppings was greatest. Five sites were selected in 1984 based on pair occupancy and logging impact.

Habitat was evaluated within a 500 foot (152.4 m) radius of each nest site or activity center from data collected at 20 plots (Figure 2) using the point-centered quarter sampling method (Mueller and Ellenberg 1974). Measurements recorded at each plot included: the basal area of live trees and stumps of logged trees (ten factor prism); canopy closure (spherical densiometer); and slope (clinometer). In addition, the age of the largest tree in each of the 20 plots was determined from a core sample (increment borer). From these samples, average age was calculated for that stand.

Habitat within a 1.5 mile (2.4 km) radius of the nest tree or activity center was typed and delineated on aerial photographs as partial cut, clear-cut, unacceptable, mixed conifer/hardwood, or by its stand conditions: old-growth, large sawtimber, closed sapling-pole-sawtimber, open sapling-pole, and shrub (Hall et al. 1985). This radius was used to delineate an area for habitat evaluations and was based on radiotelemetry studies by Forsman (1980) and recommendations to the Oregon-Washington Interagency Wildlife Committee in regard to spotted owl management (Forsman et al. 1985). Partial cut was used as a general term to describe any stand which had been logged but was not clear-cut. A clear-cut was lacking in vegetation and generally less than ten years old. Unacceptable habitat referred to non-forested areas such as south-facing rocky and grass-covered slopes or large meadows. The acreage of timber stands was measured using either an electronic planimeter or a Hewlett-Packard 9020 computer. Except for

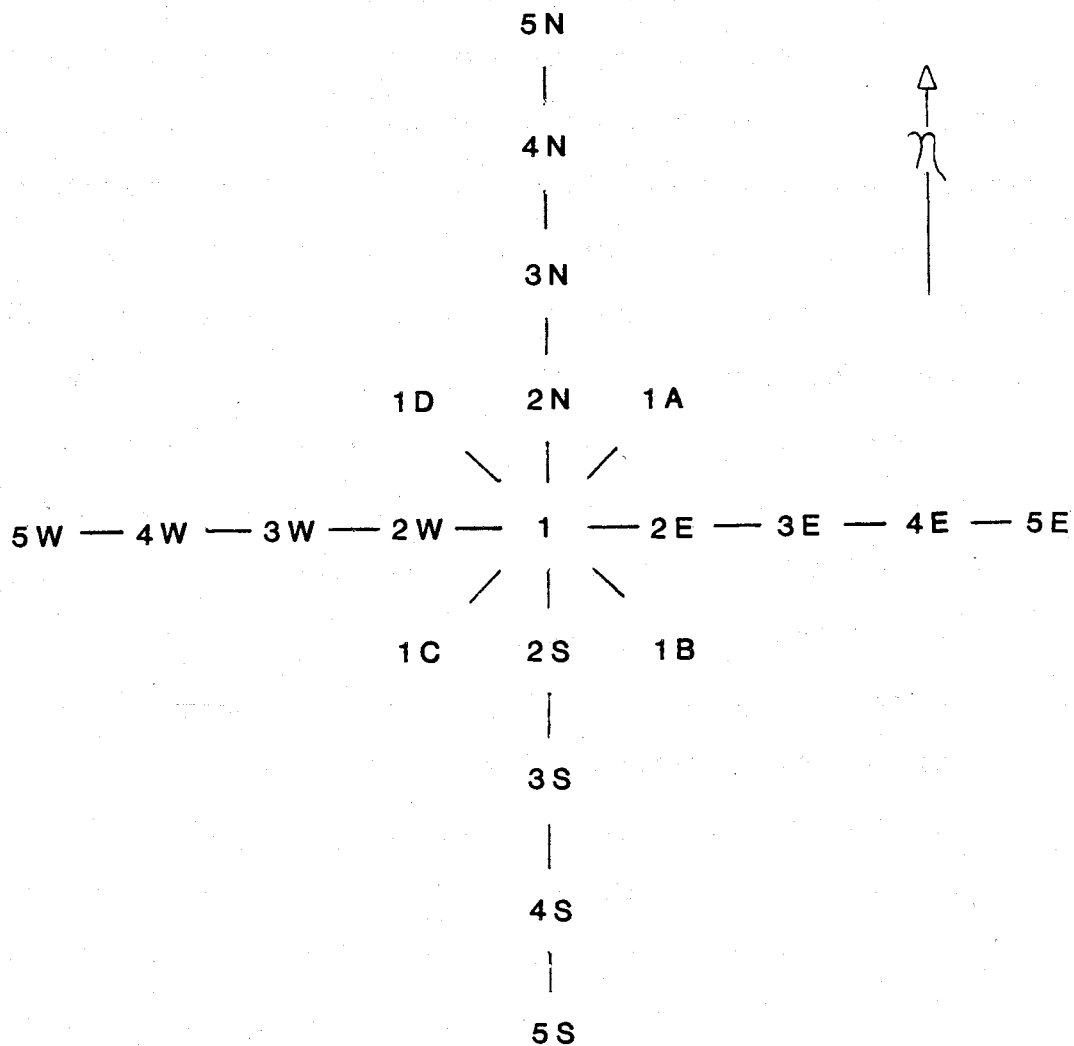


Figure 2. Points at which habitat parameters were sampled around a spotted owl nest tree or activity center (1) at 5 study sites on the BLM-Medford District, Oregon. The interval between each sample point was 100 feet. (30.5 m).

clear-cuts and unacceptable habitats, all timber stands were evaluated for the following parameters: basal area of live trees and stumps of logged trees, canopy closure, and slope. Stand structure, the amount of ground cover, and decadence were also noted. The data were obtained from 10 plots in habitat types of 100 acres (40.5 ha) or less and 15 plots in habitat types greater than 100 acres.

Habitat use by adult spotted owls at the five sites was monitored through radiotelemetry. Owls were captured using a noose pole (Forsman 1983) and each bird was weighed, sexed (Barrows et al. 1982), wing length was measured, and the bird was then banded and fitted with a radio transmitter (Dunstan 1972). Transmitters weighed approximately 23 grams and the frequency was 164 MHz. Locations of owls were determined using an AVM Model IA 12 receiver powered by a motorcycle battery, a 2-element hand-held yagi antenna, or a rotating 5-element yagi antenna mounted on the roof of a truck. I triangulated two or three compass bearing from known positions to establish the location of the owl. The possibility of an owl moving before all bearings were taken was minimal due to the way owls forage, staying at one location for a long period of time (Forsman et al. 1984). Home range was determined for each pair or single adult using the minimum convex polygon method as described by Jennrich and Turner (1969). At all of sites, home range was determined using 100% of the locations and also using 90% of the owl locations; arbitrarily excluding the outlying 10% of the locations as incidental and areas not heavily used by the adults. The owls were monitored over a three month period from 1 May - 1 August 1985. Additional roost locations were obtained weekly from an aircraft through triangulation of the radio signal from 1 September - 1 November 1985 by Frank Wagner (Oregon State Universtiy, Corvallis).

Regurgitated pellets were collected at nest sites and associated roost sites. Prey items were identified from skeletal remains, feathers, or fragments of the exoskeleton, in the case of insects. The minimum number of individuals of a prey species was estimated by counting skulls, pairs of jaws, or other remains. Prey were identified using a reference collection prepared by Gary Miller (Oregon State University, Corvallis).

Since the Bureau of Land Management uses the English system of measuring, measurements are presented in English throughout this report. When possible, metric equivalents are also given.

RESULTS

Thirteen spotted owl sites were surveyed in 1984 through night calling (Table 1). Of these thirteen, five were selected to monitor for habitat use and to determine home range size in 1985. Records of occupancy and breeding for some study sites span over 10 years (Table 2). Nest trees have been verified at all of the sites except Miller Mountain and all of the pairs have nested and fledged young at least once in the last two years.

Eight adult spotted owls, three males and five females, were fitted with radio transmitters between 9 April and 11 July 1985 (Table 3). Repeated attempts to capture the West Soda Creek male and the Miller Mountain male were unsuccessful.

Fredenburg Study Site

A large portion (67%) of Fredenburg has been partial cut (Figure 3). The two blocks of old-growth forest that remain account for less than 10% of the habitat (Table 4). The 1984 nest site was a cavity in

Table 1. Status of thirteen spotted owl sites in logged, or managed habitats, as of 1 August 1985, on the BLM-Medford District, Oregon.

Site Name	Year First Located	Results of 1984 Survey				Results of 1985 Survey				Current Status ²
		Male	Female	Young	Sign ¹	Male	Female	Young	Sign	
Deer Mobile	1979	0	0	0	0	1	1	0	0	active
W. Soda Cr.	1974	1	1	1	X	1	1	0	X	active
Green Springs Mt.	1976	0	0	0	0	0	0	0	0	unknown
Jenny Cr.	1976	0	0	0	0	0	0	0	0	unknown
Porcupine Mt.	1981	1	1	2	X	1	1	0	X	active
E. Chinquapin	1984	1	1	0	X	1	1	1	X	active
Rosebud Mt.	1983	1	1	0	X	1	1	0	X	active
Grizzly Peak-East	1982	1	1	1	X	1	1	0	X	active
Brush Mt.	1983	1	0	0	0	0	0	0	0	unknown
Mill Cr.	1975	0	1	0	X	0	0	0	X	active
Rush Cr.	1974	1	1	0	X	1	1	2	X	active
Fredenburgh	1973	1	1	1	X	1	1	1	X	active
Miller Mt.	1976	? ³	?	0	0	1	1	2	X	active

¹Sign: includes pellets, droppings, and feathers

²Status: active - pair or single bird located or sign observed

³?: adult located but sex undetermined

Table 2. History of five spotted owl sites through 1985 on the BLM-Medford District, Oregon.

Site	Year First Located	Years Site Checked	No. of Adults Located	No. of Young Located
Fredenburg	1973	1973	2	0
		1974	0	0
		1975	0	0
		1979	2	0
		1983	2	0
		1984	2	2
		1985	2	1
Miller Mt.	1976	1976	1	0
		1980	0	0
		1983	1	0
		1984	1	0
		1985	2	2
Porcupine Mt.	1981	1981	1	2
		1982	2	0
		1983	2	2
		1984	2	2
		1985	2	0
Rush Cr.	1974	1974	2	2
		1975	2	0
		1976	2	0
		1980	1	0
		1982	2	0
		1983	1	0
		1984	2	0
		1985	2	2
		W. Soda Cr.	1974	1974
1975	0			0
1980	2			0
1981	0			0
1983	2			2
1984	2			1
1985	2			0

Table 3. Physical characteristics of eight adult spotted owls captured at five study sites for a radiotelemetry monitoring project on the BLM-Medford District, Oregon from 9 April - 11 July 1985.

