DISTRIBUTION AND HABITAT OF FLAMMULATED OWLS (*OTUS FLAMMEOLUS*) IN WEST-CENTRAL IDAHO

by

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ABSTRACT

We conducted 40 flammulated owl (Otus flammeolus) surveys in Hells Canyon National Recreation Area and Payette National Forest lands from 22 May to 11 July, 1991. Sixty singing male flammulated owls were heard throughout the survey area (18 in Hells Canyon National Recreation Area and 42 in Payette National Forest). Crude density estimates ranged from 0 to 0.84 singing males per 40 ha ($x = 0.17$, $SD = 0.23$). Highest survey route densities were at Boulder Creek in the West Mountains, Dukes Creek in the Cuddy Mountains, and Lightning Ridge in the wilderness portion of Hells Canyon National Recreation Area. Regional densities were highest in the wilderness portion of Hells Canyon National Recreation Area and in the West Mountains.

Habitat characteristics at 12 owl locations were consistent with previous studies. Flammulated owls were found in areas with mature Ponderosa pine and Douglas-fir, low tree density, moderate canopy closure, and on upper slopes or ridgelines. Old and mature forests dominated 50.3-ha macrohabitat analysis areas. Natural openings were also found consistently, but in smaller quantities. Clearcuts, partial cuts with less than 50% canopy closure, and immature forests were only minor components.

Studies of flammulated owl habitat use and nesting success in relationship to forest fragmentation are needed to assess potential threats to populations. Studies of owl dispersion patterns are also needed. Managers need to map potential flammulated owl habitat, monitor flammulated owl populations, and develop plans to retain suitable flammulated owl habitat to maintain viable populations.

TABLE OF CONTENTS

INTRODUCTION

The flammulated owl (Otus flammeolus) is listed as a Species of Special Concern (category 3 - undetermined status) by the Idaho Department of Fish and Game, and as a Sensitive Species by the U.S. Forest Service in Region 4. It is also the only forest owl species in Idaho classified as a neotropical migrant, a category of species receiving increased attention from the national, multi-agency Neotropical Migratory Bird Conservation Program (Finch 1991).

Distribution and abundance of flammulated owls in Idaho is poorly known (Stephens and Sturts 1991). Wintering areas are even more poorly documented, but all flammulated owls are presumed to migrate to the neotropics each winter (Phillips 1942, Balda et. al. 1975).

Flammulated owl nesting habitat consists of mature to old forest stands (Bull and Anderson 1978, Goggans 1986, Hayward 1986, Reynolds and Linkhart 1987b, Howie and Ritcey 1987, Atkinson and Atkinson 1990), open canopies (Goggans 1986, Reynolds and Linkhart 1987b, Howie and Ritcey 1987, Bull et. al. 1990, Atkinson and Atkinson 1990), multiple canopy layers (Bull and Anderson 1978, Goggans 1986, Hayward 1986, Howie and Ritcey 1987, Bull et. al. 1990), and low tree density (Bull and Anderson 1978, Hayward 1986, Goggans 1986, McCallum and Gehlbach 1988). Roosting areas, however, have higher tree densities and canopy cover than nesting sites (Goggans 1986). Ponderosa pine (Pinus ponderosa) is a dominant or codominant tree in flammulated owl

habitat (Winter 1974, Bull and Anderson 1978, Marcot and Hill 1980, Cannings and Cannings 1982, Bloom 1983, Hayward 1986, Goggans 1986, Howie and Ritcey 1987, Reynolds and Linkhart 1987b, Bull et. al. 1990). However, flammulated owls do occupy pure Douglas-fir (Pseudotsuga menziesii) stands (Atkinson and Atkinson 1990, Howie and Ritcey 1987).

This study examined flammulated owl distribution on the Payette National Forest and the Idaho portion of Hells Canyon National Recreation Area. Objectives were to cover a wide range of the area to determine overall distribution, describe habitat characteristics where owls were located, and install nest boxes in selected areas of Hells Canyon National Recreation Area (Appendix A).

METHODS

Survey Routes:

We surveyed areas on the Weiser and Council Ranger Districts of the Payette National Forest (hereafter referred to as Payette) and the Idaho portion of Hells Canyon National Recreation Area (hereafter referred to as Hells Canyon NRA) from 22 May to 11 July 1991. We delineated six geographic regions within the study area (Figure 1). We chose survey areas by checking vegetation maps and by consulting with personnel on the Payette and Hells Canyon NRA to determine areas of mature Ponderosa pine and Douglas-fir. We did not locate survey routes randomly, but placed them in the largest and most accessible areas of suitable habitat in each of the regions. Survey areas on the Payette were located

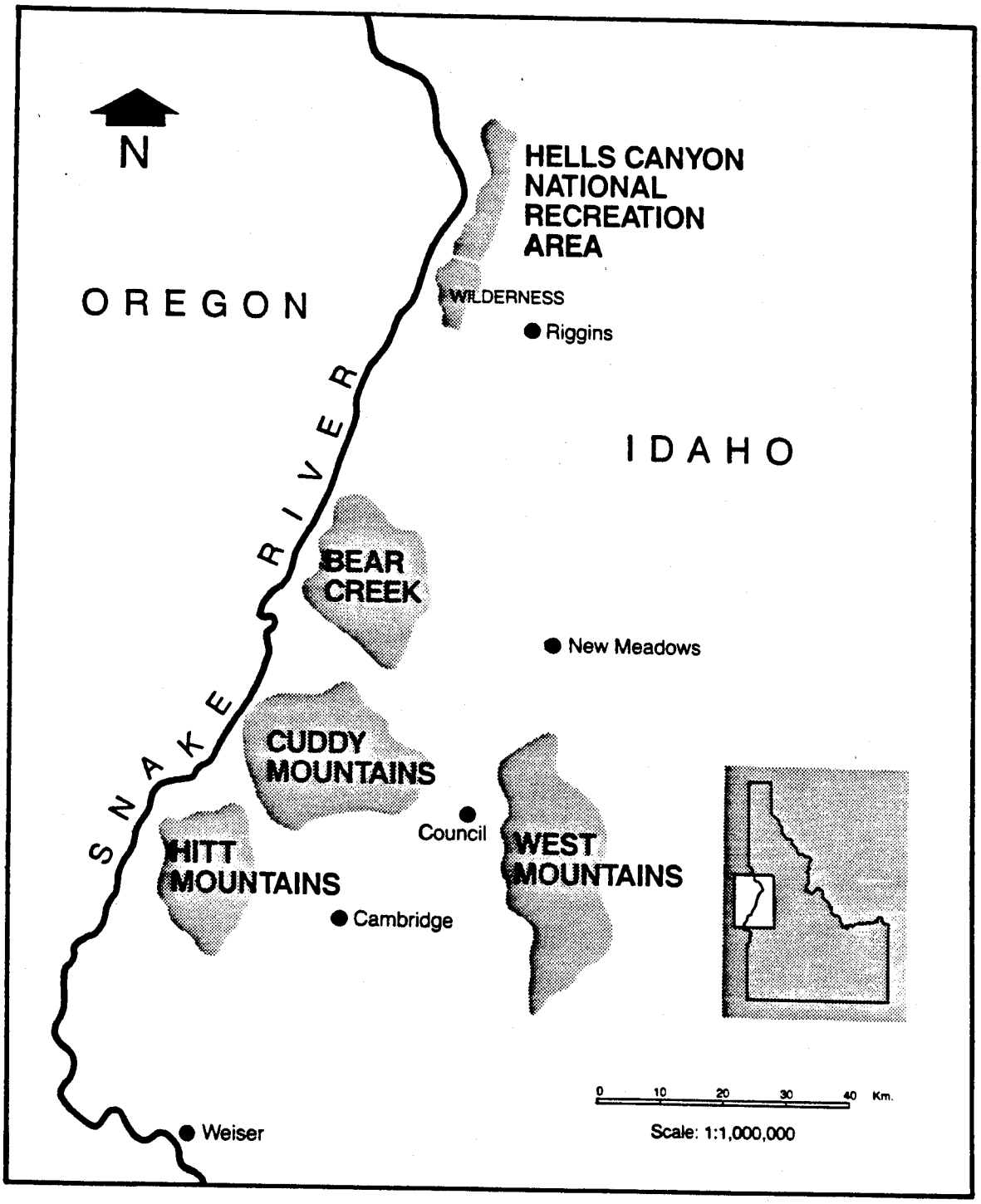

Fig 1. Locations of geographic regions of the Payette National Forest and Hells Canyon National Recreation Area used in surveys of flammulated owls, 1991.

near White-headed woodpecker (Picoides albolarvatus) survey sites for logistical simplicity. All roads and easily accessible trails were surveyed in Hells Canyon NRA.

We marked calling stations 500 meters apart on aerial photos. We conducted surveys from dusk (30-45 minutes after sundown) until approximately 0200. At each calling station we listened for 1 to 2 minutes for the male territorial song, then alternated 1-minute broadcasts of tape-recorded songs with 1-2 minute listening intervals for a total of 10 minutes. We only searched for nests in areas where we sampled habitat. All snags within habitat sampling areas with cavities excavated by northern flickers (Colaptes auratus) or piliated woodpeckers (Dryocopus pileatus) were pounded and scratched while a second person stood at a distance and watched the cavity entrance for the appearance of an owl (Goggans 1986, Atkinson and Atkinson 1990).

Owl densities and dispersion:

After surveys were completed, calling stations were mapped on 1:24,000 USGS topographic maps, 1:62,000 USGS topographic maps, 1:24,000 orthophotos, and 1:15,840 orthophotos. All areas within 500 m of one or more calling stations were considered surveyed for flammulated owls. Our survey routes were not linear, therefore we could not use the soundscape formula developed by Howie and Ritcey (1987). Therefore, we planimetered survey areas (areas of overlap were only planimetered once) and calculated flammulated owl density for each survey route. Mean densities were calculated for each geographic region and for the study area

overall.

Distance to the next nearest owl was recorded for each owl location. Owl dispersion patterns were analyzed for each region using a nearest neighbor technique where the measure of dispersion, $\underline{R}$, is equal to $\underline{r}$ (the mean distance to the nearest owl in meters) divided by $\underline{r}_{rand}$ (the reciprocal of $2\sqrt{d}$, where d = males per meter squared). A $\underline{R}$ value of 1 indicates random dispersion, $R < 1$ indicates owls are clumped, and $R > 1$ indicates owls are superdispersed. Because this method assumes owl locations are known, we eliminated locations not accurate to within 150 m from these calculations.

Habitat sampling:

We sampled habitat only for those flammulated owl locations in which we were confident. Only those detections within 200 m of a calling station were sampled to minimize the effect of exaggerating errors in azimuth with increasing distance. Unsolicited detections were used when possible because male flammulated owls will approach broadcast audio recordings beyond their territory boundaries (Reynolds 1987). Habitat characteristics for a 3.1-ha circular plot centered on the owl's location were measured on five 0.04-ha circular subplots. We centered the first subplot on the estimated owl location and placed four additional subplots 50 m from the center in cardinal directions (Noon et. al 1981). We measured habitat characteristics on each subplot after methods described in Noon (1981). Tree density and dbh were measured on each subplot using

point-center quarter method (Cottam and Curtis 1956). Other variables measured on subplots are described in Appendix B. Means of forested (i.e. >10 % canopy cover) subplot measurements were used as data points in calculating the plot mean for percent ground cover, percent shrub cover, percent canopy cover, and tree density. Dbh measures from subplots were pooled in calculating mean dbh. Means and standard deviations of all measurements taken on the 3.1 ha owl-centered plots were then calculated.

