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E HABITAT INVENTORY IN SOUTHEASTERN MONTANA

RESEARCH CONDUCTED BY:
MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

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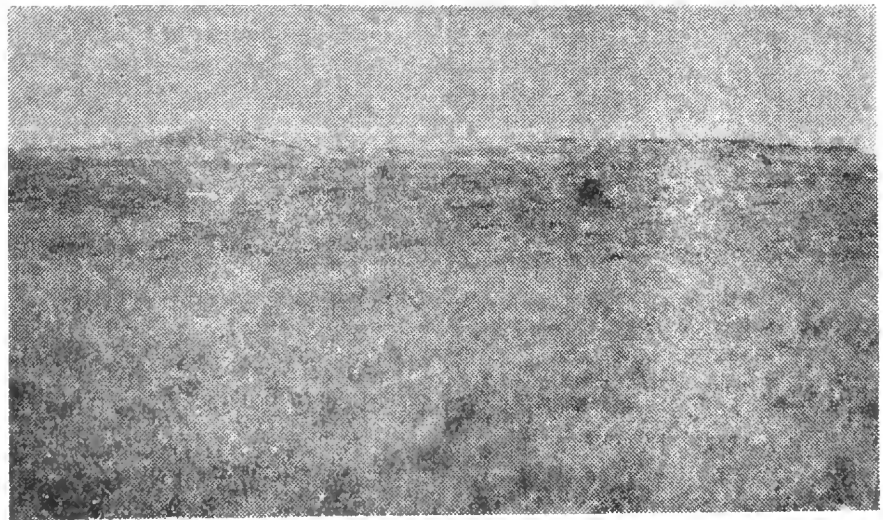
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Abstract

A wildlife inventory study on three areas of southeastern Montana (Otter Creek, Prairie Dog Creek and Hanging Woman Creek) encompassing approximately 105,200 acres was begun in April 1979. Field work was completed July 1, 1980. This report, will, among other things, be used to determine habitats unsuitable for mining according to the Secretary of the Interior's "unsuitability criteria."

Game species observed on the Otter Creek study area include mule deer, white-tailed deer, antelope, sharp-tailed grouse and ring-necked pheasants. One hundred and ten bird species, including the golden eagle, Swainson's hawk, prairie falcon, upland sandpiper, mountain bluebird and Brewer's sparrow, were observed. Twenty-nine mammals including beaver, raccoon, black-tailed prairie dog and red fox were observed on the study area. Ten species of amphibians and reptiles were observed.

The mule deer population structure in October 1979 was 8.7 percent bucks, 41.7 percent does and 49.5 percent fawns. Fawn production was extremely high at 118.6 fawns per 100 does. Antelope production, as observed in August 1979 was 64.4 fawns per 100 does. Twenty sharp-tailed grouse dancing grounds were located. Bird species composition was determined on grassland, sagebrush, ponderosa pine-juniper and riparian habitat types. The riparian type had the highest diversity, 31 species, while the sagebrush habitat type had the lowest diversity, 6 species. Prairie falcon aeries and red-tailed hawk nests were located. Small mammal trapping was conducted on 5 habitat types; grassland, sagebrush, ponderosa pine-juniper, deciduous tree riparian and marsh riparian. The deciduous tree riparian type had the highest number of captures, 63, and the sagebrush type had the lowest, 2.

The Hanging Woman Creek area had mule deer, antelope, sage grouse, sharp-tailed grouse and ring-necked pheasants as resident game species. Seventy-eight bird species, including Cooper's hawk, ferruginous hawk, golden eagle and prairie falcon, were observed. Fifteen mammal species including the coyote, yellow-bellied marmot and black-tailed prairie dog were observed. Eight amphibian and reptilian species were observed.

Over 1800 mule deer observations were made during the study period. Fawn production was observed to be 92.2 fawns per 100 does in October 1979. Antelope production, as observed in July 1979, was 67.4 fawns per 100 does. Three sharp-tailed grouse dancing grounds and five sage grouse strutting grounds were documented. Bird species composition was determined on grassland and sagebrush habitat types. Numbers observed were highest on the sagebrush type while species diversity was highest on the grassland type. Small mammal trapping was conducted on the sagebrush and grassland habitat types. Fourteen prairie dog towns were located within or near the Hanging Woman study area.

Mule deer and sharp-tailed grouse were the only resident game species observed on the Prairie Dog Creek study area. Seventy bird species, including turkey vulture, great horned owl, prairie falcon, and red-tailed hawk were observed. Only 10 mammal species, including coyote and porcupine, were observed. Five species of reptiles and amphibians were observed.

Only 142 mule deer were observed during the study. None were observed during the fall season. They may have moved to the adjacent Tongue River bottoms in search of more mesic conditions. One sharp-tailed grouse dancing ground was located. Bird species composition was determined on ponderosa pine-juniper and riparian habitat types. The riparian type had the most observations and the greatest species diversity. Small mammal trapping was conducted in the ponderosa pine-juniper and deciduous tree riparian habitat types.

Recommendations made included exclusion from leasing sharp-tailed grouse and sage grouse breeding areas, mule deer and antelope wintering areas and all creekbottoms and associated "riparian habitats."

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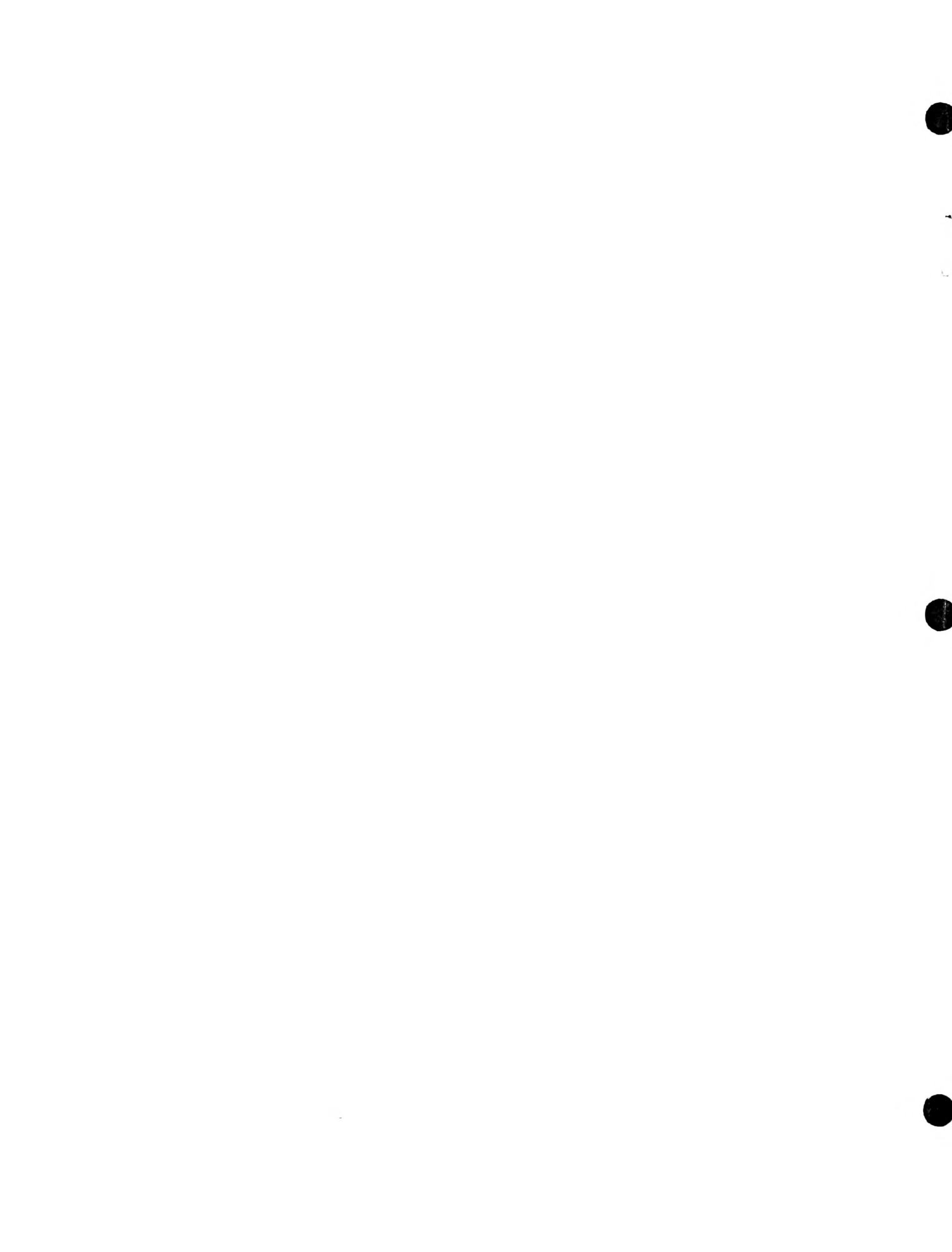
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Southeast Montana Wildlife Inventory Study - Final Report

INTRODUCTION

In response to the worldwide energy situation, the United States government has begun to shift emphasis from oil to coal as our basic energy source. Because of this shift, interest has been expanded in the massive coal deposits of eastern Montana. In order to enhance orderly, responsible development of that resource and reasonable protection for Montana's considerable wildlife resource, the Montana Department of Fish, Wildlife and Parks conducted the southeastern Montana wildlife inventory study on three potential coal lease areas; Otter Creek, Hanging Woman Creek and Prairie Dog Creek.

Information gathered in this study, contracted by the Bureau of Land Management (BLM), will be used to (1) update the BLM's land use planning system; (2) establish baseline data to assist in predicting impacts from coal development; (3) assess the reclamation potential of the habitat; and (4) determine habitats unsuitable for mining according to the Secretary's "unsuitability criteria."

This study was begun in April 1979 and field work was concluded in June 1980. The primary game species found in the three study areas are mule deer (*Odocoileus hemionus*), pronghorn antelope (*Antilocapra americana*), sharp-tailed grouse (*Pediocetes phasianellus*), sage grouse (*Centrocercus urophasianus*) and ring-necked pheasants (*Phasianus colchicus*). White-tailed deer (*Odocoileus virginianus*) are also found on the study area.

Non-game bird species of special interest or concern (Flath 1979b) found in the study areas were the Swainson's hawk, Cooper's hawk, ferruginous hawk, golden eagle, bald eagle, prairie falcon, upland sandpiper, burrowing owl, long-eared owl, mountain bluebird, clay-colored sparrow, Brewer's sparrow and field sparrow. The black-tailed prairie dog (*Cynomys ludovicianus*) was the only non-game mammal of special interest or concern (Flath 1979b) found during the study.

PROCEDURES

Game Mammals

Observations were made during low-level fixed-wing aerial flights in a super cub airplane. Aerial surveys were conducted monthly and data were compiled on a seasonal basis as follows: winter (December-February), spring (March-May), summer (June-August) and fall (September-November). Each study area was completely covered by flying a grid transect at half-mile intervals, oriented parallel to the major drainage. Flight times were planned to coincide with feeding periods so that

maximum numbers could be observed. This biased observations in favor of the more open habitat and vegetation types. Observations were also recorded during vehicular surveys and while walking through the study areas. At each observation vegetation type, activity, type of terrain, slope, exposure and time of day were recorded (Appendix Table 1). Examples of various vegetation types are shown in Appendix Figures 1-14. Pertinent population data were also recorded. Each observation was assigned a grid coordinate number to determine distribution patterns and for future reference.

Game Birds

The primary emphasis was directed towards locating sharp-tailed grouse dancing grounds and sage grouse strutting grounds. The importance of these breeding grounds to these species cannot be understated. These grounds were found by driving, listening and looking from the ground and by flying low over likely terrain features and either seeing the birds on their arenas or flushing them into the air.

Pheasant crow count routes were conducted during the spring breeding season to determine the density of cock pheasants (Kimball 1949).

Ponds, sloughs, and creeks were visited during the spring and summer months to obtain waterfowl observations.

Songbirds

Species composition, relative abundance, and breeding densities of songbirds were determined using a strip-census method suggested by Hickey and Mikol (1979) for use in coal mine baseline studies. Two 100 m wide, 2500 m long strips were established in each of the four main habitats found in the study areas (grassland, sagebrush, ponderosa pine-juniper forest, deciduous tree riparian). Songbirds were mapped along each strip five times during the breeding season (early May - early July) in 1979 and three times in 1980. Two methods were used to estimate breeding bird densities as described by Hickey and Mikol (1979). The first method uses the sum of the average number per census run of singing (territorial) males of each species. This method may underestimate the number of birds for two reasons: 1) late migrants such as western wood pewees may not have been present during the earlier census runs; 2) some birds are silent and therefore undetected during some census runs. The second method, called the summation method, uses the sum of the highest counts of singing males for each species. This method may overestimate the number of birds during periods when migrants (which often sing) are present along with residents. It may underestimate the number of birds in most cases, since it is unlikely that all the resident males along a strip will be detected in one census run.

A species list was compiled for each study area. Nomenclature follows the A.O.U. checklist (1957) and Supplements (1973,1976).

Raptors

Raptor nests were located using the methods described by Call (1978). Creekbottoms were searched in the early spring by airplane and from the ground for hawk and eagle stick nests. Suitable cliffs were examined by airplane and on foot for falcon aeries and eagle nests. Observations of all raptors except kestrels were mapped during the breeding season to aid in delineating territories. Intensive foot searches were employed when highly defensive adults were encountered. Prairie dog towns were checked during July for burrowing owl broods.

Non-game Mammals

Non-game mammals were sampled using the trapping method suggested by Flath (1979a) for use in baseline studies. Two traplines were set up on each of the four main habitats, and run for five days consecutively. One trapline in deciduous tree riparian habitat was heavily disturbed by raccoons, so an extra trapline was set up in this habitat and run for six days consecutively. One trapline was also set up in marsh riparian habitat and run for six days consecutively. Each trapline consisted of 25 stations spaced 10 m apart. Each station contained one Sherman live-trap, two mouse snap-traps, and one 5-pound coffee can pitfall trap. A mixture of peanut butter and rolled oats was used as bait. Live traps and snap traps which were sprung, but empty were subtracted from the total trap nights. Several pitfall trap-nights were also subtracted due to flooding.

STUDY AREA

Otter Creek

The Otter Creek portion of the study area (Figure 1) is located east of the Tongue River near Ashland, Montana. It lies primarily in Powder River county with about 10 percent of its approximately 59,000 surface acres in Rosebud County.

Otter Creek is the primary drainage system in the study area flowing from the southern border northeast to the Tongue River at Ashland. Double E coulee and Cook Creek provide for drainage of the northern portion of the area. Home Creek and Three-mile Creek are the major tributaries of Otter Creek in the southern portion. Several other creeks are also found in the area.

The area south of U.S. Highway 212 is dominated by Otter Creek and its associated agricultural fields. Terraces adjacent to the creek and dissected mid-slopes comprise most of the area. Near the edge of the Custer National Forest, ponderosa pine uplands and steep sandstone bluffs are the dominant features. North of the highway, ponderosa pine breaks and creekbottoms are most prominent. The plateau areas between drainages have some agricultural development.

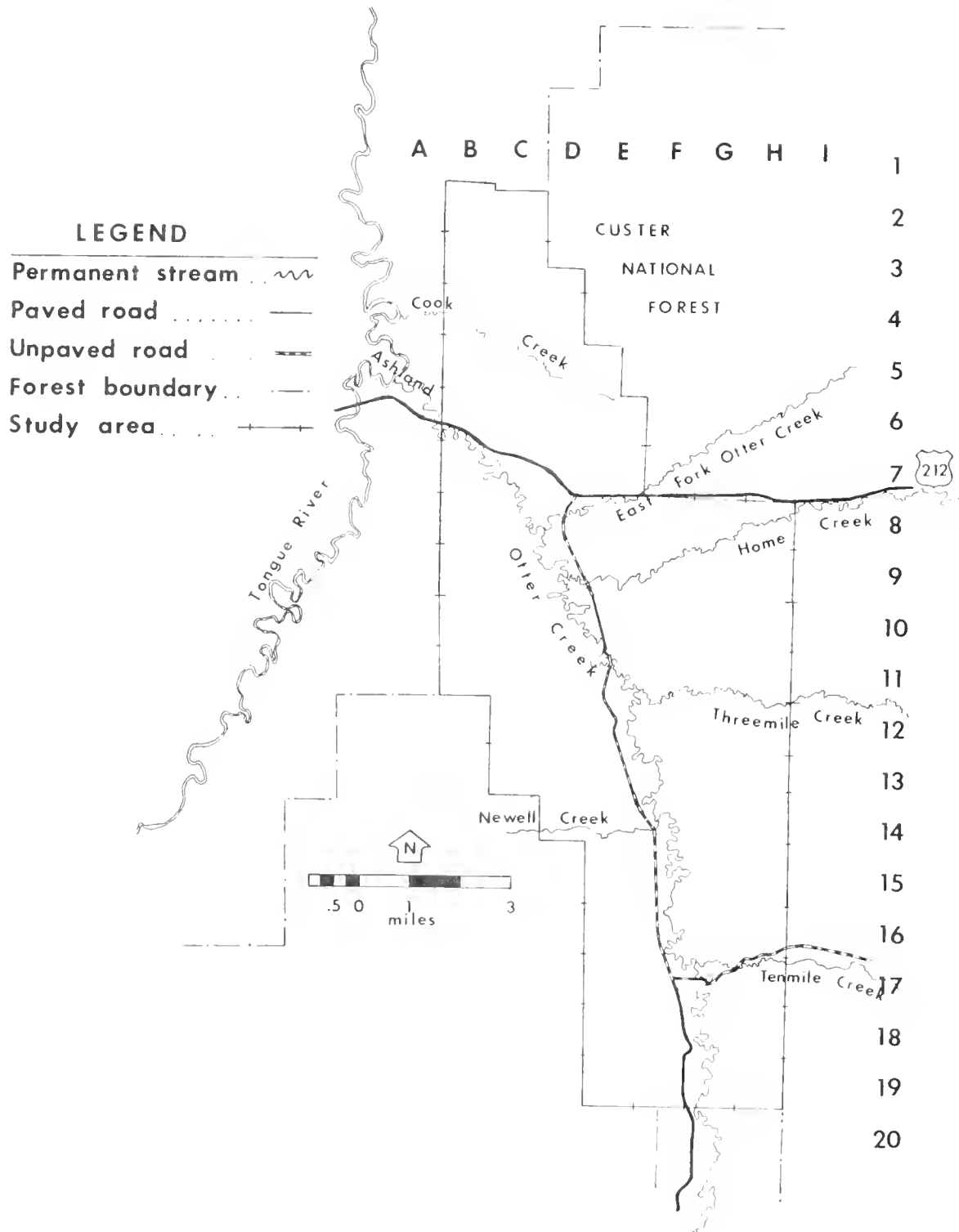


Figure 1. Otter Creek study area.

A broad vegetation map (Figure 2) shows the three primary native vegetation types as they occur within the Otter Creek study area. These types are the ponderosa pine, the sagebrush-grassland and the riparian. Each type is very diverse with several subtypes, which are not depicted. The type boundaries are only approximations and include portions of the other vegetation types. The figure is presented only to give the reader a general feeling for the vegetative makeup of the area. A more detailed vegetation map has been published by the Western Energy and Land Use Team, U.S. Fish and Wildlife Service (U.S.D.I. 1978).

Hanging Woman Creek

The Hanging Woman Creek portion of the study area (Figure 3), is located 10 miles south of Birney, Montana and 3 miles north of the Montana-Wyoming border. It is about 12 miles east of the Tongue River Reservoir. It covers nearly 35,200 acres, all in Big Horn County.

Hanging Woman Creek is the principal waterway and prominent terrain feature. It runs from the southern to the northern boundary. Horse Creek, East Fork Trail Creek, Corral Creek and First Creek are the major side drainages. Sagebrush and grassland vegetation types (Figure 4) constitute most of the ground cover in this study area. The only agricultural endeavor is hay production, primarily along Hanging Woman Creek bottoms.

Prairie Dog Creek

The Prairie Dog Creek portion of the study area (Figure 5), is located about 7 miles west of Birney. It is adjacent to and south of the Northern Cheyenne Indian Reservation. It lies approximately 11 miles northwest of the Tongue River Reservoir. Nearly 11,000 acres of Rosebud County are included in this study area.

Prairie Dog Creek is the principal drainage and flows in a southeasterly direction across the area. Bull Creek borders on the north and Canyon Creek borders the area on the south.

This area is characterized by high buttes with over 500 feet in relief from the plateau tops to the creekbottoms. Ponderosa pine is the dominant vegetation type (Figure 6) and there is practically no agricultural development.

RESULTS AND DISCUSSION

Each species or group of species is discussed separately for each of the three study areas. Distribution maps are presented for the important game species and most of the non-game species of special interest or concern.

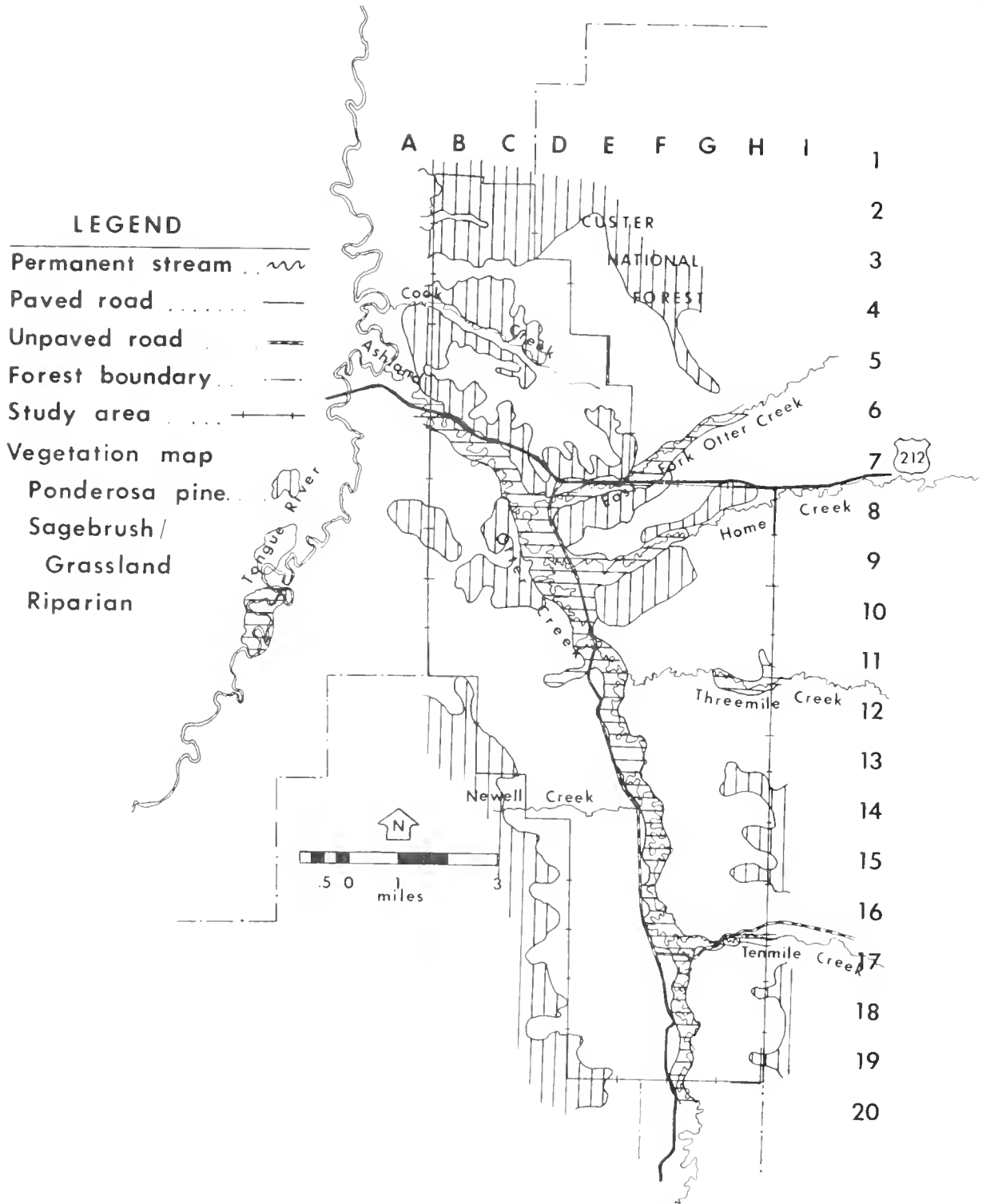


Figure 2. Otter Creek study area vegetation map.

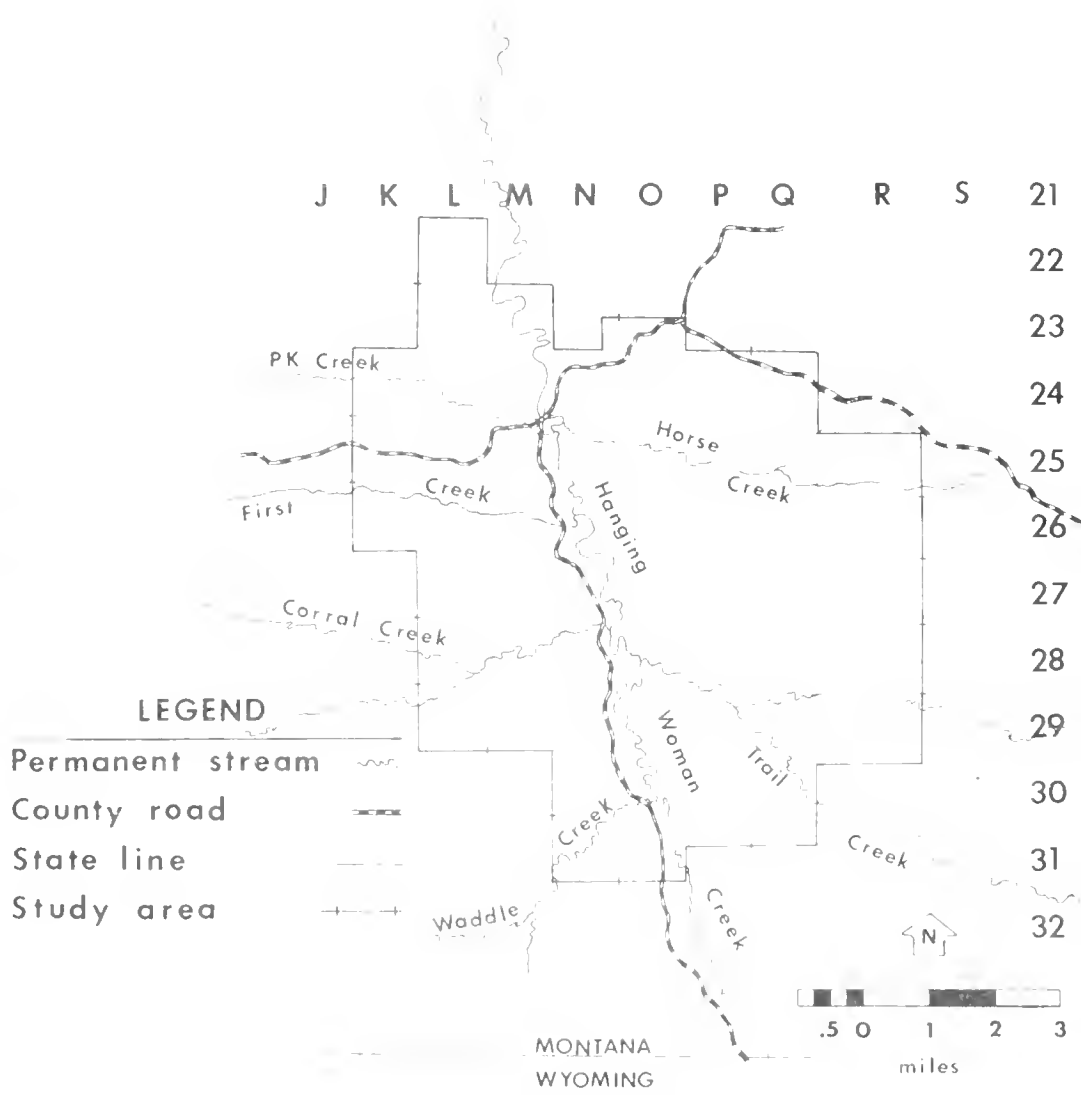


Figure 3. Hanging Woman Creek study area.

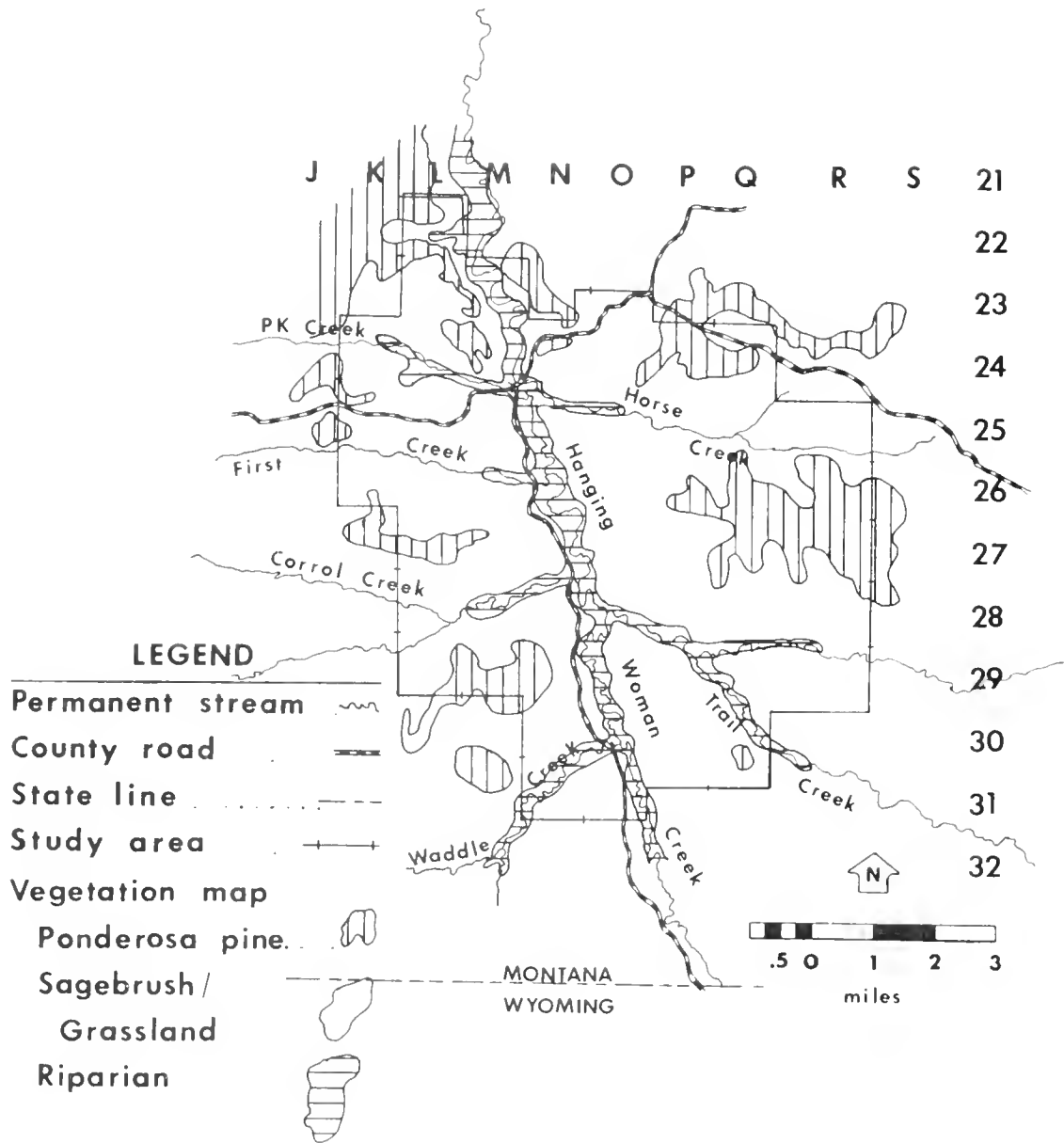


Figure 4. Hanging Woman Creek study area vegetation map.