Site	Adult Radioed	Date Radioed	Weight (g)	Wing Length (cm)
Fredenburg	male	9 April 1985	555	32.6
	female	13 June 1985	625	30.3
Miller Mt.	female	13 June 1985	625	29.5
Porcupine Mt.	male	18 April 1985	595	29.7
	female	18 April 1985	725	31.6
Rush Cr.	male	2 May 1985	595	30.2
	female	11 July 1985	650	32.7
W. Soda Cr.	female	1 May 1985	670	28.8

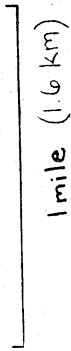
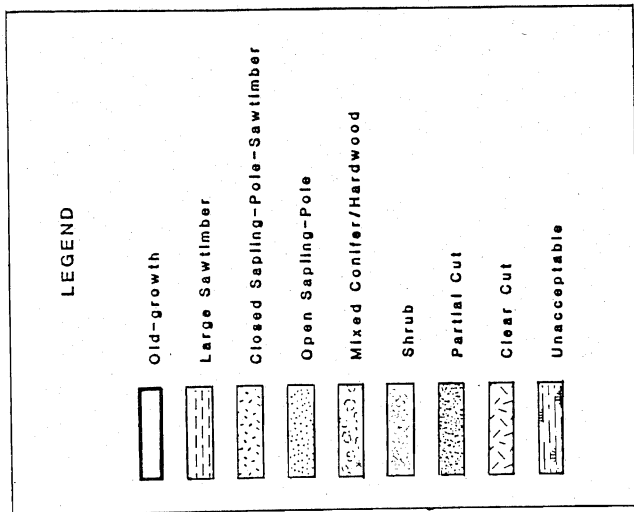
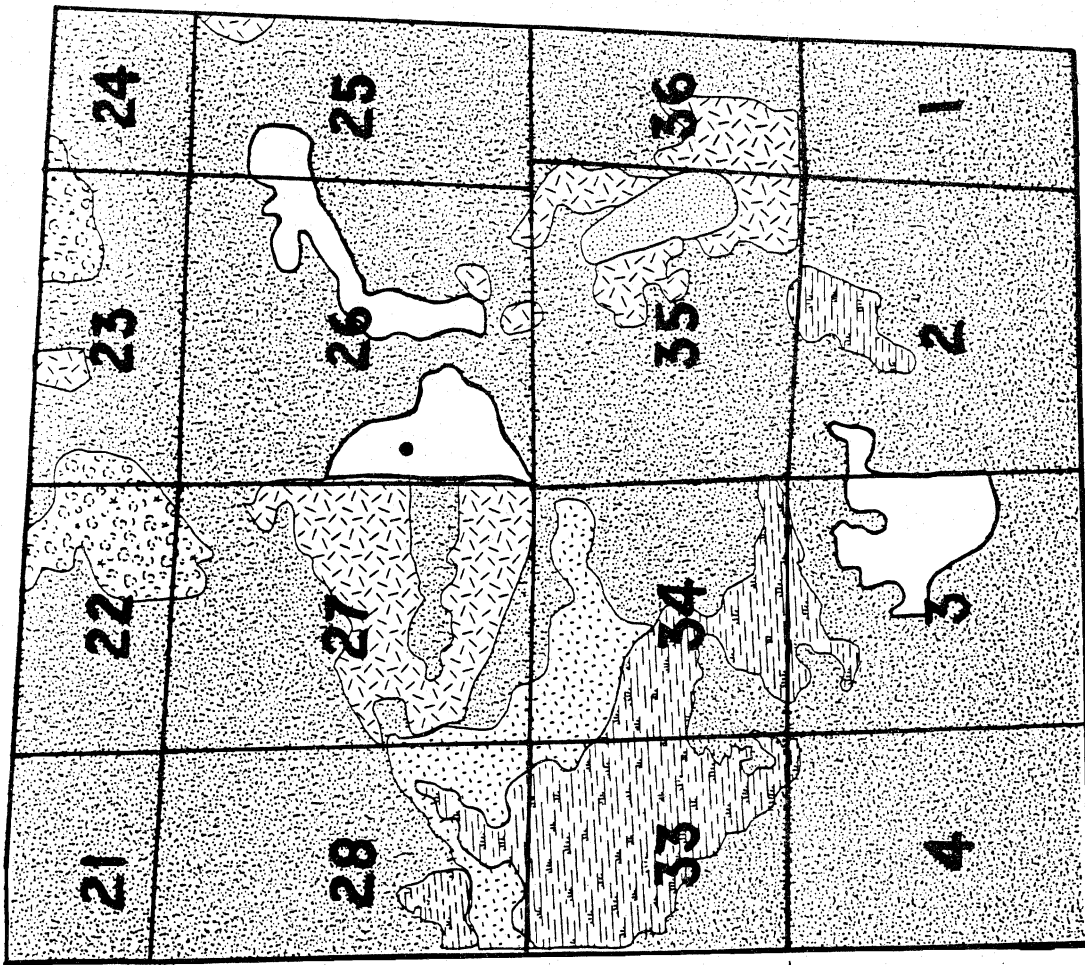


Figure 3. Spotted owl nest location (dot) and habitat types at the Fredenburg study site on the BIM-Medford District, Oregon, 1985.

Table 4. Percent of each habitat type available to a pair of spotted owls within a 1.5 mile (2.4 km) radius of the nest tree or activity center at five study sites on the BLM-Medford District, Oregon.

Site	Old-Growth	Large Sawtimber	Closed Sapling-Pole	Mixed Conifer/ Hardwood	Open Sapling-Pole	Shrub	Unacceptable	Clear-Cut	Partial Cut
Fredenburgh	6	—	4	3	1	—	10	9	67
Miller Mt.	10	4	—	33	4	1	—	10	38
Porcupine Mt.	2	1	5	—	—	1	12	9	70
Rush Cr.	3	4	25	18	1	1	26	—	22
W. Soda Cr.	11	10	24	6	—	—	18	7	24

a Douglas fir, approximately 190 years old. We were unable to verify that the owls used the same nest tree in 1985 although the female was heard in the area several times. The nest stand structure was typical of the old-growth stand condition.

Miller Mountain Study Site

Miller Mountain was a diverse mosaic of habitat types (Figure 4). Mixed conifer/hardwood stands and partial cuts comprised more than 50% of the habitat (Table 4). The nest area was a small 30 acre (12.1 ha) stand of old-growth dominated by Douglas fir. A nest tree was not located.

Porcupine Mountain Study Site

Much of the Porcupine Mountain site has been partial cut, resulting in island-like blocks of other habitat types (Figure 5). Approximately 2% of the habitat was old-growth forest and nearly 80% has been either clear-cut or partial cut (Table 4). Clear-cuts in sections 26 and 35 were logged September - November 1985.

The nest tree was a Douglas fir approximately 75 years old and, in 1984, the owls nested in a mistletoe clump. Although there was decadence and disease in the nest stand, it lacked the natural openings, ground cover, and the multistoried stand structure typical of old-growth. It was, therefore, designated as large sawtimber.

Rush Creek Study Site

Rush Creek illustrates unique transitions from one habitat type into another (Figure 6). Large blocks of any habitat type were lacking. Mixed conifer/hardwood, closed sapling-pole, partial cuts,

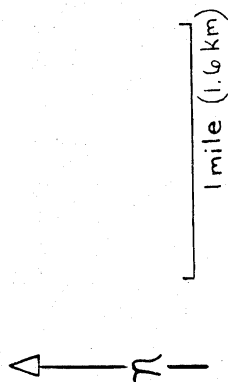
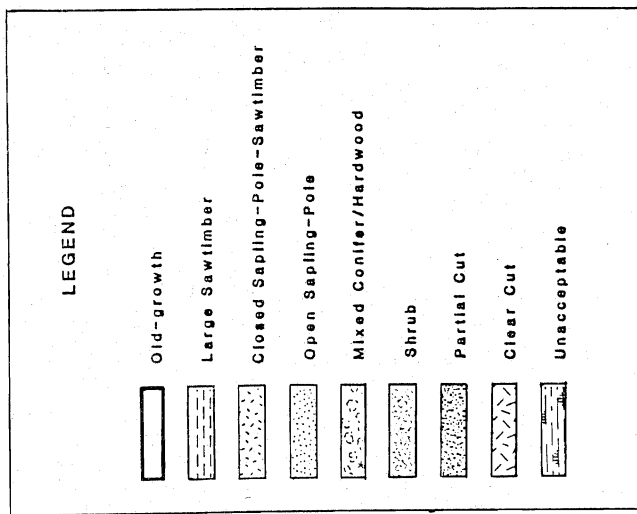
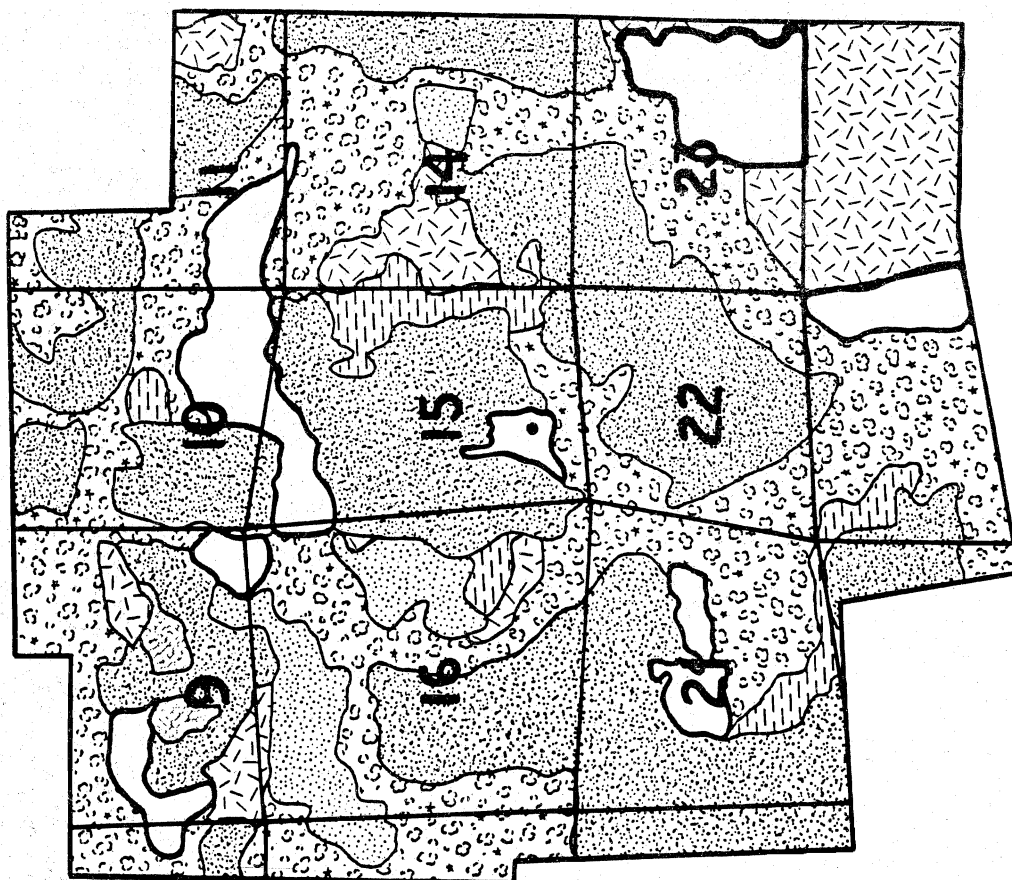


Figure 4. Spotted owl activity center (dot) and habitat types at the Miller Mountain study site on the BIM-Medford District, Oregon, 1985.