Macrohabitat analysis:

In addition to field plots, we also analyzed macrohabitat patterns using 1:15,840 aerial photos and 1:24,000 orthophotos marked by district silviculturists with forest age and treatment classes termed "strata" (Appendix C). Strata were lumped into classes to simplify the analysis (Appendix C). A 400-m radius (50.3 ha) circle centered on the owl's estimated location was overlayed on these aerial and orthophotos. This analysis area was chosen because the radius is the same as the diameter of a flammulated owl territory (Reynolds and Linkhart 1987a) and therefore the circle is likely to contain the entire territory plus surrounding habitats. The area of each strata within the circle was measured using a planimeter. Edges between forested stands and natural openings, clearcuts, partial cuts with light residual canopy, and open woodland were measured in kilometers using a planimeter.

RESULTS

We conducted 38 flammulated owl surveys from 22 May to 11 July 1991. During our surveys we heard 60 singing male flammulated owls (Table 1). Flammulated owls were first heard on 24 May and last heard on 11 July. Little time was spent searching for nests or fledglings and none were found.

Owl Densities and dispersion:

Singing male densities varied from 0.09 to 0.84 males/40 ha on survey routes with owls (Table 2). Three survey areas had higher densities than all other survey routes. These areas were Boulder Creek in the West Mountains, Dukes Creek in the Cuddy Mountains, and Lightning Ridge in Hells Canyon wilderness region (Table 2).

The Hells Canyon NRA wilderness region had the highest crude density and the highest density of survey routes with owls. Crude density for the study area was 0.17. The density of only survey routes with owls was 0.31 (Table 3).

Owl dispersion patterns were highly variable. Clumped dispersion patterns were found in the NW Council region (R=0.26), and West Mountains (R=0.66). Dispersion was between clumped and random in the Cuddy Mountains (R=0.78). Hells Canyon wilderness and non-wilderness regions were random (R=1.09 and 0.93, respectively). The Hitt Mountains region was random to slightly

Table 1. Flammulated owls detected on the Weiser and Council Ranger Districts, Payette National Forest, and Hells Canyon National Recreation Area, Idaho; 1991.

Region Location	Owl ID#	Date (m-d)	UTMN	UTME	TRS
PAYETTE NF					
Bear Creek					
Cuprum	10	6-20	4992200	526200	20N,3W,11,SE
Cuprum	11	6-20	4992700	526400	20N,3W,11,NE
Cuprum	12	6-20	4992200	526700	20N,3W,11,SE
Deer Creek	8	6-18	4979200	529700	19N,2W,19,SE
Cuddy Mountains					
Crooked River	13	6-22	4971100	524000	18N,3W,15,SW
Crooked River	14	6-22	4970500	525400	18N,3W,22,NE
Crooked River	15	6-22	4969800	526100	18N,3W,23,NW
Crooked River	16	6-22	4970200	526300	18N,3W,23,NW
Crooked River	17	6-22	4970200	526900	18N,3W,23,NE
Dukes Creek	1	5-24	4961500	511800	17N,4W,17,SW
Dukes Creek	2	5-24	4961300	511800	17N,4W,17,SW
Dukes Creek	3	5-24	4961300	511600	17N,4W,17,SW
Dukes Creek	40	7-1	4960500	513200	17N,4W,21,NW
Dukes Creek	41	7-1	4960200	513100	17N,4W,21,NW
Dukes Creek	42	7-1	4961300	513200	17N,4W,16,SW
Dukes Creek	43	7-1	4961200	513500	17N,4W,16,SW
Dukes Creek	44	7-1	4960900	513500	17N,4W,16,SW
Dukes Creek	45	7-1	4961300	511800	17N,4W,17,SW*
Dukes Creek	46	7-2	4960500	512600	17N,4W,20,NE
Dukes Creek	47	7-2	4960300	512400	17N,4W,20,NE
Dukes Creek	48	7-2	4959500	512700	17N,4W,20,SE
East Brownlee	38	6-29	4954200	514800	16N,4W,10,NW
East Brownlee	39	6-29	4955300	515300	16N,4W,3,NE
Johnson Creek	9	6-19	4955400	533400	16N,2W,4,NE
Hitt Mountains					
Middle Brownlee	35	6-28	4946800	506600	16N,5W,35,SW
Middle Brownlee	36	6-29	4947000	506100	16N,5W,34,SE
Middle Brownlee	37	6-29	4944700	505700	15N,5W,10,NE
Mulmick Gulch	5	5-27	4933900	404700	14N,5W,9,SE
Sawlog Gulch	4	5-27	4933500	505300	14N,5W,15,NW

Table 1.(cont) Flammulated owls detected on the Weiser and Council Ranger Districts, Payette National Forest, and Hells Canyon National Recreation Area, Idaho; 1991.

Region Location	Owl ID#	Date (m-d)	UTMN	UTME	TRS
West Mountains					
Boulder Creek	23	6-27	4946500	556600	15N,1E,1,NW
Boulder Creek	24	6-27	4947000	556700	16N,1E,36,SW
Boulder Creek	25	6-27	not available		15N,1E,1,SW
Boulder Creek	26	6-27	4946400	557300	15N,1E,1,NE
Boulder Creek	27	6-27	4946600	557400	15N,1E,1,NE
Boulder Creek	28	6-27	4946800	557600	16N,1E,36,SE
Boulder Creek	29	6-27	4947000	558000	16N,2E,31,SW
Little Weiser R	59	7-10	4933200	560400	14N,2E,17,NE
Little Weiser R	60	7-10	4933500	560600	14N,2E,17,NE
Little Weiser R	61	7-10	4933300	560500	14N,2E,17,NE
Mica Creek	33	6-27	4942800	558700	15N,2E,18,NW
Middle Fork Weiser	30	6-27	4943000	555300	15N,1E,14,NW
Middle Fork Weiser	31	6-27	4943100	555100	15N,1E,14,NW
Middle Fork Weiser	32	6-27	4943600	555800	15N,1E,11,SE
HELLS CANYON NRA					
Non-wilderness					
Big Canyon Saddle	18	6-23	not available		27N,1W,11,SW
Camel Ridge	7	6-12	5041100	543800	25N,1W,10,NE
Dixon Corral	6	6-11	5052600	547900	26N,1E,6,NW
Dixon Corral	21	6-25	5050500	544900	2N,1W,11,NW
Dixon Corral	22	6-25	5051200	545700	2N,1W,2,SE
Kirby Creek	50	6-10	not available		26N,1W,21,SE
Sawpit Saddle	19	6-24	5041500	540100	25N,1W,5,SW
Sawpit Saddle	20	6-24	5042000	539700	25N,1W,5,SW
Sawpit Saddle	49	6-24	not available		25N,1W,7,SE
Tablelands	34	6-25	5046700	548400	26N,1E,19,SW
Wilderness					
Clarks Ridge	51	7-9	5034900	540200	25N,1W,32,NE
Clarks Ridge	52	7-9	5035300	540600	25N,1W,29,SE
Clarks Ridge	53	7-9	5035000	541200	25N,1W,33,NW
Lightning Ridge	54	7-11	5033800	539500	25N,1W,32,SW
Lightning Ridge	55	7-11	5034000	539700	25N,1W,32,SW
Lightning Ridge	56	7-11	5033600	540500	25N,1W,32,SE
Lightning Ridge	57	7-11	5033700	540300	25N,1W,32,SE
Lightning Ridge	58	7-11	5033500	540900	25N,1W,32,SE

* Believed to be same individual as reported on 5-24 at this location.

Table 2. Flammulated Owl survey routes, detections, and densities in Hells Canyon National Recreation Area and Payette National Forest, Idaho; 1991.

Region Survey Route Name	Area (ha)	Number Detections	Density (owls/40 ha)
PAYETTE N.F.			
Bear Creek			
Bear	319	0	n/a
Cuprum	337	3	0.36
Deer Creek	446	1	0.09
Huntley Gulch	208	0	n/a
Summit Gulch	404	0	n/a
Windy Ridge	404	0	n/a
Cuddy Mountains			
Board Gulch	167	0	n/a
Brownlee	311	2	0.26
Crooked River	487	5	0.41
Dukes Creek	592	11	0.74
Lower Johnson Cr	343	1	0.12
Seid Creek	395	0	n/a
Upper Johnson Cr	437	0	n/a
Hitt Mountains			
Hitt Creek	393	0	n/a
Mann Creek	280	2	0.29
Middle Brownlee Cr	395	3	0.30
Mill Creek	280	0	n/a
West Mountains			
Boulder Creek	334	7	0.84
Little Weiser R	465	3	0.26
Mica Creek	202	1	0.20
Middle Fork Weiser	355	3	0.34
Shingle Flat	449	0	n/a
HELLS CANYON NRA			
Non-wilderness			
Big Canyon Saddle	375	1	0.11
Camel Ridge	367	1	0.11
Dixon Corral	394	1	0.10
Hardin Mill	451	0	n/a
Kirkwood Azimuth	168	0	n/a
Kirkwood Corral	461	1	0.09
Klopton Creek	305	0	n/a
Lost Valley Creek	303	0	n/a
Low Saddle	369	0	n/a
Pittsburg Saddle	267	0	n/a
Road 1819	222	0	n/a
Sawpit Saddle	514	3	0.23
Table Lands	235	1	0.17
Trail Creek	237	2	0.34
Wilderness			
Clark's Ridge	277	3	0.43
Lightning Ridge	269	5	0.74

Table 3. Flammulated owl densities on Hells Canyon National Recreation Area and Payette National Forest, Idaho by geographic region; 1991.

Region		All Surveys		Surveys with Detections	
	n[1]	x	SD	x	SD
HELLS CANYON NRA					
Non-wilderness	14	0.08	0.10	0.16	0.09
Wilderness	2	0.59	0.22	0.59	0.22
PAYETTE N.F.					
Bear Creek	6	0.07	0.14	0.22	0.19
Cuddy Mountains	7	0.22	0.28	0.38	0.27
Hitt Mountains	4	0.17	0.20	0.33	0.07
West Mountains	5	0.33	0.31	0.41	0.29
TOTAL	38	0.17	0.23	0.31	0.22

[1] n = number of survey routes

superdispersed (R=1.27). Dispersion for the entire survey area was between clumped and random (R= 0.74). Thirteen owls (23%) were more than 1 km from other owls, but six of these distances are probably overestimates because they spanned unsurveyed areas. Omitting these six, only seven owls (13%) were more than 1 km from another owl.

Habitat analysis:

We sampled habitat at 12 flammulated owl locations. Unfortunately, we were unable to sample two unsolicited responses at Mulmick Gulch and Sawlog Gulch before the area was harvested. We used nine unsolicited locations and three solicited responses.

Of 12 plots sampled, five were predominantly on upper slopes, three were predominantly on ridgelines, two were predominantly on midslopes, two were predominantly valley bottoms, and none were on lower slopes. Slope aspect was highly variable. Mean slope aspect for 12 plots was 7 degrees (r = 0.56). Mean elevation was 1561 meters (SD = 138).

No silvicultural treatment occurred on any of the forested area within seven of the plots. Two additional plots were mostly very old selective cuts that took very few trees. Although highly variable, an average of 65% of each plot was not silviculturally treated (SD = 45), 20% of each plot had limited selective cutting (SD = 35), and 12% of each plot was clearcut (SD = 23). No plots had shelterwood or seed tree cuts.