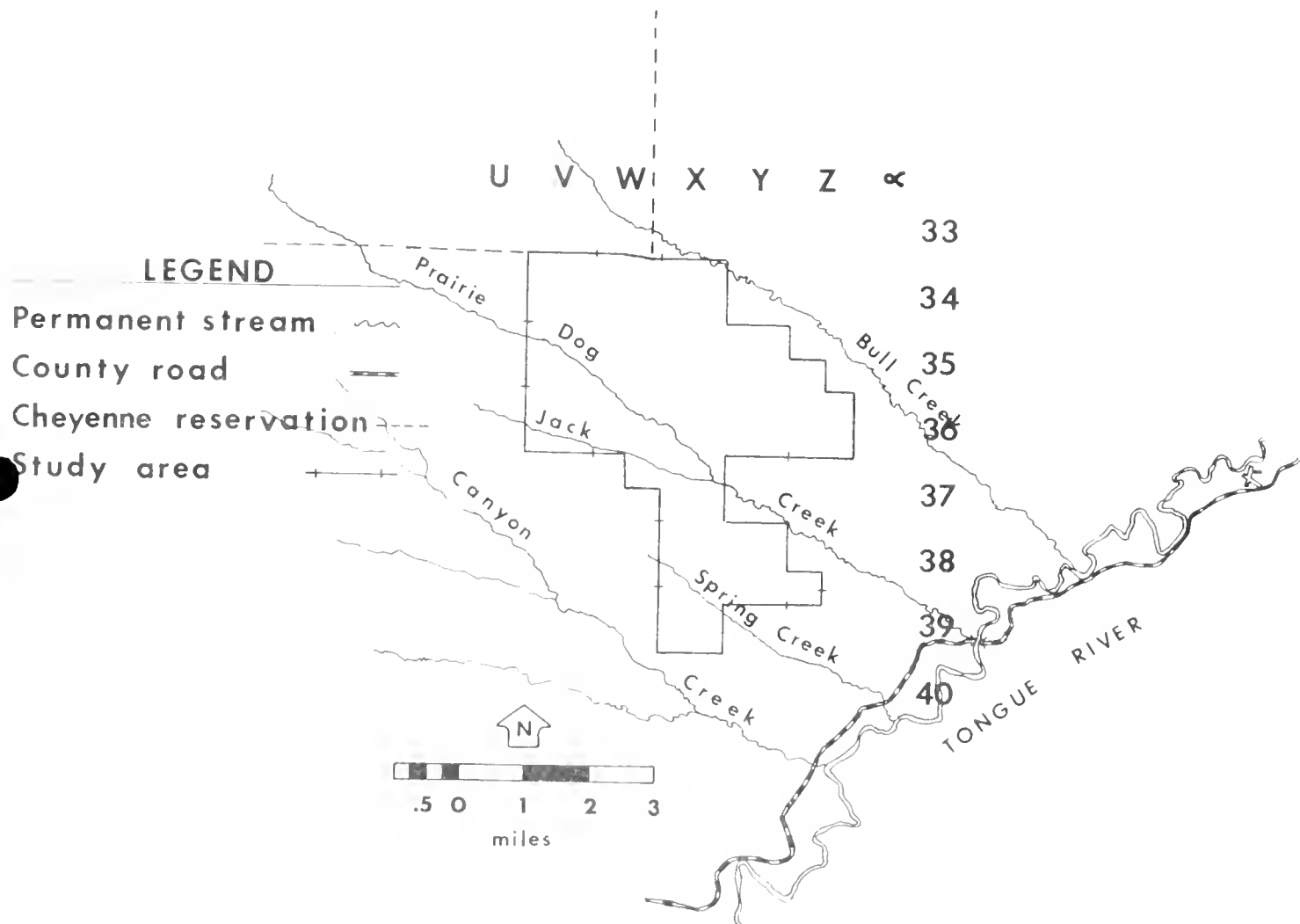


Figure 5. Prairie Dog Creek study area.

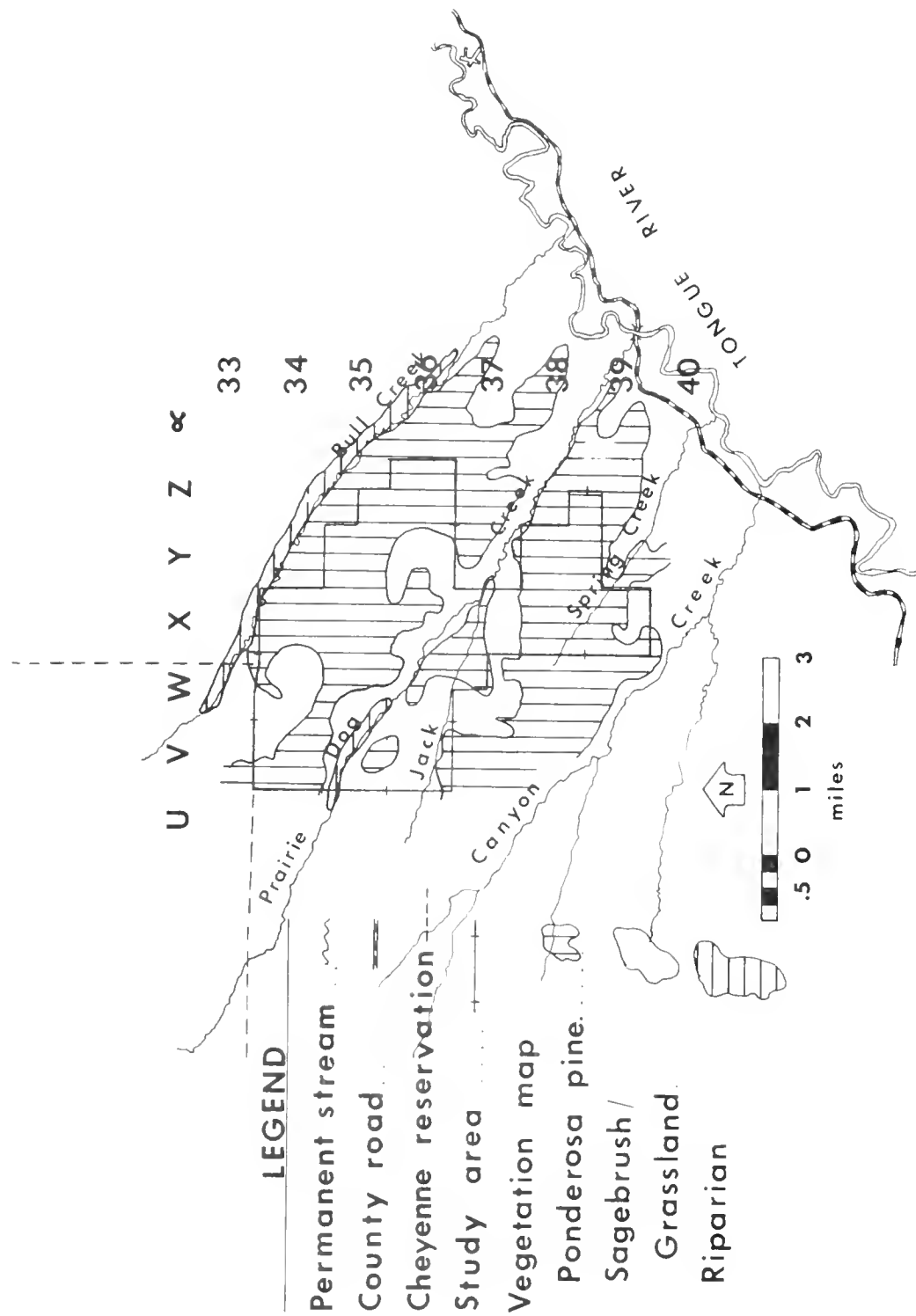


Figure 6. Prairie Dog Creek study area vegetation map.

Care should be taken in interpretation of the tables and figures presented herein as they represent only fifteen months observations. The winter period was exceptionally mild and the remainder of the months were marked by below normal precipitation in most instances.

Otter Creek

Mule Deer

Population characteristics: During the study 831 mule deer were observed in the Otter Creek study area (Table 1). Average group size ranged from 2.4 during the summer months (1979) to 6.9 during winter. April 1980 had the highest individual monthly average as mule deer remained in herds prior to spring green-up. Deer were most scattered in May and June of 1980. Dusek (1978) reported group size variation from 2.0 in summer to 5.6 in winter in the Bull Mountains near Roundup.

The indices of relative abundance (Odum 1959) have been used to determine population trends in southeastern Montana (Martin 1980). Mule deer observations per hour of aerial survey (Table 2) show the highest numbers during fall when an average 31.1 deer were observed. November was the best month for observation as 55.0 mule deer were observed per hour of flight. This coincides with the time of year that deer should be most numerous. February was the second most productive month, 40.4 deer observed per hour, reflecting the deer's need to feed more as the effects of winter are being manifested. The fewest deer were seen in May of 1980. This unusually low number, 2.8 per hour, is at least partially due to windy conditions during the flight. Low numbers per hour should be expected in spring and summer as the fawns have either not been born or are not traveling with the adults. Martin (1980) reported a range of 6.1 mule deer observations per hour in summer to 25.3 in fall in the Sarpy Creek area.

Mule deer population structure was determined during September and October (Table 3). During these months fawns are traveling with the adults and are still small enough to be easily identified. Bucks are also easily classified. While there has been some natural mortality among the young deer and some loss of adults to poaching and other factors, the population is at its yearly peak during this season. As can be seen production was extremely good this year with 118.6 fawns per 100 does observed in October prior to the hunting season. Considering the extremely hard winters the last two years, 1977-78 and 1978-79, it seems that this herd came through in excellent condition. They apparently are considerably below the carrying capacity of this range. They also appear to be on an increasing trend as Swenson (1978) reported that mule deer need only a 40 percent fawn level to remain stable. The October flight revealed nearly 50 percent of the population to be fawns.

Table 1. Average group size of mule deer in the Otter Creek, Hanging Woman Creek and Prairie Dog Creek study areas.

Year	Month	OTTER CREEK			HANGING WOMAN			PRAIRIE DOG		
		Groups Observ.	Total	\bar{x} ^{1/}	Groups Observ.	Total	\bar{x}	Groups Observ.	Total	\bar{x}
1979	April	-	-	- ^{2/}	22	191	8.7	1	12	12.0
	May	24	101	4.2	29	133	4.6	10	26	2.6
	Spring	24	101	4.2	51	324	6.4	11	38	3.5
1979	June	17	41	2.4	26	42	1.6	7	7	1.0
	July	16	35	2.2	31	56	1.8	1	2	2.0
	Aug	14	35	2.5	16	46	2.9	5	9	1.8
	Summer	47	111	2.4	73	144	2.0	13	18	1.4
1979	Sept	15	52	3.5	19	93	4.9	0 ^{3/}	0	0
	Oct.	23	103	4.5	30	134	4.5	0	0	0
	Nov.	9	33	3.7	-	-	-	-	-	-
	Fall	47	188	4.0	49	227	4.6	0	0	0
1979	Dec.	8	44	5.5	10	65	6.5	2	12	6.0
	Jan	4	24	6.0	13	231	12.2	-	-	-
1980	Feb	12	97	8.1	12	123	10.3	5	34	6.8
	Winter	24	165	6.9	41	419	10.2	7	46	6.6
1980	Mar	15	103	6.9	12	151	12.6	4	22	5.5
	April	19	124	9.1	38	280	7.4	2	11	5.5
1980	May	6	12	2.0	39	182	4.7	2	6	3.0
	Spring	40	239	6.0	89	613	6.9	8	39	4.9
1980	June	17	27	1.6	51	103	2.0	1	1	1.0
	July	-	-	-	-	-	-	-	-	-
	Aug	-	-	-	-	-	-	-	-	-
	Summer	17	27	1.6	51	103	2.0	1	1	1.0

1/ \bar{x} = average

2/ No surveys made

3/ No observations made on surveys

Table 2. Mule deer, antelope and coyote aerial observations per hour in the Otter Creek study area.

Year	Hours	Aerial Observations						Observations/Hour						Coyotes per 100:		
		Mule Deer	Ant.	Coyote	Mule Deer	Ant.	Coyote	Mule Deer	Ant.	Coyote	Mule Deer	Ant.				
1979	April	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	May	90	91	10	17.1	17.3	1.9	11.1	11.1	1.9	11.1	11.1	11.0	11.0	11.0	11.0
	Spring	90	91	10	17.1	17.3	1.9	11.1	11.1	1.9	11.1	11.1	11.0	11.0	11.0	11.0
1979	June	38	75	02/	12.1	23.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	July	26	153	1	13.0	76.5	.20	15.4	15.4	.20	15.4	15.4	2.6	2.6	2.6	2.6
	Aug	30	140	2	13.6	63.6	0.9	6.7	6.7	0.9	6.7	6.7	1.4	1.4	1.4	1.4
	Summer	94	368	6	12.8	50.1	0.8	6.4	6.4	0.8	6.4	6.4	1.6	1.6	1.6	1.6
1979	Sept	52	78	2	23.1	34.7	0.9	3.8	3.8	0.9	3.8	3.8	2.6	2.6	2.6	2.6
	Oct	103	100	1	32.2	31.3	0.3	1.0	1.0	0.3	1.0	1.0	1.0	1.0	1.0	1.0
	Nov	33	0	1	55.0	0	1.7	3.0	3.0	1.7	3.0	3.0	2.2	2.2	2.2	2.2
	Fall	188	173	4	31.1	29.4	0.7	2.1	2.1	0.7	2.1	2.1	2.2	2.2	2.2	2.2
	Dec	44	201	0	20.0	91.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1980	Jan	24	77	0	12.6	40.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Feb	97	220	4	40.4	91.7	1.7	4.1	4.1	1.7	4.1	4.1	1.8	1.8	1.8	1.8
	Winter	165	498	4	25.4	76.6	0.6	2.4	2.4	0.6	2.4	2.4	0.8	0.8	0.8	0.8
1979	March	31	179	5	12.4	71.6	2.0	16.1	16.1	2.0	16.1	16.1	2.8	2.8	2.8	2.8
	April	36	80	3	14.4	32.0	1.2	8.3	8.3	1.2	8.3	8.3	3.8	3.8	3.8	3.8
	May	9	61	0	2.8	9.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Spring	76	320	8	9.3	39.0	1.0	10.5	10.5	1.0	10.5	10.5	2.5	2.5	2.5	2.5
	June	6	51	0	4.3	36.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1980	July	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Aug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Summer	6	51	0	4.3	36.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

1/ No surveys made
2/ No observations made on surveys

Table 3. Mule deer population characteristics in the Otter Creek area in 1979.

Month	Number Classified				Fawns:100		Bucks:	Population Structure (%)		
	Total	Bucks	Does	Fawns	Does	Adults	100 Does	Bucks	Does	Fawns
September	52	5	24	23	95.8	79.3	20.8	9.6	46.2	44.2
October	103	9	43	51	118.6	98.1	20.9	8.7	41.7	49.5

Distribution: Spring distribution is shown in Figure 7. Most observations are located in a band across the center of the study area between Threemile and East Fork Otter Creeks. Several of the observations were in the 9-15 size category. More than half of the observations were in the 1-3 range. The deer are beginning to disperse over the area and break up the wintering groups.

This dispersal and reduction of group size reaches its zenith during the summer season (Figure 8). Only three observations were of groups greater than three.

Fall observations (Figure 9) show the deer beginning to group together as the number of observations in the 4-7 size category increased significantly. Also the deer were not as widespread as during the summer months. Three groups of deer appear to be forming: those north of highway 212; the central group stretching across the study area on a southwest-northeast axis centered on Home Creek; and a southern group extending from above Newell Creek to below Ten Mile Creek.

The 1979-1980 winter in contrast to the two previous winters, was very mild with little snow fall. As a result, mule deer remained quite widespread and did not gather into large concentrations (Figure 10). Nearly all observations were in the 4-8 size category. One observation of a group larger than 15 animals was made and four groups in the 9-15 range were seen. Two major wintering areas were determined: one southwest of Otter Creek north of the Custer National Forest; the other east of Otter Creek and south of Threemile Creek. The remainder of the observations were too scattered to consider. It is likely that many deer wintered in the adjacent Custer National Forest.

Vegetation type usage: A considerable difference between years is apparent in usage of vegetation types (Table 4). Ninety-three percent of the spring 1979 observations were in the ponderosa pine type while only 15 percent utilized the pine type in 1980. The weather pattern, deep snow and cold in 1978 extending into the 1979 spring which forced deer out of the creekbottoms and sagebrush/grassland types, explains the variation. During the mild 1979-80 winter mule deer were able to utilize vegetation types other than pine and only 58 percent were observed in the pine type. The extremely dry summer of 1980 forced deer to utilize the more mesic coulees and draws of the pine type.

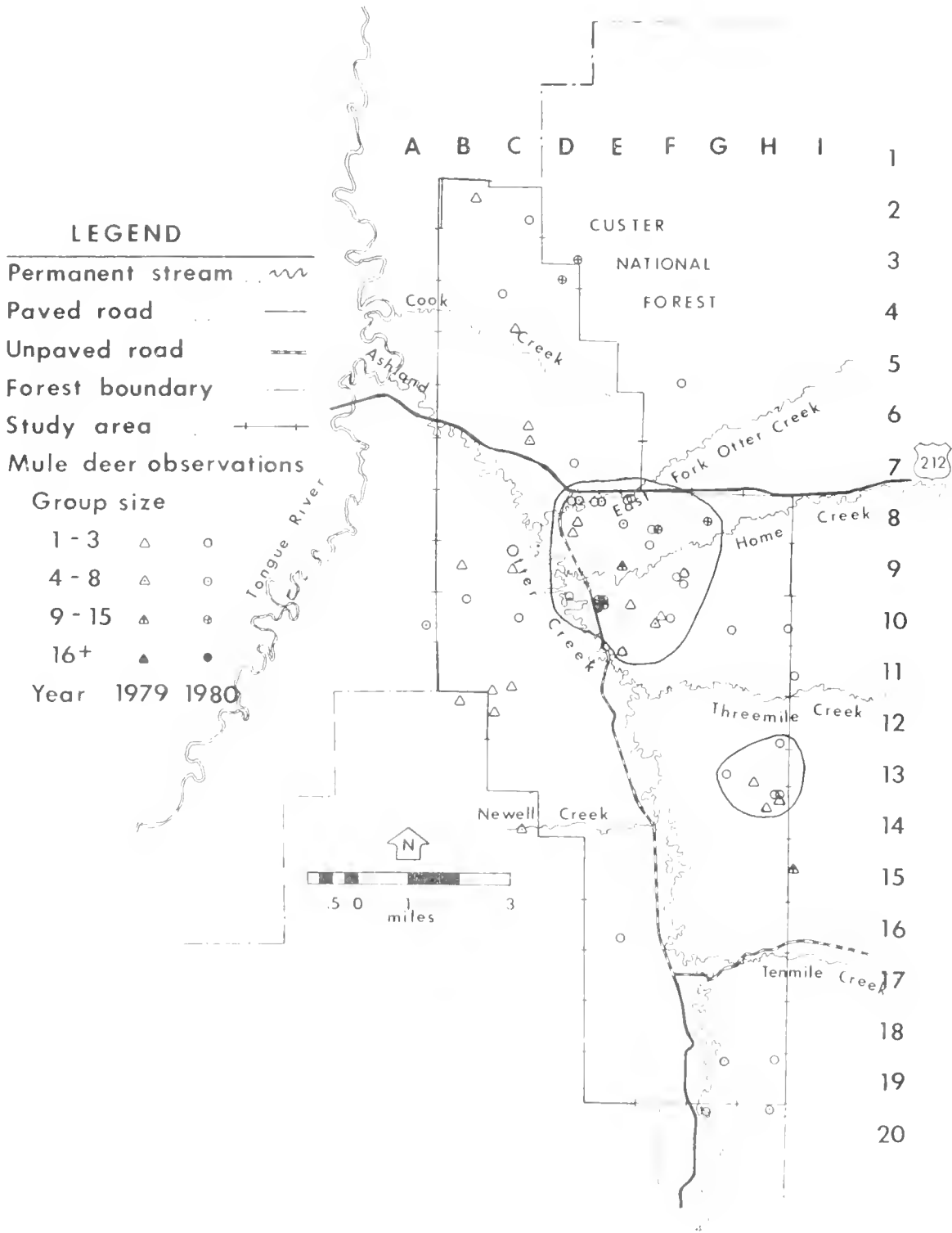


Figure 7. Spring mule deer distribution in the Otter Creek area.

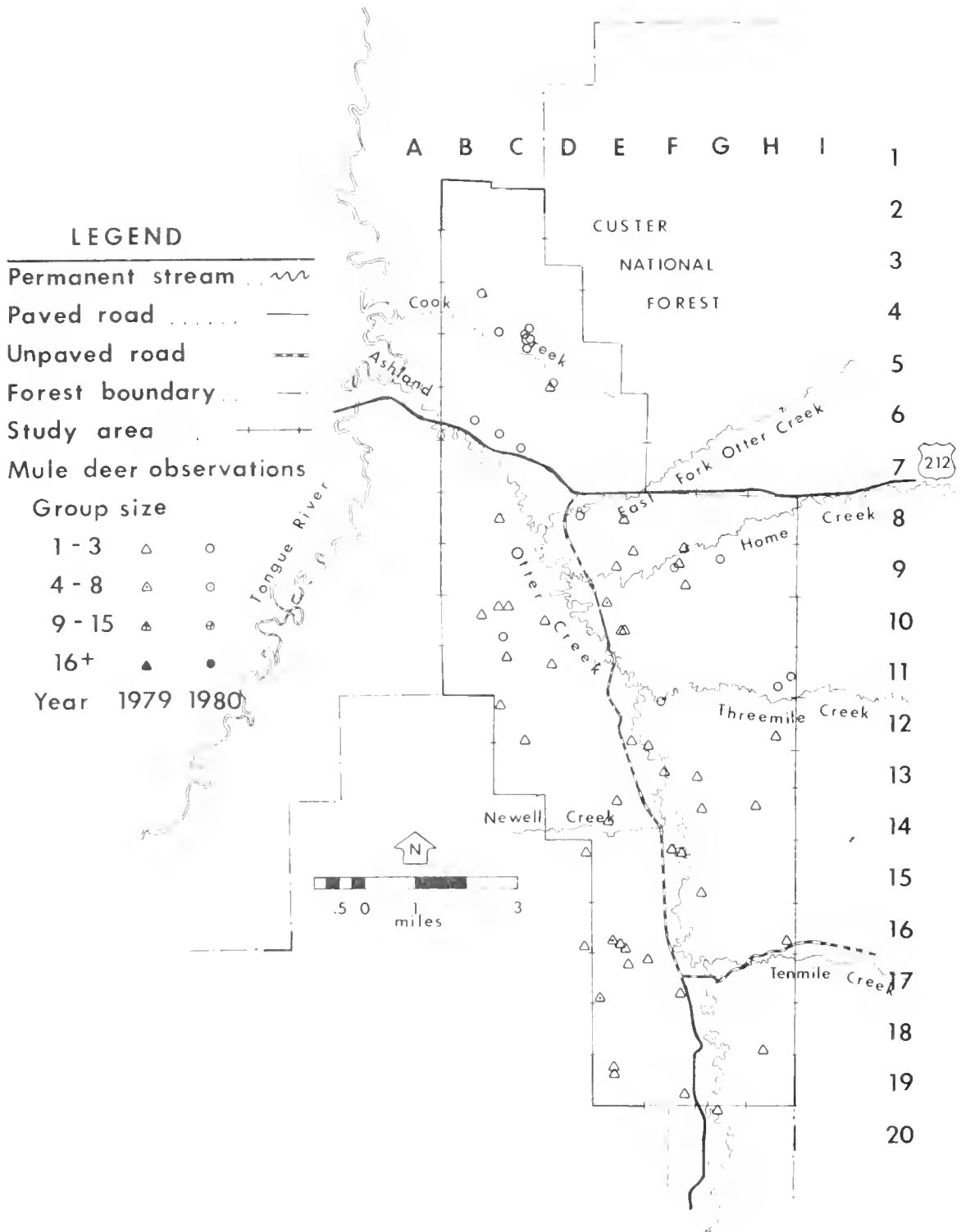


Figure 8. Summer mule deer distribution in the Otter Creek area.

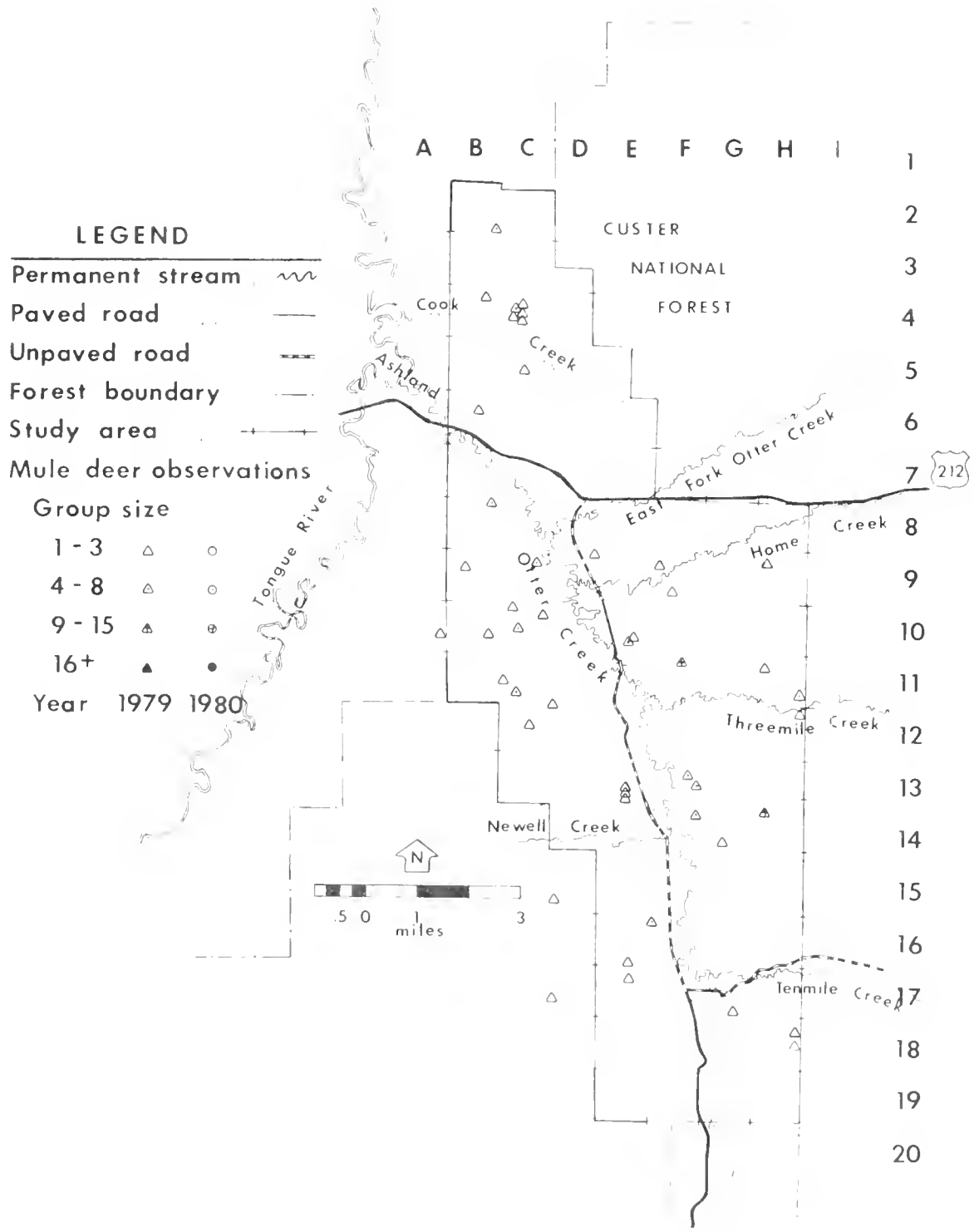


Figure 9. Fall mule deer distribution in the Otter Creek area.