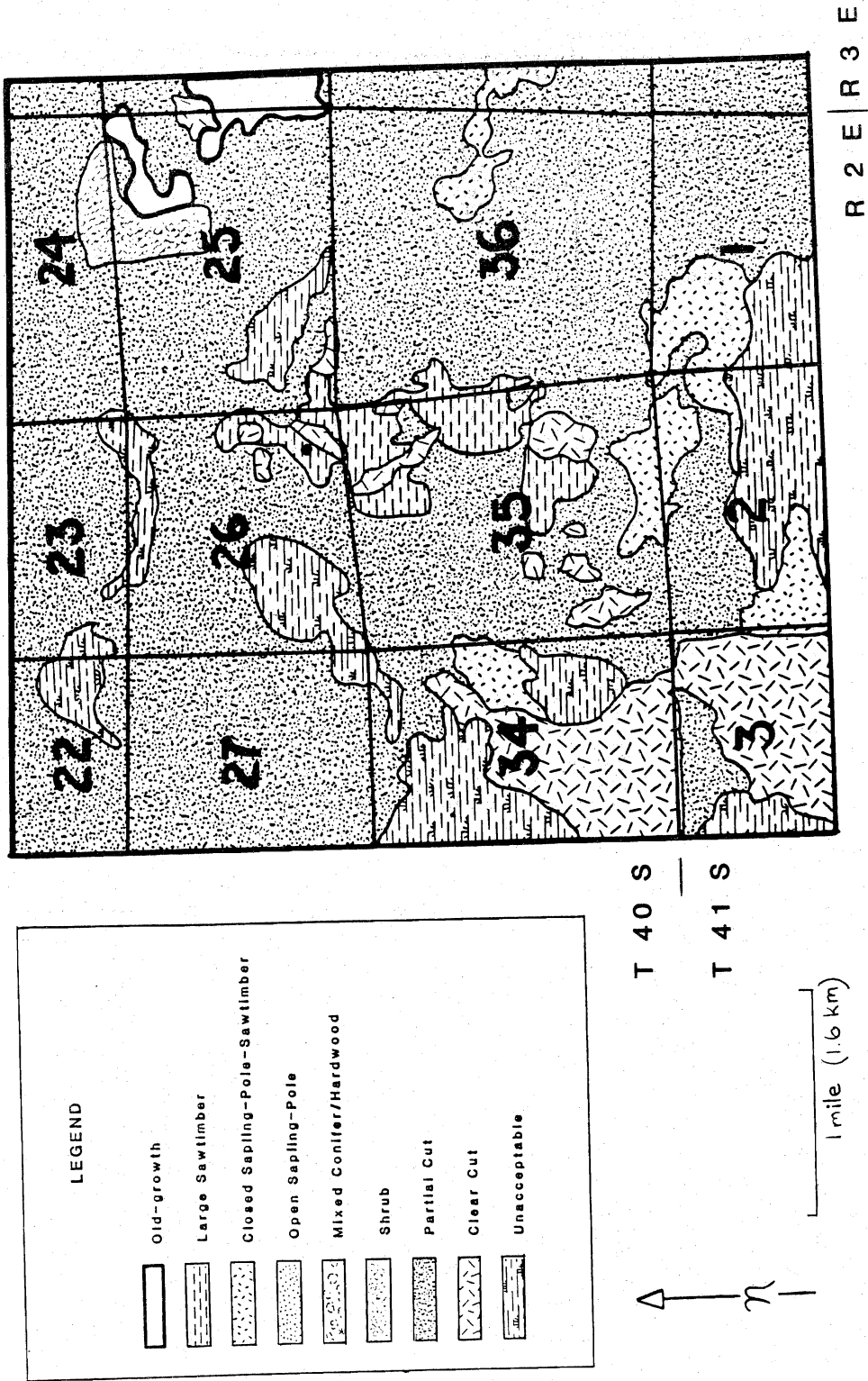
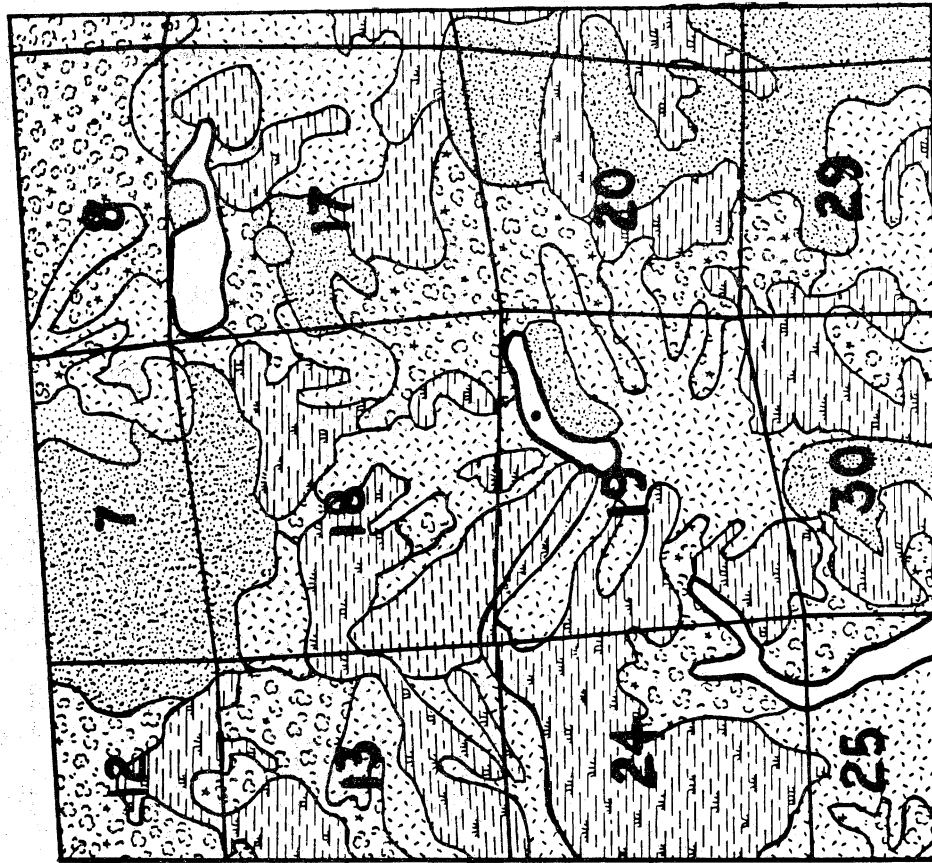


Figure 5. Spotted owl nest tree location (dot) and habitat types at the Porcupine Mountain study site on the BLM-Medford District, Oregon, 1985.



R 2 W | R 1 W

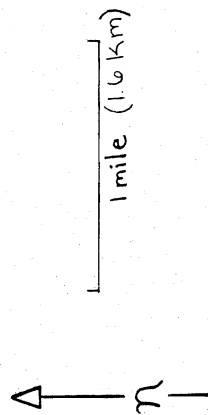
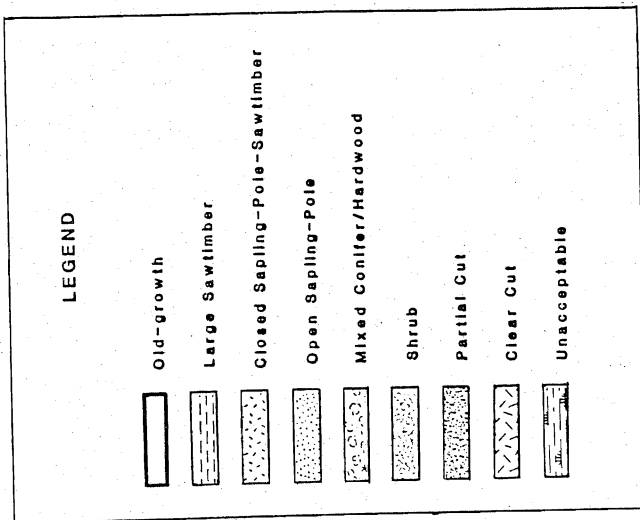


Figure 6. Spotted owl nest tree (dot) and habitat types at the Rush Creek study site on the BIM-Medford District, Oregon, 1985.

and unacceptable habitats made up the greatest percentage of habitat types.

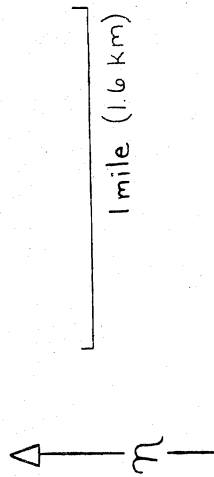
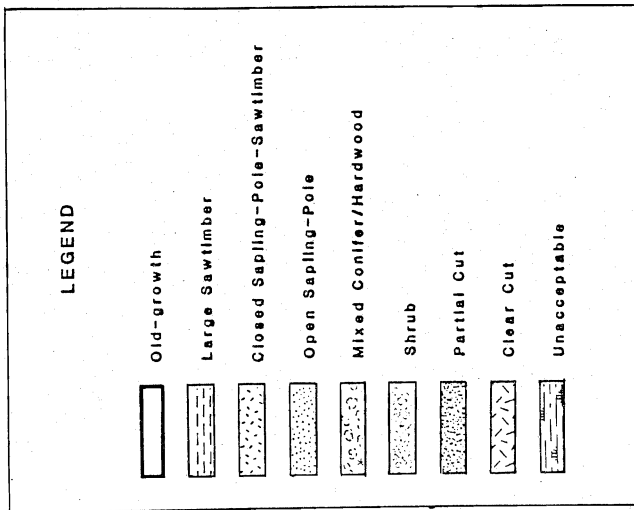
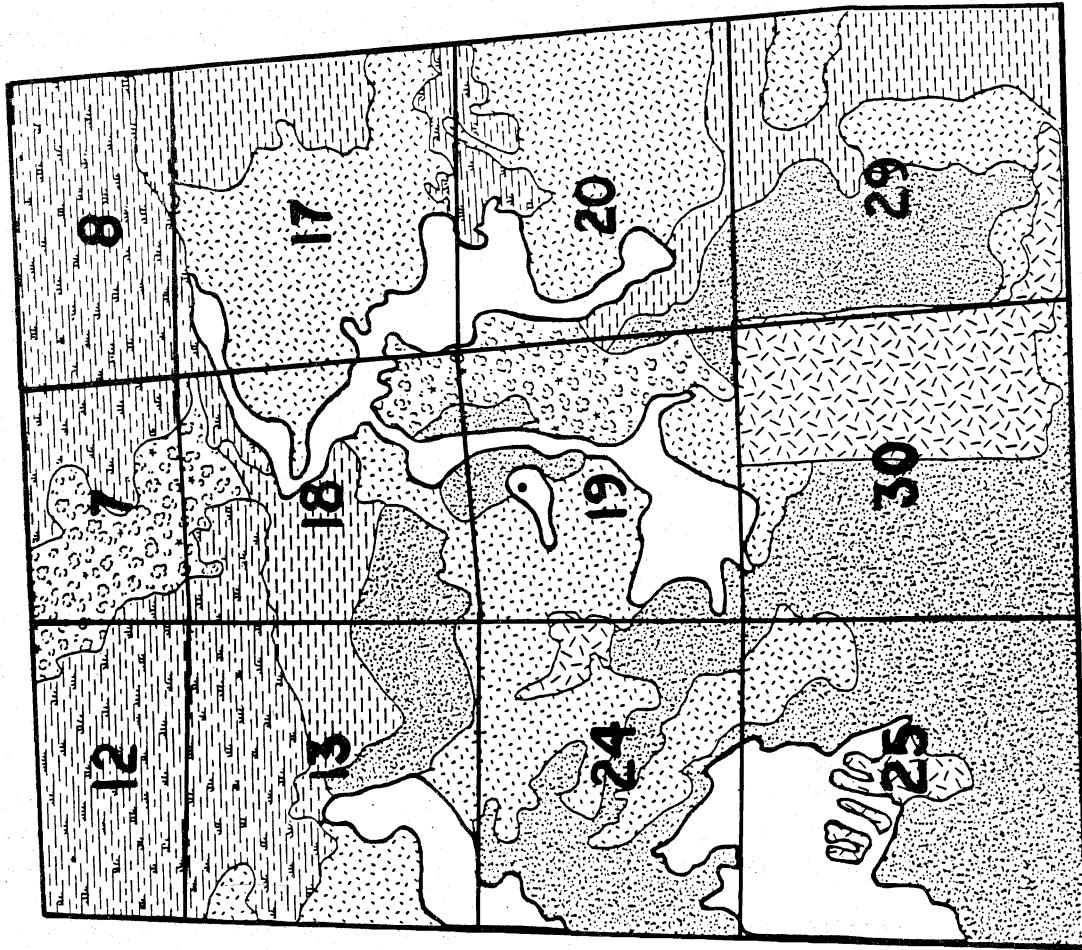
The nest site was in remnant old-growth stand dominated by Douglas fir. The owls nested in a Douglas fir which was approximately 70 years old and heavily diseased with mistletoe.

West Soda Creek Study Site

In the Soda Creek and Deer Creek drainages, there were contiguous stands of old-growth timber intermingled with large stands in the closed sapling-pole and large sawtimber stand condition (Figure 7). Nearly 50% of the habitat has not been logged (Table 4). The nest area was a 10 acre (4.0 ha) stand of old-growth Douglas fir. The 1984 nest was in a mistletoe clump in a 60 year old Douglas fir.

Home Range and Habitat Use

Home range was calculated for three pairs and four individuals (Table 5). Based on 90% of the samples, home range size ranged from 402.3 ac (162.8 ha) for the female at West Soda Creek to 1,693.1 ac (685.2 ha) for the female at Miller Mountain. Based on 100% of the samples, the Miller Mountain female again utilized the largest area, 3,033.2 ac (1,227.5 ha). Nesting pairs (Rush Creek and Fredenburg) or individual members of nesting pairs (Miller Mountain) concentrated their activity around the nest site or activity center but had larger home ranges than non-nesting birds (Porcupine Mountain and West Soda Creek). Except for the Rush Creek birds, all of the owls were utilizing some partial cut stands for roosting and foraging (Figures 8-13). The owls also showed a disproportionately high use of old-growth, or large sawtimber (Porcupine Mountain), at four sites (Table 6).