The mean closest distance to a snag with a potential nesting cavity from any subplot center was 57 m (SD= 38, n=10). No

potential cavities were found on two plots.

Ponderosa pine and Douglas-fir occurred consistently in habitat plots (Table 4). One or both of these species dominated at least one subplot in every 3.1-ha plot. Ponderosa pine dominated an average of 20% of each 3.1-ha plot, Douglas fir dominated an average of 13% , and Douglas-fir and Ponderosa pine codominated an average of 42% (Table 4).

All 12 plots contained mature forest. Nine plots were predominantly either mature or old forests; three were mostly mature/immature (Table 4). Immature forest was found on only one subplot.

In forested areas within 3.1-ha plots mean canopy closure was 64% (SD = 12), mean ground cover was 49% (SD = 10), mean shrub cover was 16% (SD = 13), the mean number of canopy layers was 1.8 (SD = 0.3), mean tree density was 498 trees/ha (SD = 294), and mean dbh was 32 cm (SD = 5).

Macrohabitat analysis:

We sampled macrohabitat attributes on nine flammulated owl locations on the Payette National Forest.

The 50.3-ha area surrounding flammulated owl locations was dominated by old (x = 16 ha) and Mature (x = 15 ha) age classes (Table 5). Next in importance was natural openings (x = 6 ha) and partial cuts with heavy residual canopy (x = 6 ha). Clearcuts, light partial cuts, open woodland, and unclassified areas were relatively low (x < 2 ha) in cover. Immature forest did not occur on any plot.

Table 4. Dominant tree cover and age on 3.1 ha habitat plots centered on flammulated owl locations, Payette National Forest and Hells Canyon National Recreation Area, Idaho; 1991.

		Percent Cover of 3.1 ha plots based on five 0.04 ha subplots: Dominant Tree Cover				Age Class			
Owl ID#	Natural Openings	PIPO/ PSME	PIPO	PSME	OTHER	IMM	IMM-MAT	MAT	OLD
2	20	60	0	20	20[1]	0	0	60	20
13	40	20	40	0	0	20	20	20	0
17	0	100	0	0	0	0	100	0	0
43	0	60	40	0	0	0	0	0	100
40	0	60	0	40	0	0	0	0	100
27	0	40	60	0	0	0	0	0	100
30	60	20	0	20	0	0	40	0	0
11	40	60	0	0	0	0	0	0	60
10	20	20	0	20	40[2]	0	60	20	0
53	0	0	100	0	0	0	0	0	100
56	0	20	0	0	80[2]	0	0	0	100
21	0	40	0	60	0	0	80	20	0
X	15	42	20	13	12	02	25	18	40
SD	21	28	33	20	25	06	36	31	47

[1] = Populus tremuloides, [2] = Abies grandis

Table 5. Strata found on nine 50.3 ha macroplots centered on flammulated owl locations, Payette National Forest, Idaho; 1991.

	Hectares of Each Strata [1]							
Owl ID#	Natural Openings	Clearcut	Partial Cut-L	Partial Cut-H	Mature	Old	Open Woodland	Other
2	1(2)	0	0	0	19(38)	29(58)	0	0
13	07(14)	05(10)	05(10)	07(14)	25(50)	0	0	0
17	06(12)	0	0	24(48)	17(34)	0	0	03(6)
43	09(18)	0	0	0	0	42(83)	0	0
40	1(2)	0	0	0	07(14)	42(83)	0	0
27	04(8)	0	0	07(14)	08(15)	19(38)	0	13(26)
30	0	0	16(32)	0	34(68)	0	0	0
11	10(20)	11(22)	0	0	12(24)	11(22)	06(12)	0
10	15(30)	0	0.5(1)	17(34)	17(35)	0	0	0
x	6	2	2	6	15	16	1	2
SD	5	4	5	9	10	18	2	4

[1] Percent of plot in each strata given in parentheses.

Our analysis areas contained more edge with natural openings than edge with clearcuts, partial cuts with light residual canopy, and open woodland combined (Table 6).

DISCUSSION

Owl densities and dispersion:

The densities reported here could be lower than actual densities because areas were surveyed only once. No information is currently available on the number of survey replications needed to adequately access flammulated owl abundance. These estimates of singing male densities are probably higher than densities of breeding pairs because unpaired males sing and defend territories (Goggans 1986, Reynolds 1987).

Crude flammulated owl densities found on this study were within the range of 0.03-1.09 owls/40 ha in northern California (Marcot and Hill), 0.03-0.5 owls/40 ha in British Columbia (Howie and Ritcey 1987), 0-1.25 owls/40 ha in east-central Idaho (Atkinson and Atkinson 1990), and near the mean of 0.20 owls/40 ha reported in New Mexico (Johnson and Zwank 1990). However, our total and regional density estimates fell below crude densities of 0.72 males/40 ha in Eastern Oregon (Goggans 1986), 0.8 males/40 ha in Colorado (Reynolds and Linkhart 1987), and 2.1 males/40 ha in California (Winter 1974). High density estimates in Colorado and Oregon, as well as the highest survey route densities in this study (Boulder Creek, Dukes Creek, and Lightning Ridge) were found in old Ponderosa pine/ Douglas-fir

Table 6. Forest Edge found on nine 50.3 ha macroplots centered on flammulated owl locations, Payette National Forest, Idaho; 1991.

Owl ID#	Length (km) of Forest edges adjoining: Natural Openings	Clearcut	Partial Cut-light	Open Woodland
2	0.23	0	0	0
13	1.67	0.43	0.35	0
17	1.44	0	0	0
43	1.34	0	0	0
40	0.22	0	0	0
27	1.37	0	0.80	0
30	0	0	0.85	0
11	0.67	0.62	0	1.62
10	2.68	0	0.13	0
x	1.07	0.12	0.24	0.18
SD	0.86	0.24	0.35	0.54

forests with no silvicultural treatment or limited selective cutting (Reynolds and Linkhart 1987b, Goggans 1986, personal observation).

If the ratios of singing males to breeding territories are similar to those reported in Oregon by Goggans (1986) and in Colorado by Reynolds and Linkhart (1987b), breeding pair densities should range from about 0.11 to 0.16 pairs per 40 ha.

On two occasions we observed flammulated owls ceased calling when great-horned owls were heard. Effects of other owls on flammulated owl responsiveness needs study.

Our estimates of flammulated owl dispersion do not support or refute previous reports of territory clusters (Marshall 1939, Winter 1974, Marcot and Hill 1980, Atkinson and Atkinson 1990, Johnson and Zwank 1990). Dispersion for the entire survey area was close to random, but geographic regions varied widely. Our estimate that only 13% of singing males were more than 1 km from other males agrees with a similar estimate of 12% by Johnson and Zwank (1990). This pattern may not have been caused by clumping, however, but simply by a large occupied proportion of the study area. No study to date has attempted to analyze if clumping patterns are correlated to habitat clumping patterns. We were unable to analyze any relationship to habitat patterns in this study as well, due to lack of information on the location of suitable habitat.

If flammulated owl territories are clustered, population responses to habitat losses may not be linear. Territory

clusters could indicate dispersing owls are attracted to conspecifics (see also Stamps 1988). If so, vacant habitat patches may not be colonized as frequently as they would if dispersal were random (Smith and Peacock 1990). Therefore, timber harvest activity in a territory cluster may not only take a disproportionate amount of flammulated owls in the general area, but lower the probability of owls dispersing to adjacent remaining habitat patches. In assessing potential impacts of proposed projects on flammulated owls it is important to determine if territories are clustered. If so, impacts will be greater if not enough of these clusters are retained to facilitate dispersal. Studies of flammulated owl dispersion patterns over large areas are needed prior to conducting environmental assessments.

Habitat characteristics:

Habitat analysis of 3.1-ha areas supported findings of other studies, indicating flammulated owls use forest stands with mature to old Ponderosa pine and Douglas-fir, multiple canopy layers, low tree densities, moderate to low canopy closure, and moderate ground cover. These stands were on upperslopes or ridges, and were most often not silviculturally treated. However, survey routes were initially chosen for presence of old and mature Ponderosa pine and Douglas-fir. Also, because no attempt was made to describe available habitats, habitat selection could not be implied from these data.

Reynolds and Linkhart (1987b) suggested older, open

Ponderosa pine forests may allow faster drying times and therefore quicker insect activity after storms, higher prey densities, and easier foraging maneuverability for flammulated owls. Linkhart (1984) found all intensive foraging areas were within mature forests, and most were in Ponderosa pine mixed with Douglas-fir on midslopes or ridgetops.

The consistency in which natural openings occurred on plots suggests proximity to natural openings is also important for flammulated owls. Flammulated owls foraged most often at forest/grassland edges followed by open Ponderosa pine forests in Oregon (Goggans 1986). Higher prey densities in grasslands, followed by open Ponderosa pine forests were believed to cause this pattern.

Macrohabitat characteristics:

The consistency in which mature to old forests were found in the 50.3-ha analysis areas, similar to the pattern in 3.1-ha habitat plots, indicates the extent of mature to old forest in an area may be important to flammulated owls. No plot had less than 17 ha of old or mature forest. However, the amount of old and mature forest cover in these plots is greater than the size of a flammulated owl territory (Linkhart 1984, Goggans 1986). This pattern could indicate one of several possibilities: 1) mature and old forest in the study area is abundant, 2) flammulated owls select areas with enough mature and old forest to support neighboring territories, 3) structural, floristic, or faunal components of contiguous forests are advantageous to flammulated

owls, or 4) flammulated owls are avoiding other strata types because of predators or competitors.

Natural openings also occur regularly in the macrohabitat plots but in smaller quantities (x = 6 ha). Natural openings may be important foraging habitat (Goggans 1986). In contrast, clearcuts, partial cuts with light residual canopy, and immature forest are apparently unimportant in our study area. The lack of light partial cuts and immature forests in the 3.1-ha plots strengthens this suggestion. Possibilities explaining this pattern include a low occurrence of these types on the survey area or flammulated owl avoidance of these areas.

Forest edges around flammulated owl territories are predominantly with natural openings. This may be related to the abundance of natural openings or to prey availability in natural openings.

Management Recommendations: (not in prioritized order)

1. Conduct nocturnal surveys of all forested areas within a project planning area for flammulated owls from May to late June before planning timber sale activity. Several surveys may be necessary in each area.

2. Develop 1:24,000 maps of all existing mature Ponderosa pine, mature Douglas-fir, old Ponderosa pine, and old Douglas-fir forests on the Payette National Forest and Hells Canyon National Recreation Area to determine the extent of available habitat.

3. Develop permanent monitoring areas in managed and

unmanaged areas to enable estimation of population trends.

4. Implement uneven-aged management practices in flammulated owl habitat. Uneven-aged management may better retain the structure of open, multi-canopied Ponderosa pine forests for nesting and foraging (Goggans 1986). Maintain a mosaic of these uneven-aged Ponderosa pine stands, grasslands for foraging, and denser forests with some large Ponderosa pines for roosting needed by flammulated owls (Goggans 1986).

5. Develop plans to retain mature to old Ponderosa pine. Partial removal of Douglas-fir or grand fir understories with prescribed burns or selective harvest of these understory species may be necessary, but in all cases the large Ponderosa pines and snags must be retained if flammulated owl habitat is the treatment goal. Structural characteristics described by Reynolds and Linkhart (1987b) and Goggans (1986) must also be retained.

6. Retain areas of high flammulated owl densities until population viability, habitat requirements, and effects of forest fragmentation on flammulated owls are known, and plans to maintain viable flammulated owl populations are developed and implemented.