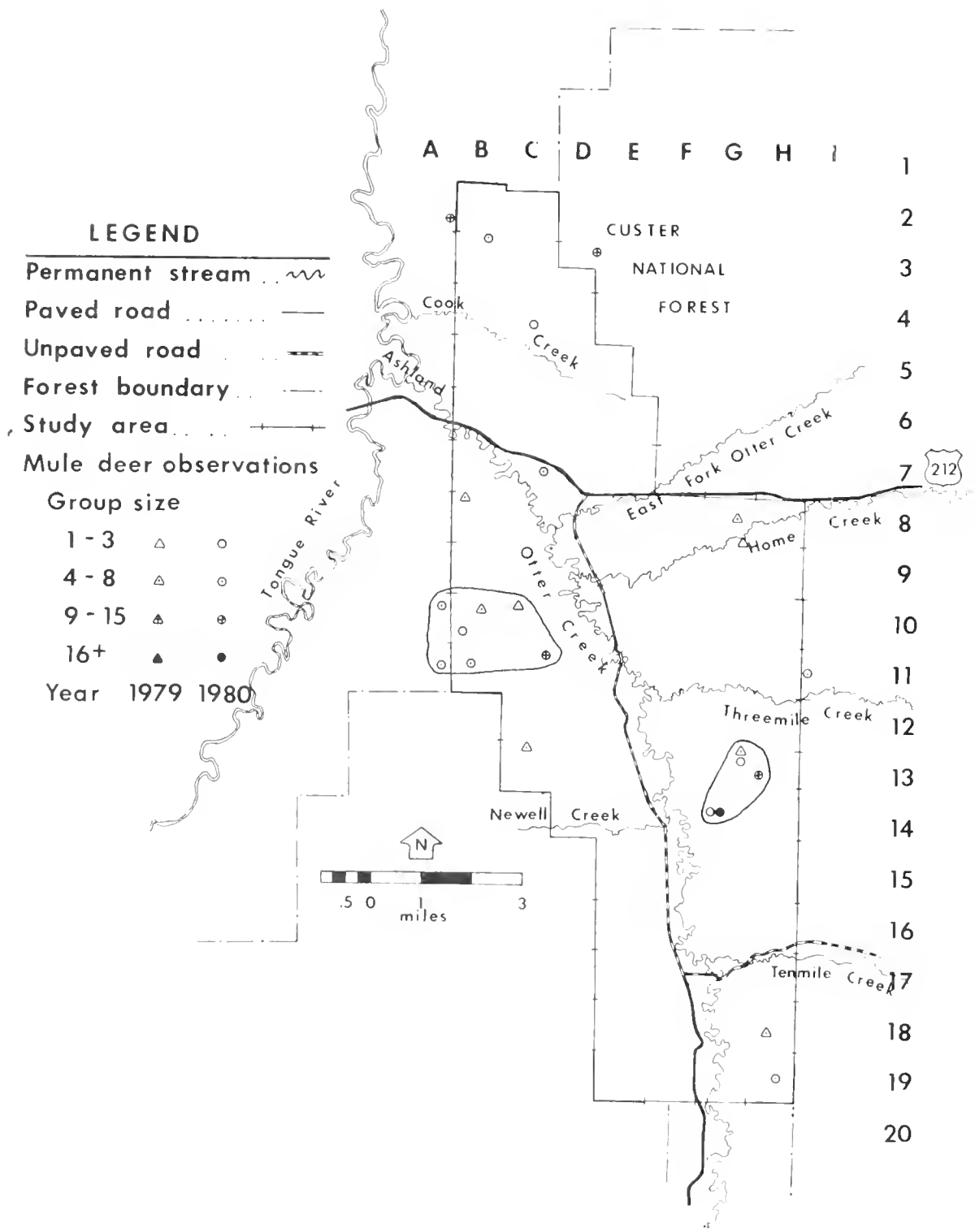


Figure 10. Winter mule deer distribution in the Otter Creek area.

Table 4. Seasonal use of vegetation types by mule deer in the Otter Creek area.

Vegetation subtypes	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	1979-80	1980	1980
	101 ¹ / ₁	111	188	165	209	27
Ponderosa pine	92 ¹ / ₁	15	21	8	3	37
Sagebrush	17	5	2	13	2	7
Grassland	47	10	13	17	7	19
Skunkbush	-	7	5	2	-	11
Juniper	21	8	-	18	2	-
Snowberry	-	-	-	-	-	-
Total Ponderosa Pine	93	45	40	58	15	74
Sagebrush	7	20	31	22	19	7
Deciduous shrub	-	-	4	-	-	-
Grassland	-	11	19	12	37	11
Total Sagebrush/Grassland	7	31	55	34	56	19
Tree	-	5	2	-	1	-
Shrub	-	4	2	8	4	4
Total Creekbottom	-	9	3	8	6	4
Ponderosa pine	-	-	1	-	4	-
Sagebrush/Grassland	-	4	-	-	14	4
Creekbottom	-	12	1	-	6	-
Total Agricultural	-	15	2	-	24	4

1/ Total observations

2/ Percent of observations rounded to nearest whole number

The sagebrush/grassland type received its highest usage in the fall of 1979 and spring of 1980, 55 and 56 percent, respectively. Its lowest usage was noted in the spring of 1979 and the dry summer of 1980 with 7 and 19 percent of the observations respectively. Apparently the sagebrush/grassland type is not preferred by deer in either weather extreme, snow and cold or hot and dry.

The creekbottom type usage ranged from none to nine percent over the course of the study. A goodly proportion of the Otter Creek bottoms have been developed into farmland. As a result only a few sections have adequate cover. Those remaining stretches with good riparian vegetation are extremely important to deer and other wildlife species. They should be protected in every possible instance. Combined creekbottom subtypes showed the highest usage, 21 percent of observations, during the 1979 summer.

Deer utilize the agricultural areas quite heavily during the period of initial "greenup." This occurred in the early summer months of 1979 and spring of 1980 when 15 and 24 percent of the deer were observed in agricultural fields in those seasons respectively. Very few observations were made in the agricultural types in any other season.

Activity: Examination of mule deer activity at the time of observation (Table 5) gives some insight into the habits and condition of the deer herd. The high percentages of deer feeding in spring and summer indicate they were building up their fat reserves. A small, but substantial, percentage (over 25 percent) was observed feeding during fall and winter. The seasons of greatest stress, the cold spring of 1979, winter 1979-80 and the hot, dry 1980 summer, correlate with the greatest numbers observed lying down. Since most of the deer resorted to pine cover areas with their inherent observability bias, the percentage actually lying down was no doubt underestimated.

Table 5. Seasonal activity of mule deer in the Otter Creek area.

Activity	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	101 ^{1/}	111	188	165	218	27
Standing	36 ^{2/}	37	63	44	11	15
Running	8	9	9	20	6	30
Lying	10	5	1	10	tr ^{3/}	11
Feeding	47	50	27	26	83	44

^{1/} Total observations

^{2/} Percent of observations rounded to nearest whole number

^{3/} tr = trace; a percentage less than 0.5

Use of topography: Dissected midslopes were most heavily used by mule deer in all seasons of the study (Table 6), averaging nearly 80 percent for the six seasons. Two distinct peaks of lowland usage were noted, 19 percent in summer 1979 and 26 percent in spring 1980. These two seasons represent the initial "green-up" period for the respective years. A similar decrease in usage of the uplands types was noted from spring highs of 22 and 24 percent for 1979 and 1980 respectively to summer lows of 3 and 0 percent respectively. A lack of water at the higher elevations has been cited as being responsible for this shift in other areas of eastern Montana (Martin 1980, Knowles 1975).

Table 6. Seasonal use of topography by mule deer in the Otter Creek area.

Topography	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	101 ^{1/}	111	188	165	218	27
Mesa-butte top	13 ^{2/}	1	4	2	24	-
Mesa-butte steep slopes	9	2	5	3	tr ^{3/}	-
Dissected mid-slopes	73	78	86	87	50	89
Alluvium/terrace	-	5	2	-	22	7
Flood plain	-	14	3	8	4	4

^{1/} Total observations

^{2/} Percent of observations rounded to nearest whole number

^{3/} tr = trace; a percentage less than 0.5.

Use of exposure: Seasonal use of exposure is shown in Table 7. Usage of northerly slopes decreased from its high, 41 percent, in the 1979 spring to its low, 17 percent, during the 1980 spring. Usage of southerly slopes was at or near 45 percent in all seasons except the 1979 summer and 1980 spring which have been discussed previously as being the green-up period. Easterly exposures were least used during the two spring seasons with 26 and 13 percent for 1979 and 1980 respectively. All other seasons usage levels were between 31 and 39 percent. Conversely, usage of westerly exposures were highest during the spring seasons. The 1979 spring saw 58 percent of mule deer observations on westerly slopes, the highest figure recorded during the course of the study. Numbers observed on flat lands were highest during the summer of 1979, 16 percent and the spring of 1980, 21 percent.

Table 7. Seasonal use of exposure by mule deer in the Otter Creek area.

Exposure	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	101 ^{1/}	111	188	165	218	26
North	6 ^{2/}	14	12	5	10	27
South	10	12	21	39	15	23
East	-	12	12	10	7	23
West	14	-	13	14	30	4
Northeast	24	11	17	21	6	-
Northwest	11	13	2	5	1	-
Southeast	2	16	2	6	-	15
Southwest	33	6	20	-	11	4
Flat	1	16	2	-	21	4

^{1/} Total observations

^{2/} Percent of observations rounded to nearest whole number

Use of slope: Usage of the medium and steep slopes was highest during the seasons of cold and snow. Eighty percent were observed on the steeper slopes in the 1979 spring season (Table 8). Sixty-eight and 71 percent were observed during the fall and winter seasons respectively. The summers of 1979 and 1980 with 54 and 66 percent respectively and the 1980 spring with 75 percent of the mule deer observations represent warm weather slope usage patterns.

Table 8. Seasonal use of slope by mule deer in the Otter Creek area.

Slope	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	101 ^{1/}	111	188	165	218	26
Flat	1 ^{2/}	16	2	-	21	8
Gentle	19	38	30	29	54	58
Medium	65	31	36	39	19	35
Steep	15	15	32	32	6	-

^{1/} Total observations

^{2/} Percent of observations rounded to nearest whole number.

Antelope

Population characteristics: During the six season study, 1784 antelope were observed in the Otter Creek study area (Table 9). Average group size ranged from a low of 3.0 in spring 1979 to a high of 18.4 during the winter months. January, in the dead of winter, recorded 25.7 antelope per group. Dispersal from winter herds occurred in April as the group size decreased from 13.4 in March to 5.0 antelope per group in April.

Antelope were most easily spotted in December and February when over 91 antelope were observed per hour of aerial survey (Table 2). This is when the antelope are concentrated in large groups. Many antelope appeared to have left the Otter Creek area during January. The total number observed from the air, 77, was considerably below the 200 plus numbers observed in December and February. Perhaps this area represents marginal wintering habitat for antelope. High numbers per hour were also observed in July and August. This corresponds to the time frame when antelope numbers should be at their seasonal peak just shortly after fawn recruitment.

Production figures and population structure percentages are shown in Table 10. August data in 1979 show 64.4 fawns per 100 does. This compares to 68 and 59 fawns per 100 females in Fish, Wildlife and Parks hunting units 740 and 741 in 1978 and 1977 respectively, the latest year in which surveys were conducted (Wentland 1979). June of 1980 saw the percentage of fawns in the population remain stable at slightly over 20 percent, while the number of fawns per 100 does increased from 33.3 to 40.0 over June of 1979. The percentage of bucks was 28.9 in June of 1980, slightly lower than the average of 30.7 recorded for hunting unit 740 since 1963 (Wentland 1979).

Distribution: Antelope spring distribution is shown in Figure 11. There appears to be four widely scattered groupings of antelope observations. One is located on either side of Cook Creek north of highway 212. Another stretches along the southwest side of Otter Creek north of the Custer National Forest. This group appears to have the second largest number of sightings. Another group is found astride Threemile Creek on the eastern edge of the study area. The greatest number of observations occurred in the southern portion of the study area with Newell Creek as its approximate northern boundary.

Many antelope are still in large herds at this time exhibited by the number of group sightings in the 9-15 and over 15 categories.

During the summer months (Figure 12), antelope were more dispersed than during spring. The four groupings mentioned above seemed to

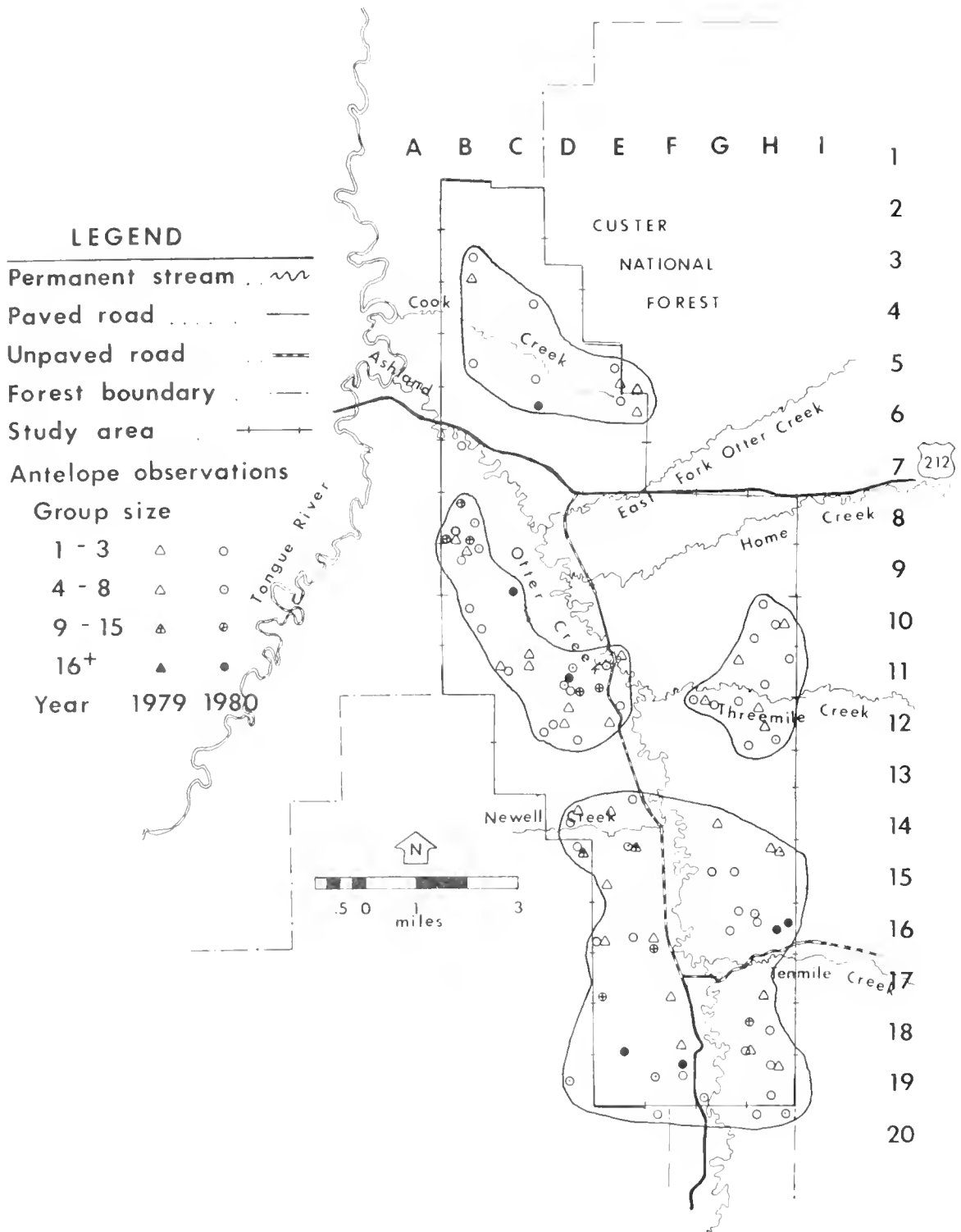


Figure 11. Spring antelope distribution in the Otter Creek area.

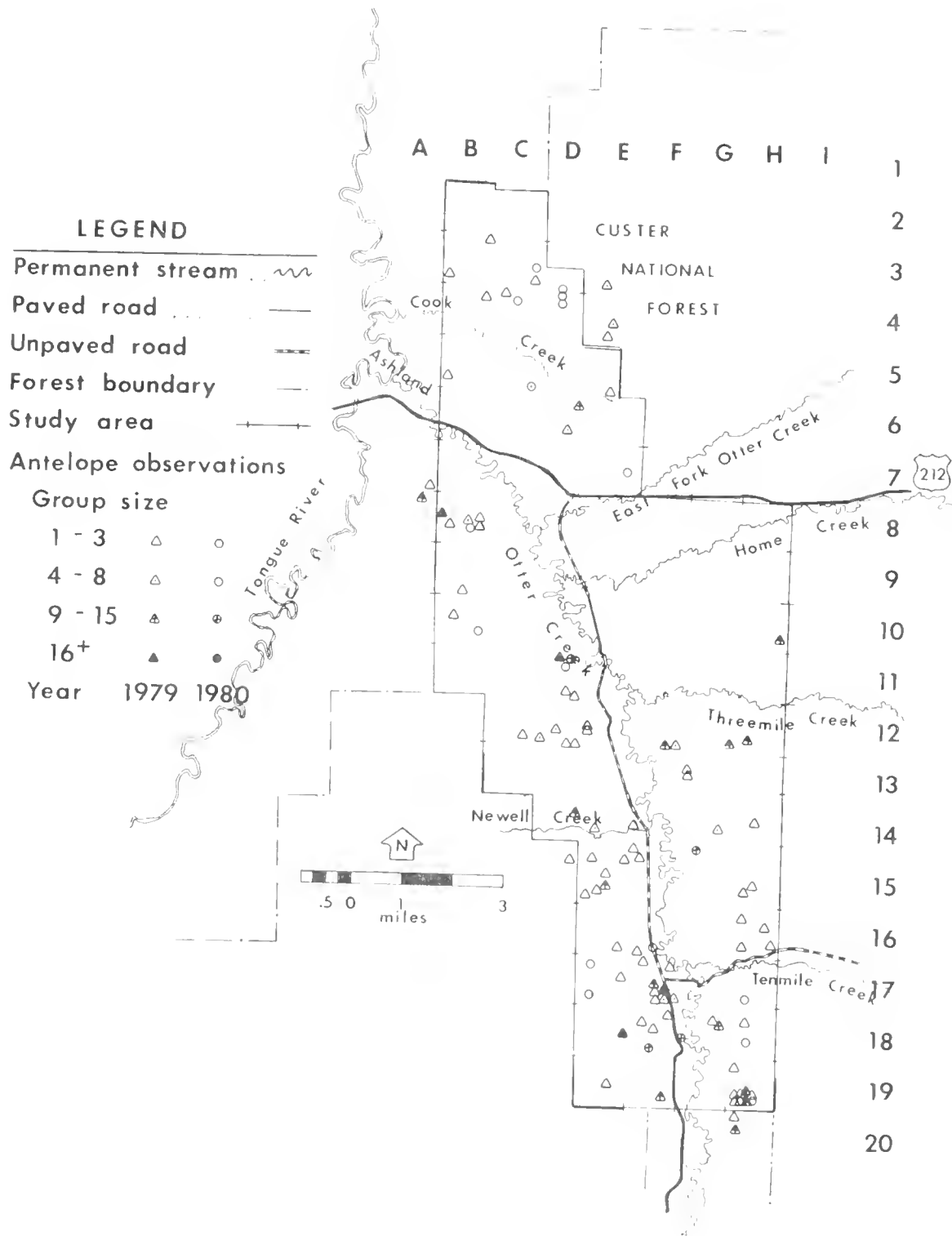


Figure 12. Summer antelope distribution in the Otter Creek area.

Table 9. Average group size of antelope in the Otter Creek, Hanging Woman Creek and Prairie Dog Creek study areas.

Month	Otter Creek			Hanging Woman			Prairie Dog		
	Groups Observ.	Total	\bar{x} ^{1/}	Groups Observ.	Total	\bar{x}	Groups Observ.	Total	\bar{x}
April	1	2	2.0	26	113	4.3	0	0	0
May	32	97	3.0	67	201	3.0	0	0	0
Spring	33	99	3.0	93	314	3.4	0	0	0
June	34	96	2.8	54	93	1.7	0	0	0
July	29	213	7.3	49	243	5.0	0	0	0
Aug	27	177	6.6	21	135	6.4	0	0	0
Summer	90	486	5.4	124	471	3.8	0	0	0
Sept.	20	119	6.0	45	287	6.4	0	0	0
Oct.	10	100	10.0	30	237	7.9	0	0	0
Nov	0 ^{2/}	0	0	- ^{3/}	-	-	-	-	-
Fall	30	219	7.3	75	524	7.0	0	0	0
Dec	9	201	22.3	8	449	56.1	0	0	0
Jan	3	77	25.7	3	274	91.3	-	-	-
Feb	15	220	14.7	14	381	27.2	0	0	0
Winter	27	498	18.4	25	1104	44.2	0	0	0
March	16	214	13.4	27	301	11.1	0	0	0
April	25	125	5.0	45	216	6.0	0	0	0
May	24	73	3.0	46	203	4.4	0	0	0
Spring	65	412	6.3	118	720	6.6	0	0	0
June	21	70	3.3	48	175	3.6	0	0	0
July	-	-	-	-	-	-	-	-	-
Aug	-	-	-	-	-	-	-	-	-
Summer	21	70	3.3	48	175	3.6	0	0	0

^{1/} \bar{x} = average

^{2/} No observations made on survey

^{3/} No surveys made

Table 10. Antelope population characteristics in the Otter Creek area.

Month	Number Classified				Fawns:100		Bucks:	Population Structure (%)		
	Total	Bucks	Does	Fawns	Does	Adults	100 Does	Bucks	Does	Fawns
1979										
June	96	16	60	20	33.3	26.3	26.7	16.6	62.5	20.8
July	213	26	116	71	61.2	50.0	22.4	12.2	54.4	33.3
Aug	165	22	87	56	64.4	51.3	25.3	13.3	52.7	33.9
Sept	81	18	43	20	46.5	32.8	41.9	22.2	53.1	24.7
1980										
June	59	17	30	12	40.0	25.5	56.7	28.9	50.8	20.3

blend together with a slight overall shift to the southern portion of the study area. The northern group still appears to be separated from the rest of the study area. While some larger herds remained intact, more observations in the 1-3 range were recorded than in any other season.

Antelope fall distribution is shown in Figure 13. The number of observations are greatly reduced because there was only one fall season in the study and antelope are beginning to congregate into their winter herds. Except for a few scattered observations, the antelope seemed to be located in the southern portion of the study area with Threemile Creek as the approximate northern boundary. Five groups larger than 15 were observed and six groups in the 9-15 category were spotted.

Figure 14 shows the winter antelope distribution. The pattern established during fall was continued as most of the observations were made south of Threemile Creek. A large majority of the antelope were in herds of over 16 individuals. The average group size was 18.4 (Table 9). Since the 1979-80 winter season was quite mild, antelope were free to roam about their range at will. Therefore the areas used during this study probably include more area than that used in more severe winter conditions.

Vegetation type usage: Antelope were found primarily on the sagebrush/grassland vegetation types (Table 11). Ninety-seven percent of the antelope were observed on this type during the fall and winter seasons. The smallest percentage utilizing sagebrush types was seen in spring 1979, 84 percent. That spring 16 percent were observed in the ponderosa pine grassland subtype.

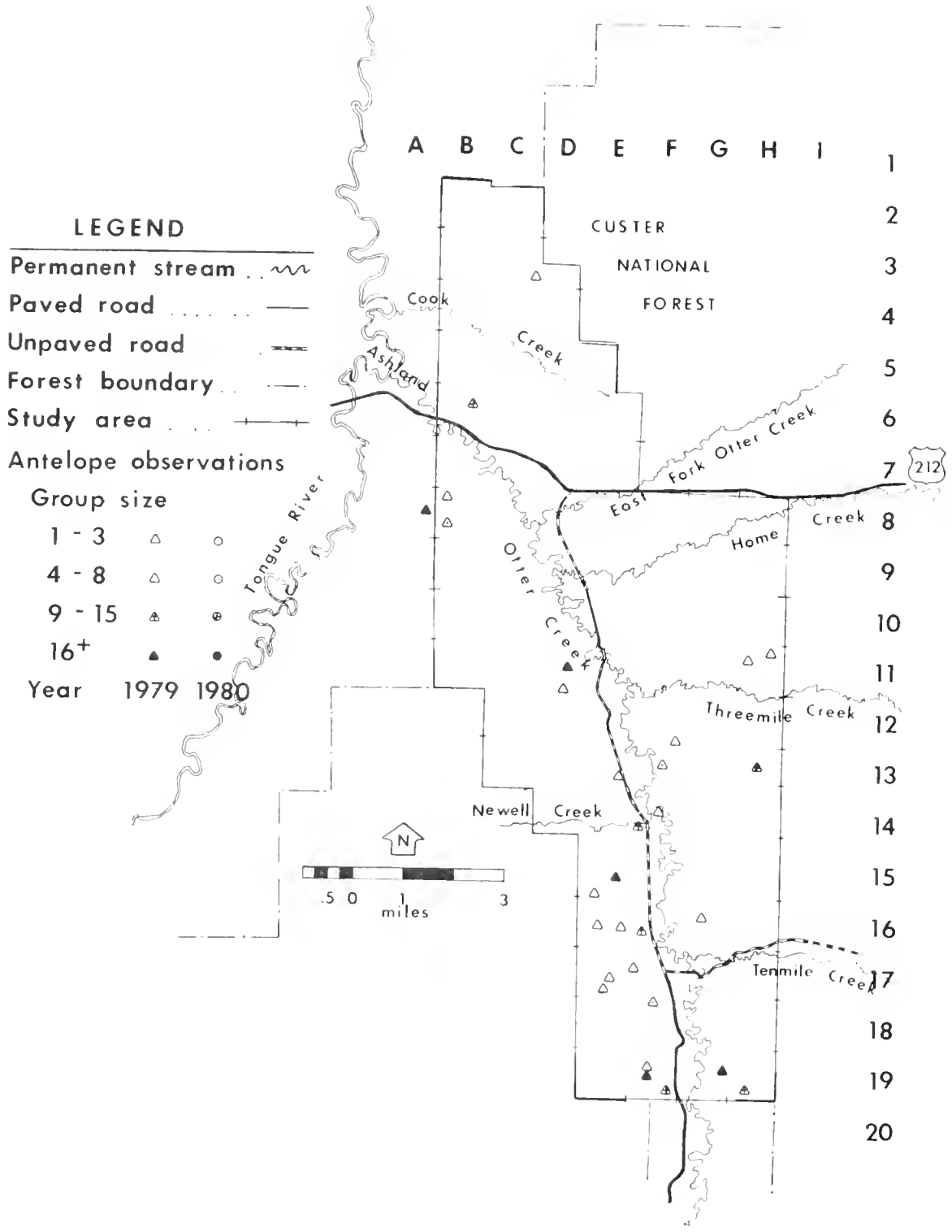


Figure 13. Fall antelope distribution in the Otter Creek area.

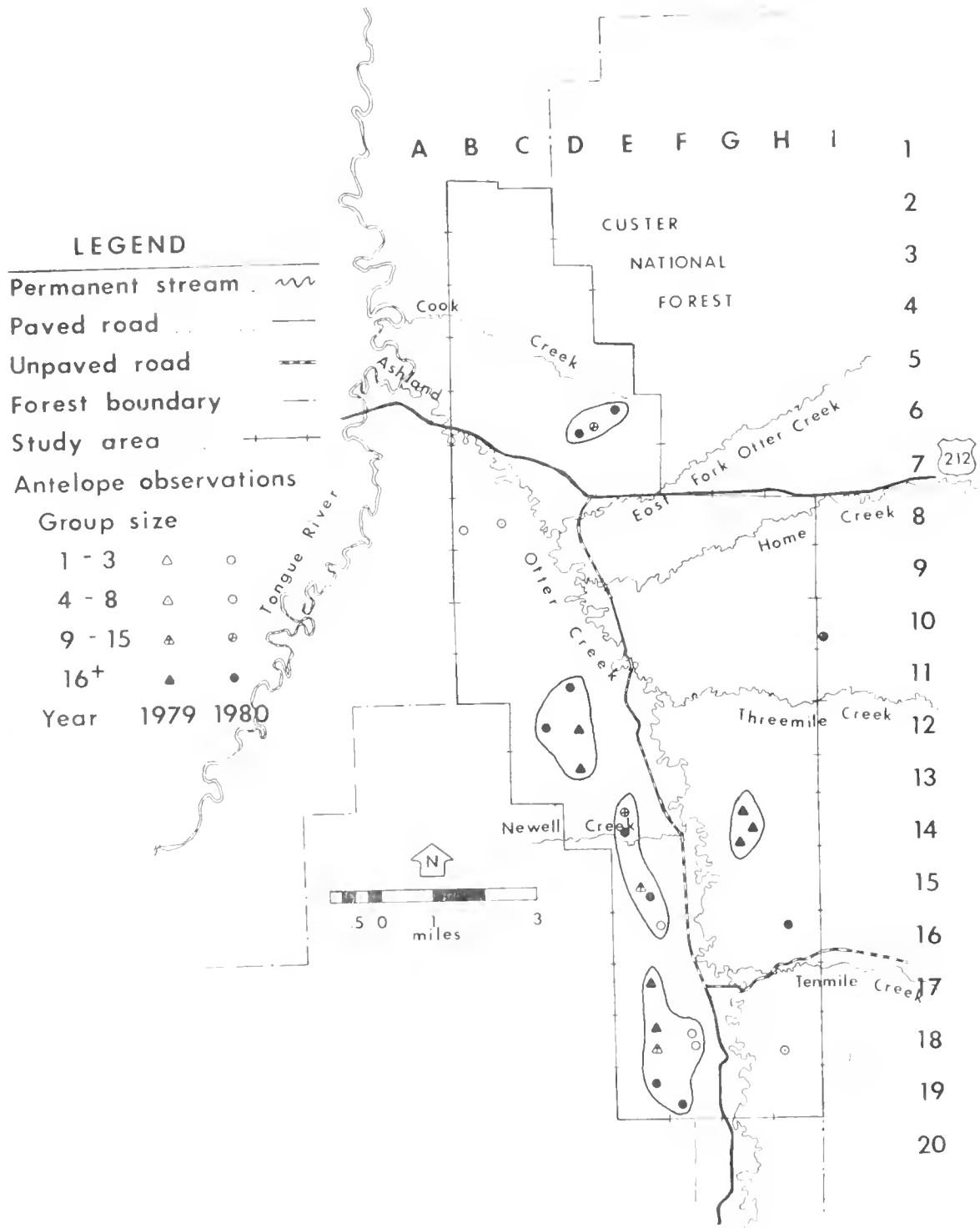


Figure 14. Winter antelope distribution in the Otter Creek area.

The only other subtype to receive more than minimal usage was the agricultural sagebrush/grassland subtype in the summer of 1980, where 9 percent of the antelope were observed.

Table 11. Seasonal use of vegetation types by antelope in the Otter Creek area.

Vegetation Subtypes	Spring 1979	Summer 1979	Fall 1979	Winter '79-80	Spring 1980	Summer 1980
	99 ^{1/}	486	219	498	412	70
Ponderosa pine	-	-	-	-	-	-
Sagebrush	-	2	-	1	2	1
Grassland	16 ^{2/}	2	-	-	2	-
Skunkbush	-	1	-	-	-	-
Juniper	-	-	-	-	-	-
Snowberry	-	-	-	-	-	-
Total Ponderosa pine	16	5	-	1	4	1
Sagebrush	34	43	53	39	51	24
Deciduous shrub	-	-	-	-	-	-
Grassland	49	48	44	58	40	66
Total Sagebrush/Grassland	84	91	97	97	91	90
Tree	-	1	-	-	4	-
Shrub	-	-	-	1	-	-
Total Creekbottom	-	1	-	1	4	-
Ponderosa pine	-	-	-	-	-	-
Sagebrush/grassland	-	-	tr ^{3/}	-	1	9
Creekbottom	-	2	3	-	1	-
Total Agricultural	-	2	3	-	2	9

1/ Total observations

2/ Percent of observations rounded to nearest whole number

3/ tr = trace; a percentage 0.5

Activity: Antelope are more apt to run during aerial observation surveys than are mule deer. During the summer surveys, the highest percentage of running antelope were observed feeding in the spring months. More antelope were observed standing, 51 percent, in the winter time than in any other season.