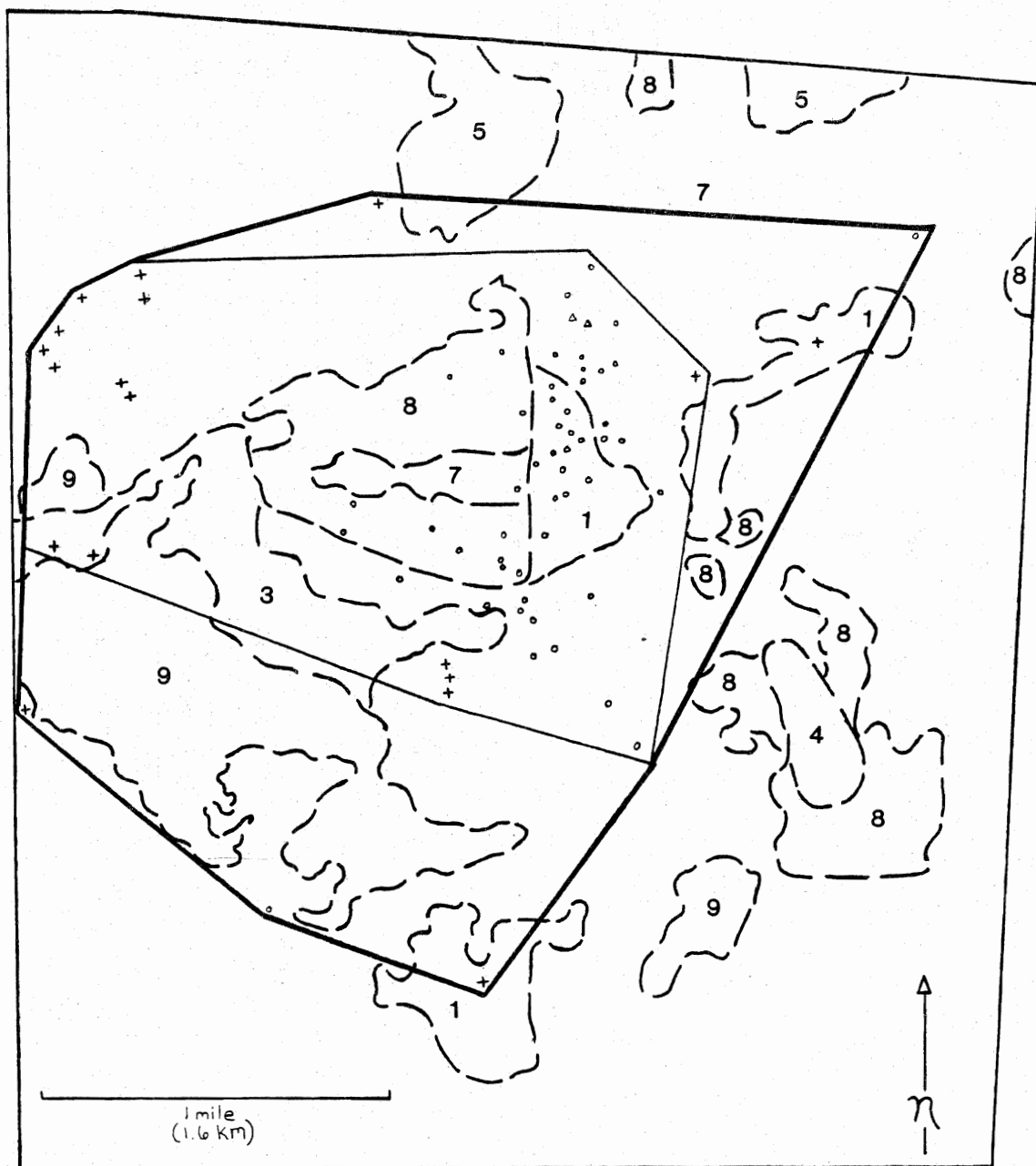


R 1 E | R 2 E

Figure 7. Spotted owl nest tree (dot) and habitat types at the West Soda Creek study site on the BIM-Medford District, Oregon, 1985.

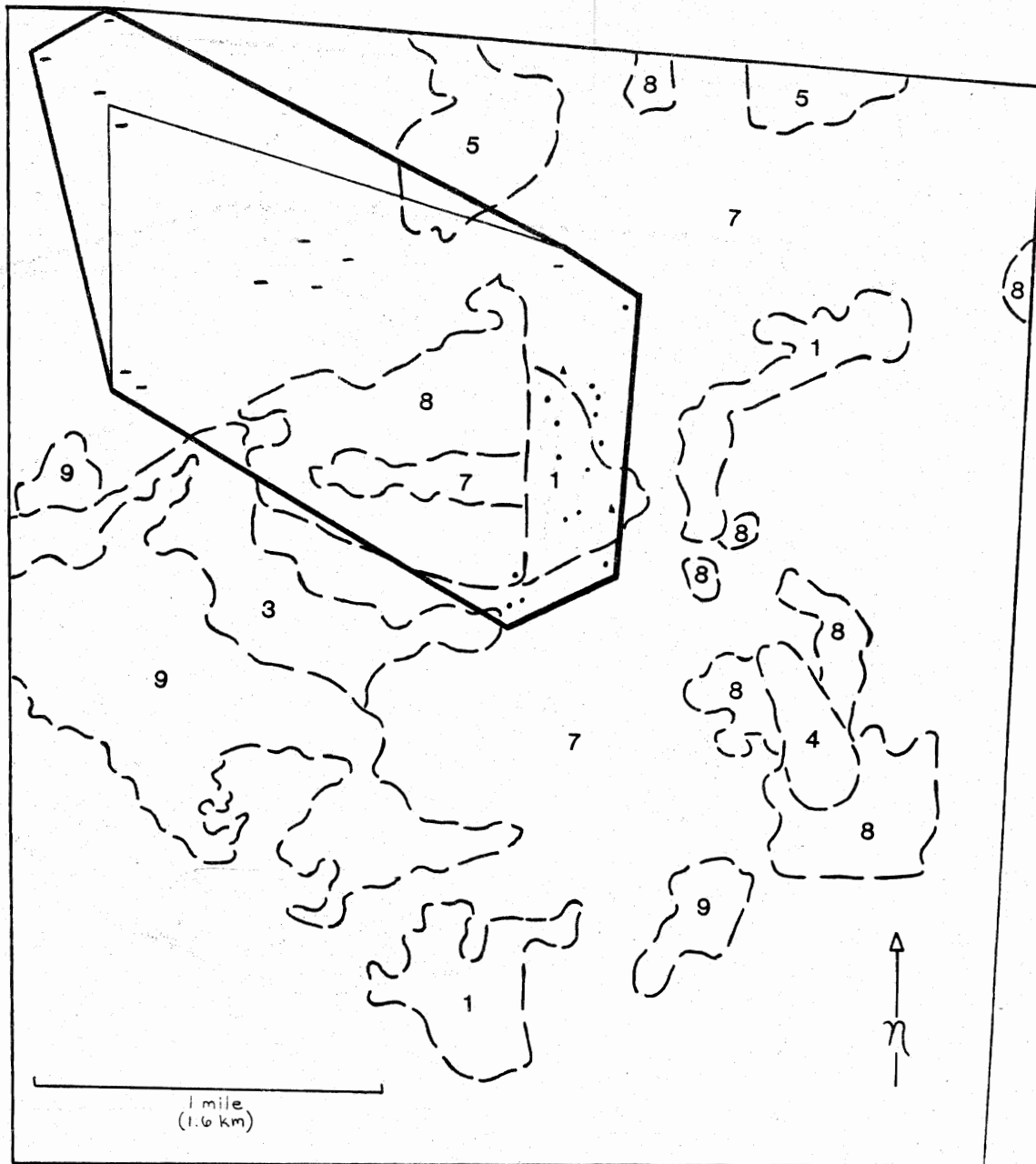
Table 5. Home range size of spotted owls at five study sites on the BLM-Medford District, Oregon.

Site	Adult Radioed	Date Radioed	Nesting	100% Minimum Convex Polygon			90% Minimum Convex Polygon		
				No. of Owl Locations	Individual Home Range (acres)	Pair Home Range (acres)	No. of Owl Locations	Individual Home Range (acres)	Pair Home Range (acres)
Fredenburg	male	4/09/85	yes	72	2375.0	2399.0	64	1323.4	1484.9
	female	6/13/85	yes	28	1119.7	—	26	910.0	—
Miller Mt.	female	6/13/85	yes	55	3033.2	—	50	1693.1	—
Porcupine Mt.	male	4/18/85	no	19	—	1492.8	18	—	578.0
	female	4/18/85	no	26	—	—	23	—	—
Rush Cr.	male	5/02/85	yes	—	—	1804.8	24	—	1434.9
	female	7/11/85	yes	23	—	—	—	—	—
W. Soda Cr.	female	5/01/85	no	29	1348.1	—	26	402.3	—
Mean Home Range					1969.0	1898.9		1082.2	1165.9



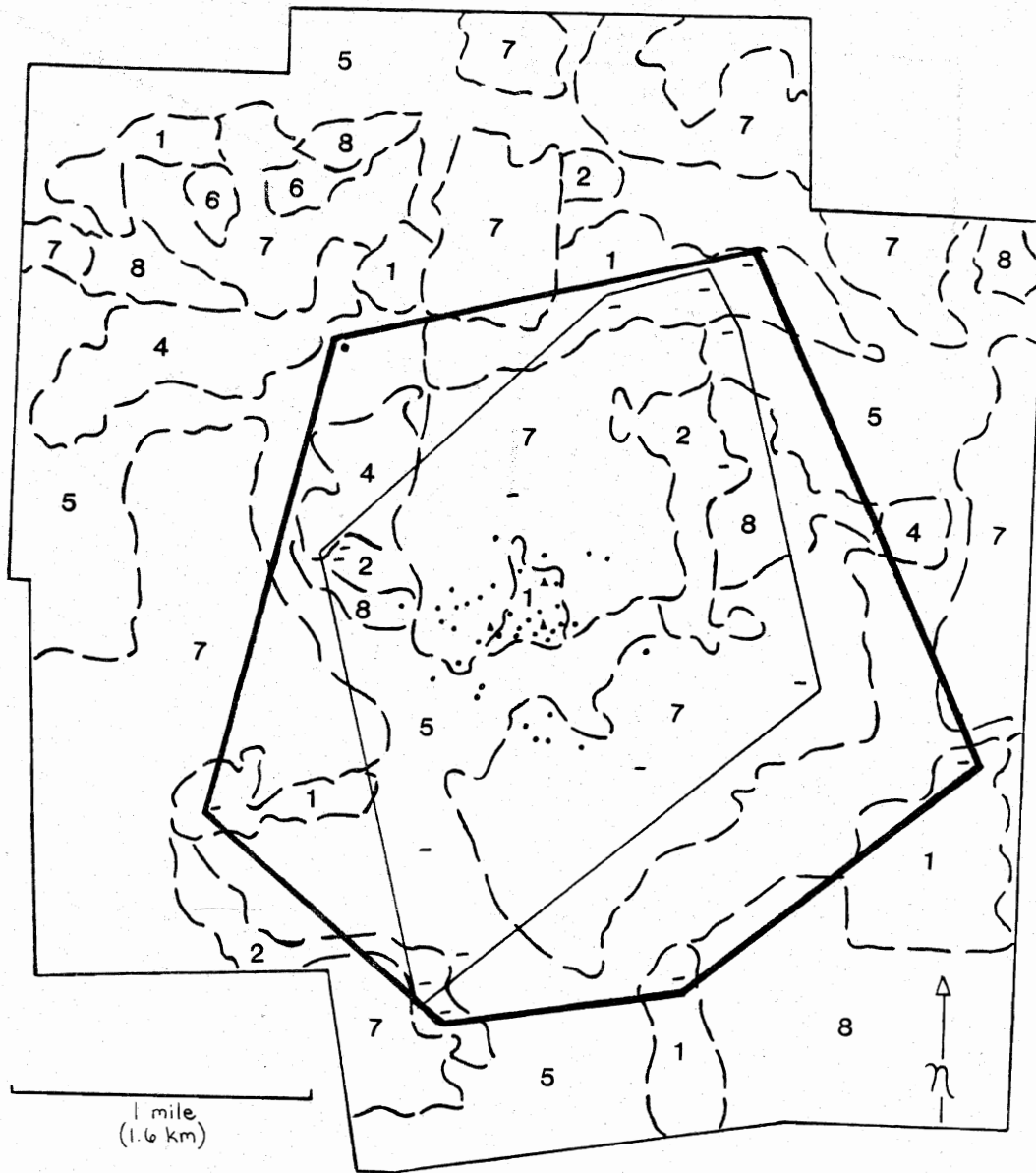
LEGEND			
1	Old-growth	5	Mixed Conifer/ Hardwood
2	Large Sawtimber	6	Shrub
3	Closed Sapling- Pole-Sawtimber	7	Partial Cut
4	Open Sapling-Pole	8	Clear Cut
		9	Unacceptable

Figure 8 . Home range and habitat use by the male spotted owl at the Fredenburg study site based on 100% (heavy line) and 90% (thin line) of the sample locations from 9 April - 31 October 1985 on the BLM-Medford District, Oregon: (o) foraging locations, (Δ) summer roosting locations, and (+) fall roosting locations.