7. Preserve snags for meeting the nesting requirements of flammulated owls. Live trees must also be preserved in harvest areas to provide snag recruitment as existing snags fall down. Areas of suitable flammulated owl habitat should be managed for pileated woodpecker (Dryocopus pileatus) and northern flicker

(Colaptes auratus) populations.

8. Encourage and support studies of the relationship of flammulated owl habitat requirements to forest management practices. Currently, the analysis of impacts of forest management on flammulated owls is difficult due to lack of information, especially on cumulative effects. Questions include:

a.Does the extent of immature/mature and old forest strata in our analysis indicate flammulated owls select for areas with large amounts of these types or simply indicate availability on the study area? More owl samples and an analysis of available strata are needed.

b.How does flammulated owl occurrence and density relate to forest fragmentation patterns (ratio of old forest to other strata; shape, size, and dispersion of forest patches; amount of edge)? Does this relationship differ between natural and man-induced fragmentation?

c.How is nesting success related to forest fragmentation patterns? Are there threshold limits for successful nesting? Does territory size vary with habitat fragmentation as suggested by Linkhart (1984)?

d.Does nesting success differ in owls occupying managed forests (e.g., selective cuts) versus unmanaged forest?

e. How do owl numbers in a drainage relate to the amount of suitable habitat? Are flammulated owls clustered in distribution? If so, what are the size of these clusters and habitat characteristics associated with them?

f.What survey methods and how many surveys are needed to adequately estimate flammulated owl occurrence in an area?

g.What is nesting success in nest boxes? Does it vary with forest stand structure or forest fragmentation patterns?

h. Do flammulated owls generally return to the same nesting territories each year?

i.How do prey densities relate to forest age, vegetation type, and silvicultural treatment? For example, do they differ between clearcuts, natural grasslands, and seed tree cuts?

j. What are the mean values and variances associated with genetic and demographic variables such as productivity, mortality, life span, population size, etc, needed to determine population viability?

k.Where do flammulated owls winter in the neotropics and what is the status of their wintering habitat?

ACKNOWLEDGEMENTS

This project was funded by the Payette National Forest and Wallowa-Whitman National Forest under the USDA Forest Service Challenge Cost Share Program and the Idaho Department of Fish and Game, Nongame and Endangered Wildlife Program. We gratefully acknowledge Craig Groves, Ralph Anderson and Floyd Gordon for initiating the study and for their support and encouragement. Frances Cassirer was instrumental in getting the study off the ground. Thanks go to Jeff Rohlman for providing logistical support and for sharing his office space with us. Housing was provided on the Council and Weiser Ranger Districts thanks to Frank Shirtcliff and Curt McChesney. Earl Baumgarten, Steve Donnelly, Norval Moritz, and Sue Stafford were helpful in locating suitable areas for the surveys. We also thank Mark Robertson, Brian Holbrook, John O'Neill, Matt McCoy, Dave Felley, and Lia Speigel for volunteering on the surveys. We thank Steve Nadeau for providing us with logistical support and a field assistant in the West Mountains. Michael Mancuso helped us obtain equipment and maps. Access into the Dukes Creek drainage was generously provided by Mike Hillman across his ranch property. Craig Groves reviewed a draft of this report and provided valuable direction throughout the project.

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APPENDIX A

Nest box placement design

APPENDIX A

Summary of flammulated owl nest box placement design, Hells Canyon National Recreation Area, Idaho; 1991.

Ninety-seven nest boxes were placed six to nine meters above the ground on live Ponderosa pine or Douglas-fir trees with box entrance aspects of 45 to 135 degrees. All boxes were placed in forest stands dominated or codominated by mature Ponderosa pine or Douglas-fir. Boxes were placed in eight different stand conditions (see the following page for details) to enable future studies of nesting success in relationship to distances to edge, type of edge, and amount of mature to old forest in the surrounding area. Half the boxes were placed in areas with "much" mature to old growth Ponderosa pine and Douglas-fir in the surrounding area (approximately 1-km radius), and half were placed in areas with "little" mature to old growth Ponderosa pine and Douglas-fir. Half the boxes were placed in forest stands where the nearest opening was a natural grassland, and half were placed in forest stands where the nearest opening was a clearcut. Half of the boxes were placed less than 100 meters from an edge, and half the boxes were placed more than 100 meters interior to the stand from a forest edge.

We do not recommend comparing use or nonuse of these boxes to these stand categories as flammulated owl nest site selection may be influenced by the presence of other owls (Reynolds and Linkhart 1987b). Additionally, it was impossible to standardize stand characteristics such as canopy closure or tree density.

Studies relating nesting success to these stand categories should involve a multivariate analysis of other habitat characteristics as well. This design simply allows a range of forest fragmentation characteristics between boxes. Maps and directions to individual box locations are available from R. Anderson, Wallowa Whitman National Forest, Enterprise, OR. Nest box placement categories and individual boxes in each category are as follows:

I. Much mature to old growth Ponderosa pine and Douglas-fir forest in surrounding area, nearest forest opening natural:
- A. Sawpit Saddle
  - 1. Interior boxes: 65,63,72,70,69,68
  - 2. Edge boxes: 51,66,64,62,71,61
- B. Low Saddle
  - 1. Interior boxes: 90,89,97,93,94,95,96
  - 2. Edge boxes: 85,86,87,88,91,92

II. Much mature to old growth Ponderosa pine and Douglas-fir forest in surrounding area, nearest forest opening a clearcut:
- A. Camel Ridge/ Valley Creek:
  - 1. Interior boxes: 49,50,51,52,53,56
  - 2. Edge boxes: 54,55,57,58,59,60
- B. Sawpit Saddle
  - 1. Interior boxes: 83,73,84,39,81,82
  - 2. Edge boxes: 74,75,77,78,79,80

III. Little mature to old growth Ponderosa pine and Douglas-fir in area, nearest forest opening natural:
- A. Dixon Cow Camp and Hiltsely Creek
  - 1. Interior boxes: 41,42,43,46,47,48
  - 2. Edge boxes: 4,5,6,40,44,45
- B. Kirkwood Creek Azimuth
  - 1. Interior boxes: 8,10,12,14,16,23
  - 2. Edge boxes: 7,9,11,13,15,22

IV. Little mature to old growth Ponderosa pine and Douglas-fir in surrounding area, nearest forest opening a clearcut:
- A. Kirkwood Corral and China Mill
  - 1. Interior boxes: 18,20,24,26,36,38
  - 2. Edge boxes: 1,2,3,17,19,21,25,37
- B. Dixon Corral
  - 1. Interior boxes: 29,31,33,35
  - 2. Edge boxes: 28,30,32,34

APPENDIX B

Variables measured on 0.04-ha plots

Appendix B. Measurements taken on five 0.04-ha subplots for each 3.1-ha plot centered on estimated flammulated owl locations.

Elevation: in meters from estimated location using USGS topographic maps.

Topographic position: ridgeline, upperslope, midslope, lowerslope, valley bottom

Aspect:in degrees

Dominant tree cover: tree species visually estimated to dominate cover; indicated both species if codominant.

Dominant understory vegetation: species visually estimated to dominate cover

Number of canopy layers:

Silvicultural treatment: none, partial cut (few trees removed, often old), partial cut (many trees removed, such as shelterwood or seed tree), thin, or clearcut

Stand age: immature (trees not cone bearing), immature/mature (mix of immature and mature trees), mature (trees cone bearing, but not yet "old"), old (multiple canopy layers, large snags abundant, and trees with dbh generally greater then 64 cm).

Percent canopy cover: using a densiometer

Percent ground cover: % of 20 points spaced along two 22.6 meter line transects.

Percent shrub cover: % of 20 points spaced along two 22.6 meter line transects.

Distance to the nearest snag with cavity: distance in meters to the nearest snag with a flicker or larger sized cavity.

APPENDIX C

Strata codes and definitions

Appendix C. Strata classification codes and definitions used in anlaysis of 50.3 ha plots centered on flammulated owl locations on Payette National Forest, 1991. The 1987 strata were planimetered on orthophotos; the 1990 strata were planimetered on aerial photos.

Strata Name	Strata Codes 1987	Strata Codes 1990	Definition
Non-forest	60	60,61	Canopy Closure <10%
Clearcut	20	20	Seedlings not visible on photo
Open woodland	40	41	Noncommercial forest: low canopy closure; commercially innaccessable; or regeneration difficult.
Partial Cut (light)	21	21	Canopy Closure <50%
Partial Cut (heavy)	22	22	Canopy Closure >50%
Immature	30,31,32	31,32	Poles, saplings visible on photos; trees generally < 50 years[1]
Mature	26,27,28, 33,34,35	34,35	Trees generally 50 to 100 years.[1]
Old	23,24,25	23,24,25	Trees generally > 120 years.[1]
Other	98,99,private	98,99,private	Water, unclassifiedlands

[1] Ages were based on stand exam verification of aerial photo interpretation.

APPENDIX D

Other owls detected

Appendix D. Other owls detected during flammulated owl surveys, Payette National Forest and Hells Canyon National Recreation Area, 22 May through 12 July, 1991.

Region Transect name	Date (m-d)	Species	UTMN	UTME	TRS
HELLS CANYON NATIONAL RECREATION AREA					
Non-wilderness					
Big Canyon Saddle	6-23	Short-eared	5059100	545600	27N,1W,11,SE
Big Canyon Saddle	6-23	Great-horned	5059500	544900	27N,1W,11,SW
Hardin Mill	6-11	Great-horned, Saw whet	5048800	547000	26N,1W,13,NE
Kirkwood Azimuth	6-25	Great-horned	5047300	544200	26N,1W,22,NE
Low Saddle	6-12	Pygmy	5038600	539300	25N,1W,18,SE
Sawpit Saddle	6-24	Great-horned (2)	5041400	539300	25N,1W,8,NW
Sawpit Saddle		short-eared	5042600	539100	25N,1W,6,NE
Mothorn Saddle	6-23	Short-eared	5059100	545500	27N,1W,11,SE
Wilderness					
Clarks Ridge	7-9	Barred	5035000	541100	25N,1W,33,NW
Clarks Ridge	7-9	Barred	5035100	541100	25N,1W,28,SW
Clarks Ridge	7-9	Great-horned	5035100	540700	25N,1W,29,SE
PAYETTE NATIONAL FOREST					
Bear Creek					
Bull Gulch[1]	5-20	Great-horned	4984700	518300	19N,4W,1,NE
Deer Creek	6-18	Great-horned	4978000	529700	19N,2W,30,NE
Degits Creek[1]	5-3	Long-eared (pair)	4985400	519500	20N,3W,31,SW
Degits Creek[1]	5-20	Great-horned	4985500	518700	20N,4W,36,SE
Huntley Gulch	6-20	Great-horned	4989000	525200	20N,3W,22,SE
Lick Creek[1]	6-19	Great-horned	4981700	526000	19N,3W,14,NW
Summit Gulch[1]	5-1	Great gray	4987400	524200	20N,3W,27,SW
Summit Gulch	6-20	Great-horned	4986300	524600	20N,3W,33,NE
Windy Ridge[1]	4-28	Great-horned	4986200	516700	20N,4W,35,NE
Windy Ridge[1]	5-26	Long-eared	4986300	516400	20N,4W,35,NW
Windy Ridge[1]	5-26	Great-horned (fledgling)	4986000	516700	20N,4W,35,NW