Use of topography: Antelope were most often observed on dissected mid-slope areas (Table 13) in all seasons. The percentage observed ranged from 74 in the summer of 1980 to 97 in the fall of 1979. Alluvium/terraces received use in every season except spring 1979 reaching its highest level, 21 percent, in summer 1980. Mesa-butte tops were slightly used every season except fall 1979. Mesa-butte steep sides and flood plains were seldom used.

Table 12. Seasonal activity of antelope in the Otter Creek area.

Activity	Spring 1979 99 ₁ /	Summer 1979 486	Fall 1979 219	Winter '79-80 498	Spring 1980 412	Summer 1980 70
Standing	25	35	36	51	37	31
Running	34	45	39	25	18	44
Lying	16	8	8	9	15	6
Feeding	24	13	17	14	30	19

1/ Total observations

2/ Percent of observations rounded to the nearest whole number.

Table 13. Seasonal use of topography by antelope in the Otter Creek area.

Topography	Spring 1979 99 ₁ /	Summer 1979 486	Fall 1979 219	Winter '79-80 498	Spring 1980 412	Summer 1980 66
Mesa-butte top	10 ₂ /	6	-	2	2	5
Mesa-butte steep sides	-	1	-	-	-	-
Dissected mid- slopes	90	90	97	95	86	74
Alluvium/terrace	-	2	3	2	8	21
Flood plain	-	1	-	1	3	-

1/ Total observations

2/ Percent of observations rounded to nearest whole number

Use of exposure: Antelope were observed on all exposures in nearly every season (Table 14). The greatest usage occurred on southerly exposures in the spring of 1979, 57 percent. Flat lands generally had the least amount of antelope usage. This reflects their lack of usage of floodplains and plateau areas as discussed above. Northerly slopes were most highly used in the fall season, 56 percent of the observations, and least used in the spring of 1979. Easterly slopes were most often used in spring 1979 and summer 1980, 50 and 49 percent respectively.

Table 14. Seasonal use of exposure by antelope in the Otter Creek area.

Exposure	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	99 <u>1</u> /	486	219	498	412	66
North	3 <u>2</u> /	21	12	10	14	12
South	19	9	10	5	8	11
East	-	14	9	7	15	3
West	6	15	-	14	6	-
Northeast	25	14	27	24	24	23
Northwest	5	5	17	3	7	6
Southeast	25	12	3	6	8	23
Southwest	13	6	19	26	17	17
Flat	3	4	3	5	3	6

1/ Total observations

2/ Percent of observations rounded to nearest whole number.

Use of slope: Antelope avoided the flat and steep slopes throughout the study (Table 15) with 6 percent being the highest percentage observed in any season. The spring and summer seasons of 1979 saw almost identical usage at gentle and medium slopes. In all other seasons, gentle slopes supported more antelope than medium slopes. Its highest level was 66 percent in the fall of 1979.

Table 15. Seasonal use of slope by antelope in the Otter Creek area.

Slope	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	99 <u>1</u> /	486	219	498	412	66
Flat	3 <u>2</u> /	4	3	5	3	6
Gentle	46	45	66	56	59	53
Medium	49	47	32	36	32	41
Steep	3	4	-	3	6	-

1/ Total observations

2/ Percent of observations rounded to the nearest whole number.

Sharp-tailed Grouse

Twenty dancing grounds have been located in or near the Otter Creek study area (Figure 15). Attendance by male birds at known grounds averaged 15.3 in 1979 and 17.8 in 1980 (Table 16). The average number of birds in 1980 at the seven grounds located in 1979 was 23.0. This represents a 50.3 percent increase from 1979 to 1980. Obviously the overwinter survival was extremely high.

There are approximately 0.22 dancing grounds per square mile in the study area. This compares with .09 grounds per square mile in the Sarpy Creek drainage (Martin 1980) and 0.12 per square mile in the Colstrip area (Schwarzkoeph 1980).

No broods were observed in the study area. One observation of approximately 150 birds was made along Home Creek north of dancing ground number 7 in early November.

Table 16. Sharp-tailed grouse dancing grounds in the Otter Creek study area and number of males attending in 1979 and 1980.

Dancing Ground	Location				Activity	
	T	R	S		1979	1980
1	5S	45E	23	NE $\frac{1}{4}$	12	13
2	5S	45E	3	SE $\frac{1}{4}$	9	20
3	4S	45E	33	SE $\frac{1}{4}$	12	33
4	4S	45E	12	NW $\frac{1}{4}$	20	36
5	4S	45E	3	NW $\frac{1}{4}$	1	5
6	3S	45E	8	SE $\frac{1}{4}$	13	24
7	3S	45E	35	NE $\frac{1}{4}$	40	30
8	2S	45E	32	NW $\frac{1}{4}$	-	36
9	3S	45E	5	NE $\frac{1}{4}$	-	33
10	3S	45E	3	SE $\frac{1}{4}$	-	9
11	3S	44E	23	SE $\frac{1}{4}$	-	7
12	3S	44E	36	SE $\frac{1}{4}$	-	5
13	3S	46E	30	SW $\frac{1}{4}$	-	20
14	3S	46E	31	SW $\frac{1}{2}$	-	2
15	4S	45E	5	SE $\frac{1}{4}$	-	16
16	4S	45E	17	SE $\frac{1}{4}$	-	6
17	4S	45E	26	NW $\frac{1}{4}$	-	20
18	4S	45E	36	SW $\frac{1}{4}$	-	16
19	5S	45E	15	NW $\frac{1}{4}$	-	16
20	5S	45E	22	SW $\frac{1}{4}$	-	9
Average males per ground					15.3	17.8

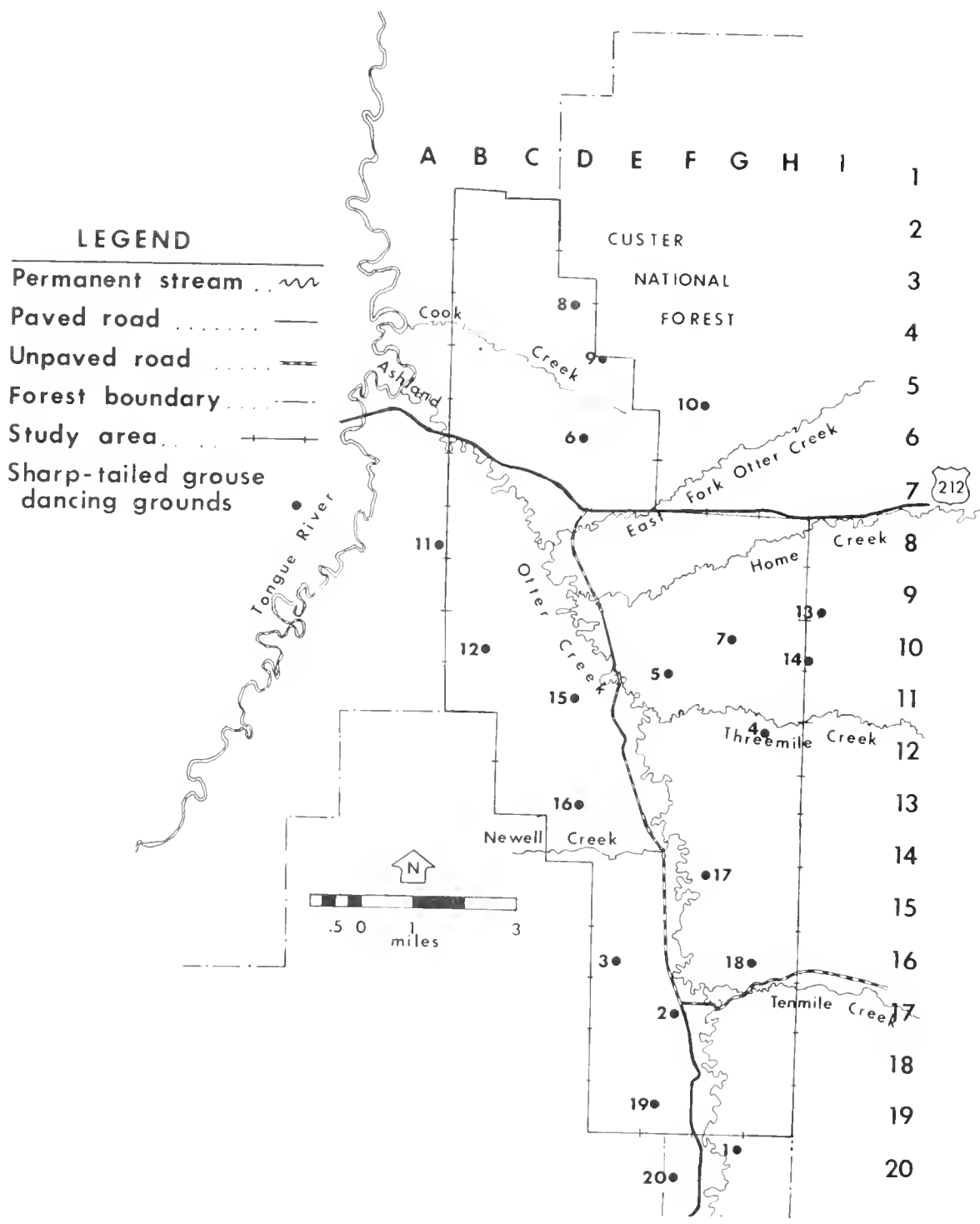


Figure 15. Sharp-tailed grouse dancing grounds in the Otter Creek area.

Ring-necked Pheasant

Ring-necked pheasants occur in the study area along all the major drainage ways. Highest numbers were observed along Otter Creek. A pheasant crow count route has been conducted south from the Otter Creek road - U.S. Highway 212 junction by the Montana Department of Fish, Wildlife and Parks since 1974. The average number of calls per two minute stop over the 20 mile route has been 18.9 (Knapp 1979), ranging from a low of 14.5 in 1978 to a high of 24.4 in 1977.

Waterfowl

Seven species of waterfowl game birds were observed on the Otter Creek study area (Table 17). Of these only the mallard was observed to breed in the area. It is possible that several of the others also breed within the study area, especially in good water years. Both spring seasons of this study were marked by drought conditions with 1980 being the most severe. Most of the reservoirs were dry while Otter Creek and some spring-fed ponds had water.

Songbirds

One hundred and ten species of birds, including game birds, were observed on the study area (Table 17). The Swainson's hawk, Cooper's hawk, golden eagle, bald eagle, prairie falcon, upland sandpiper, burrowing owl, long-eared owl, mountain bluebird, clay-colored sparrow, Brewer's sparrow, and field sparrow were listed by Flath (1979b) as species of special interest or concern. All of these except the bald eagle and burrowing owl, both listed as migratory birds of high federal interest (U.S.D.I. 1979), were known or suspected to breed in the study area. Habitat suitable for breeding burrowing owls existed in the study area, so breeding for this species is possible in the future.

Four breeding bird census strips were located on the Otter Creek study area, one each in grassland (without sagebrush), sagebrush, ponderosa pine, juniper, and boxelder-ash riparian habitats (Figure 16). Tables 18-21 list the percent composition and average number of birds observed per census run for each of the bird species found on the four breeding bird census strips. The average number and the highest number of singing males observed on each strip are also listed along with breeding pair density estimates derived from them. Estimates were not made for red crossbills, which were present as large, non-breeding flocks during the censusing.

Western meadowlarks dominated the grassland and sagebrush census strips. Chipping sparrows, lark sparrows, and western wood pewees were the three most abundant species on the ponderosa pine census strip. House wrens and yellowwarblers were the two

Table 17. Breeding status of the bird species observed on the Otter Creek study area.

Species	Breeding Status	Species	Breeding Status
1. Pied-billed grebe	B ^{1/}	51. Least flycatcher	b
2. Great blue heron	t	52. Western wood pewee	b
3. Whistling swan	M	53. Horned lark	b
4. Canada goose	M	54. Violet green swallow	b
5. Mallard	B	55. Tree swallow	b
6. Gadwall	M	56. Barn swallow	B
7. Pintail	M	57. Cliff swallow	B
8. Green-winged teal	M	58. Black-billed magpie	B
9. Blue-winged teal	M	59. Common crow	b
10. Northern shoveler	M	60. Pinyon jay	b
11. Turkey vulture	b	61. Black-capped chickadee	b
12. Sharp-shinned hawk	b	62. White-breasted nuthatch	b
13. Cooper's hawk	b	63. Red-breasted nuthatch	b
14. Red-tailed hawk	B	64. House wren	B
15. Swainson's hawk	b	65. Canyon wren	b
16. Rough-legged hawk	W	66. Rock wren	b
17. Golden eagle	B	67. Gray catbird	b
18. Bald eagle	M	68. Brown thrasher	b
19. Marsh hawk	b	69. American robin	B
20. Prairie falcon	B	70. Mountain bluebird	B
21. American kestrel	B	71. Townsend's solitaire	b
22. Sharp-tailed grouse	B	72. Water pipit	M
23. Ring-necked pheasant	B	73. Bohemian waxwing	W
24. Turkey	b	74. Loggerhead shrike	b
25. American coot	b	75. Starling	b
26. Killdeer	b	76. Solitary vireo	b
27. Common snipe	b	77. Warbling vireo	b
28. Upland sandpiper	b	78. Yellow warbler	B
29. Spotted sandpiper	b	79. Yellow-rumped warbler	b
30. Solitary sandpiper	M	80. Ovenbird	M
31. Willet	M	81. Common yellowthroat	b
32. Black tern	M	82. Yellow-breasted chat	b
33. Mourning dove	B	83. House sparrow	b
34. Yellow-billed cuckoo	b	84. Western meadowlark	B
35. Black-billed cuckoo	b	85. Yellow-headed blackbird	M
36. Great horned owl	B	86. Red-winged blackbird	b
37. Burrowing owl	M	87. Northern oriole	B
38. Long-eared owl	B	88. Brewer's blackbird	b
39. Poor-will	B	89. Common grackle	B
40. Common nighthawk	b	90. Brown-headed cowbird	b
41. White-throated swift	b	91. Western tanager	b
42. Belted kingfisher	b	92. Black-headed grosbeak	b
43. Common flicker	B	93. Lazuli bunting	b
44. Red-headed woodpecker	B	94. Evening grosbeak	W
45. Hairy woodpecker	B	95. Cassin's finch	W
46. Downy woodpecker	b	96. Pine siskin	W
47. Eastern kingbird	b	97. American goldfinch	b
48. Western kingbird	B	98. Red crossbill	b
49. Cassin's kingbird	b	99. Rufous-sided towhee	b
50. Say's phoebe	B	100. Lark bunting	b

Table 17 continued.

Species	Breeding Status	Species	Breeding Status
101. Grasshopper sparrow	b	106. Chipping sparrow	B
102. Vesper sparrow	B	107. Clay-colored sparrow	b
103. Lark sparrow	B	108. Brewer's sparrow	b
104. Dark-eyed junco	b	109. Field sparrow	b
105. Tree sparrow	W	110. White-crowned sparrow	M

1/ Breeding status

- B - Hard evidence of breeding
- b - Circumstantial evidence of breeding
- t - Occurs, but no evidence of breeding
- W - Overwintering observations
- M - Migratory observation

most abundant species on the riparian census strip. The riparian census strip supported the highest number of species and breeding bird density, followed by the ponderosa pine census strip. The sagebrush census strip supported the lowest number of species and breeding bird density, although the grassland census strip supported densities nearly as low. The higher number of species observed on the grassland strip than on the sagebrush strip was probably due to greater proximity of the grassland census strip to ponderosa pine habitat.

Raptors

Eleven species of hawks and three species of owls were observed on the study area. Inconspicuous species such as screech owls and saw-whet owls may also have occurred in the study area. Goshawks were observed within ten miles of the study area, and suitable nesting habitat for them was present in the study area. This species may have been overlooked because of poor visibility in the dense forests it prefers.

Accipiters: Cooper's hawks were observed twice in the study area in 1980 (Figure 17). One of the observations was during the nesting season (June). One sharp-shinned hawk was observed on 1 June 1980. Both of these species probably nested in the study area.

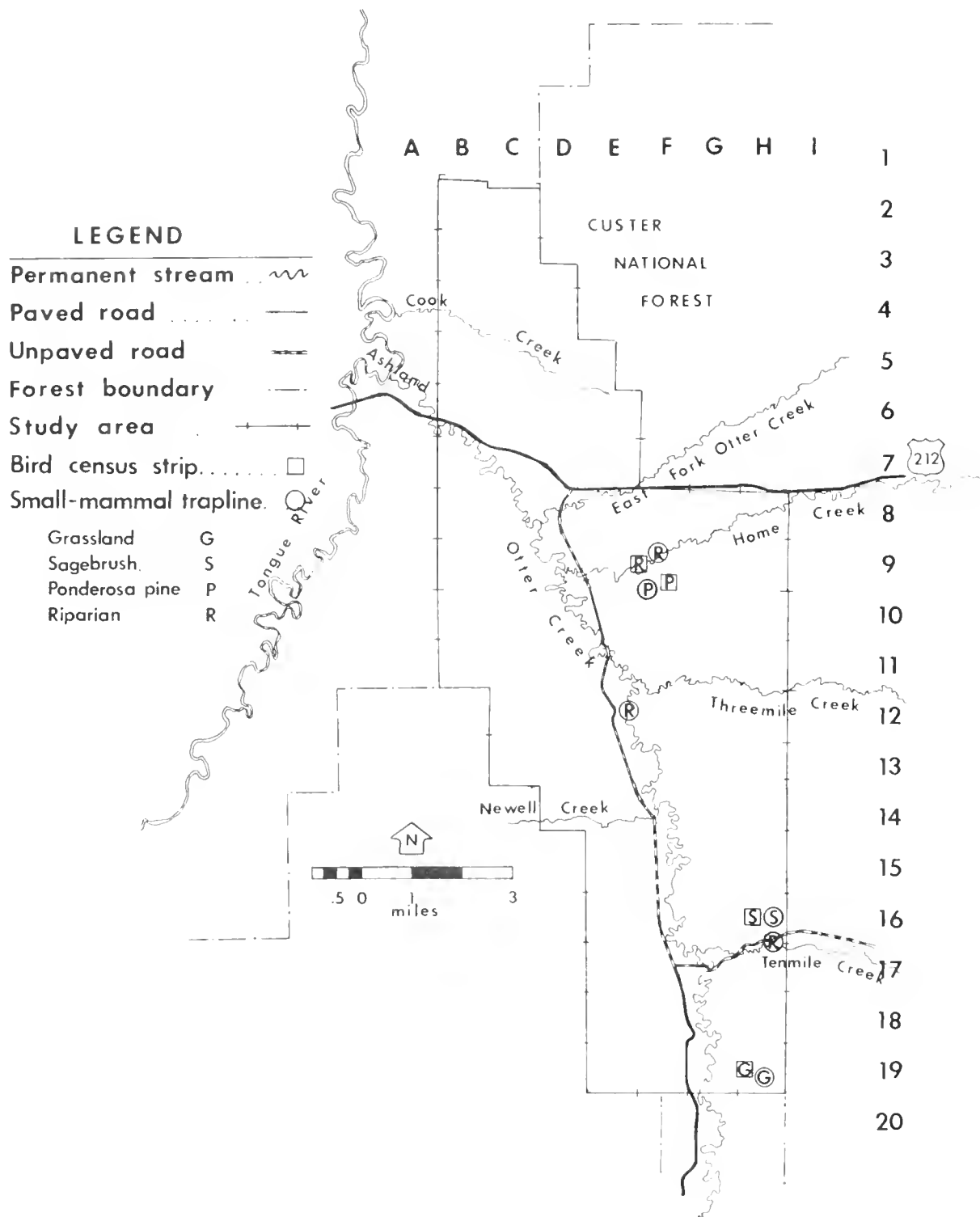


Figure 16. Location of songbird census strips and small mammal traplines on the Otter Creek study area.

Table 18. Numbers per census run, percent composition, and breeding pair density of birds observed on the grassland census strip in the Otter Creek study area.

Species	Average No. Birds per Census Run		Percent Composition		Average No. Singing Males Per Census Run		Highest No. Singing Males in any Census Run	
	1979	1980	1979	1980	1979	1980	1979	1980
Western meadowlark	15.8	17.3	44	46	5.0	7.7	11	16
Grasshopper sparrow	7.0	0	19	0	7.8	0	12	0
Vesper sparrow	5.0	8.0	14	21	4.4	6.3	8	9
Lark sparrow	5.0	5.0	14	13	3.0	3.0	5	6
Mourning dove	1.0	1.7	3	4				
Killdeer	0.6	0.3	2	1				
Eastern kingbird	0.4	1.3	1	4				
Pinyon jay	0.4	0	1					
Red-winged blackbird	0.2	0.3	+	1				
Rufous-sided towhee	0.2	0	+					
American goldfinch	0.2	0.7	+	2				
Western kingbird	0.2	0	+					
Sharp-tailed grouse	0	1.7		4				
American robin	0	1.0		3				
Lark bunting	0	0.7		2				
Totals	36.0	38.0	98	101	20.2	17.0	36	31

+ Less than one percent

Table 19. Numbers per census run, percent composition, and breeding pair density of birds observed on the sagebrush census strip in the Otter Creek study area.

Species	Average No. Birds per Census Run		Percent Composition		Average No. Singing Males per Census Run		Highest no Singing Males in any Census Run	
	1979	1980	1979	1980	1979	1980	1979	1980
Western meadowlark	24.0	24.3	74	80	11.0	12.7	17	20
Vesper sparrow	4.6	5.3	14	18	4.0	5.0	6	7
Lark sparrow	2.2	0	7	0	0.8	0	2	-
Grasshopper sparrow	1.2	0	4	0	1.0	0	2	-
Brewer's sparrow	0.4	0.6	1	2	0.4	0.7	1	2
American kestrel	0.2	0	1	0	0	0	0	-
Totals	32.6	30.2	101	100	17.2	18.4	28	29

+ Less than one percent

Table 20. Numbers per census run, percent composition, and breeding pair density of birds observed on the ponderosa pine census strip in the Otter Creek study area.

Species	Average No. Birds Per Census Run		Percent Composition		Average No. Singing Males Per Census Run		Highest No. Singing Males in any Census Run	
	1979	1980	1979	1980	1979	1980	1979	1980
Chipping sparrow	17.8	16.3	21	20	8.6	11.0	11	17
Lark sparrow	16.4	10.3	20	13	6.2	8.0	17	14
Western wood pewee	13.2	11.3	16	14	11.2	11.0	18	17
House wren	8.8	6.0	11	7	8.4	5.0	11	6
Yellow-rumped warbler	4.2	6.3	5	8	4.2	5.7	7	8
Mourning dove	3.4	2.7	4	3	3.2	2.3	5	5
American robin	2.8	6.3	3	8	0.8	0.3	2	1
Black-capped chickadee	2.6	2.0	3	2	1.8	1.0	3	3
White-breasted nuthatch	2.0	1.7	2	2	1.6	1.7	4	2
Solitary vireo	1.8	1.7	2	2	1.4	1.7	2	2
Rufous-sided towhee	1.6	1.7	2	2	1.6	1.7	3	3
Brown-headed cowbird	1.6	3.3	2	4				
Mountain bluebird	1.4	3.0	2	4	0.6	2.3	1	2
Western meadowlark	1.4	1.3	2	2	1.0	1.3	4	2
Eastern kingbird	0.8	0.3	1	+	0.4	0	2	0
Red-headed woodpecker	0.8	0.3	1	+	0.8	0.3	2	1
Hairy woodpecker	0.6	0.7	1	1	1.2	0.3	2	1
Vesper sparrow	0.6	1.0	1	1	0.6	1.0	1	2
Common flicker	0.6	1.3	1	2	0.8	1.3	1	2
Western kingbird	0.4	1.3	+	2	0.2	0.7	1	1
Great-horned owl	0.2		+					
Red-breasted nuthatch	0.2		+					
American kestrel	0.2		+		0.2	0	1	0
Northern oriole	0.2	1.0	+	1	0.2	0.3	1	1
Common nighthawk	0.2		+					
Cassin's kingbird		0.7		1	0	0.3	0	1
Least flycatcher		0.3		+	0	0.3	0	1
Sharp-shinned hawk		0.3		+				
Pinyon jay		0.3		+				
Yellow warbler		0.3		+	0	0.3	0	1
Red crossbill	P	P						
Totals	83.8	81.7	100	99	55	57.8	99	93

+ Less than one percent

P = Present, no counts obtained

Table 21. Numbers per census run, percent composition, and breeding pair density of birds observed on the riparian census strip in the Otter Creek study area.

Species	Average No. Birds Per Census Run		Percent Composition		Average No. Singing Males Per Census Run		Highest No. Singing Males in Any Census Run	
	1979	1980	1979	1980	1979	1980	1979	1980
House wren	30.0	21.3	26	16	23.8	19.0	31	20
Yellow warbler	21.2	22.6	19	17	15.2	19.0	24	23
Lark sparrow	8.2	6.3	7	5	1.4	2.3	2	4
Eastern kingbird	6.6	4.3	6	3	4.4	3.3	7	5
American robin	5.6	5.3	5	4	1.0	2.0	3	4
Rufous-sided towhee	4.6	10.7	4	8	4.2	8.3	8	10
Lazuli bunting	4.4	2.0	4	2	4.2	2.0	7	4
Northern oriole	3.8	4.0	3	3	2.2	2.7	4	6
American goldfinch	3.4	4.7	3	4	0.8	1.3	3	2
Western kingbird	3.4	1.0	3	1	1.8	0.6	3	2
Common flicker	2.6	1.0	2	1	2.0	1.0	5	3
Brown thrasher	2.4	5.3	2	4	0.4	3.7	2	9
Yellow-breasted chat	1.6		1		1.4	0	2	0
Mourning dove	1.2	2.3	1	2				
Black-capped chickadee	1.2	1.7	1	1	0.2	0.3	1	1
Western wood pewee	1.2	2.7	1	2	1.0	2.7	2	7
Black-headed grosbeak	1.2	0.7	1	+	1.2	0.7	3	2
Gray catbird	1.0	2.3	1	2	0.2	1.7	1	4
Common yellowthroat	0.8	1.0	1	1	0.8	1.0	2	2
Downy woodpecker	0.6		+		0.4	0	1	0
White-breasted nuthatch	0.6		+		0.6	0	1	0
Warbling vireo	0.6		+		0.6	0	3	0
Chipping sparrow	0.6	0.7	+	+	0.4	0	1	0
Least flycatcher	0.6	1.0	+	1	0.6	1.0	1	3
Western meadowlark	0.4	1.3	+	1	0.4	1.0	1	2
Belted kingfisher	0.2		+					
Red-headed woodpecker	0.2	1.3	+	1	0	1.3	0	3

Table 21. Continued

Species	Average No. Birds Per Census Run		Percent Composition		Average No. singing Males Per Census Run		Highest No. Singing Males In Any Census Run	
	1979	1980	1979	1980	1979	1980	1979	1980
Tree swallow	0.2	1.0	+	1	0	0.7	0	1
American kestrel	0.2		+					
Starling	1.8	4.7	2	4	0.8	0.3	2	1
Common grackle	1.0	4.7	1	4				
Ring-necked pheasant	2.2		2					
Rock wren		0.3		+	0	0.3	0	1
Brown-headed cowbird		2.3		2				
White-crowned sparrow		0.3		+				
Field sparrow		0.3		+	0	0.3	0	1
Cassin's kingbird		0.3		+				
Red-winged blackbird		0.7		+	0	0.7	0	1
Hairy woodpecker		1.3		1	0	1.0	0	2
Clay-colored sparrow		8.0		6				
Brewer's sparrow		3.7		3				
Mountain bluebird		1.0		1	0	0.3	0	1
Red crossbill	P	P						
Totals	113.6	132.1	96	101	70.0	78.5	120	124

+ = Less than one percent

P = Present, no counts obtained

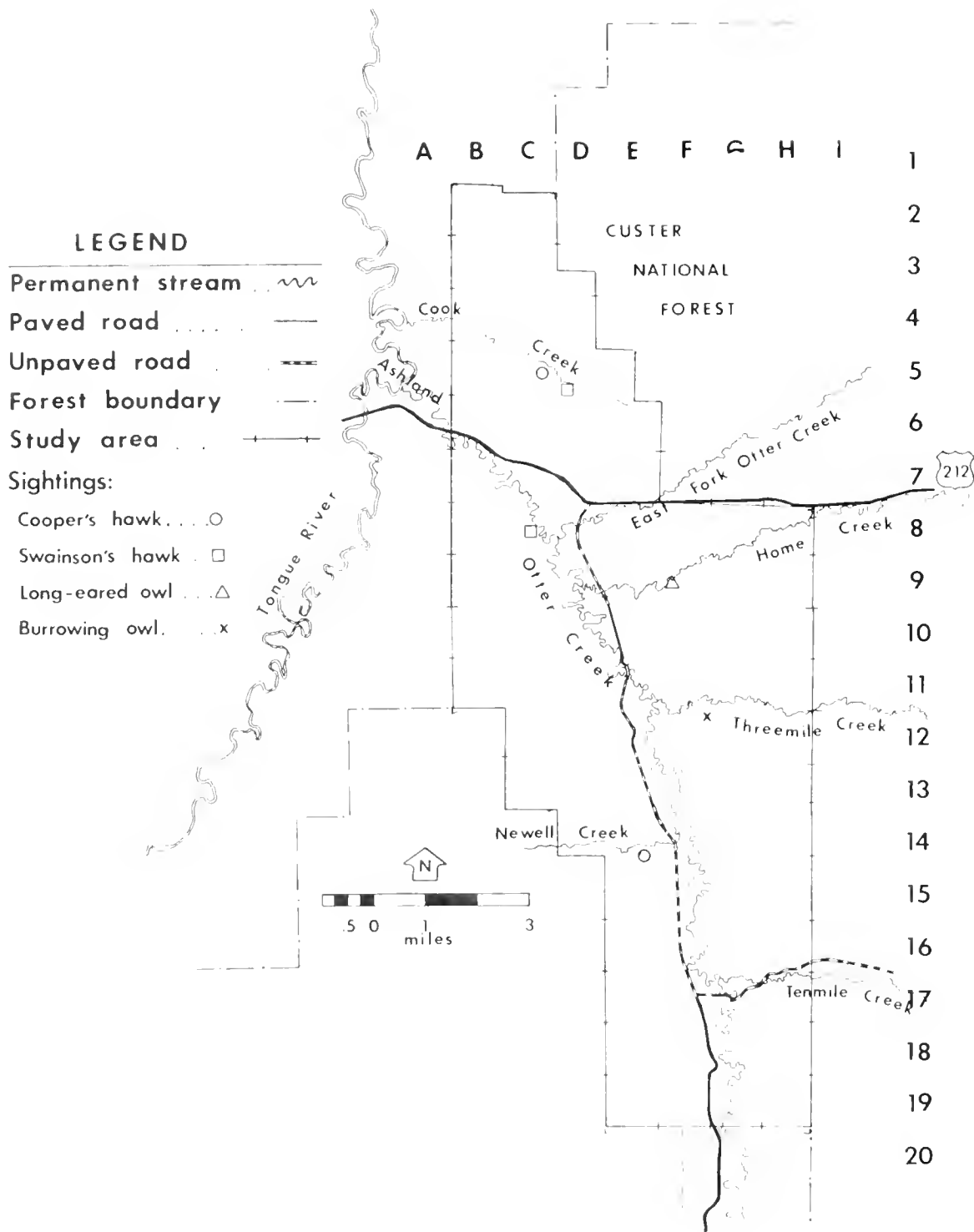


Figure 17. Sightings of raptorial birds of special interest or concern on the Otter Creek study area.