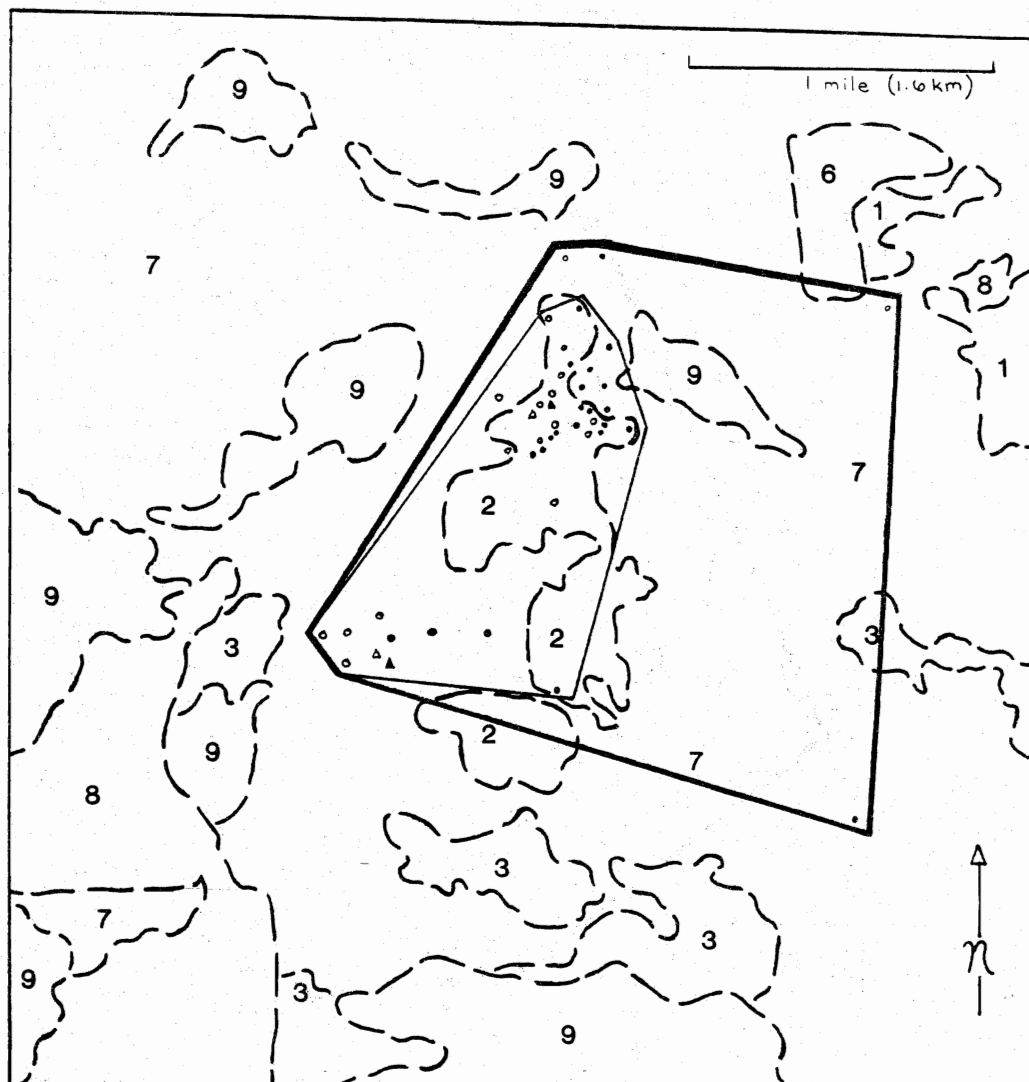
LEGEND			
1	Old-growth	5	Mixed Conifer/ Hardwood
2	Large Sawtimber	6	Shrub
3	Closed Sapling- Pole-Sawtimber	7	Partial Cut
4	Open Sapling-Pole	8	Clear Cut
		9	Unacceptable

Figure 9. Home range and habitat use by the female spotted owl at the Fredenburg study site based on 100% (heavy line) and 90% (thin line) of the sample locations from 13 June - 31 October 1985 on the BLM-Medford District, Oregon: (•) foraging locations, (▲) summer roosting locations, and (-) fall roosting locations.



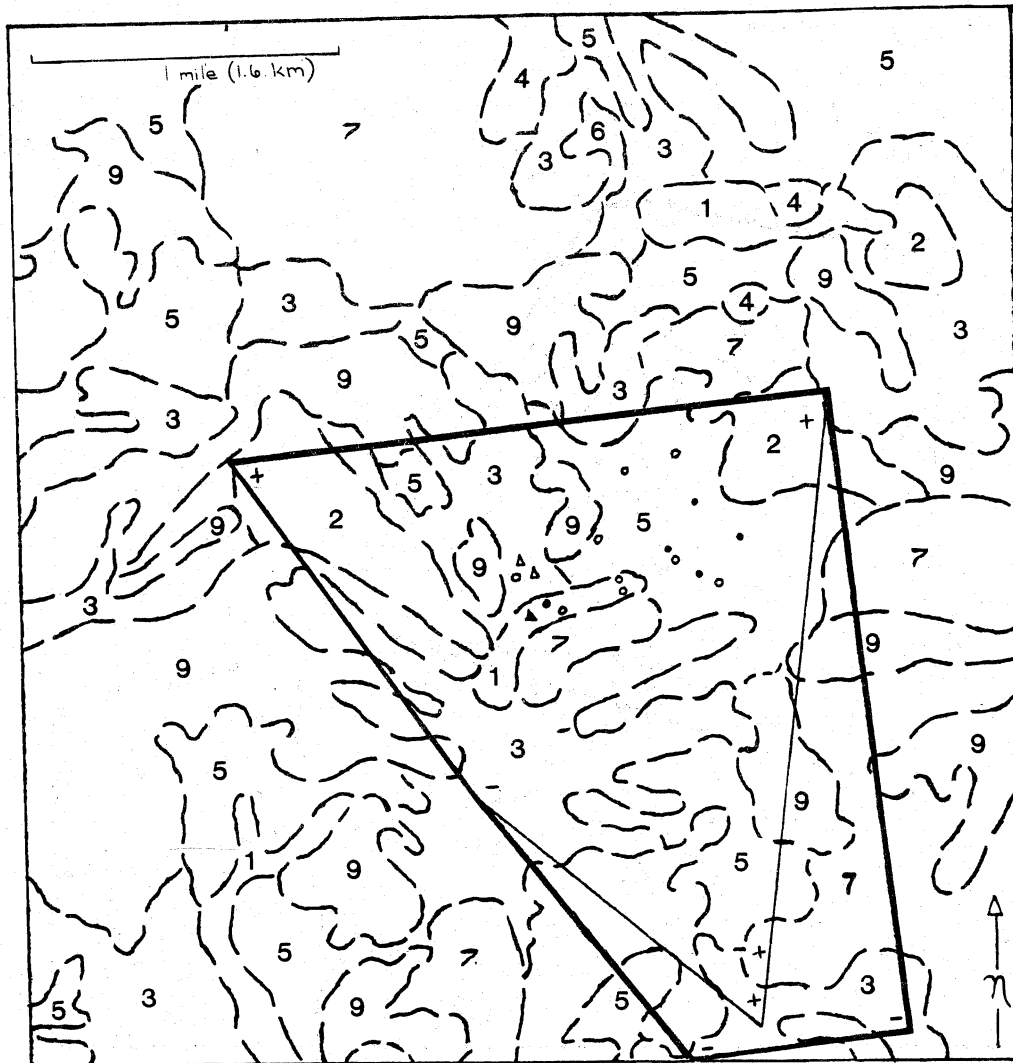
LEGEND			
1	Old-growth	5	Mixed Conifer/ Hardwood
2	Large Sawtimber	6	Shrub
3	Closed Sapling- Pole-Sawtimber	7	Partial Cut
4	Open Sapling-Pole	8	Clear Cut
		9	Unacceptable

Figure 10. Home range and habitat use by the female spotted owl at the Miller Mountain study site based on 100% (heavy line) and 90% (thin line) of the sample locations from 13 June - 31 October 1985 on the BLM-Medford District, Oregon: (•) foraging locations, (▲) summer roosting locations, and (-) fall roosting locations.



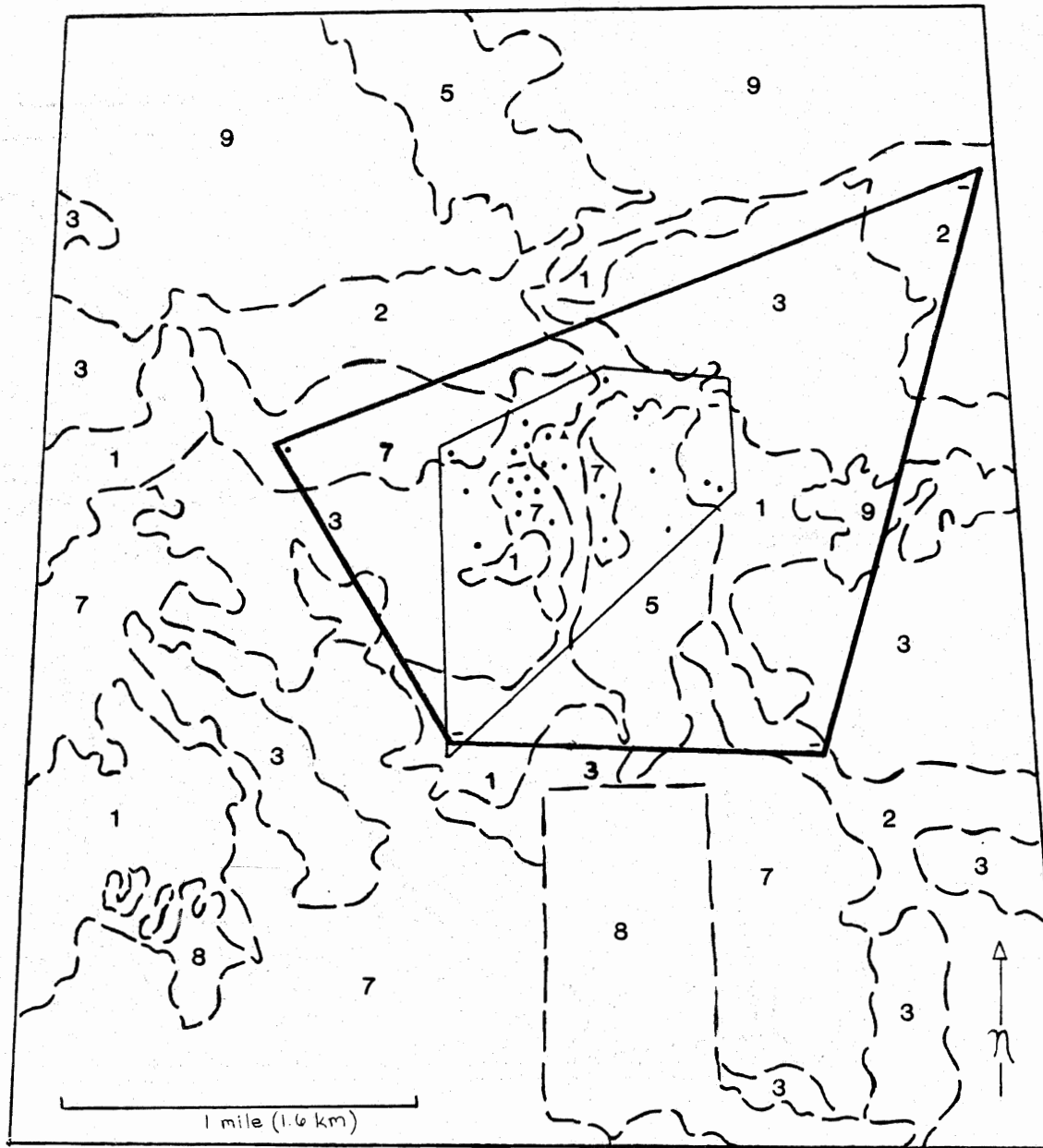
LEGEND			
1	Old-growth	5	Mixed Conifer/ Hardwood
2	Large Sawtimber	6	Shrub
3	Closed Sapling- Pole-Sawtimber	7	Partial Cut
4	Open Sapling-Pole	8	Clear Cut
		9	Unacceptable

Figure 11. Home range and habitat use by the spotted owl pair at the Porcupine Mountain study site based on 100% (heavy line) and 90% (thin line) of the sample locations from 18 April - 31 October 1985 on the BLM-Medford District, Oregon: (●) female foraging locations, (○) male foraging locations, (▲) female summer roosting locations, and (△) male summer roosting locations.