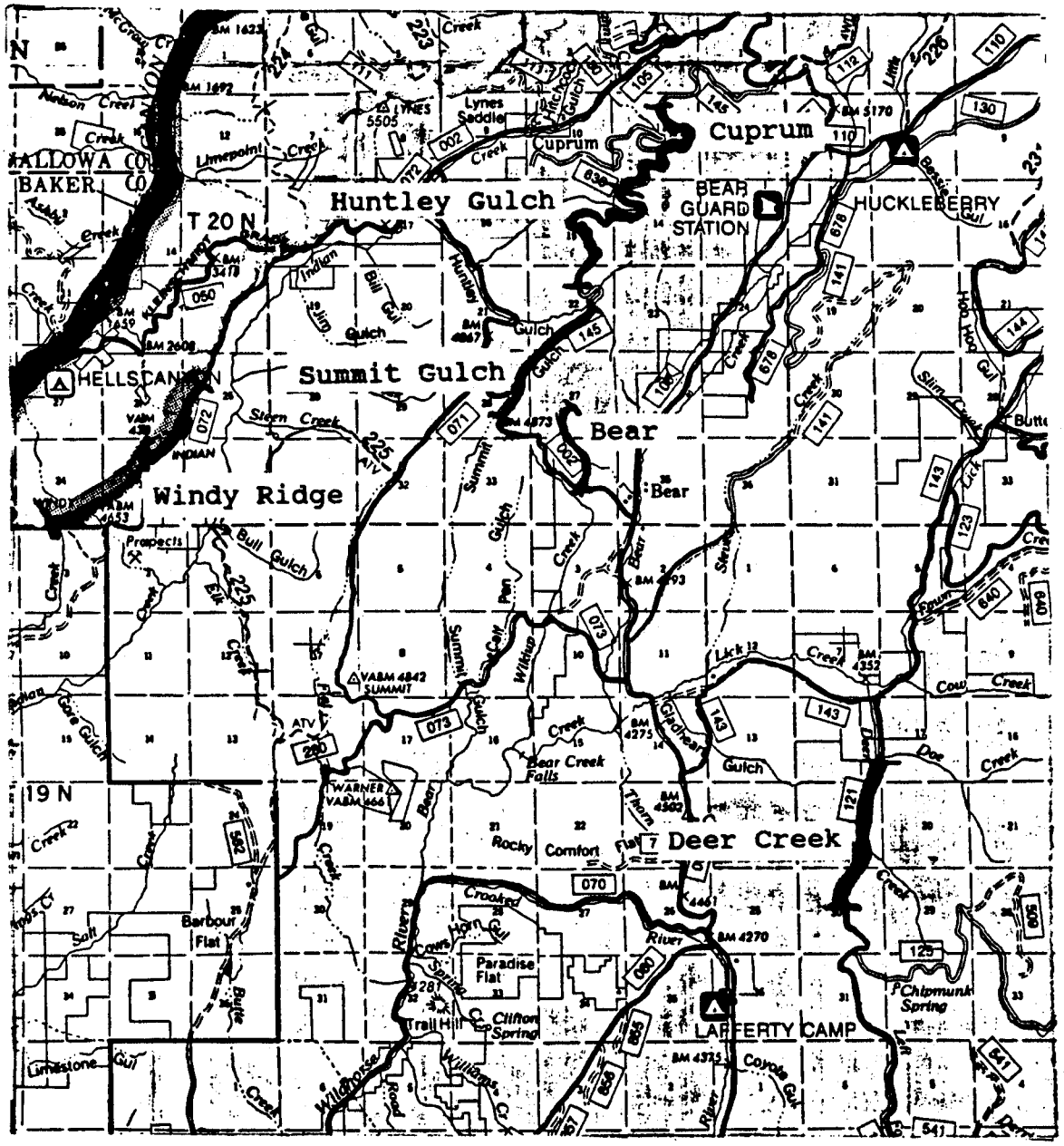
Appendix D. (cont.)Other owls detected during flammulated owl surveys, Payette National Forest and Hells Canyon National Recreation Area, 22 May through 12 July, 1991.

Region Transect name	Date (m-d)	Species	UTMN	UTME	TRS
Cuddy Mountains					
Seid Creek	6-29	Great-horned (2)	4952000	514800	16N,4W,15,NW
Crooked River	6-22	Great-horned (2)	4969700	526300	18N,3W,23,SE
Dukes Creek	8-15	Pygmy	4961400	511700	17N,4W,17,SW
Skunk Cabbage Flat[1]	6-19	Great-horned (2)			16N,2W,7,SE
Hitt Mountains					
Hitt Creek[1]	5-28	Great-horned	4933400	506900	14N,5W,14,NW
Mann Creek	5-27	Long-eared	4933300	504900	14N,5W,16,NE
Mill Creek[1]	7-16	Great-horned			16N,4W,31,SE
West Mountains					
Boulder Creek	6-27	Great-horned	494600	556700	16N,1E,36,SW

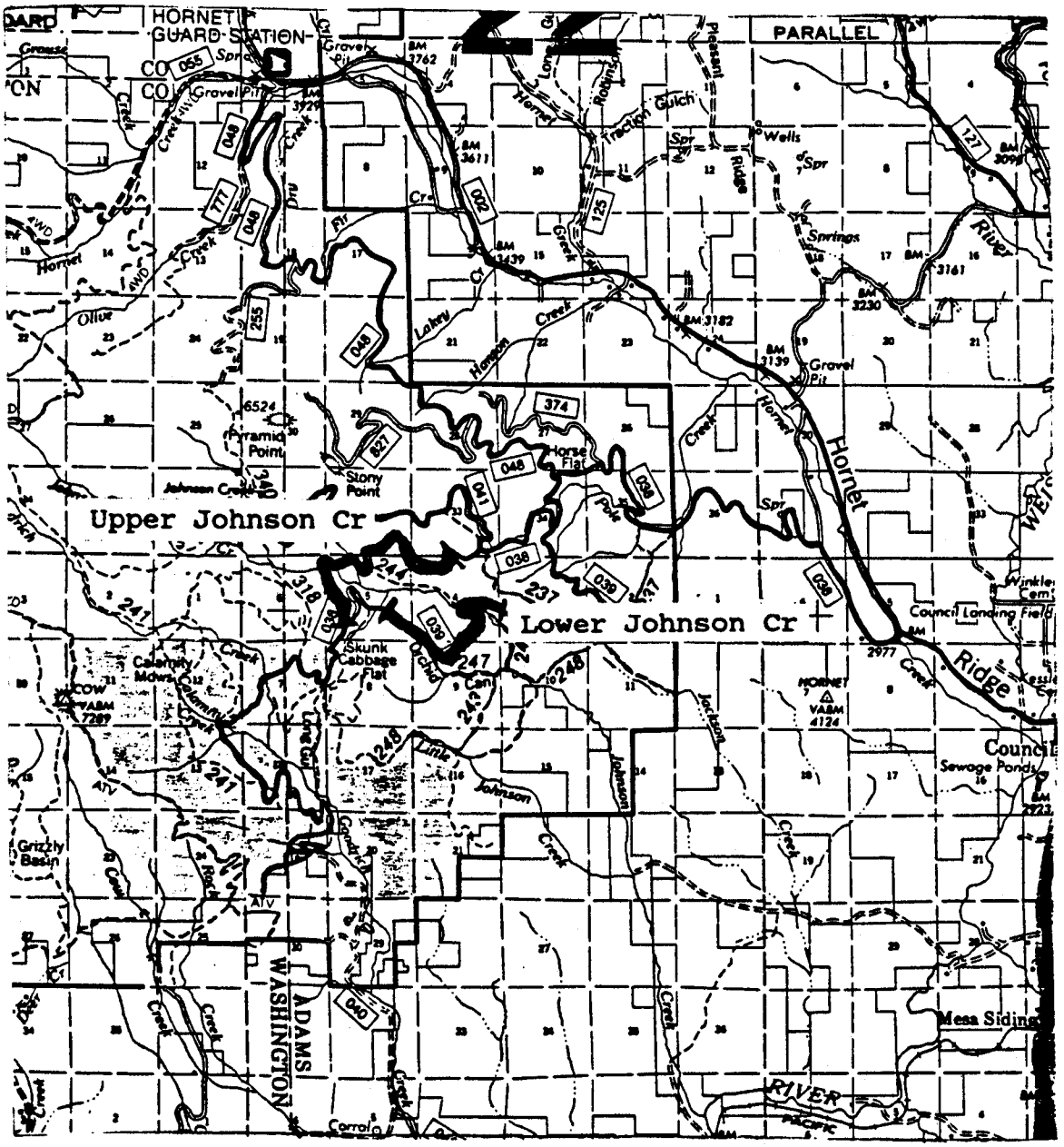
[1] Observations not made during nocturnal surveys

APPENDIX E

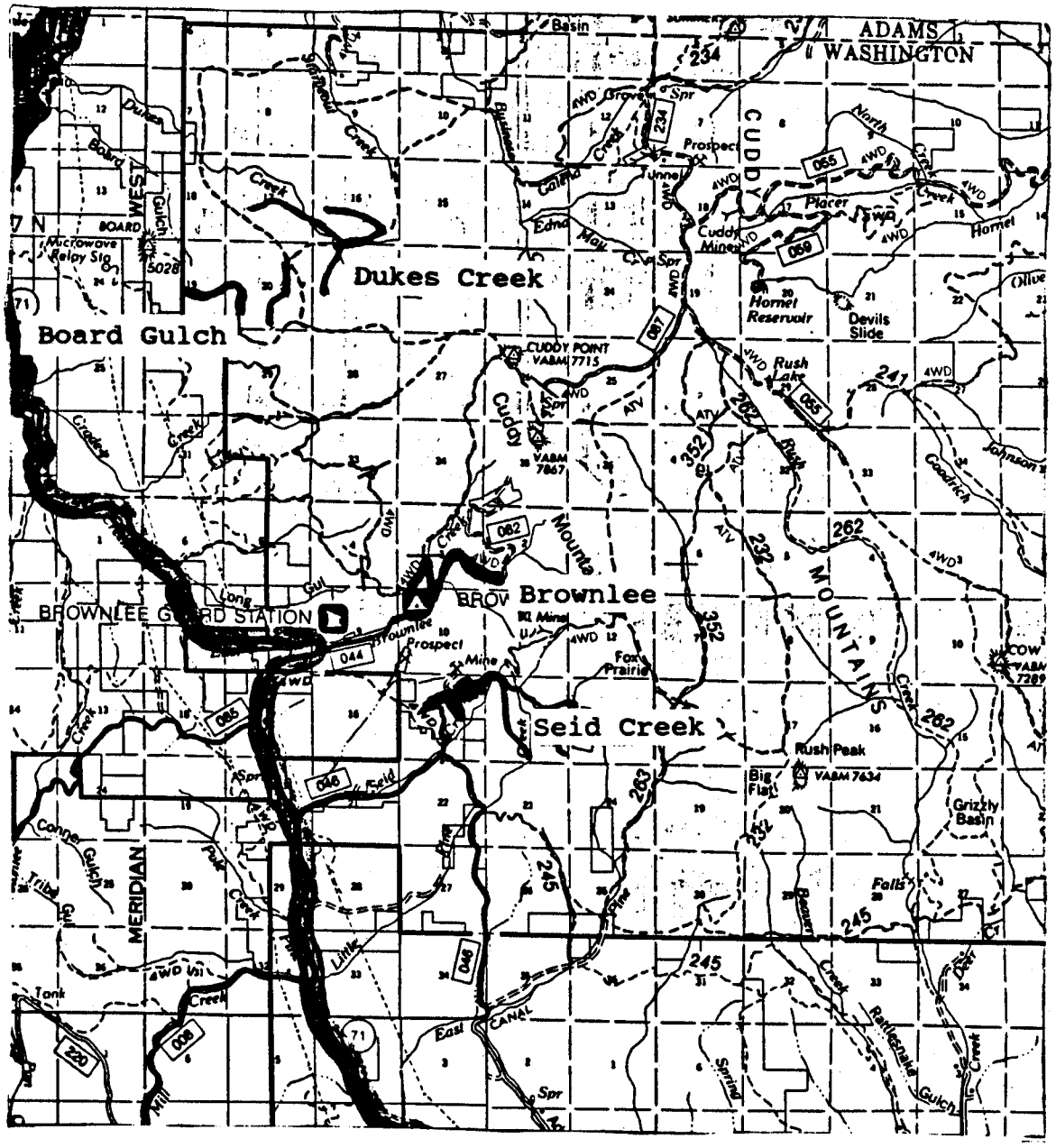
Location of flammulated owl survey routes