Buteos: Swainson's hawks were observed several times in the study area (Figure 17), and nesting was suspected. Rough-legged hawks were common on the study area during winter. Two migrating adult bald eagles were sighted by landowners.

Red-tailed hawks were the most common buteo on the study area. Five active nests were located in 1979 and three active nests were located in 1980 (Figure 18). Several other inactive nests were found. One nest was located on a cliff, two were in deciduous trees and six were in ponderosa pine trees (Table 22).

Golden eagles were seen regularly on the study area. Seven nests were located (Figure 19), two in ponderosa pine trees and five on cliffs (Table 22). A pair of eagles initiated nesting in nest number 12 (Figure 19), but abandoned the nest in mid-May. The landowner in the area indicated that this nest was used about every other year. An adult and two juvenile eagles were observed several kilometers northeast of this nest in late summer 1979, indicating the possibility of an undetected nest either in or near the study area. Another landowner stated that he often saw eagles in the area just west of nests 14, 15, and 16 during 1979, but rarely saw them during 1980. These nests were not found until 1980, so their status in 1979 remains unclear.

Harriers: Marsh hawks were common and probably nested in the study area. They were usually observed hunting over grasslands and hay meadows.

Falcons: Kestrels were the most common raptor in the study area. They nested mainly in old woodpecker holes in dead pine snags and large cottonwood trees.

Two prairie falcon aeries were located on cliffs in the study area (Figure 20). One was active in 1979 and the other was active in 1980. A third aerie was known to be located on or near the study area as shown in figure 20. Highly defensive adults were seen in the area several times in 1980, but the nest hole was not located. Suitable nest potholes for prairie falcons were present on several other cliffs in the study area. Prairie falcons used hay meadows along Otter Creek and Three-mile Creek for hunting.

Owls: Great-horned owls were common in the study area and two nests were found. Four long-eared owls were observed for several days in mid-August 1979 (Figure 17). One pair of burrowing owls was seen on a prairie dog town on 1 May 1980 (Figure 17). The prairie dog town had been poisoned two weeks previous to the sighting and was poisoned again in mid-May with strychnine oats.

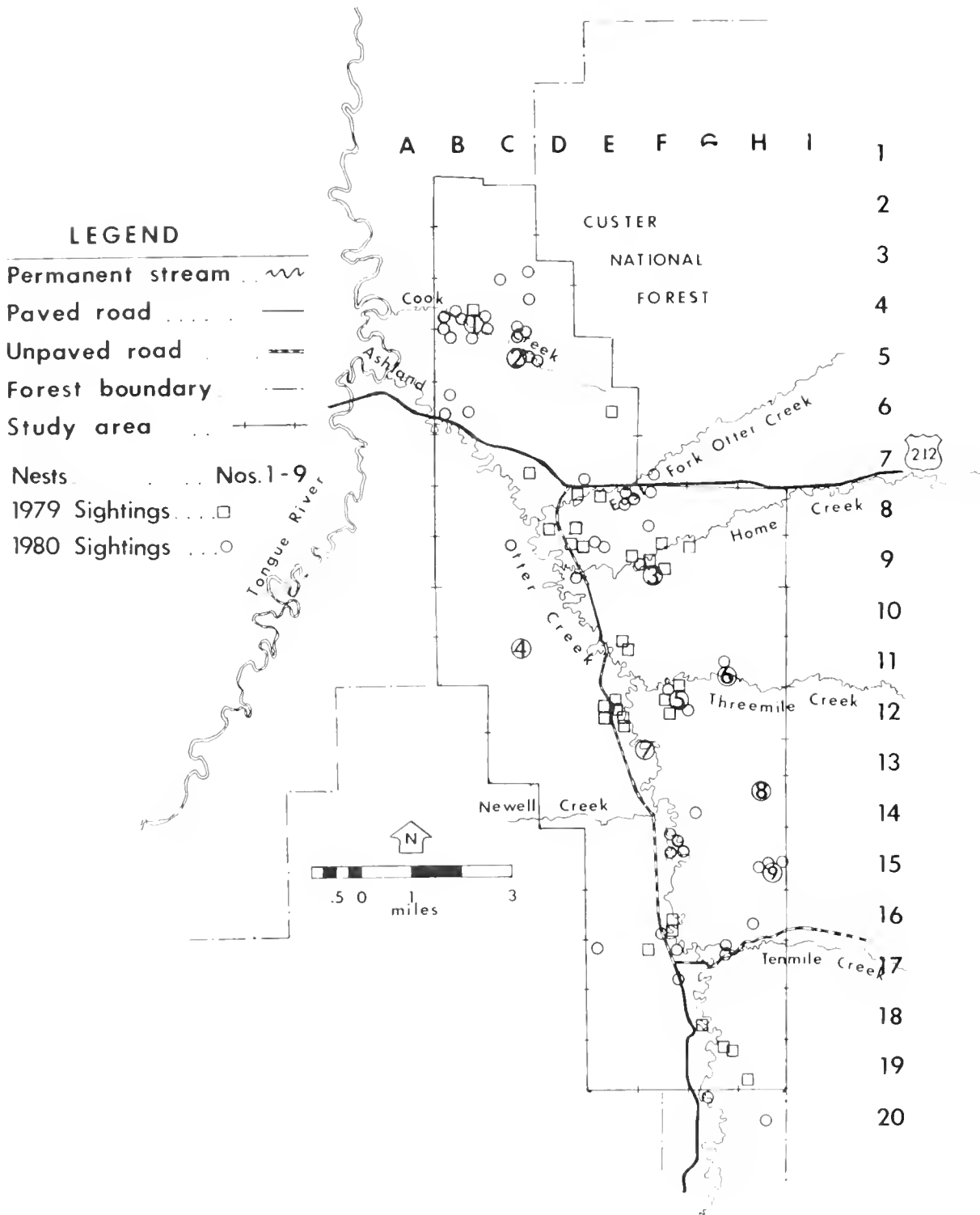


Figure 18. Nests and sightings of red-tailed hawks on the Otter Creek study area.

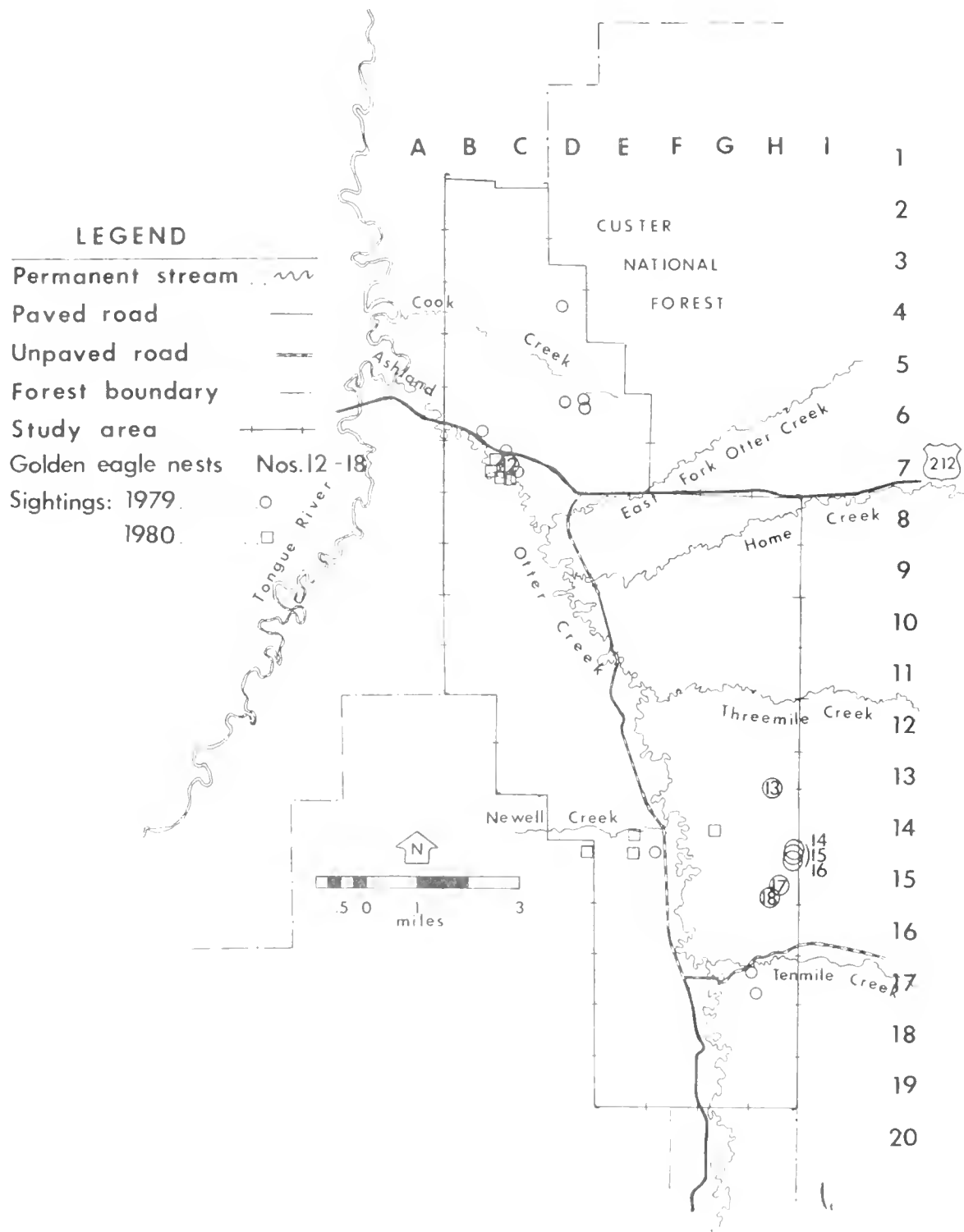


Figure 19. Nests and sightings of golden eagles on the Otter Creek study area.

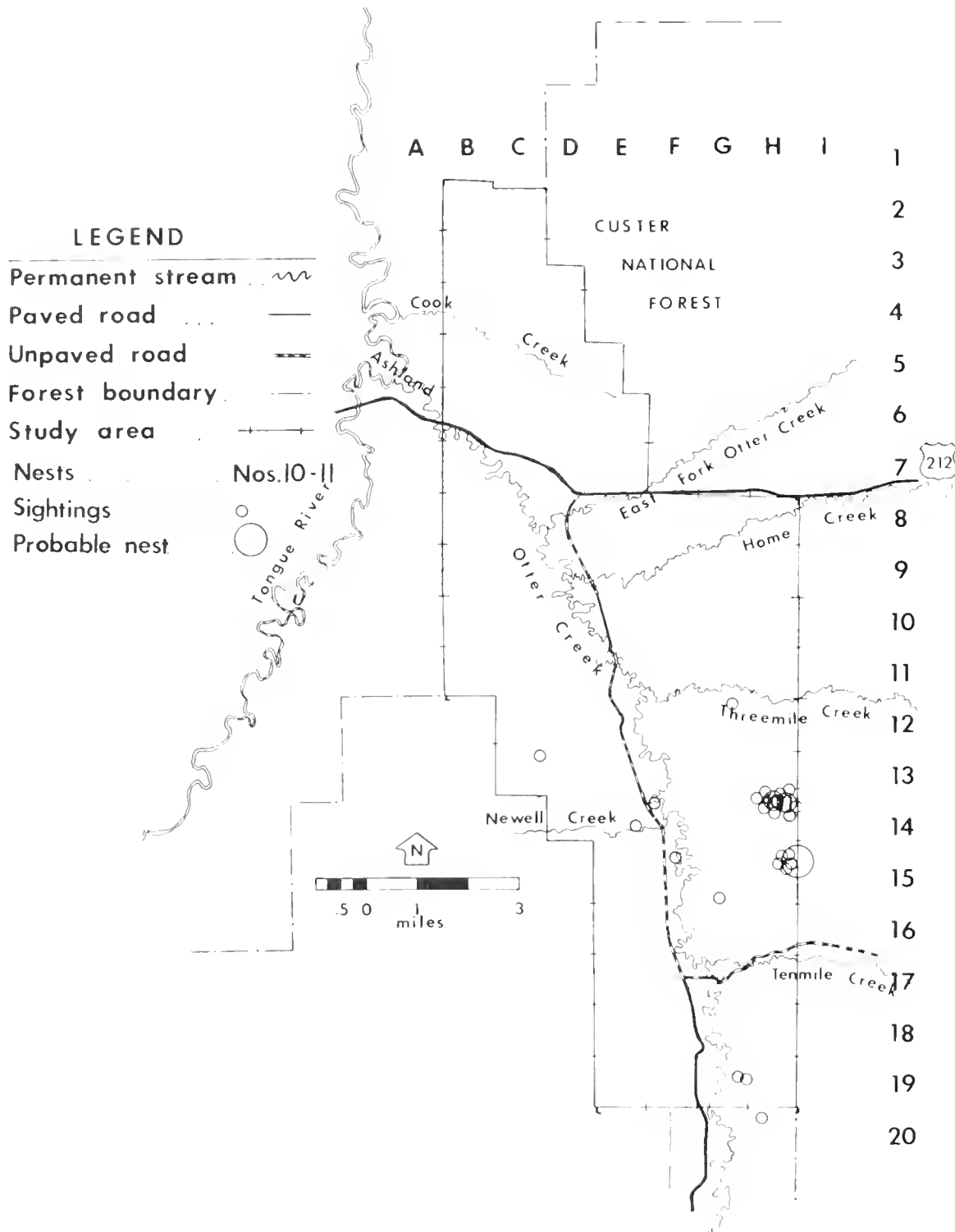


Figure 20. Nests and sightings of prairie falcons on the Otter Creek study area.

Table 22. Raptor nest sites on the Otter Creek area.

Number	Species	Substrate	Activity	
			1979	1980
1	Red-tailed hawk	Ponderosa pine tree	Fledged 3 young	Fledged 3 young
2	Red-tailed hawk	Ponderosa pine tree	Inactive	Inactive
3	Red-tailed hawk	Ponderosa pine tree	Fledged 1 young	Inactive
4	Red-tailed hawk	Ponderosa pine tree	Inactive	Inactive
5	Red-tailed hawk	Ponderosa pine tree	Fledged 1 young	Active-no production data
6	Red-tailed hawk	Cottonwood tree	Active-no production data	Inactive
7	Red-tailed hawk	Green ash tree	Active-no production data	Inactive
8	Red-tailed hawk	Ponderosa pine tree	Status unknown	Inactive
9	Red-tailed hawk	Cliff	Status unknown	Active-no production data
10	Prairie falcon	Cliff	Inactive	Active-fledged 4 young
11	Prairie falcon	Cliff	Active-no production data	Inactive
12	Golden eagle	Ponderosa pine tree	Inactive	Active-abandoned without young
13	Golden eagle	Ponderosa pine tree	Inactive	Inactive-old remains of young eagle
14, 15, 16	Golden eagle	All 3 on same cliff	Status unknown	Inactive
17	Golden eagle	Cliff	Inactive	Inactive
18	Golden eagle	Cliff	Inactive	Inactive

Non-game Mammals

Twenty-nine species of mammals were observed in the study area (Table 23). Mink (*Mustela vison*) and yellow-bellied marmots (*Marmota flaviventris*) were observed in the region and probably occurred in the study area. One dead hoary bat was found in riparian habitat. Other species of bats undoubtedly were present in the study area. The blacktail prairie dog was listed by Flath (1979b) as a species of special interest or concern. Two small towns were located (Figure 21).

Table 23. Mammals observed on the Otter Creek study area.

1. Masked or common shrew	<i>Sorex cinereus</i>
2. Hoary bat	<i>Lasiurus cinereus</i>
3. Raccoon	<i>Procyon lotor</i>
4. Shorttail weasel	<i>Mustela erminea</i>
5. Badger	<i>Taxidea taxus</i>
6. Striped skunk	<i>Mephitis mephitis</i>
7. Coyote	<i>Canis latrans</i>
8. Red fox	<i>Vulpes vulpes</i>
9. Bobcat	<i>Lynx rufus</i>
10. Blacktail prairie dog	<i>Cynomys ludovicianus</i>
11. Thirteen-lined ground squirrel	<i>Spermophilus tridecemlineatus</i>
12. Least chipmunk	<i>Eutamias minimus</i>
13. Red squirrel	<i>Tamiasciurus hudsonicus</i>
14. Northern pocket gopher	<i>Thomomys talpoides</i>
15. Wyoming pocket mouse	<i>Perognathus fasciatus</i>
16. Beaver	<i>Castor canadensis</i>
17. Western harvest mouse	<i>Reithrodontomys megalotis</i>
18. Deer mouse	<i>Peromyscus maniculatus</i>
19. Bushytail woodrat	<i>Neotoma cinerea</i>
20. Meadow vole	<i>Microtus pennsylvanicus</i>
21. Prairie vole	<i>Microtus ochrogaster</i>
22. Muskrat	<i>Ondatra zibethicus</i>
23. House mouse	<i>Mus musculus</i>
24. Porcupine	<i>Erethizon dorsatum</i>
25. Whitetail jackrabbit	<i>Lepus townsendii</i>
26. Desert cottontail	<i>Sylvilagus audubonii</i>
27. Mule deer	<i>Odocoileus hemionus</i>
28. Whitetail deer	<i>Odocoileus virginianus</i>
29. Antelope	<i>Antilocapra americana</i>

Six small-mammal traplines were run in the study area, one each in grassland, sagebrush, ponderosa pine-juniper, and marsh riparian habitat, and two traplines in boxelder-ash riparian habitat (Figure 16). The marsh riparian habitat consisted of a cattail (*Typha*), bulrush (*Scirpus*) area around a stockpond. Table 24 lists the total trap nights, trapping success, and numbers of each species caught in each habitat. The highest

number of species were caught in marsh riparian habitat and the highest trapping success was in boxelder-ash riparian habitat. The trapline in sagebrush habitat met with very poor trapping success. This may not have been typical of all sagebrush habitat in the study area.

Three of the *Peromyscus* captured in riparian habitat were suspected to be white-footed mice (*P. leucopus*). They were counted as *P. maniculatus* in the data until identification of the specimens is positively verified.

Table 24. Results of small-mammal trapping on the Otter Creek study area.

	Grass- land	Sage- Brush	Ponderosa Pine Juniper	Boxelder- Ash Riparian	Marsh Riparian
Total captures	11	2	12	63	14
Trap nights	448	486	468	806	541
Captures/100 trap nights	2.5	0.4	2.6	7.8	2.6
Number of species caught	3	2	2	4	5
Species:					
<i>Peromyscus maniculatus</i>	8	1	7		2
<i>Reithrodontomys megalotis</i>				29	1
<i>Microtus pennsylvanicus</i>					2
<i>Microtus ochrogaster</i>		1		22	6
<i>Mus musculus</i>				6	
<i>Spermophilus tridecemlineatus</i>	2				
<i>Eutamias minimus</i>			5		
<i>Perognathus fasciatus</i>	1				
<i>Sorex cinereus</i>				6	3

Amphibians and Reptiles

Four species of amphibians and six species of reptiles were seen on the Otter Creek study area (Table 25). The snapping turtle was listed by Flath (1979b) as a species of special interest or concern. Snapping turtles were fairly common along Otter Creek. Only one sagebrush lizard was encountered, in ponderosa pine-juniper habitat with large boulders. The other species were common to abundant in the study area.

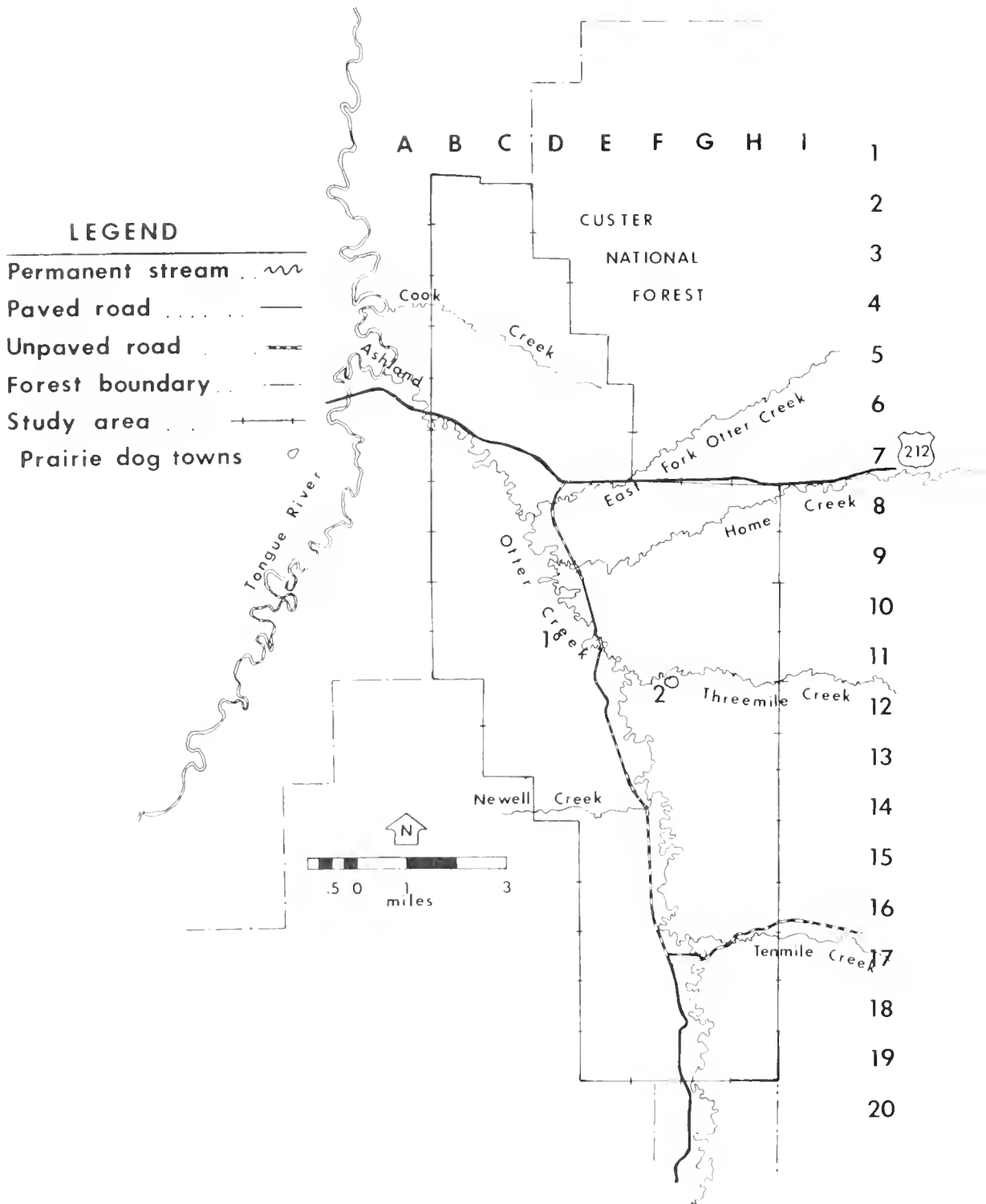


Figure 21. Prairie dog towns on the Otter Creek study area.

Table 25. Amphibians and reptiles observed on the Otter Creek study area.

1. Woodhouse toad	<i>Bufo woodhousei</i>
2. Tiger salamander	<i>Ambystoma tigrinum</i>
3. Northern chorus frog	<i>Pseudacris triseriata</i>
4. Leopard frog	<i>Rana pipiens</i>
5. Snapping turtle	<i>Chelydra serpentina</i>
6. Painted turtle	<i>Chrysemys picta</i>
7. Sagebrush lizard	<i>Sceloporus graciosus</i>
8. Racer	<i>Coluber constrictor</i>
9. Bull snake	<i>Pituophis catenifer</i>
10. Prairie rattlesnake	<i>Crotalus viridis</i>

Hanging Woman Creek

Mule Deer

Population characteristics: During the fifteen months of field work, 1830 mule deer were observed in the Hanging Woman Creek study area (Table 1). Group size averages were largest during the winter season, 10.2, and smallest during the summer time, 2.0. Deer gradually separated from their winter herds during April and May in both years reaching their smallest sized groups in June. Winter herds were formed in December.

Hanging Woman Creek supported the highest density of mule deer of the three study areas. Observations per hour of aerial survey ranged from a summer low of 19.4 to a winter high of 74.8 (Table 26). During the January flight, 144.4 mule deer were seen per hour of flight. The highest number seen in Otter Creek per hour was 55.0 (Table 2).

The population structure (Table 27) shows a slightly lower percentage of fawns than observed in the Otter Creek area. Does comprised 47.8 percent of the population in October. This is slightly higher than the 41.7 percent observed in the Otter Creek area (Table 3). While the fawn production was lower than that observed on Otter Creek, it was still very good at 92.2 fawns per 100 does. This area has been classified as having stable population levels (Swenson 1978) of mule deer in low nutritional condition (Swenson and Knapp 1979). These data seem to indicate an under-harvested mule deer herd.

Distribution: Spring mule deer distribution is shown in Figure 22. The deer are fairly evenly distributed throughout the study area. The largest grouping of observations stretches across

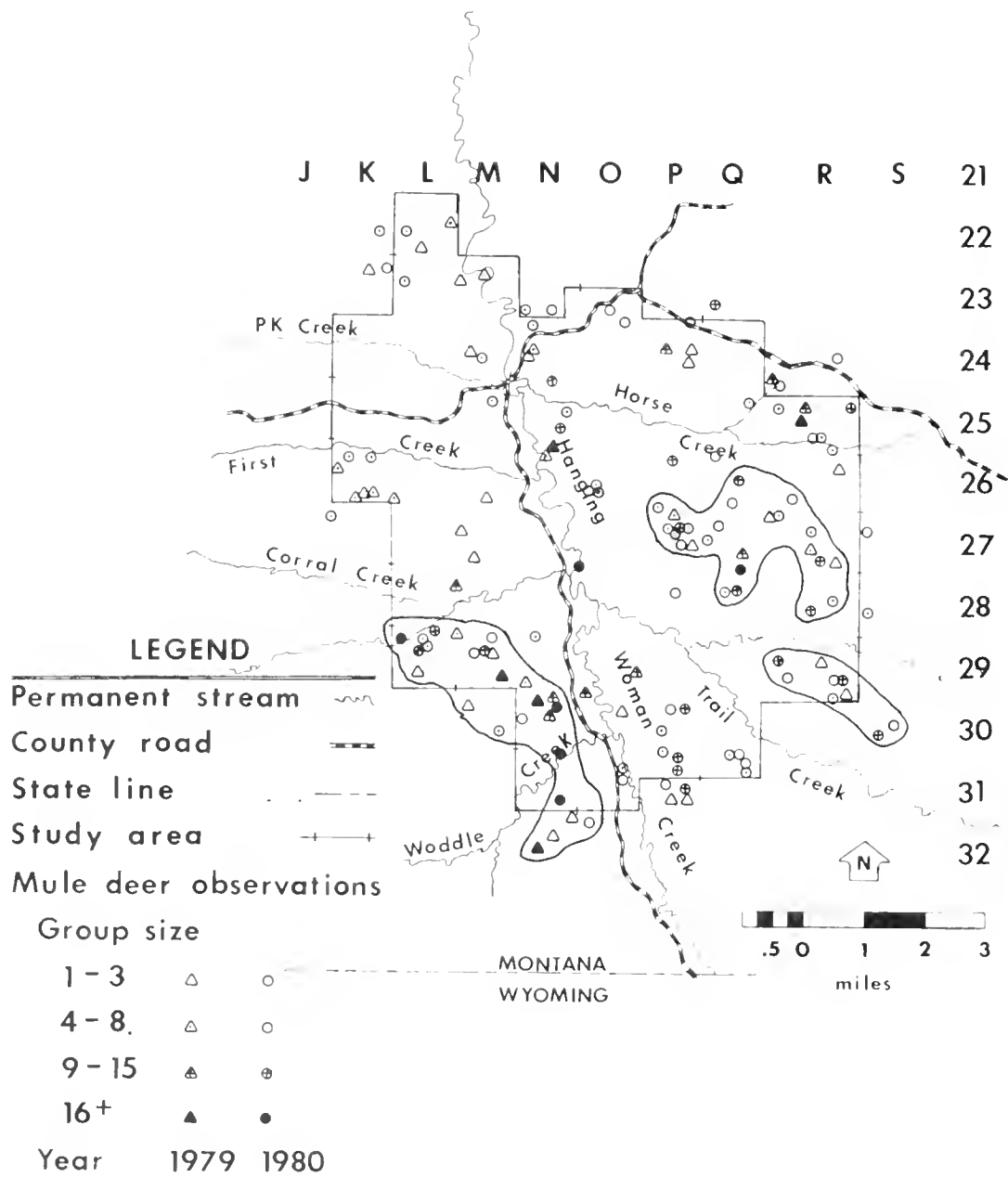


Figure 22. Spring mule deer distribution in the Hanging Woman Creek area.

Table 26. Mule deer, antelope and coyote aerial observations per hour in the Hanging Woman Creek area.