LEGEND			
1	Old-growth	5	Mixed Conifer/ Hardwood
2	Large Sawtimber	6	Shrub
3	Closed Sapling- Pole-Sawtimber	7	Partial Cut
4	Open Sapling-Pole	8	Clear Cut
		9	Unacceptable

Figure 12. Home range and habitat use by the spotted owl pair at the Rush Creek study site based on 100% (heavy line) and 90% (thin line) of the sample locations from 2 May - 31 October 1985 on the BLM-Medford District, Oregon: (●) female foraging locations, (○) male foraging locations, (▲) female summer roosting locations, (△) male summer roosting locations, (-) female fall roosting locations, and (+) male fall roosting locations.



LEGEND			
1	Old-growth	5	Mixed Conifer/ Hardwood
2	Large Sawtimber	6	Shrub
3	Closed Sapling- Pole-Sawtimber	7	Partial Cut
4	Open Sapling-Pole	8	Clear Cut
		9	Unacceptable

Figure 13. Home range and habitat use by the female spotted owl at the West Soda Creek study site based on 100% (heavy line) and 90% (thin line) of the sample locations from 1 May - 31 October 1985 on the BLM-Medford District, Oregon: (•) foraging locations, (▲) summer roosting locations, and (-) fall roosting locations.

Table 6. Chi-square analysis of percent habitat available within 90% of the minimum convex polygon home range (Jennrich and Turner 1969) versus habitat used (percent owl locations) by spotted owls at five study sites on the BLM-Medford District, Oregon.

Site	% Old-Growth (acres)	% Locations (N)	% Non-Old-Growth (acres)	% Locations (N)	χ^2
Fredenburg	6 (83.4)	23 (21)	94 (1401.5)	77 (69)	10.325 ^b
Miller Mt.	5 (77.3)	33 (17)	95 (1615.8)	67 (34)	23.684 ^c
Porcupine Mt.	41 ¹ (238)	60 (24)	59 (340)	40 (16)	6.481 ^a
Rush Cr.	3 (44.2)	22 (5)	97 (1390.7)	78 (18)	14.811 ^c
W. Soda Cr.	31 (124.4)	35 (9)	69 (277.9)	65 (17)	.204 ^{ns}

¹ There was no old-growth within the home range of the Porcupine Mt. owls; data used are for large sawtimber, the successional stage before old-growth.

^a $P < 0.05$

^b $P < 0.005$

^c $P < 0.001$

ns not significant

Territorial encounters were observed at Fredenburg between the resident pair and a single male, and at Porcupine Mountain between the resident male and a single male. The degree of home range overlap is not known. At least one, and as many as five, other spotted owl pairs live within a 3 mile (4.8 km) radius of each study site (Figures 14-18).

Habitat Evaluation

Habitat was evaluated at each of the five sites. Winter weather and time restrictions prevented me from completing evaluations within the 1.5 mile (2.4 km) radius at Porcupine Mountain and Rush Creek, and nesting habitat evaluations at Miller Mountain. Because the Rush Creek owls nested in 1985 but not in 1984, we were able to sample from both an activity center (Rush Cr. '84) and a nest tree (Rush Cr. '85).

Habitat around the nest site or activity center was structurally typical of mature or old-growth stands. Percent canopy closure was high ranging from 87% to 96% and although the stands were uneven-aged, average age was generally less than 100 years (Table 7). Logging was encountered at all of the sites on the perimeter of the sampling area and affected canopy closure, basal area, and density by reducing the values of the measures.

Five different habitat types were sampled within 1.5 miles (2.4 km) of the nest site or activity center. Average canopy closure values varied greatest within mixed conifer/hardwood stands and, excluding Porcupine Mountain, canopy closure averaged at least 82% in partial cuts (Table 8). Slope values (Table 9) were not comparable from site to site nor within the different habitat types and basal

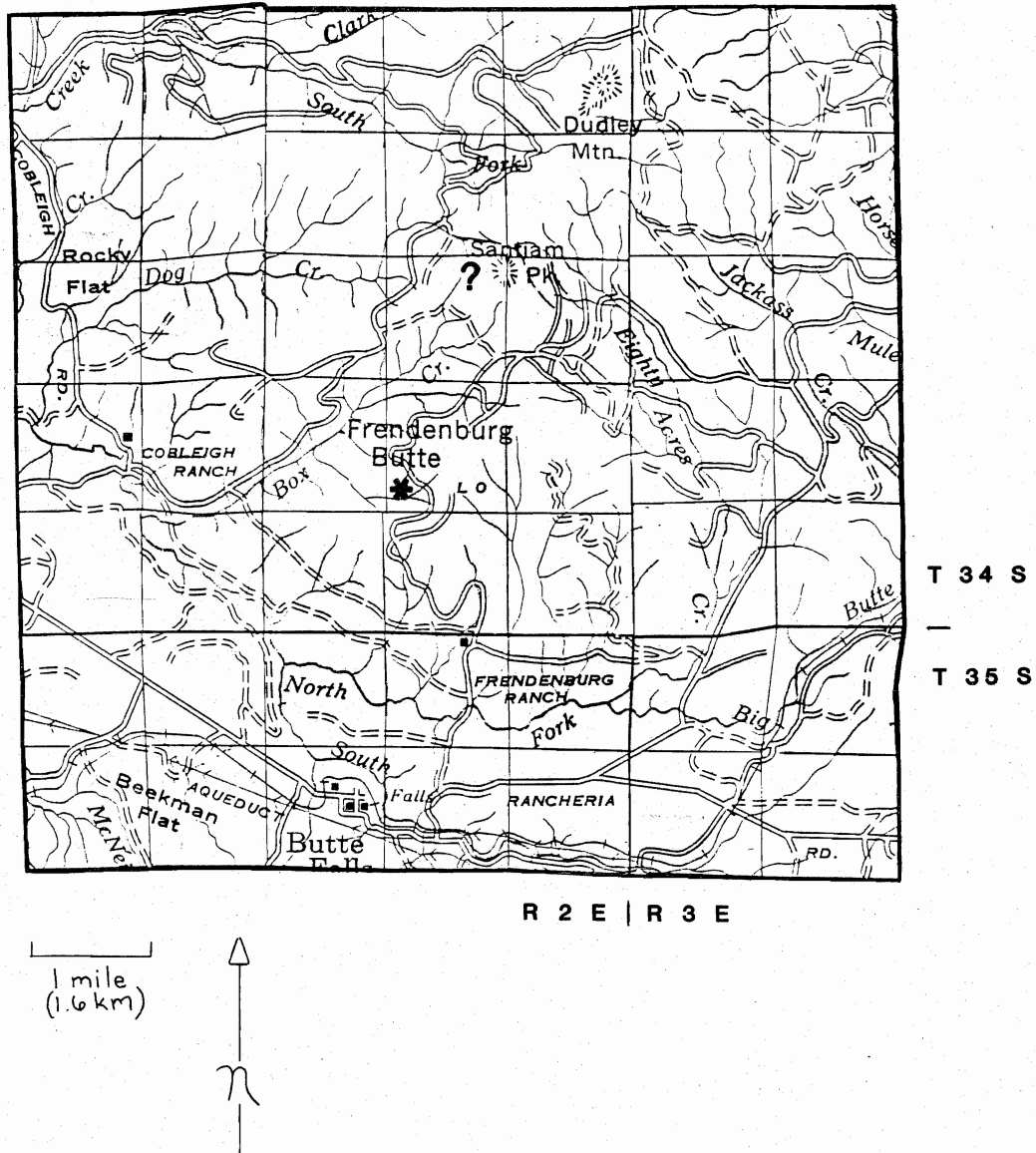


Figure 14. Approximate locations of confirmed (●) and uncertain (?) spotted owl sites within a 3 mile radius of the Fredenburg study site (*) on the BLM-Medford District, Oregon.

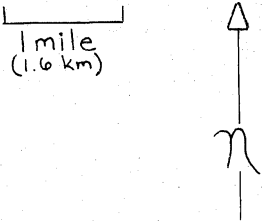
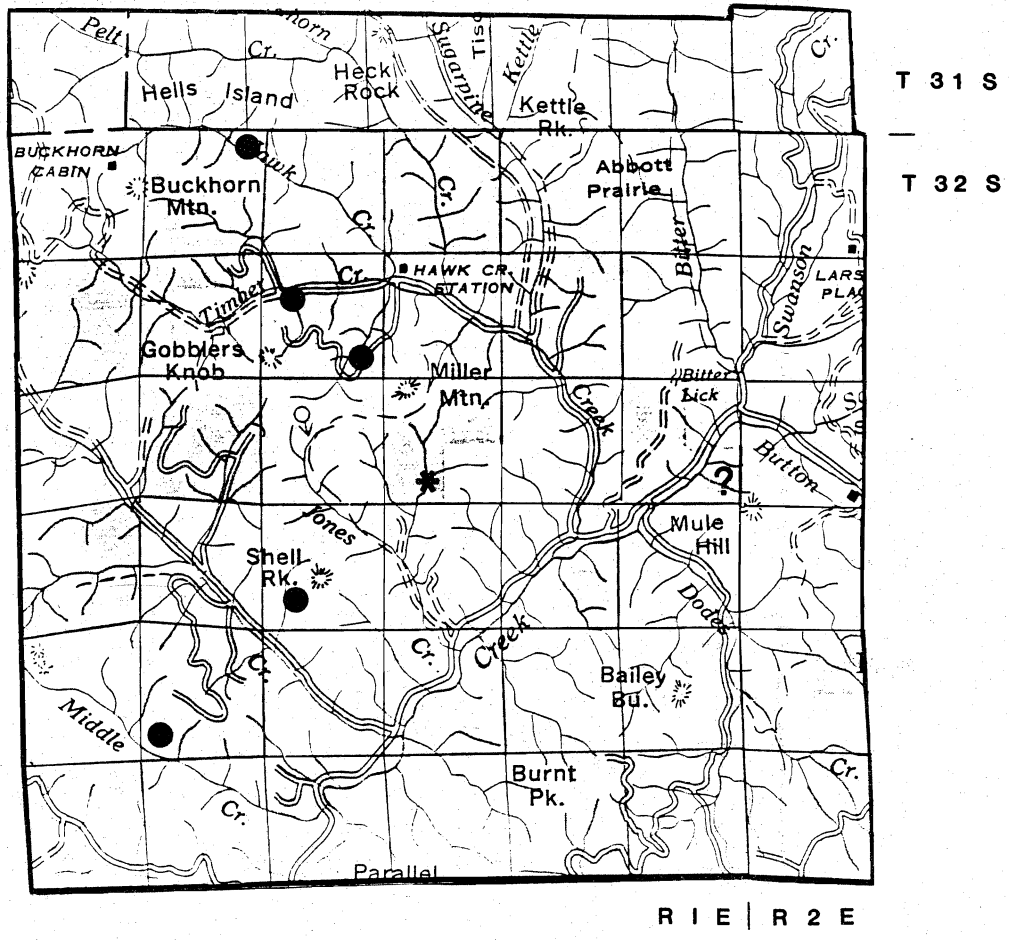


Figure 15. Approximate locations of confirmed (●) and uncertain (?) spotted owl sites within a 3 mile radius of the Miller Mountain study site (*) on the BIM-Medford District, Oregon.