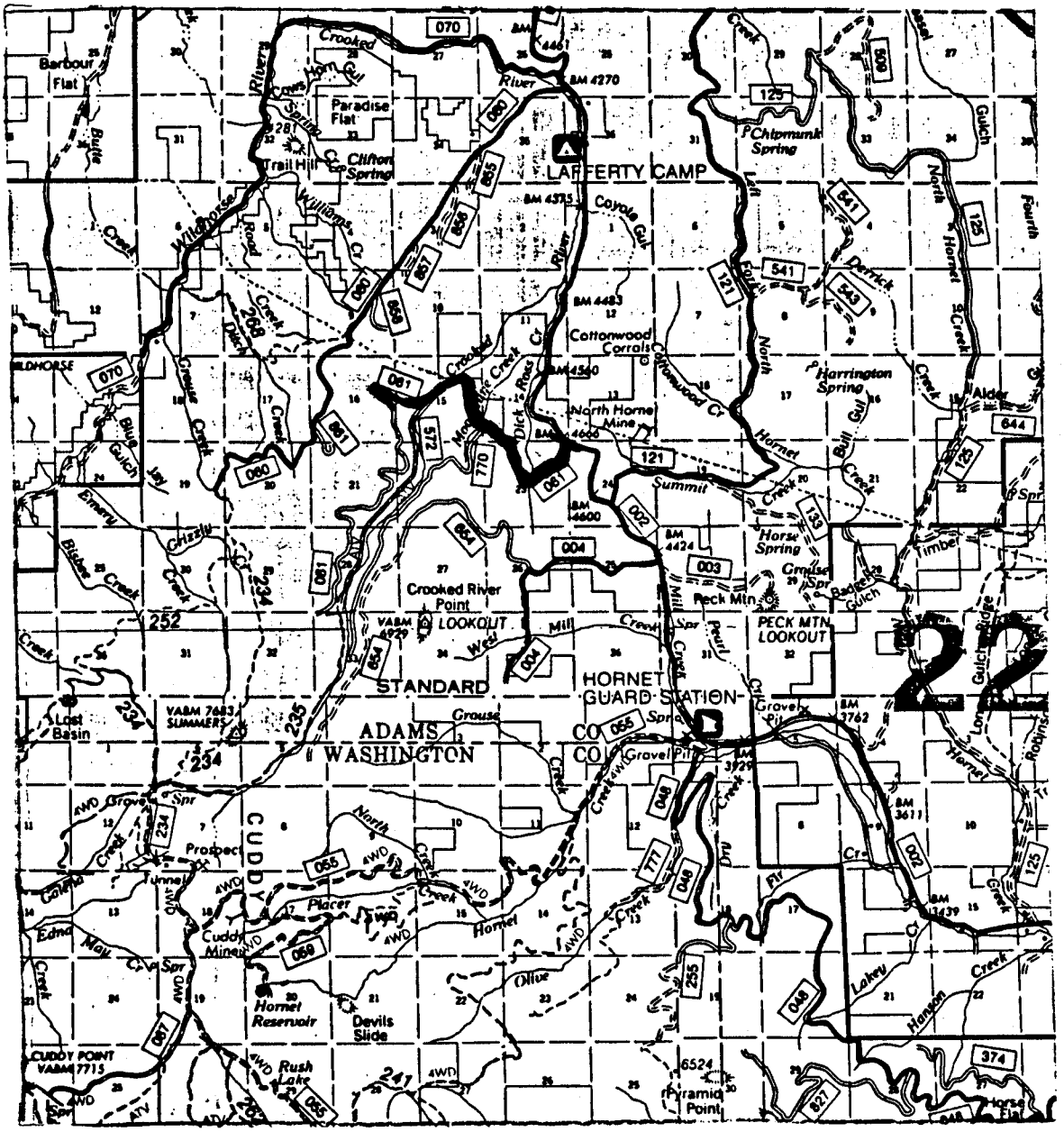
Map 1. Portion of 1990/91 Payette National Forest Travel Map showing Bear, Cuprum, Deer Creek, Huntley Gulch, Summit Gulch, and Windy Ridge flammulated owl survey routes conducted in the Bear Creek region; 1991.



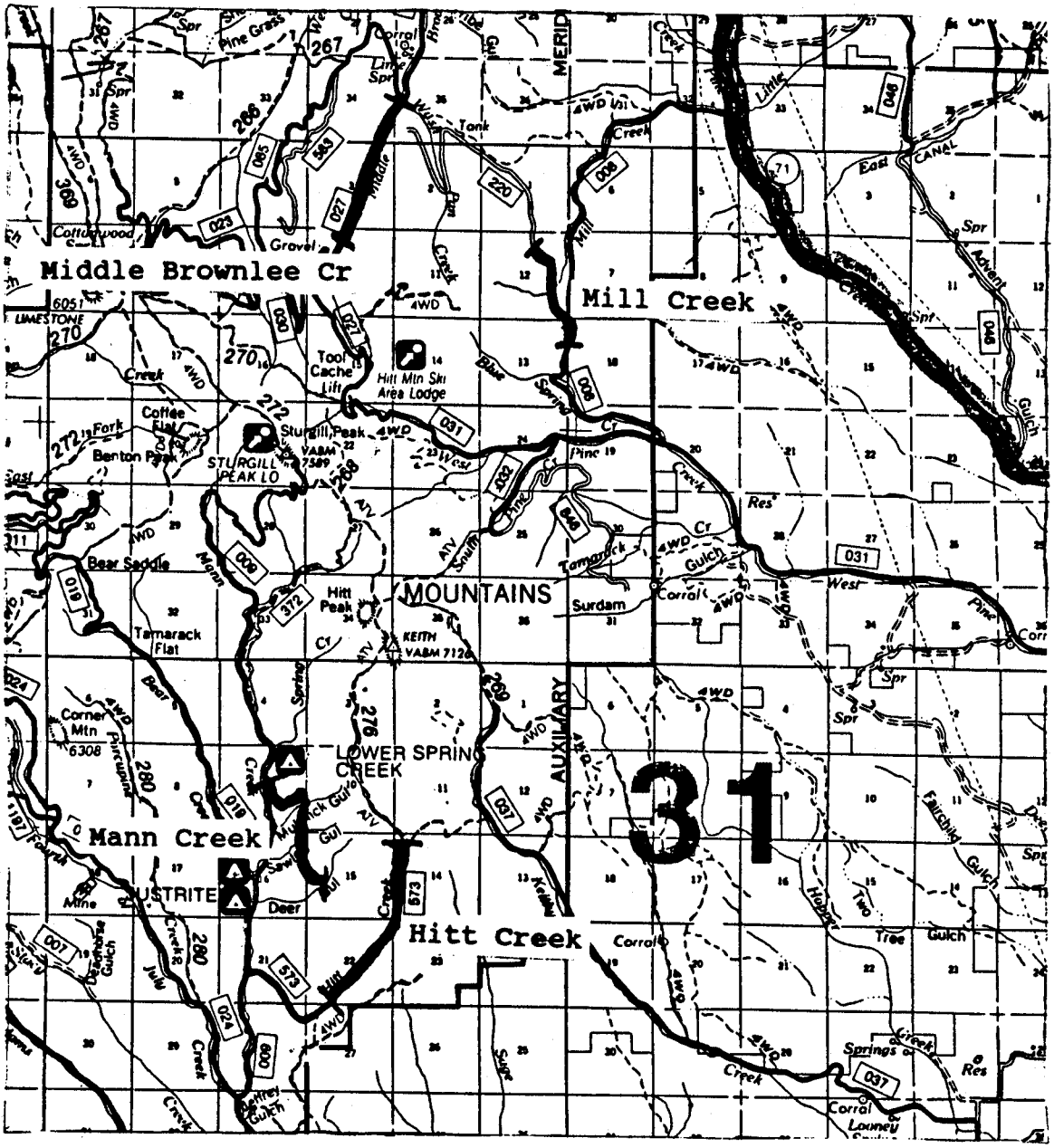
Map 2. Portion of 1990/91 Payette National Forest Travel Map showing Lower Johnson Creek and Upper Johnson Creek flammulated owl survey routes conducted in the Cuddy Mountains region; 1991.



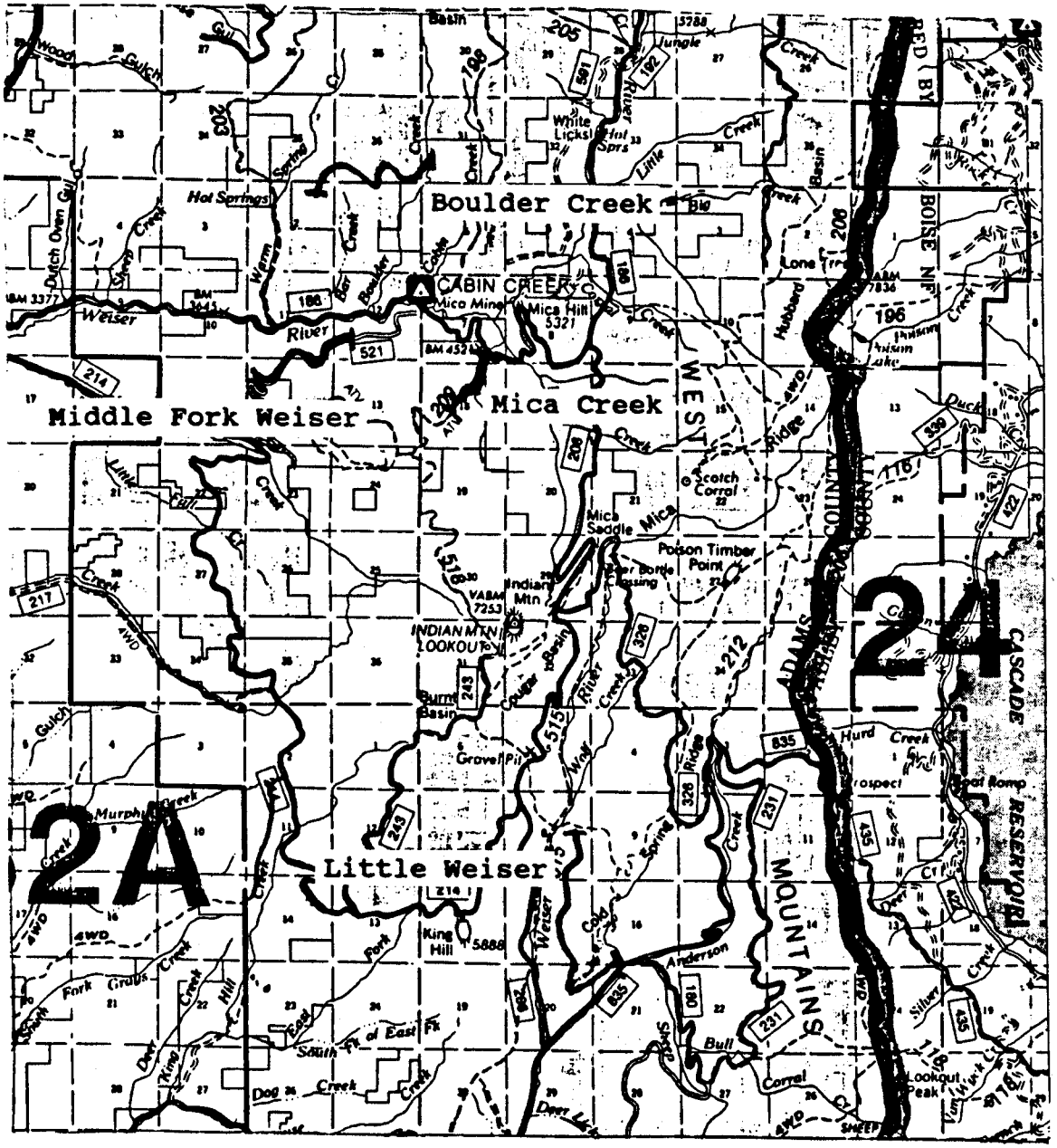
Map 3. Portion of 1990/91 Payette National Forest Travel Map showing Board Gulch, Dukes Creek, Brownlee, and Seid Creek flammulated owl survey routes conducted in the Cuddy Mountains region; 1991.