Month	Hours	Aerial Observations			Observations/Hour			Coyotes per 100:	
		Mule Deer	Ant.	Coyotes	Mule Deer	Ant.	Coyote	Mule Deer	Antelope
April	2.25	143	110	5	63.6	48.9	2.2	3.5	4.5
May	2.25	123	146	2	54.7	64.9	0.9	1.6	1.4
Spring	4.5	266	256	7	59.1	56.9	1.6	2.6	2.7
June	2.3	38	61	3	16.5	26.5	1.3	7.9	4.9
July	2.3	46	197	5	20.0	85.7	2.2	10.9	2.5
Aug	2.1	46	121	3	21.9	57.6	1.4	6.5	2.5
Summer	6.7	130	379	11	19.4	56.6	1.6	8.5	2.9
Sept	2.3	89	191	14	38.7	83.0	6.1	15.9	7.3
Oct	2.25	135	237	5	60.0	105.3	2.2	3.7	2.1
Nov	1/	-	-	-	-	-	-	-	-
Fall	4.55	224	428	19	49.2	94.1	4.2	8.4	4.4
Dec	1.9	65	449	2	34.2	236.3	1.1	3.1	0.4
Jan	1.6	231	274	4	144.4	171.3	2.5	1.7	1.5
Feb	2.1	123	381	6	58.6	181.4	2.9	4.9	1.6
Winter	5.6	419	1104	12	74.8	197.1	2.1	2.9	1.1
March	2.9	151	298	4	52.1	102.8	1.4	2.6	1.3
April	2.3	199	138	3	86.5	60.0	1.3	1.5	2.2
May	2.0	131	136	0 ^{2/}	65.5	68.0	0.0	0.0	0.0
Spring	7.2	481	572	7	66.8	79.4	1.0	1.5	1.2
June	2.3	87	119	4	37.8	51.7	1.7	4.6	3.4
July	-	-	-	-	-	-	-	-	-
Aug	-	-	-	-	-	-	-	-	-
Summer	2.3	87	119	4	37.8	51.7	1.7	4.6	3.4

1/ No surveys made

2/ No observations made on surveys

Table 27. Mule deer population characteristics in the Hanging Woman Creek area in 1979.

Month	Number Classified				Population Structure (%)					
	Total	Bucks	Does	Fawns	Fawns:100 Does	Adults	Bucks: 100 Does	Bucks	Does	Fawns
September	77	8	38	31	81.6	67.4	21.1	10.4	49.4	40.3
October	134	11	64	59	92.2	78.7	17.2	8.2	47.8	44.0

the ridge from Waddle Creek to Corral Creek west of Hanging Woman Creek. Another major group was observed east of Hanging Woman between Horse Creek and Trail Creek.

While deer were still observed in most portions of the study area, a noticeable converging on Hanging Woman Creek occurred during the summer season (Figure 23). Mule deer were staying close to their primary water supply, i.e. Hanging Woman Creek. The greatest concentration of observations was located east of Hanging Woman Creek south from Horse Creek through the mouth of Trail Creek to the southern boundary of the study area. Practically all the observations were in the 1-3 group size category.

The number of fall observations is greatly reduced from spring and summer because group sizes are bigger and only one year's data were gathered (Figure 24). The greatest numbers observed were in the vicinity of coordinates 0, 26. Most observations were in the central and southern portions of the study area.

Winter observations are mapped in Figure 25. Four wintering areas are evident. The largest, both in numbers of deer and observations, is located along the ridge between Horse Creek and Trail Creek. The second largest group is found astride Corral Creek in the southwest portion of the study area. Two smaller groups, one north of Horse Creek and one astride Trail Creek in the southeast corner, make up the remainder of the mule deer wintering areas. Practically all of the observations were of large groups of mule deer.

Vegetation type usage: The ponderosa pine type was most heavily used in the spring of 1979 when 48 percent of the mule deer were observed in that type (Table 28). The winter season saw 44 percent of the deer in the pine subtypes. The least number of deer were observed in the ponderosa pine type during the fall season.

Sagebrush/grasslands were most often used by mule deer in all seasons and averaged 56.8 percent over the course of the study. Seventy-three percent of the deer were observed in the sagebrush/grassland type in the spring of 1980. This type covered the largest amount of surface in the study area (Figure 4).

Creekbottoms were extremely important during the summer and fall months. This type, with a very small percentage of surface area, accounted for 17 and 23 percent of the summer observations in 1979 and 1980 respectively. During the summer of 1980, the driest season of the study, fully 30 percent of the mule deer observations were made in creekbottom subtypes. This includes the agricultural creekbottom type which is primarily hay fields.

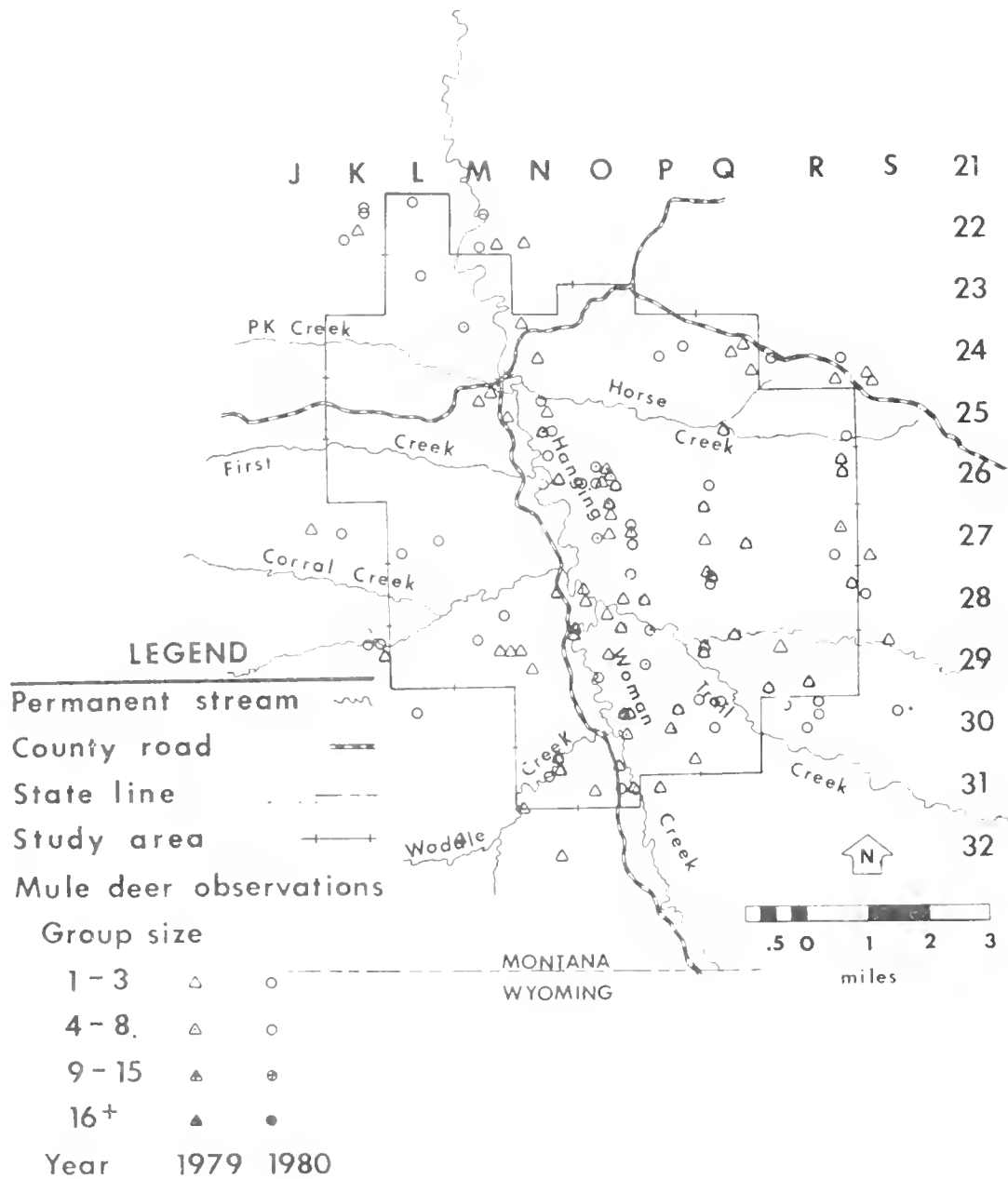


Figure 23. Summer mule deer distribution in the Hanging Woman Creek area.

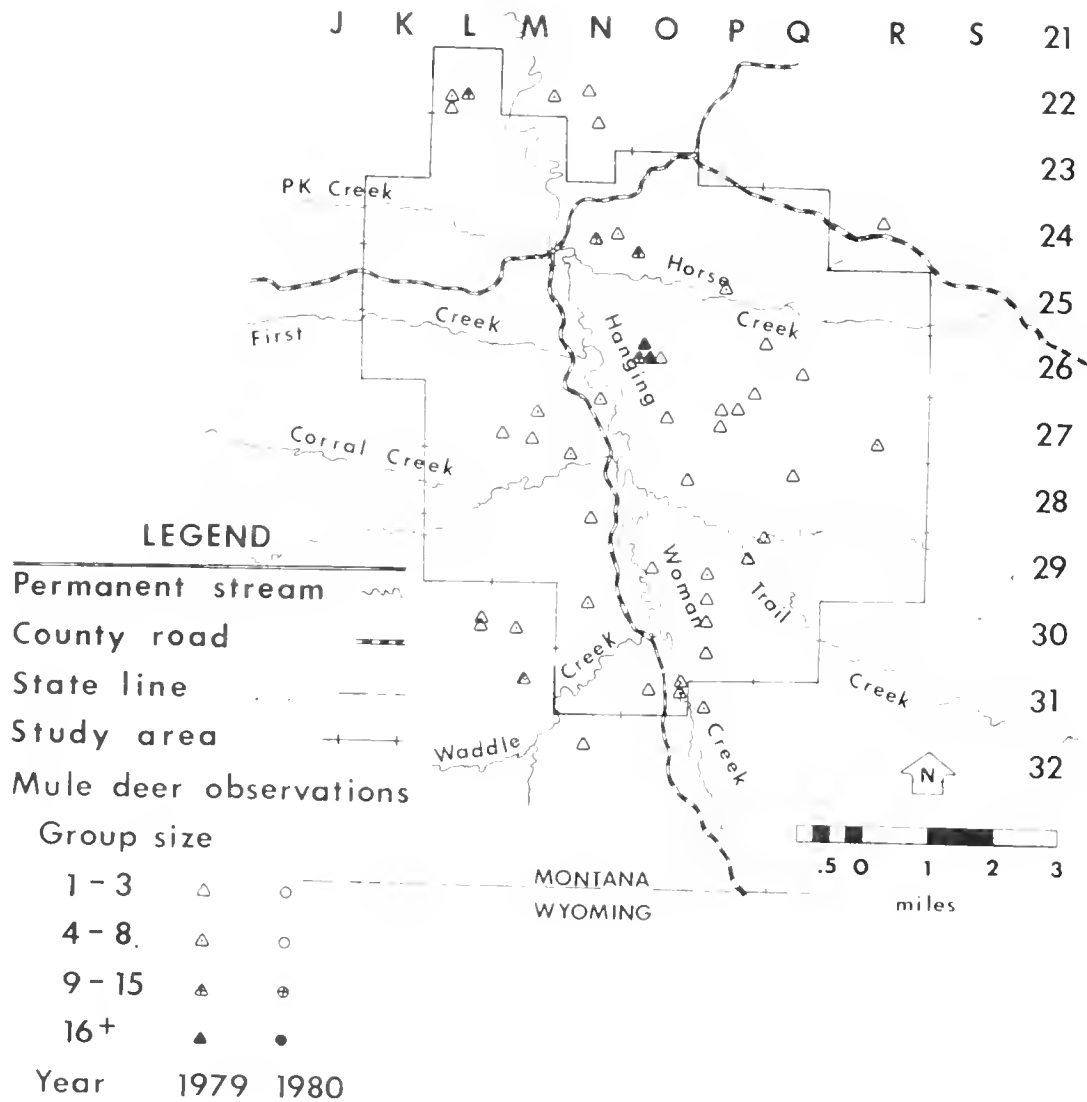


Figure 24. Fall mule deer distribution in the Hanging Woman Creek area.

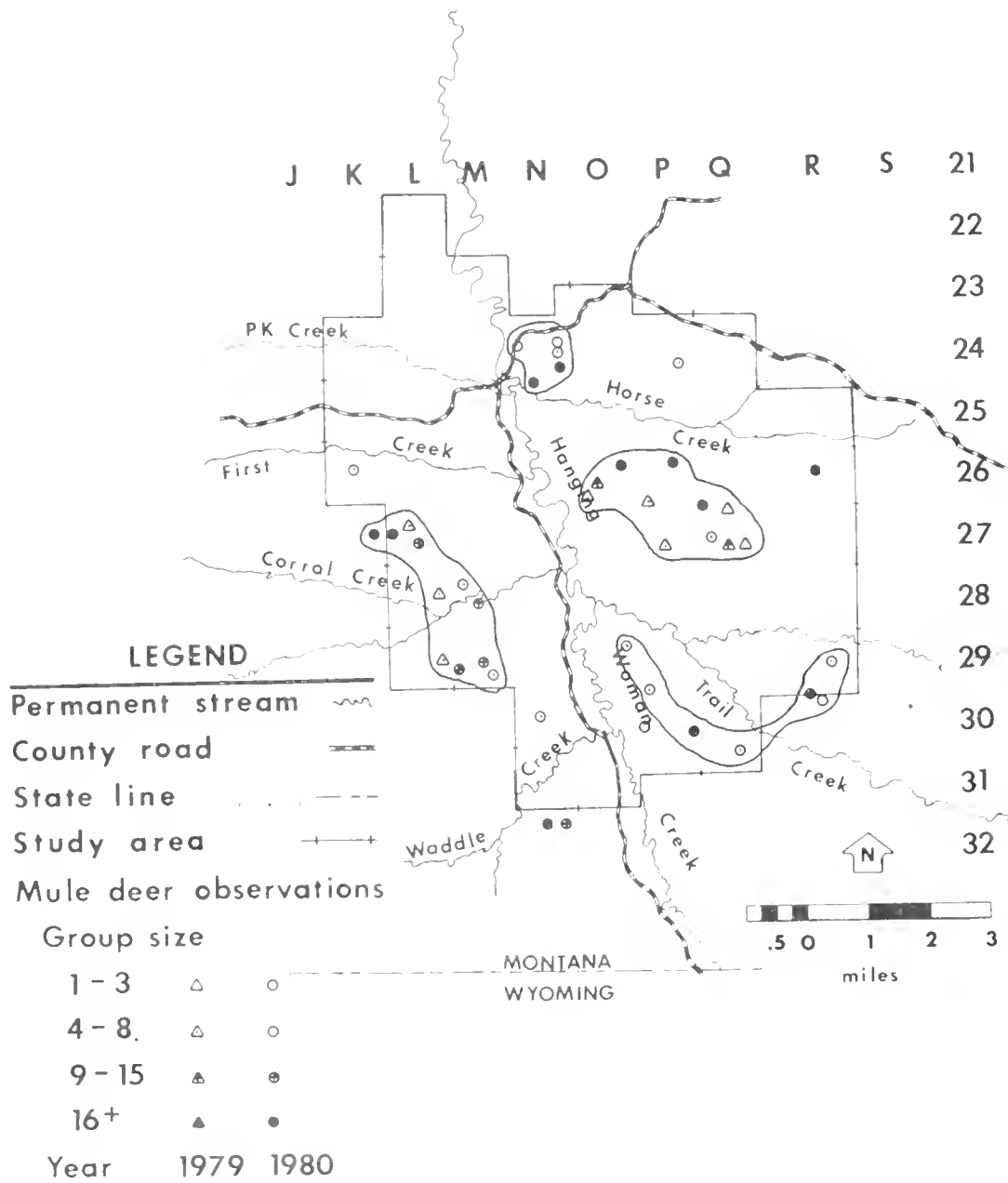


Figure 25. Winter mule deer distribution in the Hanging Woman Creek area.

Activity: The lack of ponderosa pine cover made deer easier to observe as they lay out in the open. For that reason more deer were observed lying in the Hanging Woman study area than in the Otter Creek area (Table 29). Most deer were observed standing in all seasons except spring 1980 when more deer were observed feeding.

Use of topography: Use of the dissected mid-slopes was the highest in every season (Table 30). The highest percentage of observations using the hillside category was during the winter season, 89 percent. This topographic area is most likely to offer shelter from the wind and, at the same time, be free of snow cover.

The lowland features, alluvium/terrace and flood plains, had peak use during summer and fall seasons. Deer were forced onto the riparian bottom lands in search of water and succulent forage. These types received heaviest usage, 31 percent, during the driest season, summer of 1980.

Use of exposure: Deer were observed on every aspect in every season (Table 31). They were fairly evenly distributed with a few exceptions. During the spring 1979 season 48 percent of the deer were observed on southerly slopes. This occurred just after a long hard winter and the southern slopes were the first to become free of snow and offer new growth to eat.

The summer seasons were marked by substantial increases in the usage of flat, lowland categories. Again, deer were reacting to the lack of moisture in the upland areas. The mild nature of the 1979-80 winter was demonstrated by the 62 percent usage figure on northerly slopes.

Use of slope: Seasonal use of slopes by mule deer in the Hanging Woman Creek area is presented in Table 32. Usage of steep slopes was highest during the winter months when 32 percent usage was observed. The lowest percentage was observed during the summer of 1980, 6 percent.

More deer were observed on medium slopes than any other in all seasons except winter when gentle and steep slopes had more deer. Medium slopes averaged 41 percent of mule deer observations during the study. Flat land areas received the most during the two summer seasons with 28 and 37 percent for 1979 and 1980 respectively.

Antelope

Population characteristics: During the six seasons of study, 3,308 antelope were observed on the Hanging Woman Creek area (Table 9). Average group size ranged from 3.4 antelope per group during the first spring season to 44.2 antelope per group in the winter months. January was by far the largest when 3 groups averaged 91.3 antelope per group were observed.

Table 28. Seasonal use of vegetation types by mule deer in the Hanging Woman Creek area.

Vegetation Subtypes	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	324 ^{1/}	144	227	419	612	103
Ponderosa pine	-	4	3	10	2	5
Sagebrush	31 ^{2/}	10	4	26	14	6
Grassland	6	3	5	-	6	6
Skunkbush	tr ^{3/}	3	4	2	1	1
Juniper	11	3	-	5	2	7
Snowberry	-	-	1	-	-	-
Total Ponderosa Pine	48	24	17	44	25	24
Sagebrush	40	28	40	34	62	26
Deciduous shrub	-	-	-	15	6	9
Grassland	7	28	26	7	5	8
Total Sagebrush/grassland	47	57	65	56	73	43
Tree	-	3	8	-	-	4
Shrub	3	15	9	-	2	19
Total Creekbottom	3	17	18	-	2	23
Ponderosa pine	-	1	-	-	-	3
Sagebrush/grassland	-	-	-	-	-	-
Creekbottom	2	1	-	-	-	7
Total Agricultural	2	1	-	-	-	10

^{1/} Total observations

^{2/} Percent of observations rounded to nearest whole number

^{3/} tr = a percentage 0.5

Table 29. Seasonal activity of mule deer in the Hanging Woman Creek area.

Activity	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	324 ^{1/}	144	227	419	611	103
Standing	42 ^{2/}	67	45	63	34	50
Running	17	10	9	6	8	21
Lying	15	2	36	21	10	6
Feeding	27	21	10	10	48	22

^{1/} Total observations

^{2/} Percent of observations rounded to nearest whole number

Table 29. Seasonal activity of mule deer in the Hanging Woman Creek area.

Activity	Spring 1979 324 <u>1</u> /	Summer 1979 144	Fall 1979 227	Winter '79-80 419	Spring 1980 611	Summer 1980 103
Standing	422/	67	45	63	34	50
Running	17	10	9	6	8	21
Lying	15	2	36	21	10	6
Feeding	27	21	10	10	48	22

1/ Total observations

2/ Percent of observations rounded to nearest whole number

Table 30. Seasonal use of topography by mule deer in the Hanging Woman Creek area.

Topography	Spring 1979 324 <u>1</u> /	Summer 1979 144	Fall 1979 227	Winter '79-80 419	Spring 1980 611	Summer 1980 103
Mesa-Butte top	72/	8	6	1	8	14
Mesa-Butte Steep Slopes	11	-	5	4	3	1
Dissected mid-slopes	73	72	70	89	79	55
Alluvium/terrace	5	4	3	6	7	15
Flood plain	3	15	16	-	3	16

1/ Total observations

2/ Percent of observations rounded to nearest whole number

Table 31. Seasonal use of exposure by mule deer in the Hanging Woman Creek area.

Exposure	Spring 1979 324 ^{1/}	Summer 1979 144	Fall 1979 199	Winter '79-80 419	Spring 1980 611	Summer 1980 103
North	13	19	19	18	13	16
South	29	6	4	8	9	14
East	4	6	4	13	14	6
West	10	13	25	5	10	6
Northeast	7	12	12	25	12	10
Northwest	8	5	2	19	7	3
Southeast	5	5	2	3	9	9
Southwest	14	6	12	2	17	1
Flat	10	28	20	7	8	37

1/ Total observations

2/ Percent of observations rounded to nearest whole number

Table 32. Seasonal use of slope by mule deer in the Hanging Woman Creek area.

Slope	Spring 1979 324 ^{1/}	Summer 1979 144	Fall 1979 199	Winter '79-80 419	Spring 1980 611	Summer 1980 103
Flat	10	28	18	7	9	37
Gentle	21	19	22	34	36	9
Medium	50	32	45	26	43	49
Steep	19	21	15	32	12	6

1/ Total observations

2/ Percent of observations rounded to nearest whole number

Antelope were more dense than mule deer in the Hanging Woman study area (Table 26) with greater numbers observed in every season except the initial spring survey. The number of antelope observed per hour of flight ranged from the 50's in spring and summer to a whopping 197.1 during the winter season. In December, 449 antelope were observed on the study area in a little less than 2 hours flight time. That this area is a major antelope winter range is undeniable.

Population structure and production figures are shown in Table 33. The percentage of fawns in the population in 1979 was highest in July (34.6 percent) and decreased in each succeeding month. Production figures (1979) were also highest in July when 67.4 fawns per 100 does were observed. Sixty fawns per 100 does were observed in June of 1980. The June 1979 flight was conducted before most fawns were born. These production figures compare to an average of 61.3 fawns per 100 does in Fish, Wildlife and Parks hunting unit 742 from 1963 through 1978 (Wentland 1979). The Hanging Woman Creek study area is contained within hunting unit 742.

Table 33. Antelope population characteristics in the Hanging Woman Creek area.

Month	Total	Bucks	Does	Fawns	Population Structure					
					Fawns:100		Bucks:		Percentage	
				Does	Adults	100	Does	Bucks	Does	Fawns
1979										
June	93	22	65	6	9.2	6.9	33.9	23.7	69.9	6.4
July	240	34	123	83	67.4	52.9	27.6	14.2	51.3	34.6
Aug	138	22	73	43	58.9	45.3	30.1	15.9	52.9	31.1
Sept	201	40	101	60	59.4	42.6	39.6	19.9	50.2	29.9
1980										
June	122	34	55	33	60.0	37.1	61.8	27.9	45.1	27.0

Distribution: Antelope spring distribution is shown in Figure 26. Antelope were observed throughout the study area with groups fairly evenly distributed within the size categories. A concentration of observations is evident just north of Trail Creek. Another group of observations is centered in the vicinity of Horse Creek. The entire western portion of the study area from above PK Creek south to Waddle Creek was covered with observations.

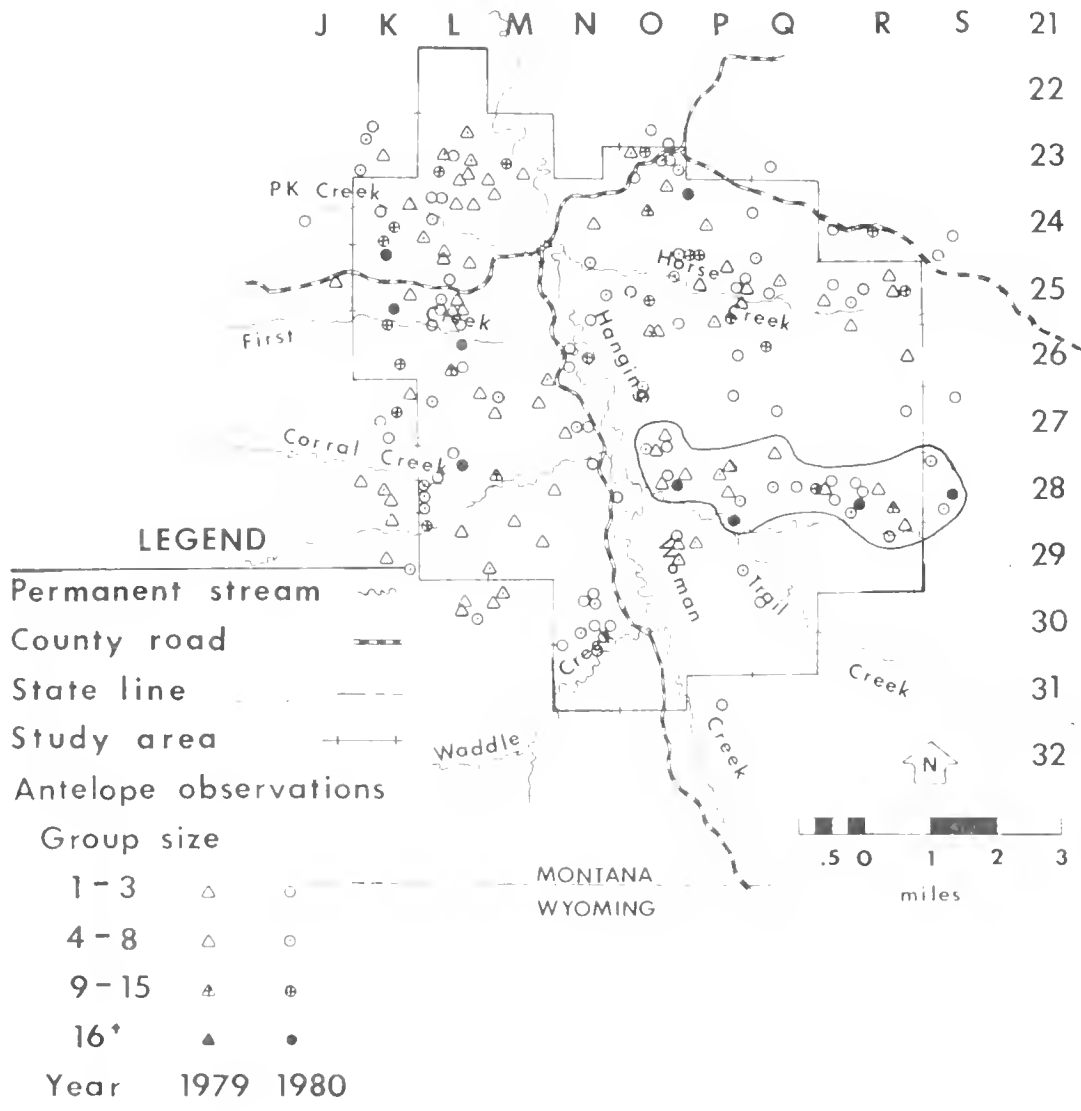


Figure 26. Spring antelope distribution in the Hanging Woman Creek area.

During the summer months, the antelope used less of the Hanging Woman Creek study area as they condensed into three major use areas (Figure 27). One large group of observations was made in the northeast portion of the study area north of Horse Creek. Another group was concentrated in the First Creek and PK Creek drainages. The third major area was located along the north side of Trail Creek and extending northward along the east side of Hanging Woman Creek approximately 2 miles north of the mouth of Trail Creek. Very few observations were made in the Corral Creek drainage.

Fall antelope observations revealed a major shift in antelope usage patterns (Figure 28). Many observations were made in the Corral Creek drainage. Antelope were noticed to be staying closer to the main water sources, PK Creek and Hanging Woman Creek. There was a definite shift to the south and west portions of the study area.

Winter antelope observations are shown in Figure 29. The major wintering area is seen to be along the north side of Trail Creek extending northward along the east side of Hanging Woman Creek. The PK Creek area is another wintering range. Antelope were also observed north of Horse Creek and between Corral and First Creeks. This was a mild winter with very little snow cover. Therefore the antelope were able to pick which ever area suited them. They may have used entirely different areas under more harsh circumstances. Practically all of the observations were of large groups of antelope.

Vegetation type usage: The fact that antelope are heavily dependent on sagebrush is evident in Table 34. Antelope usage of the sagebrush/grassland type averaged 91 percent and ranged from 81 to 99 percent during the six seasons of study. Antelope were observed in ponderosa pine subtypes in all seasons but in very low numbers. A significant percentage, 15 percent, were observed on the agricultural creekbottom type during the fall season. These antelope were on harvested hay meadows near water.

Activity: The activity of antelope at the time of observation is recorded in Table 35. More antelope were observed standing in the spring seasons, 34 percent in 1979 and 45 percent in 1980, than the other four seasons which ranged from 22 to 28 percent. The fewest numbers were observed running during the spring season as antelope seemed to be conserving energy. The relatively large percentage of antelope observed feeding and lying down in the 1979 spring is indicative of the very severe winter just completed. No antelope were observed lying down or feeding during the winter aerial surveys.

Use of topography: Antelope were most often observed in the rolling portions of the dissected midslopes (Table 36) and least often seen on steep mesa-butte hillsides. A few

Table 34. Seasonal use of vegetation types by antelope in the Hanging Woman Creek area.

Vegetation Subtypes	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	314 ^{1/}	471	524	1104	720	175
Ponderosa pine	-	1	tr	-	-	-
Sagebrush	1 ^{2/}	2	3	2	4	1
Grassland	3	1	-	-	3	1
Skunkbush	-	1	-	-	-	-
Juniper	-	tr ^{3/}	-	-	-	-
Snowberry	-	-	-	-	-	-
Total Ponderosa pine	4	5	3	2	7	1
Sagebrush	56	50	37	67	55	45
Deciduous shrub	-	-	-	-	-	-
Grassland	39	42	44	26	35	54
Total Sagebrush/grassland	94	92	81	93	90	99
Tree	-	-	-	-	-	-
Shrub	-	2	1	5	1	-
Total Creekbottom	-	2	1	5	1	-
Ponderosa pine	-	-	-	-	2	-
Sagebrush/grassland	-	-	-	-	tr	-
Creekbottom	2	2	15	-	tr	-
Total Agricultural	2	2	15	-	2	-

^{1/} Total observations

^{2/} Percent of observations rounded to nearest whole number

^{3/} tr= trace; a percentage 0.5

Table 35. Seasonal activity of antelope in the Hanging Woman area.