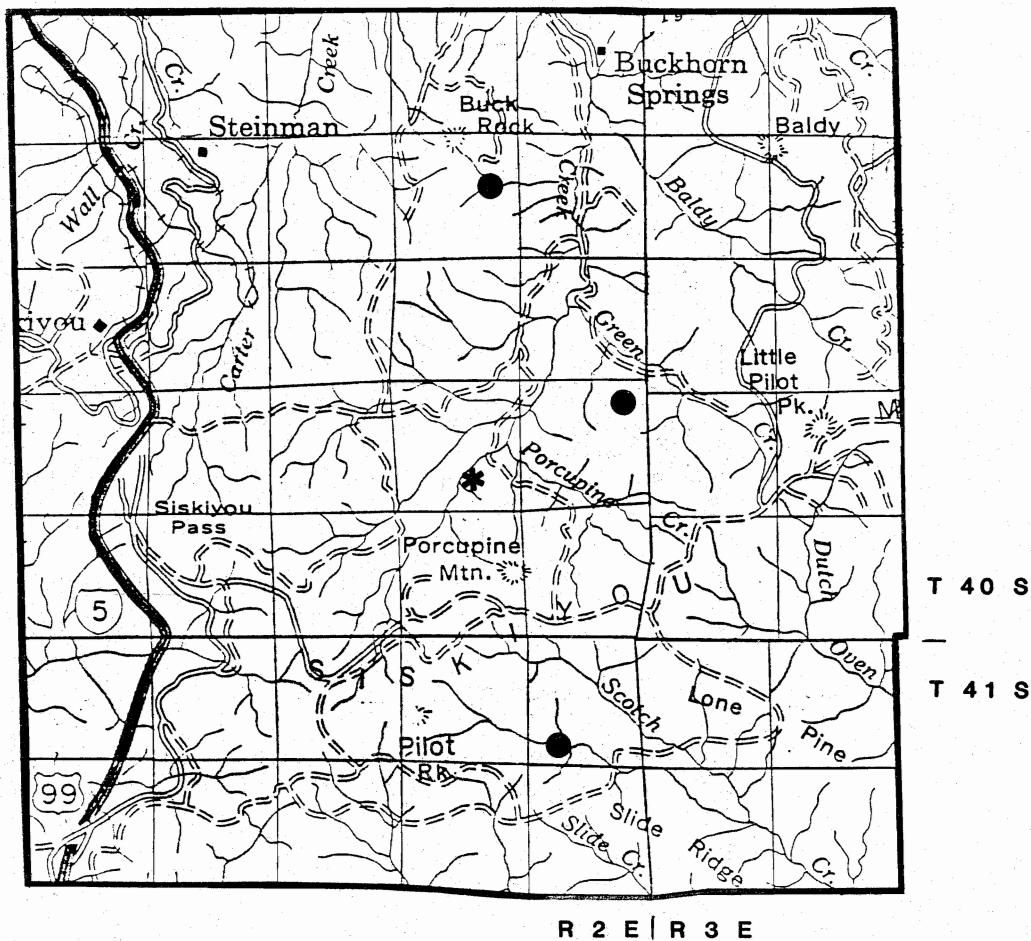


Figure 16. Approximate locations of confirmed (●) and uncertain (?) spotted owl sites within a 3 mile radius of the Porcupine Mountain study site (*) on the BIM-Medford District, Oregon.

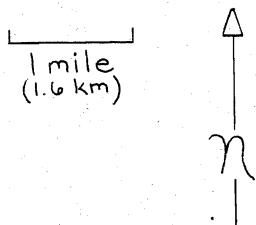
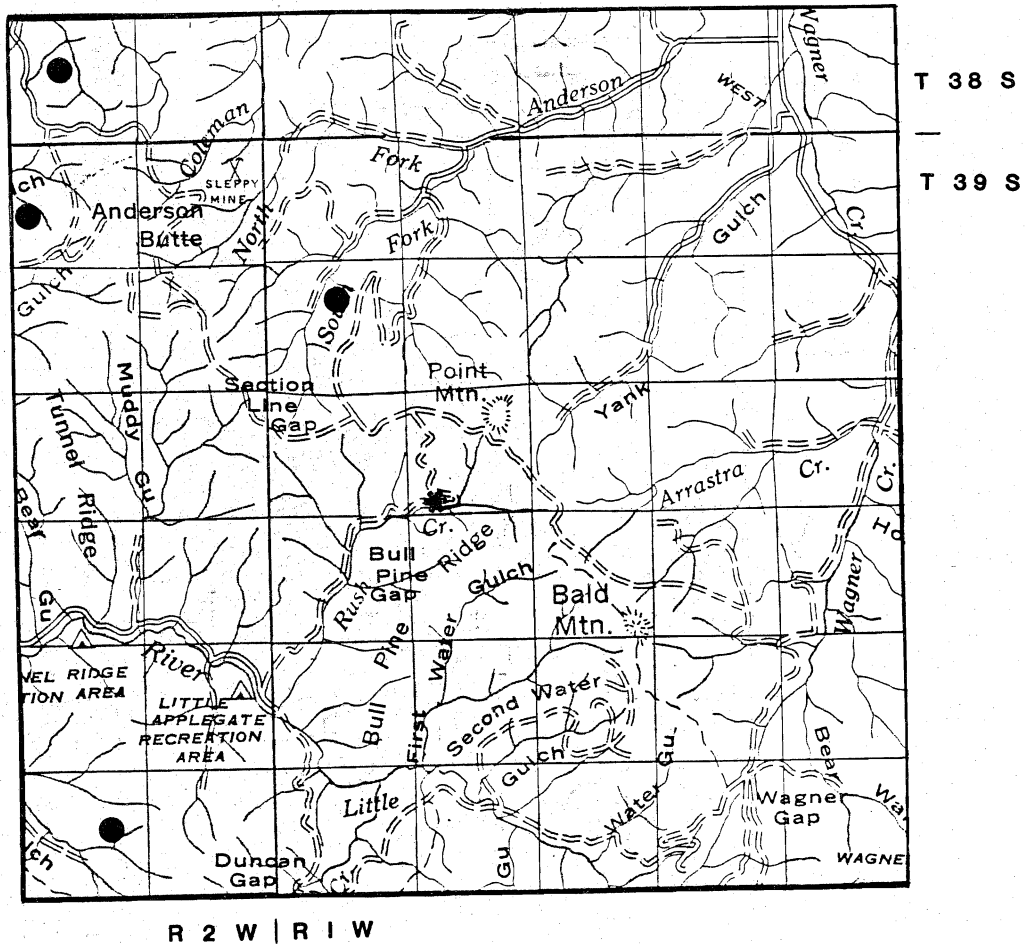


Figure 17. Approximate locations of confirmed (●) and uncertain (?) spotted owl sites within a 3 mile radius of the Rush Creek study site (*) on the BLM-Medford District, Oregon.

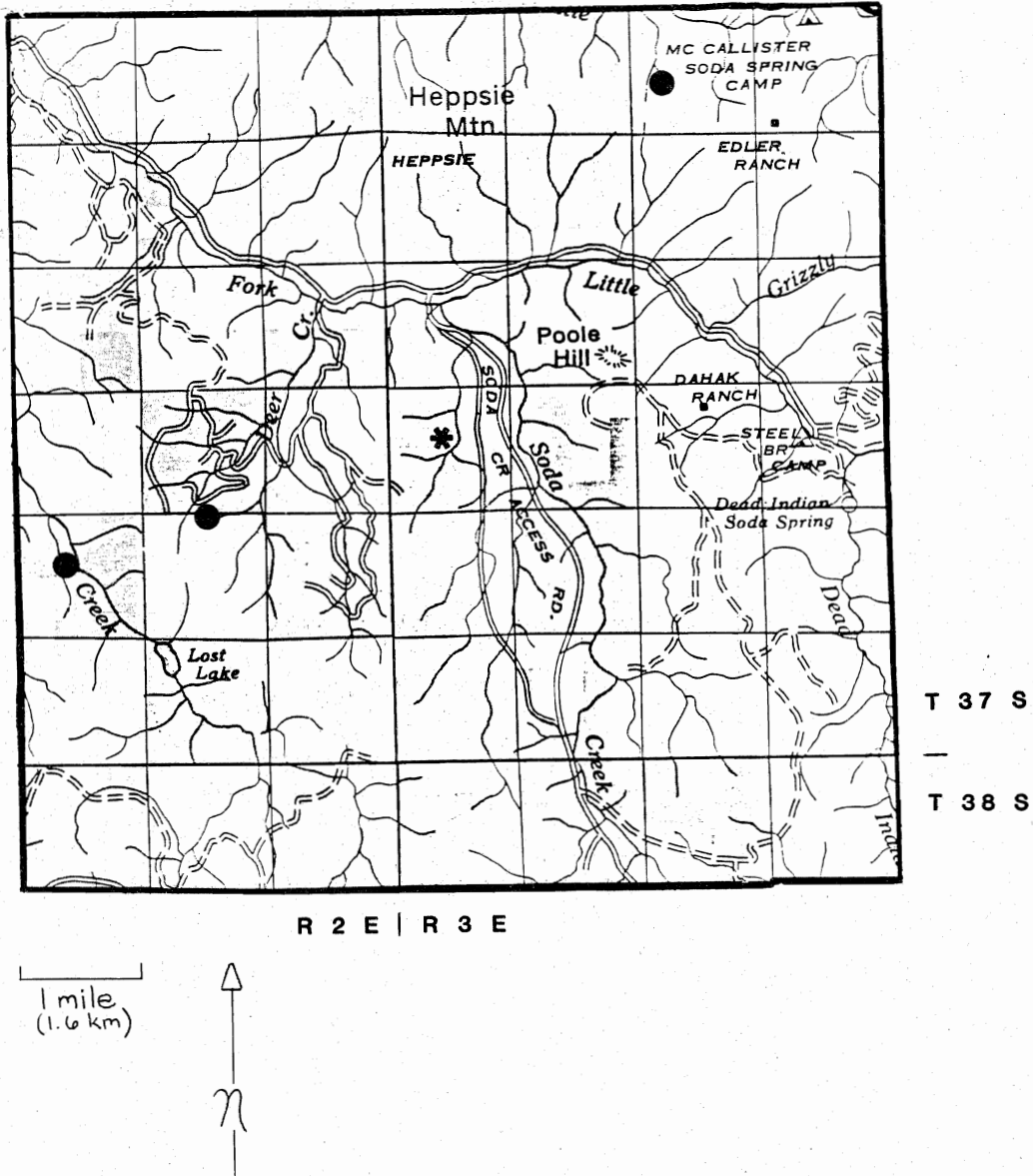


Figure 18. Approximate locations of confirmed (●) and uncertain (?) spotted owl sites within a 3 mile radius of the West Soda Creek study site (*) on the BLM-Medford District, Oregon.

Table 7. Habitat characteristics based on samples taken within a 500 ft. (152.4 m) radius of a spotted owl nest tree or activity center at five study sites on the BIM-Medford District, Oregon. Sample size at each site was 21 for all parameters except for age (n=17) and density and D.B.H. (n=84).

Site	Age		Canopy Closure (%)		Basal Area		Slope		Density		D.B.H.
	$\bar{x} \pm$ s.d.	range	$\bar{x} \pm$ s.d.	range	Live Trees	Stumps	$\bar{x} \pm$ s.d.	range	Trees/Acre	$\bar{x} \pm$ s.d.	
Fredenburg	171.9 \pm 56.4	90 - 300	96.2 \pm 2.9	89.9 - 100.0	175.71	16.19	33.7 \pm 7.5	22 - 52	112.6	19.2 \pm 13.0	3.7 - 60.8
Grizzly Peak-E.	93.8 \pm 24.8	63 - 140	87.5 \pm 16.1	30.2 - 100.0	144.76	41.43	29.4 \pm 16.9	9 - 72	114.4	14.4 \pm 9.1	1.9 - 36.0
Porcupine Mt.	73.3 \pm 8.6	55 - 90	91.6 \pm 12.5	60.4 - 100.0	130.48	37.62	46.1 \pm 17.1	24 - 76	145.7	11.7 \pm 7.8	1.5 - 34.2
Rush Cr. '84	140.2 \pm 80.5	50 - 350	92.2 \pm 9.8	54.9 - 100.0	127.61	11.43	58.0 \pm 20.7	2 - 80	97.6	18.1 \pm 14.8	4.0 - 75.1
Rush Cr. '85	91.2 \pm 49.1	35 - 250	94.2 \pm 9.7	56.1 - 100.0	70.47	1.90	40.3 \pm 16.3	2 - 65	151.3	12.3 \pm 9.7	4.0 - 46.8
W. Soda Cr.	81.0 \pm 22.2	45 - 130	92.0 \pm 11.2	57.5 - 99.5	135.71	16.19	53.7 \pm 16.7	23 - 78	112.9	15.4 \pm 9.3	4.0 - 45.0
Grand Mean	111.5		93.2		46.4		46.4		15.3		

Table 8. Percent canopy closure in habitat types within 1.5 miles (2.4 km) of a spotted owl nest or activity center at five study sites on the BLM-Medford District, Oregon.