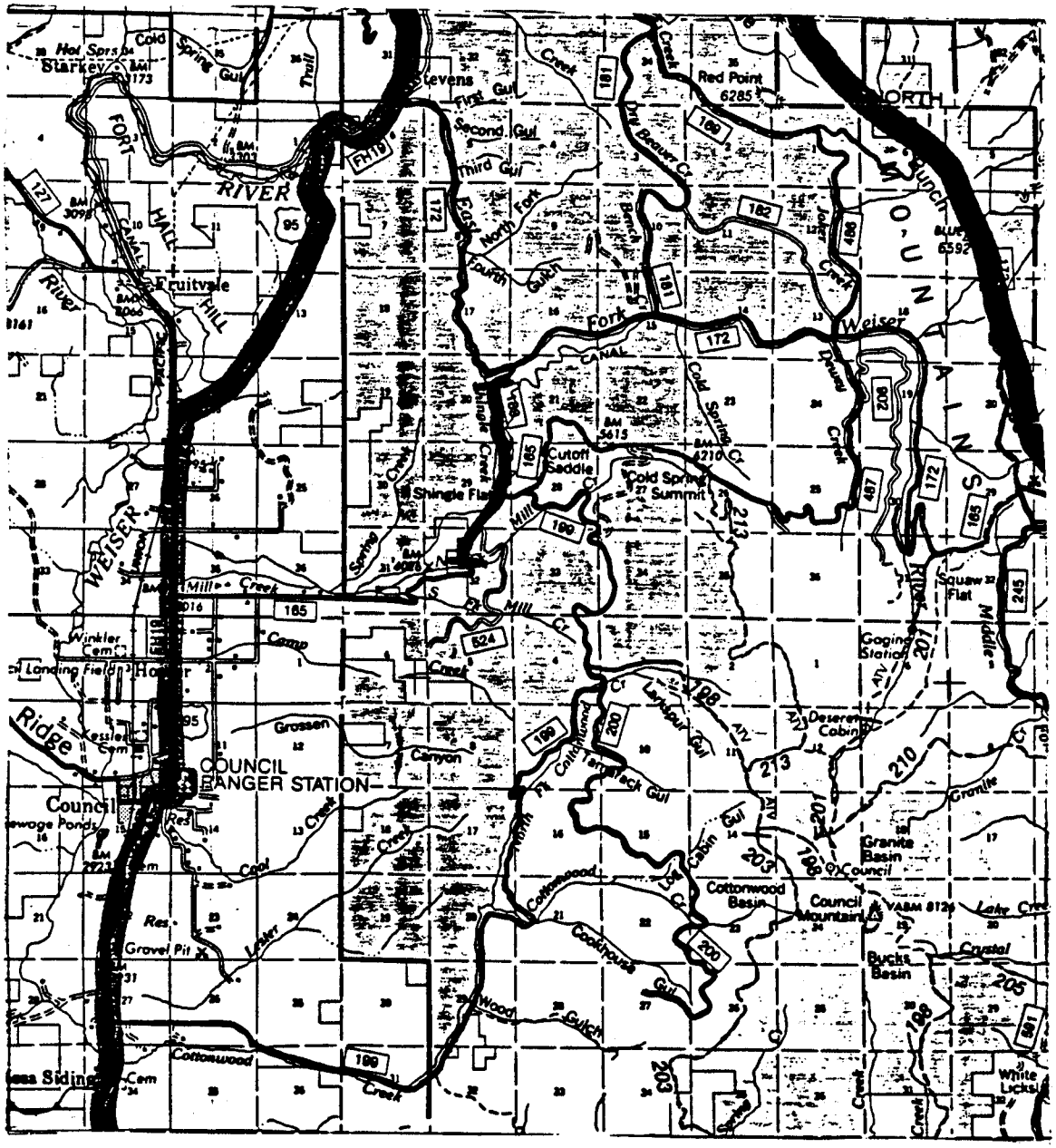
Map 4. Portion of 1990/91 Payette National Forest Travel Map showing the Crooked River flammulated owl survey route conducted in the Cuddy Mountains region; 1991.



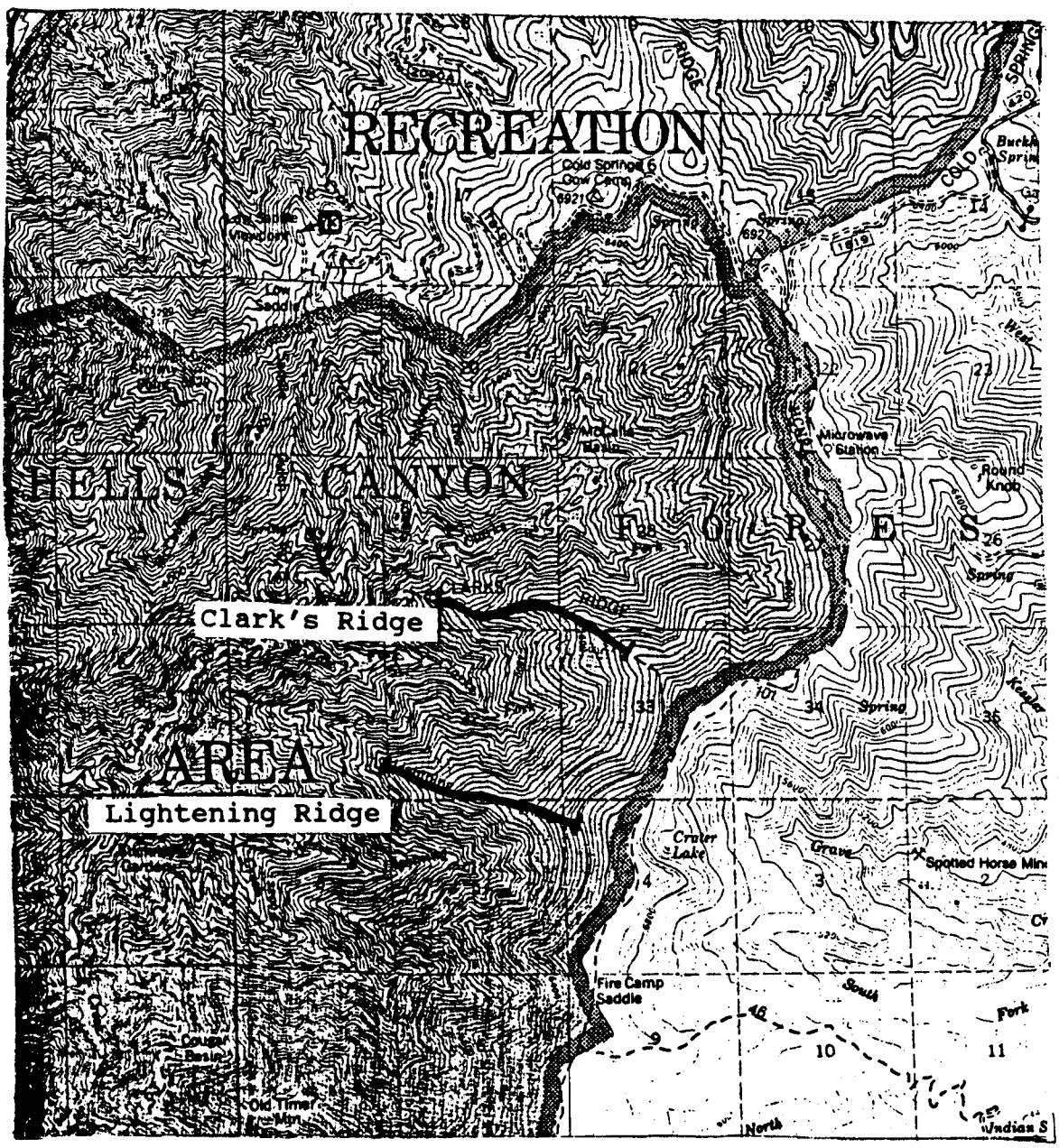
Map 5. Portion of 1990/91 Payette National Forest Travel Map showing Middle Fork Brownlee, Mill Creek, Mann Creek, and Hitt Creek flammulated owl survey routes conducted in the Hitt Mountains region; 1991.