Activity	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	314 ^{1/}	471	524	1104	720	175
Standing	34 ^{2/}	28	26	25	45	22
Running	19	51	56	75	30	39
Lying	21	9	tr ^{3/}	-	7	7
Feeding	26	12	19	-	18	23

^{1/} Total observations

^{2/} Percent of observations rounded to nearest whole number

^{3/} tr = trace; a percentage 0.5

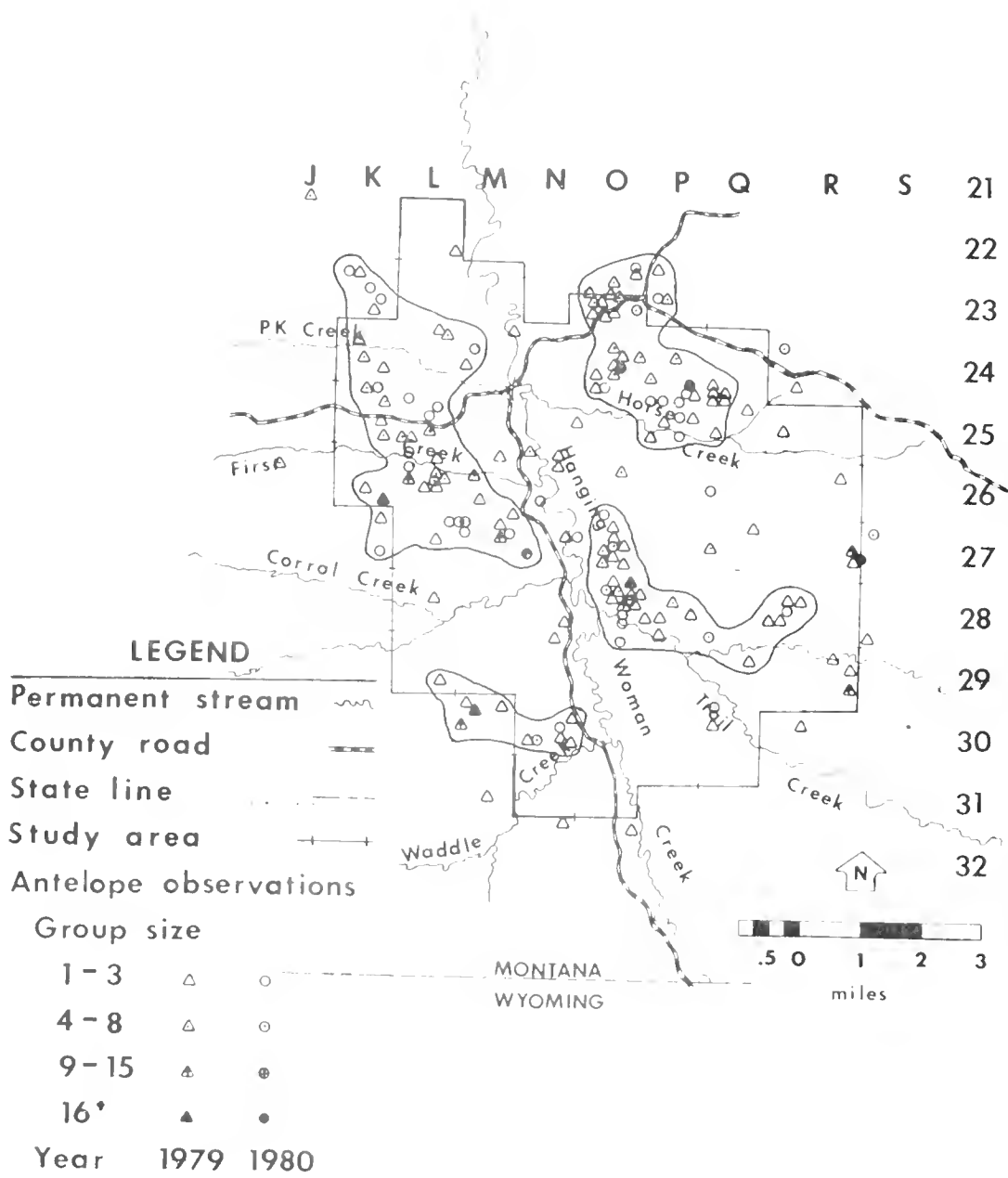


Figure 27. Summer antelope distribution in the Hanging Woman Creek area.

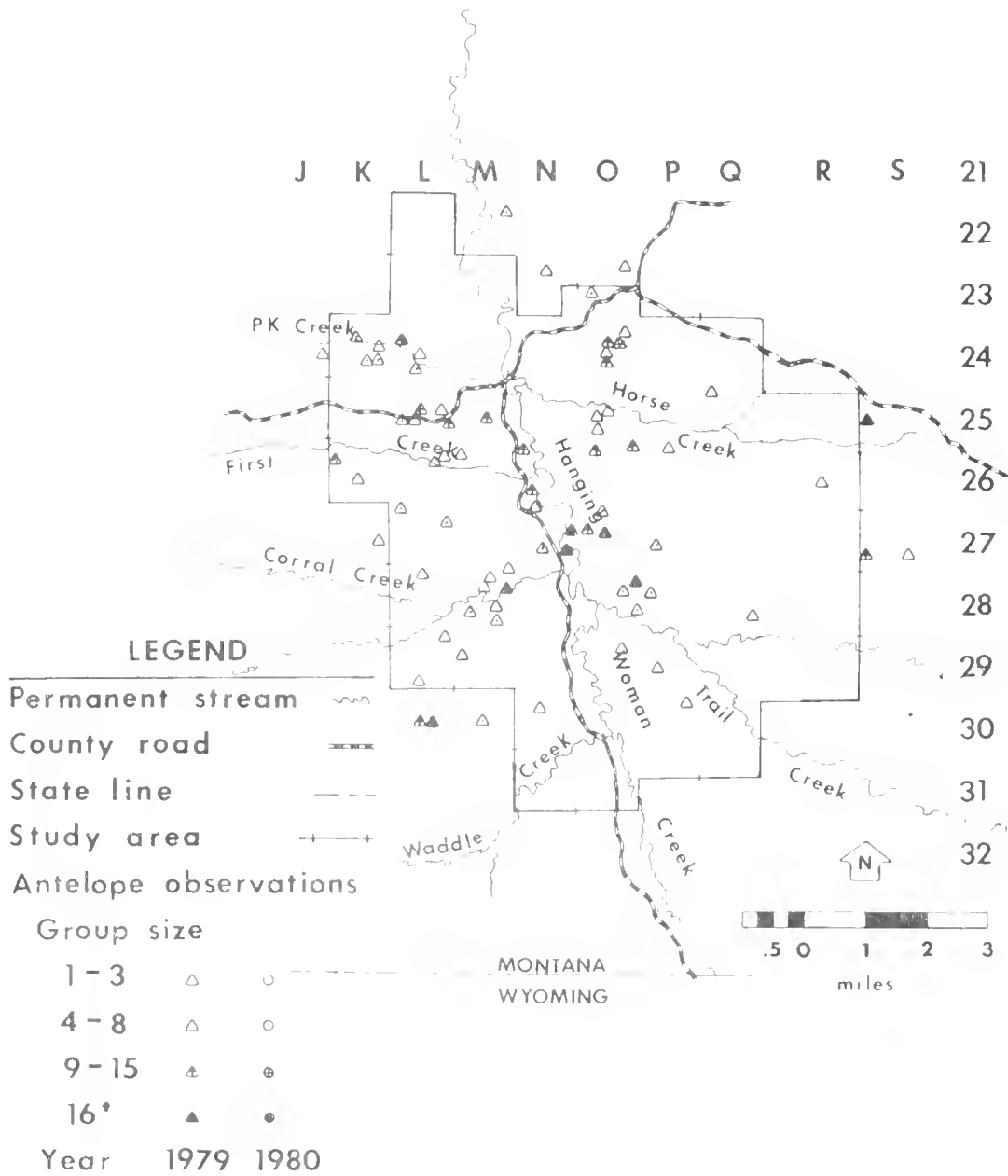


Figure 28. Fall antelope distribution in the Hanging Woman Creek area.

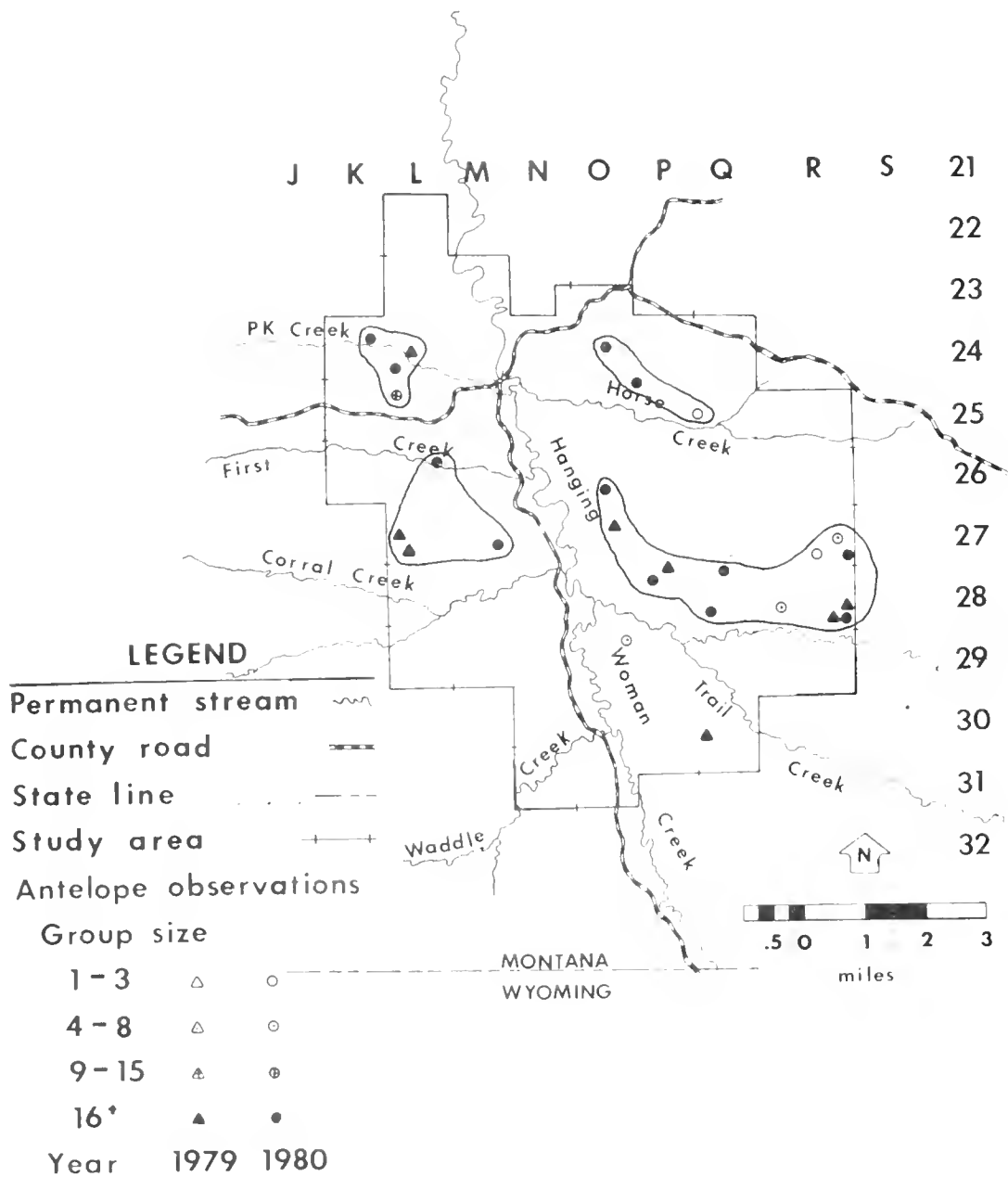


Figure 29. Winter antelope distribution in the Hanging Woman Creek area.

antelope were observed on the plateau tops in all seasons with the most, 13 percent, occurring during the winter months. Antelope were also seen on the lowland topographic features during all seasons. The fall and winter seasons, with 18 and 15 percent of the antelope respectively, had the most antelope observations of the lowland topographic categories.

Use of exposure: Antelope were observed on every exposure in every season except the north exposure during the winter months (Table 37). There were more antelope on southerly slopes than on northerly slopes in every season. Forty-two to 51 percent of the antelope were on the southern exposures in all seasons except summer 1980 when 70 percent were observed on the southerly slopes. Usage of the northerly slopes was relatively uniform, ranging from 19 to 32 percent. There were more antelope on easterly exposures than westerly in every season. Usage of flat lands was highest during the fall and winter months.

Use of slope: Antelope use of gentle and medium slopes was predominant throughout the study (Table 38) ranging from 82 to 97 percent of total observations. In the summer of 1980 medium slope usage was at its highest point, 66 percent and gentle slope usage was at its lowest point, 31 percent. Their positions were reversed in the 1979 spring when 51 percent of the antelope were observed on gentle slopes and 44 percent were seen on medium slopes.

Flat land usage was low in all seasons except fall with a 16 percent usage level. The only season with much usage of steep slopes was winter with 12 percent.

Sharp-tailed Grouse

Three active sharp-tailed grouse dancing grounds were located during the study (Figure 30). They average 14.7 male birds per ground in 1980 (Table 39). In an earlier study, Knapp (1977) reported three dancing grounds which were not located at this time. Sharp-tailed grouse have been documented as abandoning grounds in other southeastern Montana studies (Martin 1980).

Sharp-tailed grouse were observed in several locations some distance from known dancing grounds (Figure 30). Because these grouse are known to remain close to dancing grounds it is possible that grounds exist near PK Creek in the northeast portion of the study area, somewhere in the Horse Creek drainage, along the ridge between Trail Creek and East Fork Trail Creek and along the South Fork Corral Creek drainage.

Table 36. Seasonal use of topography by antelope in the Hanging Woman Creek area.

Topography	Spring 1979	Summer 1979	Fall 1979	Winter '79-80	Spring 1980	Summer 1980
	314 ^{1/}	471	524	1104	720	175
Mesa-Butte top	1 ^{2/}	5	3	13	8	1
Mesa-Butte steep sides	2	-	-	-	-	-
Dissected mid-slopes	92	90	79	72	87	99
Alluvium/Terrace	5	3	8	15	5	1
Flood plain	tr ^{3/}	2	10	-	-	-

^{1/} Total observations

^{2/} Percent of observations rounded to nearest whole number

^{3/} tr = trace; a percentage 0.5

Table 37. Seasonal use of exposure by antelope in the Hanging Woman Creek area.

Exposure	Spring 1979	Summer 1979	Fall 1979	Winter '79-80	Spring 1980	Summer 1980
	314 ^{1/}	471	524	1104	720	175
North	14 ^{2/}	9	4	-	11	9
South	9	17	23	6	20	41
East	17	23	12	22	8	6
West	5	4	6	3	5	2
Northeast	12	13	12	1	18	8
Northwest	6	4	3	20	1	5
Southeast	11	7	18	31	19	14
Southwest	25	18	6	6	12	15
Flat	2	4	16	12	6	1

^{1/} Total observations

^{2/} Percent of observations rounded to nearest whole number.

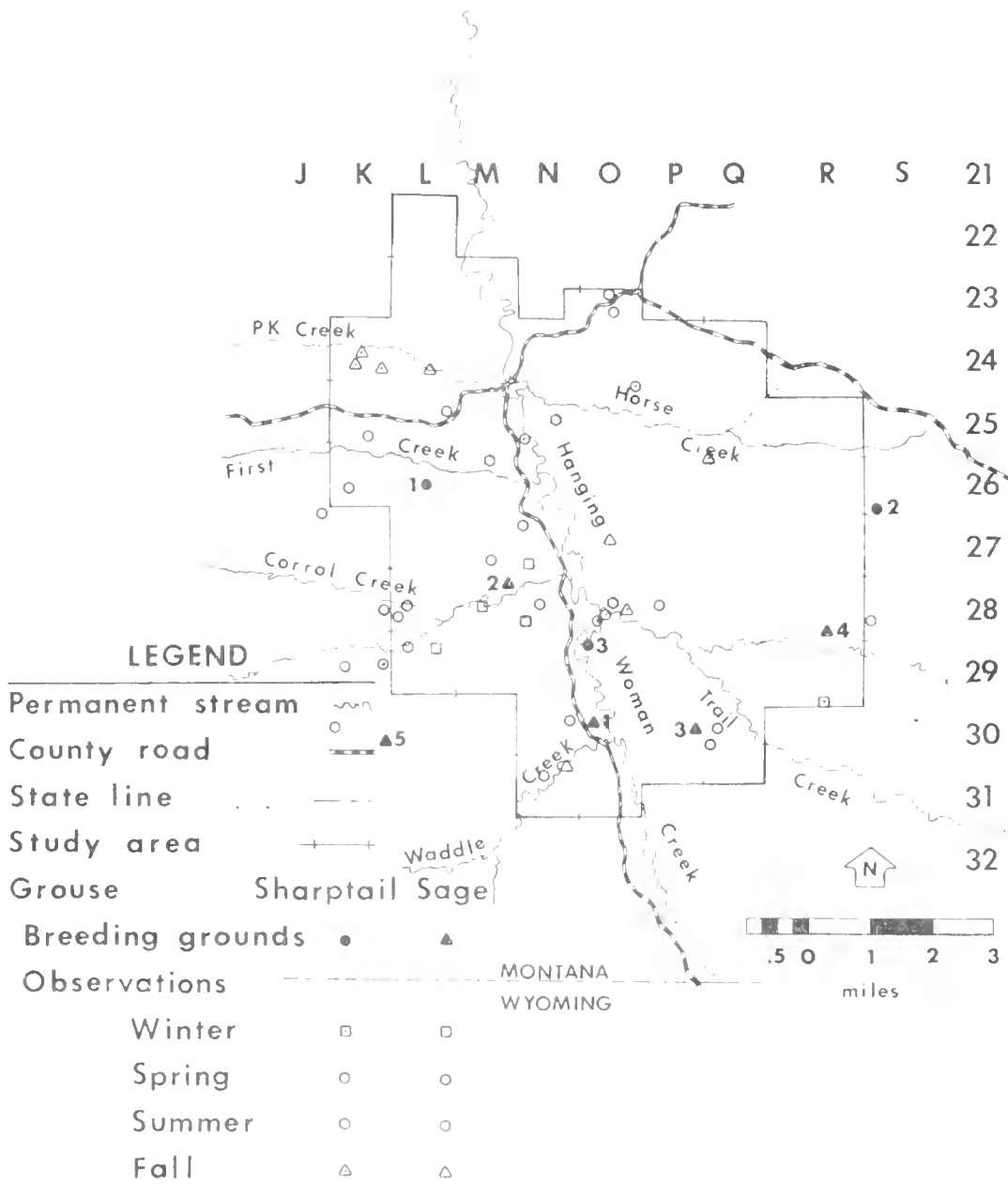


Figure 30. Sharp-tailed grouse dancing grounds, sage grouse strutting grounds and observations of both species during the study on Hanging Woman Creek.

Sage Grouse

Sage grouse were the most abundant game bird species in this area. Five strutting grounds were located on or near the Hanging Woman Creek study area (Figure 30). These are concentrated in the southern portion along the Corral Creek, Trail Creek and Hanging Woman Creek bottom lands. The largest of the grounds, the Corral Creek ground, had 73 birds (male and female) using it one morning during the 1980 breeding season. The average number of cocks observed at the four grounds within the study area boundary in 1980 was 23.9 birds (Table 40).

Sage grouse were observed in all seasons during the study. The Corral Creek sagebrush bottoms and uplands appear to be an important wintering area for sage grouse.

Twelve sage grouse broods, averaging 49 young per brood, were observed in the Hanging Woman study area in the summer of 1979. This represented good recruitment (Wallestad 1975) and coupled with an easy winter resulted in a large population increase. The number of cocks present on the two grounds observed both years increased from 36 to 72 (Table 40). This amounted to a 100 percent increase. Possibly the 1979 numbers observed were somewhat lower than the actual population levels.

Ring-necked Pheasant

Pheasants were observed along the Hanging Woman Creek bottom. A pheasant crow count survey was conducted during the 1979 breeding season. Birds were heard on 4 of the 12 stops. The average number of calls per stop was a relatively low 0.5. This low population density is probably the result of a scarcity of deciduous shrubs in the creekbottom vegetation types.

Waterfowl

Six waterfowl species were observed on the Hanging Woman Creek study area (Table 41). The most common species observed was the mallard. Only one brood of ducks was observed. That was a group of 13 young blue-winged teals with one adult feeding in a road side pond in the early summer of 1979. As in other portions of southeastern Montana, the Hanging Woman Creek area suffered through severe drought conditions in the spring and summer of 1980. Consequently the reservoirs were dry and offered little or no breeding habitat for waterfowl.

Songbirds

Seventy-eight species of birds, including game species, were observed on the study area (Table 41). The goshawk, Cooper's hawk, ferruginous hawk, golden eagle, bald eagle, prairie falcon, upland sandpiper, burrowing owl, mountain blue bird, and Brewer's

Table 38. Seasonal use of slope by antelope in the Hanging Woman Creek area.

Slope	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	314 ^{1/}	471	524	1104	720	175
Flat	22 ^{2/}	4	16	4	6	1
Gentle	51	45	34	37	42	31
Medium	44	47	48	47	51	66
Steep	3	3	2	12	1	1

^{1/} Total observations

^{2/} Percent of observations rounded to nearest whole number

Table 39. Sharp-tailed grouse dancing grounds in the Hanging Woman Creek study area and number of males attending in 1979 and 1980.

Ground Number	Location				Males Observed	
	T	R	S		1979	1980
1	8S	43E	30	SE $\frac{1}{4}$	10	16
2	8S	44E	29	SW $\frac{1}{4}$	-	12
3	9S	43E	10	NW $\frac{1}{4}$	-	16

Table 40. Sage grouse strutting grounds in the Hanging Woman Creek study area and number of males attending in 1979 and 1980.

Ground Number	Location				No. of Males Observed	
	T	R	S		1979	1980
1	9S	43E	15	NW $\frac{1}{4}$	20	16
2	9S	43E	5	NE $\frac{1}{4}$	16	56
3	9S	43E	14	SE $\frac{1}{4}$	-	8
4	9S	44E	6	SE $\frac{1}{4}$	-	15
5	9S	42E	13	SE $\frac{1}{4}$	-	2

Table 41. Breeding status of the bird species found on the Hanging Woman Creek study area.

Species	Breeding Status	Species	Breeding Status
1. Great blue heron	t ^{1/}	40. Red-headed woodpecker	b
2. Mallard	b	41. Hairy woodpecker	b
3. Gadwall	M	42. Eastern kingbird	b
4. Pintail	M	43. Say's phoebe	B
5. Green-winged teal	b	44. Western wood pewee	b
6. Blue-winged teal	B	45. Horned lark	b
7. American wigeon	M	46. Violet-green swallow	b
8. Goshawk	b	47. Barn swallow	B
9. Cooper's hawk	b	48. Cliff swallow	B
10. Ferruginous hawk	b	49. Black-billed magpie	B
12. Golden eagle	B	50. Common crow	b
13. Bald eagle	M	51. Pinyon jay	b
14. Marsh hawk	b	52. Clark's nutcracker	t
15. Prairie falcon	B	53. Black-capped chickadee	b
16. American kestrel	B	54. House wren	b
17. Sharp-tailed grouse	B	55. Rock wren	b
18. Sage grouse	B	56. Sage thrasher	b
19. Ring-necked pheasant	b	57. American robin	b
20. Turkey	b	58. Mountain bluebird	b
21. American coot	M	59. Sprague's pipit	M
22. Killdeer	b	60. Loggerhead shrike	B
23. Common snipe	b	61. Starling	b
24. Upland sandpiper	b	62. Yellow warbler	b
25. Spotted sandpiper	b	63. Yellow-rumped warbler	b
26. Solitary sandpiper	M	64. Common yellowthroat	b
27. Willet	M	65. Western meadowlark	B
28. Greater yellowlegs	M	66. Red-winged blackbird	b
29. Lesser yellowlegs	M	67. Northern oriole	b
30. Wilson's phalarope	M	68. Brewer's blackbird	b
31. Northern phalarope	M	69. Common grackle	b
32. Mourning dove	b	70. American goldfinch	b
33. Great-horned owl	B	71. Red crossbill	b
34. Burrowing owl	B	72. Rufous-sided towhee	b
35. Poor-will	b	73. Lark bunting	b
36. Common nighthawk	b	74. Grasshopper sparrow	b
37. White-throated swift	b	75. Vesper sparrow	b
38. Belted kingfisher	b	76. Lark sparrow	b
39. Common flicker	B	77. Chipping sparrow	b
		78. Brewer's sparrow	b

^{1/} Breeding status:

B = Hard evidence of breeding

b = Circumstantial evidence of breeding

t = Occurs, but no evidence of breeding

W = Overwintering observations

M = Migratory observation

sparrow were listed by Flath (1979b) as species of special interest or concern. The ferruginous hawk, golden eagle, bald eagle, prairie falcon and burrowing owl are also listed as migratory birds of high federal interest (U.S.D.I. 1979). All were suspected or known breeders in the study area except bald eagles.

Two breeding bird census strips were located on the Hanging Woman Creek study area, one each in grassland (without sagebrush) and sagebrush habitats (Figure 31). Ponderosa pine-juniper and riparian habitats were not sampled on the Hanging Woman Creek study area. These habitats probably supported most of the same species as found in similar habitat on the Otter Creek study area. Tables 42 and 43 list the percent composition and average number of birds observed per census run for each of the bird species found on the two breeding bird census trips. The average number and highest number of singing males observed on each strip are also listed, along with breeding pair density estimates derived from them.

The majority of the birds seen on the grassland census strip were western meadowlarks. Brewer's sparrows, vesper sparrows and western meadowlarks in nearly equal proportions dominated the sagebrush census strip. The sagebrush census strip supported fewer species, but a higher breeding pair density than the grassland census strip.

Raptors

Nine species of hawks and two species of owls were found on the Hanging Woman Creek study area. Short-eared owls were seen within ten miles of the study area. Inconspicuous species such as screech owls and saw-whet owls may have been overlooked.

Accipiters: One goshawk was observed on the study area on 9 May 1980 (Figure 32). It was suspected to have nested in the area. Cooper's hawks were observed on several occasions along pine ridges, where they were probably nesting (Figure 32). One bird acted defensive, but the nest was not found.

Buteos: Bald eagles were observed along Hanging Woman Creek twice in the early spring (Figure 32). They were both migrants. Ferruginous hawks were seen several times at the southern end of the study area in 1979 (Figure 32). They were suspected to be nesting in or near the study area.

Red-tailed hawks were the most common buteo. Seven nests were active in 1979 and five nests were active in 1980 (Figure 33). Eight nests were located in cottonwood trees and two were in ponderosa pine trees (Table 44).

Table 42. Numbers per census run, percent composition, and breeding pair density of birds observed on the grassland census strip in the Hanging Woman Creek area.

Species	Average No. Birds Per Census Run		Percent Composition		Average No. Singing Males Per Census Run		Highest No. Singing Males in Any Census Run	
	1979	1980	1979	1980	1979	1980	1979	1980
Western meadowlark	28.8	25.7	70	73	8.2	8.0	18	15
Vesper sparrow	5.0	2.3	12	7	4.2	2.0	8	4
Mourning dove	2.4	0.3	6	1				
Horned lark	1.2	1.0	3	3	0.6	0.7	1	2
Grasshopper sparrow	0.8		2		0.8		3	
Lark sparrow	0.8	0.7	2	2				
Burrowing owl	0.8	0.3	2	1				
Rock wren	0.6	0.7	1	2	0.4	0.7	1	1
Common nighthawk	0.2		+					
Brewer's blackbird		4.3		12				
American kestrel	0.2		+					
Sage grouse	0.2		+					
Totals	41.0	35.3	98	101	14.2	11.4	31	22
Breeding pair density (pairs/100 ha)					56.8	45.6	124	88

+ = Less than one percent.

Table 43. Numbers per census run, percent composition, and breeding pair density of birds observed on the sagebrush census strip in the Hanging Woman Creek study area.

Species	Average No. Birds Per Census Run		Percent Composition		Average No. Singing Males Per Census Run		Highest No. Singing Males Per Census Run	
	1979	1980	1979	1980	1979	1980	1979	1980
Brewer's sparrow	22.8	18.3	35	30	14.0	10.3	17	12
Vesper sparrow	22.2	16.3	34	26	19.4	10.0	25	20
Western Meadowlark	19.6	22.3	30	36	8.8	11.7	17	20
Grasshopper sparrow	0.6		1		0.6		2	
Lark bunting	0.4	2.0	+	3	0.2	2.0	1	3
Lark sparrow		0.7		1		0.7		2
Mourning dove		0.7		1				
Killdeer		1.3		2				
Totals	65.6	61.6	100	99	43.0	34.7	62	57
Breeding pair density (pairs/100 ha)					172	138.8	248	228

+ = Less than one percent

Table 44. Raptor nest sites on the Hanging Woman Creek area.