Site	Old-Growth			Closed Sapling-Pole			Open Sapling-Pole			Mixed Conifer/Hardwood			Partial Cut		
	$\bar{x} \pm$ s.d.	range	n	$\bar{x} \pm$ s.d.	range	n	$\bar{x} \pm$ s.d.	range	n	$\bar{x} \pm$ s.d.	range	n	$\bar{x} \pm$ s.d.	range	n
Fredenburg	96.5 \pm 3.8	89.0 - 100.0	(10)	86.3 \pm 24.1	22.3 - 100.0	(15)	96.9 \pm 6.2	79.8 - 100.0	(10)	95.9 \pm 6.2	80.3 - 100.0	(10)	85.3 \pm 17.4	7.8 - 100.0	(78)
Miller Mt.	94.5 \pm 3.7	86.3 - 98.8	(15)										82.5 \pm 17.4	29.9 - 100.0	(70)
Purcupine Mt.				88.3 \pm 13.6	55.6 - 98.8	(10)							64.1 \pm 23.3	23.0 - 100.0	(25)
Rush Cr.	95.2 \pm 5.5	79.1 - 99.3	(15)	98.0 \pm 0.7	96.9 - 98.8	(10)				82.3 \pm 13.4	47.7 - 98.3	(15)	84.7 \pm 14.2	50.0 - 100.0	(41)
W. Soda Cr.	96.0 \pm 5.8	71.0 - 100.0	(35)	94.2 \pm 5.1	79.8 - 100.0	(38)				78.4 \pm 24.6	27.0 - 97.1	(10)	88.1 \pm 14.6	44.6 - 100.0	(22)
Grand Mean		95.6			92.3			96.9			85.1				79.0

Table 9. Percent slope in habitat types within 1.5 miles (2.4 km) of a spotted owl nest tree or activity center at five study sites on the BIM-Medford District, Oregon.

Site	Old-Growth			Closed Sapling-Pole			Open Sapling-Pole			Mixed Conifer/Hardwood			Partial Cut		
	$\bar{x} \pm$ s.d.	range	n	$\bar{x} \pm$ s.d.	range	n	$\bar{x} \pm$ s.d.	range	n	$\bar{x} \pm$ s.d.	range	n	$\bar{x} \pm$ s.d.	range	n
Fredenburg	34.4 \pm 8.1	17 - 45	(10)	31.1 \pm 12.0	10 - 47	(15)	14.6 \pm 4.8	6 - 20	(10)	17.3 \pm 6.0	10-26	(10)	24.3 \pm 12.9	2 - 50	(78)
Miller Mt.	59.3 \pm 8.0	40 - 69	(15)										50.9 \pm 21.0	10 - 92	(70)
Porcupine Mt.				41.2 \pm 5.9	28 - 48	(10)							36.8 \pm 12.8	11 - 63	(25)
Rush Cr.	32.8 \pm 12.2	1 - 48	(15)	50.4 \pm 8.3	41 - 61	(10)				56.7 \pm 10.3	29 - 60	(15)	48.3 \pm 13.5	10 - 68	(41)
W. Soda Cr.	41.6 \pm 20.5	9 - 82	(30)	24.6 \pm 12.1		(38)				5.9 \pm 4.5	0 - 13	(10)	33.1 \pm 5.8	4 - 42	(22)

area of live trees was highest in the dense closed sapling-pole stands (Table 10).

Food Habits

A total of 161 prey items were identified from regurgitated owl pellets (Table 11). Woodrats and northern flying squirrels were the predominant prey species taken. The percentage and number of woodrats exceeded flying squirrels at all of the sites except Fredenburg. Microtines and the western pocket gopher were also important prey species. The Norway rat skull identified from the West Soda Creek study site is believed to be one of the rats used to bait the owls when capturing them or trying to locate nest trees.

DISCUSSION

The fundamental problem of spotted owl management is the continued destruction, through timber harvest, of what is considered to be typical spotted owl habitat, i.e. old-growth forests. Selective logging decreases the suitability of old-growth stands for foraging (Forsman et al. 1984). Owls responded to such cutover areas by either moving to more suitable adjacent habitat or the simply "disappeared" (Forsman et al. 1982). Relatively little information is available on spotted owls in managed habitats or habitats with limited old-growth. In contrast to these reports, some of the owls on the Medford District were found in habitats atypical to what was currently known about spotted owl habitats and habitat use. These sites lacked large blocks of old-growth; all had been subject to timber harvest varying from direct activity in the nest area to logging in adjacent roost and foraging areas. After the logging, successive surveys surprisingly

Table 10. Basal area (ft.²/acre) of live trees and stumps of logged trees in habitat types sampled within 1.5 miles of a spotted owl nest tree or activity center at five study sites on the BLM-Medford District, Oregon.

Site	Old-Growth		Closed Sapling-Pole		Open Sapling-Pole		Mixed Conifer/Hardwood		Partial Cut	
	Live Trees	Stumps	Live Trees	Stumps	Live Trees	Stumps	Live Trees	Stumps	Live Trees	Stumps
Fredenburg	153.00	8.00	192.00	27.30	94.00	19.00	190.00	3.00	111.15	28.20
Miller Mt.	165.33	0	—	—	—	—	—	—	115.00	27.71
Porcupine Mt.	—	—	198.00	5.00	—	—	—	—	90.80	48.00
Rush Cr.	215.33	2.67	200.00	5.00	—	—	122.70	23.33	112.68	36.58
W. Soda Cr.	188.00	7.00	191.25	21.00	—	—	130.00	10.00	154.10	39.10

Table 11. Diet of northern spotted owls from pellets collected at sites on the BLM-Medford District, Oregon, 1 May - 15 August 1984 and 1 April - 30 August 1985 presented as percent of total number of prey items: [] total number of prey items and () total number of individuals of a prey species.

Prey Items	Rush Cr. [26]	Grizzly Peak [16]	Fredenburg [31]	W. Soda Cr. [32]	Porcupine Mt. [32]	Incidentals [15]	Total [161]
Woodrat	46 (12)	25 (4)	10 (3)	40 (16)	35 (11)	33 (5)	32 (51)
N. flying squirrel	12 (3)	20 (3)	52 (16)	17 (7)	16 (5)	27 (4)	24 (38)
Microtines	30 (8)	25 (4)	20 (6)	10 (4)	16 (5)	7 (1)	17 (28)
W. pocket gopher	—	12 (2)	6 (2)	7 (3)	12 (4)	13 (2)	8 (13)
Coast mole	4 (1)	—	6 (2)	12 (5)	—	13 (2)	6 (10)
<u>Peromyscus</u> spp.	4 (1)	6 (1)	—	2 (1)	6 (2)	—	3 (5)
Rabbit	—	—	3 (1)	—	3 (1)	—	1 (2)
Shrew mole	—	—	—	—	3 (1)	—	1 (1)
Shrew	—	6 (1)	—	—	—	—	1 (1)
Norway rat	—	—	—	2 (1)	—	—	1 (1)
Unidentified mammals	4 (1)	—	3 (1)	—	—	—	1 (2)
Birds	—	6 (1)	—	5 (2)	9 (3)	7 (1)	4 (7)
Insects	—	—	—	5 (2)	—	—	1 (2)

found the owls not only remaining in the same area but also nesting and successfully fledging young. This combination of limited old-growth forest, logging impact, and continued presence of owls was in sharp contrast to earlier work by Forsman (1980) and Solis (1983) and prompted the initiation of this project.

Each of the sites was a mosaic of habitat types but each did include some stands in the old-growth condition (Figures 3-7). The minimum amount of old-growth necessary for nesting and foraging is unknown but I found owls active at sites with as little as 120 acres (48.6 ha) of old-growth forest within a 1.5 mile (2.4 km) radius of the nest site (Porcupine Mountain). The owls did not use each habitat within their home ranges equally and showed significantly high use of old-growth (or large sawtimber) at four sites: Fredenburg, Miller Mountain, Porcupine Mountain (large sawtimber), and Rush Creek. This was not entirely unexpected since at three sites, many of the old-growth telemetry locations are in the nest stand and can be assumed to be feeding visits to the brooding female by the male or to the juvenile(s) by both adults. Foraging opportunities would be limited in these stands where prey populations may be low due to the continued presence of an opportunistic hunter like the spotted owl.

In Forsman's (1976, 1980) studies, spotted owls utilized large blocks of old-growth almost exclusively for foraging, roosting, and nesting. The limited amount of old-growth at the Medford sites may have forced the owls to forage and sometimes roost in other habitats, including partial cuts. The partial cut stands varied from site to site and included several logging practices: salvage/mortality logging, thinning, and the first stages of a shelterwood cut. Structurally, the partial cuts ranged from even-aged stands with no

disease or understory to uneven-aged stands with disease and multistoried canopies. Some partial cuts, structurally similar to old-growth and large sawtimber stands, may be providing the owls with the necessary protection and prey base they need to survive and be reproductively successful.

Since there was limited old-growth timber available at each of the study sites, we suspected the owls may be foraging further from the nest site and the resulting home ranges would be larger than the home ranges of owls in typical habitat. However, based on 90% of the locations, home range size, overall, was less than the home ranges of owls in west-central Oregon, which averaged 2,907 acres (1,177 ha) (Forsman 1980). Solis (1983), studying owls in northern California, reported home ranges similar to ours ranging from 475 to 1,702 acres (192.2 to 688.8 ha) and Sisco (1984) reported an average winter home range of 1,721.8 acres (696.8 ha), also in northern California. Home ranges, based on 100% of the samples, were more comparable to Forsman's (1980) but generally still smaller. The home range data I collected were significant but not extensive because of the low number of locations at Rush Creek, West Soda Creek, and Porcupine Mountain and the short tracking period overall. While home range estimates, using the minimum convex polygon method of determination are statistically stable (Jennrich and Turner 1969), they become more accurate with an increased number of samples, or owl locations (Swihart and Slade 1985).

Northern flying squirrels are the predominant prey species taken by spotted owls in the Douglas fir and western hemlock forests of west-central Oregon (Forsman et al. 1984). In southwestern Oregon and northern California, however, the dusky-footed woodrat replaces the flying squirrel (Forsman et al. 1984, Solis 1983). Spotted owls in

these areas appear to be preferentially selecting woodrats over other prey species (Barrows 1980). My data correlate with these studies in that woodrats were preyed upon more heavily than flying squirrels at all sites except Fredenburg.

Both the bushy-tailed woodrat (Neotoma cinerea) and the dusky-footed woodrat (Neotoma fuscipes) occur on the Medford District (Culbertson et al. 1983) and they are found in five of the six stand conditions: shrub, open sapling-pole, closed sapling-pole, large sawtimber, and old-growth (Brown 1985). The northern flying squirrel is found primarily in large sawtimber and old-growth but also in closed sapling-pole stands (Brown 1985). Therefore, it is not surprising that spotted owls in southwestern Oregon prey heavily on woodrats; the mosaic of habitat types and the limited small stands of old-growth forest favored woodrats rather than flying squirrels. It would be interesting to continue monitoring the food habits of the owls at the Fredenburg site. Recent clear-cut logging has eliminated a large portion of flying squirrel habitat and may force the owls to prey on woodrats.

Recommendations

As timber harvesting continues and the spotted owl becomes an increasingly critical issue, it is important that wildlife biologists make sound recommendations to the land managers in regard to spotted owl management. These recommendations can only be made as a result of further research on the owl and its habitat needs.

Gutiérrez (1985) described current research needs for spotted owl management to include: habitat requirements for all major areas within the owl's range, the effects of habitat modification on spotted

owls, in particular the impact of timber harvesting on reproduction, foraging, and habitat use; demography, juvenile dispersal, and owl genetics. Although Forsman (1976) conducted calling surveys and some food habits analysis on the Medford District, this is the first evaluation of spotted owl habitat and habitat use conducted in southwestern Oregon. It partially fulfills two critical research needs in that it considers an unstudied area within the owl's range, and each site has been impacted by timber harvest. The data obtained in this study and presented here point out the possibility of spotted owls surviving and reproducing in habitats with limited old-growth timber. However, additional data are essential before management recommendations can be made. I strongly recommend that this study be continued, collecting radiotelemetry data for a minimum of one complete year on at least four spotted owl pairs. These pairs should be centrally located in an area with good road access at all times of the year and at least one site should have large blocks of old-growth timber for comparison with the managed sites. I also recommend continuing habitat evaluations and limited monitoring, through calling surveys, at other owl sites managed for timber harvest on the Medford District.

ACKNOWLEDGEMENTS

This study was supported by the Bureau of Land Management through Oregon State University and the Pacific Northwest Research Station. I would like to thank Dr. E. Charles Meslow and Gary Miller for their technical advice and field supervision. Frank Wagner and Mark Hodgkins continued to obtain roosting locations of the adults after our initial monitoring effort was completed. I owe a special thanks to Bob Hause,

who assisted me with this project.

Everyone on the Medford District was very supportive. I would especially like to thank Jim Harper and George Arnold who helped me in all aspects, in the field and at the office; Dick Bonn, Mike McMillian, and the S.C.A. (Student Conservation Association) volunteers.

Richard D. Andrews advised me on the writing and preparation of this report. His help has been greatly appreciated. Kipp C. Kruse was very helpful with the statistics. I would also like to thank John Ebinger and Michael Goodrich for their help.

Finally, I would like to thank Gayle Sitter, my "unofficial" supervisor, for his advice, support, and friendship throughout this project.

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