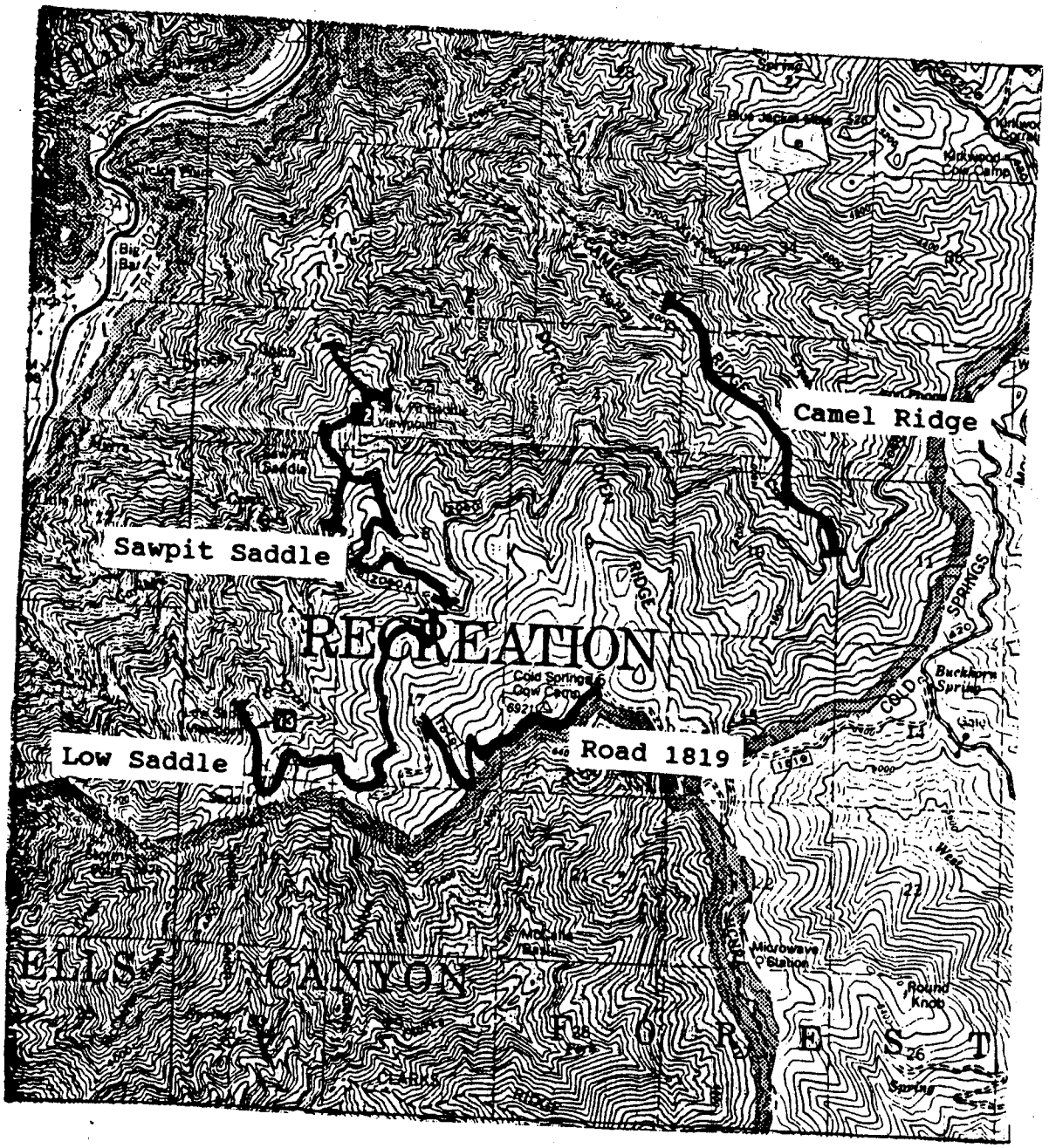
Map 6. Portion of 1990/91 Payette National Forest Travel Map showing Boulder Creek, Middle Fork Weiser, Mica Creek, and Little Weiser flammulated owl survey routes conducted in the West Mountains region; 1991.



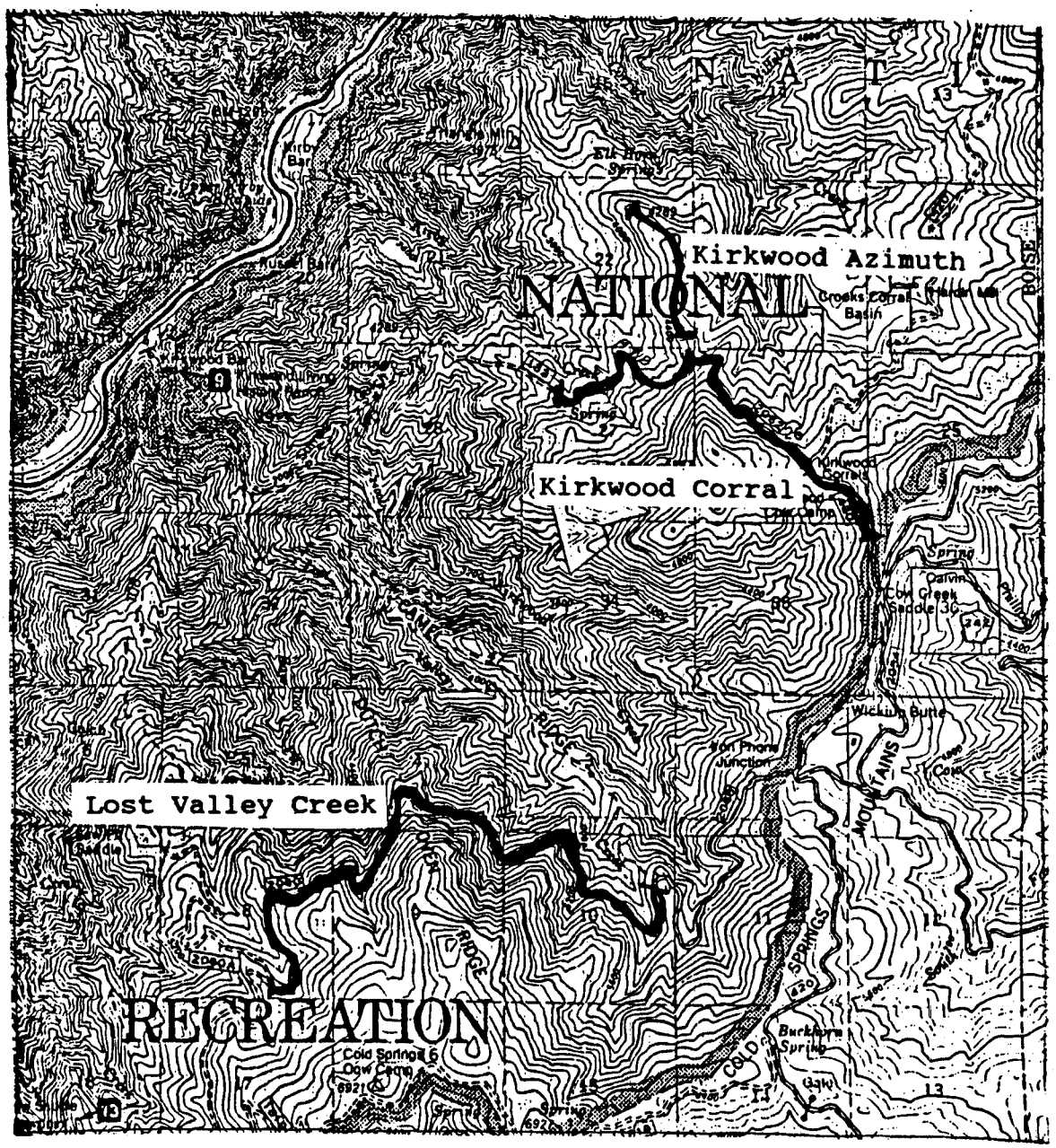
Map 7. Portion of 1990/91 Payette National Forest Travel Map showing the Shingle Flat flammulated owl survey route conducted in the West Mountains region; 1991.



Map 8. Portion of 1990/91 Hells Canyon National Recreation Area Map showing the Lightening Ridge and Clarks Ridge flammulated owl survey routes conducted in the wilderness region; 1991.

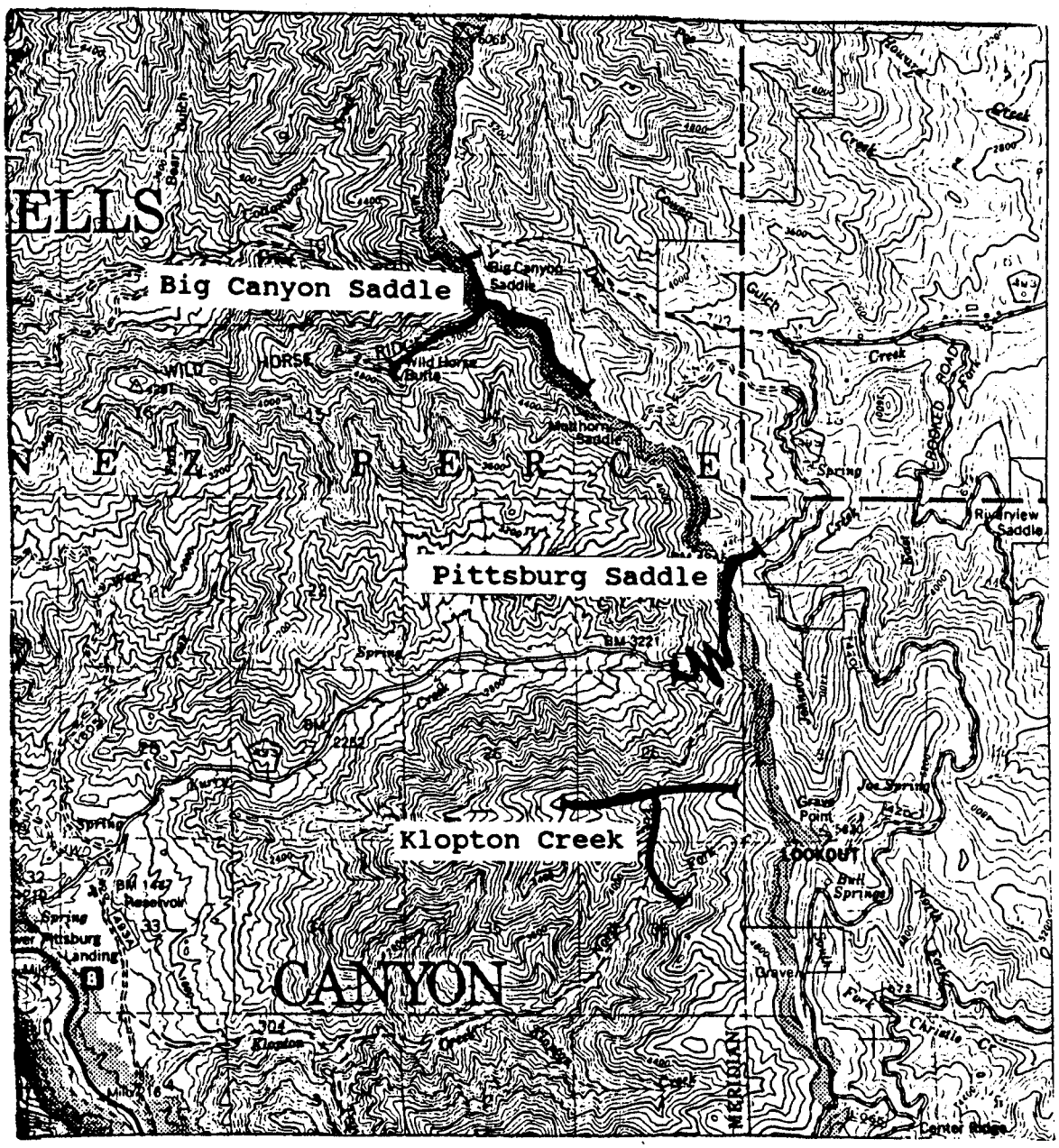


Map 9. Portion of 1990/91 Hells Canyon National Recreation Area Map showing the Low Saddle, Road 1819, Sawpit Saddle, and Camel Ridge flammulated owl survey routes conducted in the non-wilderness region; 1991.



Map 10. Portion of 1990/91 Hells Canyon National Recreation Area Map showing the Lost Valley Creek, Kirkwood Corral, and Kirkwood Azimuth flammulated owl survey routes conducted in the non-wilderness region; 1991.

Map 11. Portion of 1990/91 Hells Canyon National Recreation Area Map showing the Hardin Mill, Table Lands, Trail Creek, and Dixon Corral flammulated owl survey routes conducted in the non-wilderness region; 1991.



Map 12. Portion of 1990/91 Hells Canyon National Recreation Area Map showing the Klopton Creek, Pittsburg Saddle, and Big Canyon Saddle flammulated owl survey routes conducted in the non-wilderness region; 1991.

Submitted by: Craig R. Groves

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

Tom Reinecker 12-18-91

Tom Reinecker, Chief
Bureau of Wildlife

Wayne Melquist 12/09/91

Wayne Melquist
State Nongame Wildlife Manager &
Endangered Species Coordinator