Nest Number	Species	Substrate	Activity	
			1979	1980
1	Red-tailed hawk	Cottonwood tree	Failed, one dead young beneath nest	Inactive
2	Red-tailed hawk	Cottonwood tree	Active, no production data	Active, no production data
3	Red-tailed hawk	Ponderosa pine tree	Three young fledged	Active, no production data
4	Red-tailed hawk	Ponderosa pine tree	Status unknown	Active, no production data
5	Red-tailed hawk	Cottonwood tree	Status unknown	Active, no production data
6	Red-tailed hawk	Cottonwood tree	Active, no production data	Fledged two young
7	Red-tailed hawk	Cottonwood tree	Active, no production data	Inactive
8	Red-tailed hawk	Cottonwood tree	Inactive	Inactive
9	Red-tailed hawk	Cottonwood tree	Active, no production data	Inactive
10	Red-tailed hawk	Cottonwood tree	Active, three young	Inactive
11	Golden eagle	Cliff	Inactive	Two young hatched, 1 young fledged
12,13	Golden eagle	Both on same cliff	Inactive	Inactive
14	Paririe falcon	Cliff	Fledged at least one young	Active, no production data
15	Burrowing owl	Prairie dog hole	Fledged 5 young	Active, no production data

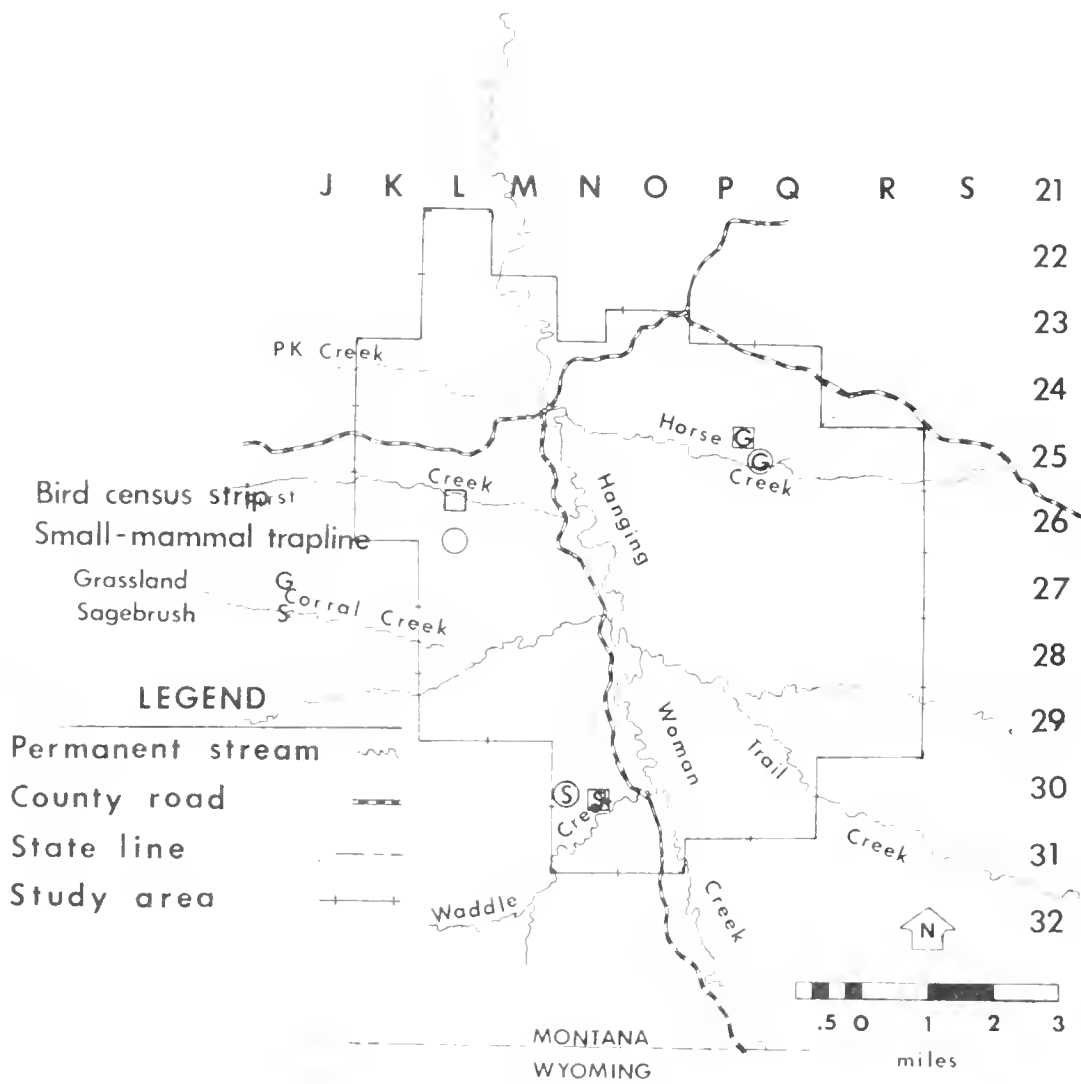


Figure 31. Locations of bird census strips and small mammal traplines on the Hanging Woman Creek study area.

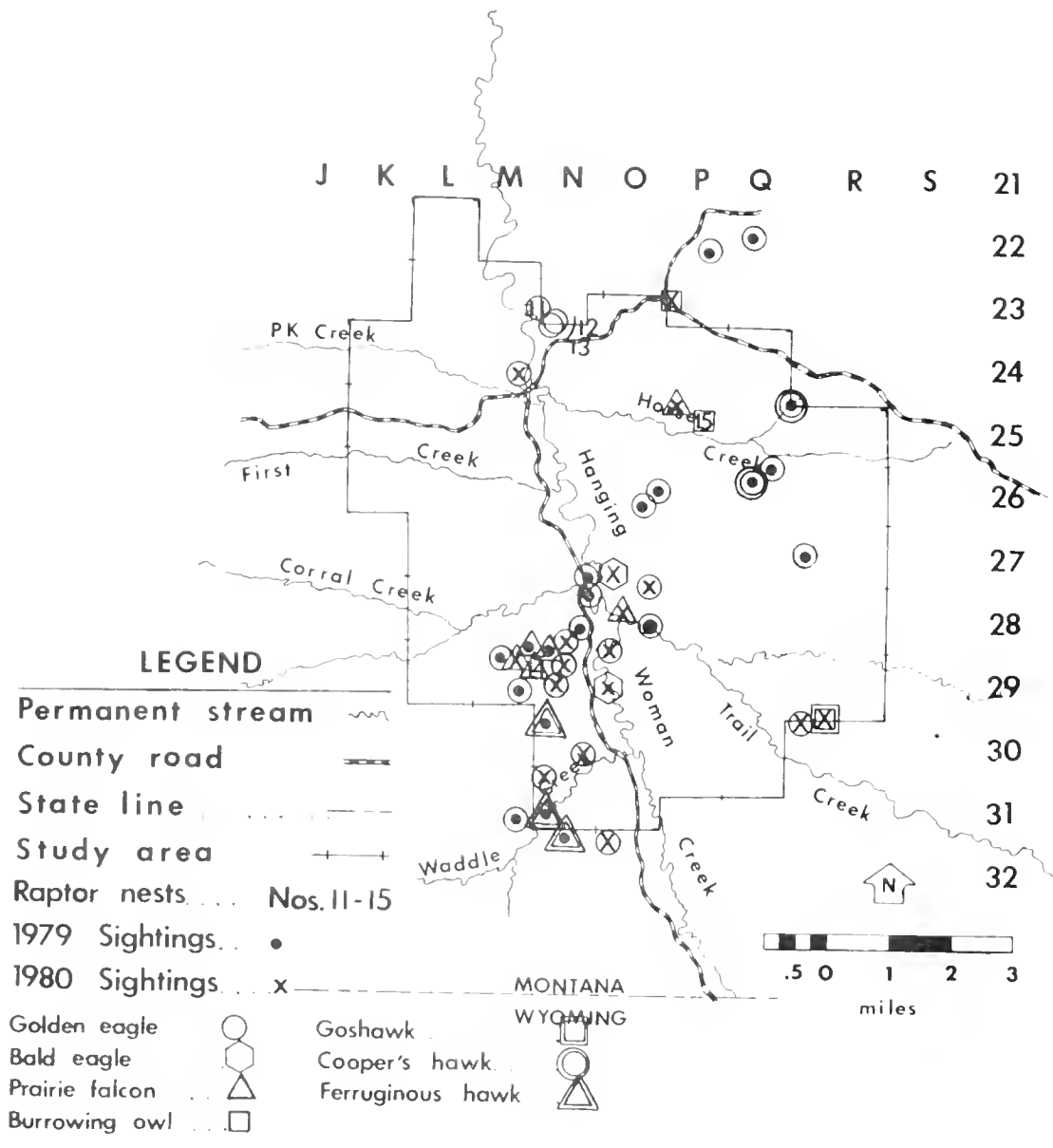


Figure 32. Nests and sightings of raptors of special interest or concern on the Hanging Woman Creek study area.

Golden eagles were frequently observed on the study area. Three nests were located on cliffs in the same area (Figure 32). One of the nests was active in 1980 and fledged one female eagle (Table 44). Many other suitable nest sites existed for eagles in large pine trees on ridges and large cottonwoods in the creekbottoms. Some nests may not have been detected due to the difficulty of finding stick nests in ponderosa pine forests. Most of the golden eagle observations were located around two ridges covered with ponderosa pine forest, indicating possible nests.

Harriers: Marsh hawks were common along the hay meadows on Hanging Woman Creek. They probably nested on the study area, but no nests were located.

Falcons: One prairie falcon aerie was located on a cliff (Figure 32). Other suitable nest potholes were located on cliffs in the north end of the study area. Prairie falcons were usually seen hunting over the hay meadows along Hanging Woman Creek.

Kestrels were the most common falcon in the study area. They mainly utilized dead pine snags found along ridges for nesting.

Owls: Great horned owls were common in the study area. Two nests were found in 1979, one in an old magpie nest and the other in a pothole on a cliff.

One pair of burrowing owls nested on a prairie dog town in 1979 and 1980 (Figure 32). They fledged five young in 1979. No brood counts were made in 1980. Another burrowing owl was sighted along a road at the north edge of the study area on 26 June 1980 (Figure 32). It may have been associated with a prairie dog town located just off the study area.

Non-game Mammals

Fifteen species of mammals were observed on the study area (Table 45). The blacktail prairie dog was listed by Flath (1979b) as a species of special interest or concern.

Two small-mammal traplines were located in the study area, one in grassland and one in sagebrush habitat (Figure 31). Table 46 lists the total trap nights, trapping success, and numbers of each species caught in each habitat. The sagebrush habitat supported the most species and the highest trapping success.

Blacktail prairie dog towns are shown in Figure 34. Exact locations and approximate size are given in table 47. All towns were searched for sign of black-footed ferrets with negative results.

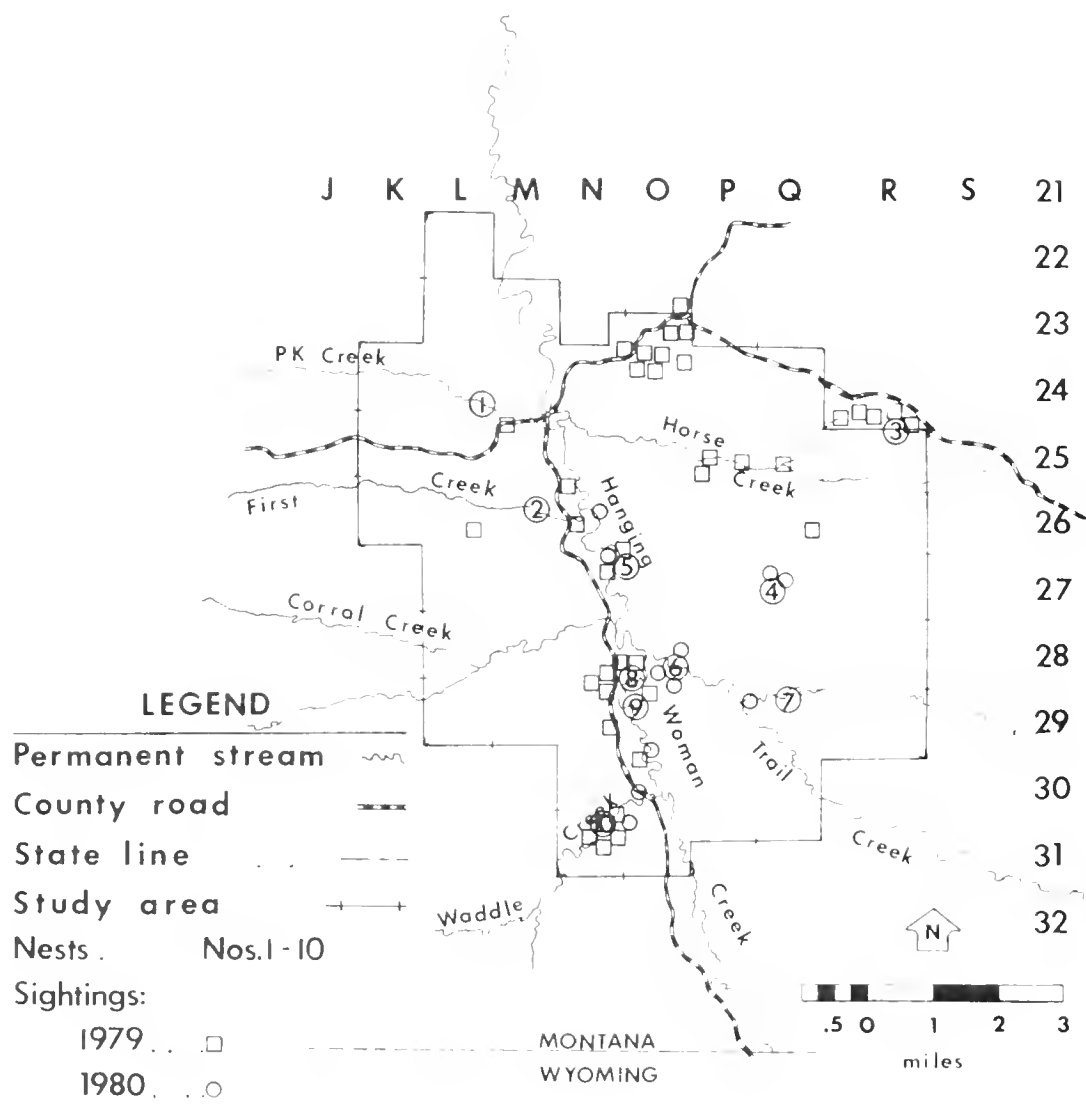


Figure 33. Nests and sightings of red-tailed hawks on the Hanging Woman Creek study areas.

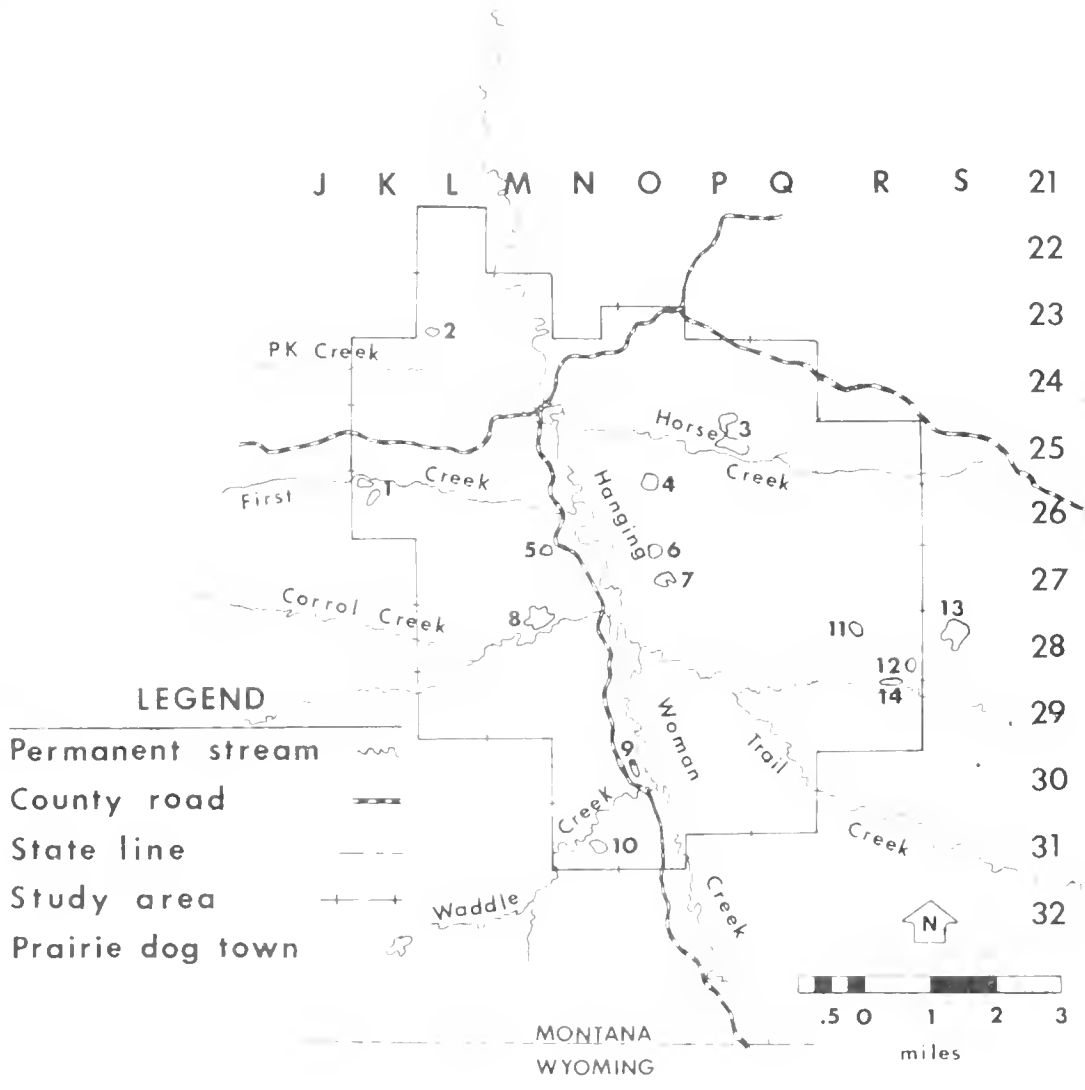


Figure 34. Prairie dog towns on the Otter Creek study area.

Table 45. Mammals observed on the Hanging Woman Creek study area.

1. Coyote	<i>Canis latrans</i>
2. Red fox	<i>Vulpes vulpes</i>
3. Yellow-bellied marmot	<i>Marmota flaviventris</i>
4. Blacktail prairie dog	<i>Cynomys ludovicianus</i>
5. Thirteen-lined ground squirrel	<i>Spermophilus tridecemlineatus</i>
6. Least chipmunk	<i>Eutamias minimus</i>
7. Northern pocket gopher	<i>Thomomys talpoides</i>
8. Deer mouse	<i>Peromyscus maniculatus</i>
9. Northern grasshopper mouse	<i>Onychomys leucogaster</i>
10. Prairie vole	<i>Microtus ochrogaster</i>
11. Porcupine	<i>Erethizon dorsatum</i>
12. Whitetail jackrabbit	<i>Lepus townsendii</i>
13. Desert cottontail	<i>Sylvilagus audubonii</i>
14. Mule deer	<i>Odocoileus hemionus</i>
15. Antelope	<i>Antilocapra americana</i>

Table 46. Results of small-mammal trapping on the Hanging Woman Creek study area.

	Grassland	Sagebrush
Total captures	4	11
Trap nights	492	461
Captures/100 trap nights	0.8	2.4
Number of species caught	3	4
Species:		
<i>Peromyscus maniculatus</i>	1	8
<i>Onychomys leucogaster</i>	1	1
<i>Microtus ochrogaster</i>		1
<i>Spermophilus tridecemlineatus</i>	2	
<i>Eutamias minimus</i>		1

Table 47. Hanging Woman Creek prairie dog town locations and size.

Number	Location			Acres
	T	R	S	
1	8S	42E	25 NW $\frac{1}{4}$	30.0
2	8S	43E	7 SW $\frac{1}{4}$	6.4
3	8S	43E	23 E $\frac{1}{2}$	60.5
4	8S	43E	27 NW $\frac{1}{4}$	9.0
5	8S	43E	32 NW $\frac{1}{4}$	16.5
6	8S	43E	34 NW $\frac{1}{4}$	20.5
7	8S	43E	34 SE $\frac{1}{4}$	31.0
8	8S	43E	5 NE $\frac{1}{4}$	29.5
9	9S	43E	15 NW $\frac{1}{4}$	8.0
10	9S	43E	21 SE $\frac{1}{4}$	11.0
11	9S	44E	6 NW $\frac{1}{4}$	28.0
12	9S	44E	6 SE $\frac{1}{4}$	10.0
13	9S	44E	5 N $\frac{1}{2}$	57.0
14	9S	44E	6 SE $\frac{1}{4}$	22.0

Amphibians and Reptiles

Three species of amphibians and five species of reptiles were observed on the study area (Table 48). Only one short-horned lizard was seen. The other species were common to abundant on the study area.

Table 48. Amphibians and reptiles observed in the Hanging Woman Creek study area.

1. Tiger salamander	<i>Ambystoma tigrinum</i>
2. Western toad	<i>Bufo boreas</i>
3. Northern chorus frog	<i>Pseudacris triseriata</i>
4. Painted turtle	<i>Chrysemys picta</i>
5. Short-horned lizard	<i>Phrynosoma douglassi</i>
6. Racer	<i>Coluber constrictor</i>
7. Bull snake	<i>Pituophis catenifer</i>
8. Prairie rattlesnake	<i>Crotalis viridis</i>

Prairie Dog Creek

Mule Deer

Population characteristics: During the six seasons of study 142 mule deer were observed on the Prairie Dog Creek study area (Table 1). Average group size was lowest during the summer months and highest in the winter season. This pattern is similar to that observed in the other two study areas.

Mule deer densities, in terms of numbers seen per hour of aerial survey (Table 49), is considerably lower than that observed on the Hanging Woman and Otter Creek study areas. The highest figure, obtained during the winter surveys, was 24.9 mule deer observed per hour of flight. The rugged terrain and large areas of ponderosa pine cover probably lowered the density figures.

No production data or population structures were ascertained because no observations were made during the fall surveys. In fact, no observations were made during five of the twelve aerial surveys conducted on the Prairie Dog Creek study area.

Distribution: Observations for all seasons of the study are shown in Figure 35. None of the observations fell into the 15 plus category. Most of the observations, especially during spring and summer, occurred on the upland area between Prairie Dog and Bull Creeks. Several deer were observed wintering in the Jack Creek vicinity and on the ridge between Spring Creek and Prairie Dog Creek.

No fall observations were made. It seems possible that many deer may have moved to the nearby Tongue River bottoms.

Vegetation type usage: The ponderosa pine type received the most usage by mule deer in the Prairie Dog Creek area (Table 50). During the spring and summer of 1979, 92 and 100 percent respectively of the mule deer observed were in the ponderosa pine type. It had substantial use during the winter and spring (1979) also. The sagebrush/grassland type had 39 and 49 percent of the mule deer observed during the winter (1979-1980) and spring (1979) seasons. The only observation in the 1980 summer occurred in the sagebrush/grassland vegetation type. The only creekbottom observation was noted during the 1980 spring season.

Activity: Mule deer activity at the moment of observation is recorded in Table 51. Most deer in the two spring seasons were feeding when observed, 55 percent in 1979 and 85 percent in 1980. During summer 1979 and winter 1979-80, 50 percent of the deer were standing. Very few deer were observed lying down in any season.

Table 49. Mule deer, antelope and coyote aerial observations per hour in the Prairie Dog Creek study area.

Month	Hours	Aerial Observation			Observation/hour			Coyotes per 100:	
		Mule Deer	Ant.	Coyotes	Mule Deer	Ant.	Coyotes	Deer	Ant.
April	<u>1/</u>	-	-	-	-	-	-	-	-
May	1.70	17	<u>02/</u>	0	10.0	0	0	0	0
Spring	1.7	17	0	0	10.0	0	0	0	0
June	1.40	7	0	1	4.1	0	0.6	14.3	*
July	0.90	2	0	0	2.2	0	0	0.	0.
Aug	1.10	9	0	2	8.2	0	1.8	22.2	*
Summer	3.4	18	0	3	5.3	0	0.9	16.7	*
Sept.	1.40	0	0	0	0	0	0	0	0
Oct	-	-	-	-	-	-	-	-	-
Nov	0.80	0	0	0	0	0	0	0	0
Fall	2.20	0	0	0	0	0	0	0	0
Dec	0.95	12	0	0	12.6	0	0	0	0
Jan	-	-	-	-	-	-	-	-	-
Feb	0.90	34	0	0	37.8	0	0	0	0
Winter	1.85	46	0	0	24.9	0	0	0	0
March	1.1	22	0	0	20.0	0	0	0	0
April	1.0	0	0	0	0.0	0	0	0	0
May	1.0	0	0	5	0.0	0	5.0	*	*
Spring	3.1	22	0	5	7.1	0	1.6	22.7	*
June	1.0	0	0	1	1.0	0	0	0	0
July	-	-	-	-	-	-	-	-	-
Aug	-	-	-	-	-	-	-	-	-
Summer	1.0	0	0	1	1.0	0	0	0	0

1/ No surveys made

2/ No observations made on survey

* Infinite

Table 50. Seasonal use of vegetation types by mule deer in the Prairie Dog Creek area.

Vegetation Subtypes	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	38 ₁ /	18	0 ₃ /	46	39	1
Ponderosa pine	-	11	-	26	-	-
Sagebrush	66 ₂ /	44	-	35	41	-
Grassland	-	17	-	-	-	-
Skunkbush	5	-	-	-	-	-
Juniper	21	28	-	-	3	-
Snowberry	-	-	-	-	-	-
Total Ponderosa pine	92	100	-	61	44	-
Sagebrush	8	-	-	39	36	100
Deciduous shrub	-	-	-	-	-	-
Grassland	-	-	-	-	13	-
Total Sagebrush/Grassland	8	-	-	39	49	100
Tree	-	-	-	-	-	-
Shrub	-	-	-	-	8	-
Total Creekbottom	-	-	-	-	8	-
Ponderosa pine	-	-	-	-	-	-
Sagebrush/grassland	-	-	-	-	-	-
Creekbottom	-	-	-	-	-	-
Total Agricultural	-	-	-	-	-	-

1/ Total observations

2/ Percent of observations rounded to nearest whole number

3/ No observations were made during the fall surveys

Table 51. Seasonal activity of mule deer in the Prairie Dog Creek area.

Activity	Spring	Summer	Fall	Winter	Spring	Summer
	1979	1979	1979	'79-80	1980	1980
	38 ₁ /	19	0 ₃ /	46	39	1
Standing	32	50	-	50	13	-
Running	13	28	-	17	-	100
Lying	-	6	-	-	3	-
Feeding	55	17	-	33	85	-

1/ Total observations

2/ Percent of observations rounded to nearest whole number

3/ No observations were made during the fall surveys

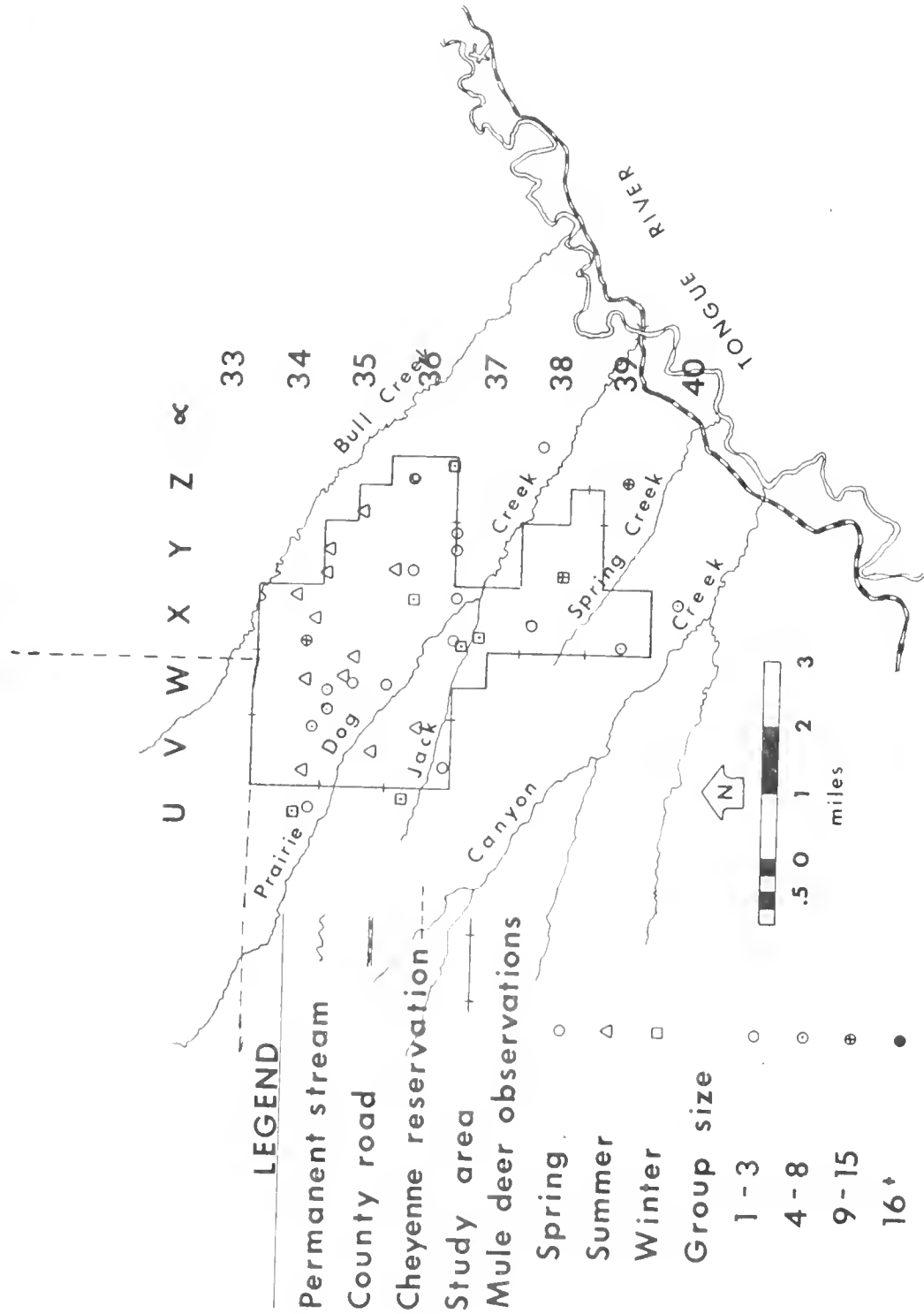


Figure 35. Mule deer observation on the Prairie Dog Creek study area.

Use of topography: The most significant information gleaned from Table 52 is the lack of use of the lowland features by mule deer. During the four seasons when more than one observation was made, only in the spring of 1980 were deer observed on a flood plain. None were observed on alluvium/terrace terrain. The heavy use of the bottom lands by domestic livestock and much human activity in the form of core drilling, road building and various environmental studies may have kept deer usage to a minimum.

Dissected midslopes were used in every season observations were made, ranging from 34 to 100 percent. Mesa-butte tops (plateaus) and mesa-butte steep side were used quite heavily by mule deer. These topographic features comprise a rather large percentage of the Prairie Dog Creek surface area.

Table 52. Seasonal use of topography by mule deer in the Prairie Dog Creek area.

Topography	Spring 1979	Summer 1979	Fall 1979	Winter '79-80	Spring 1980	Summer 1980
	38 ^{1/}	18	0 ^{3/}	46	39	1
Mesa-butte top	34 ^{2/}	-	-	54	23	-
Mesa-butte steep sides	32	33	-	-	28	-
Dissected mid-slopes	34	67	-	46	41	100
Alluvium/terrace	-	-	-	-	-	-
Flood plain	-	-	-	-	3	-

1/ Total observations

2/ Percent of observations rounded to nearest whole number

3/ No observations were made during the fall surveys.

Use of exposure: Use of exposure by mule deer is shown in Table 53. Deer were most scattered during the summer 1979 season, as they were observed on seven of the nine exposures. Usage of northerly slopes was greatest during the spring and summer of 1979. Southern exposures were most heavily used during the winter and spring of 1979 seasons. Eastern exposures received substantial use in the summer of 1979, 56 percent, and the winter season, 50 percent. The use of flat terrain, in this case primarily upland plateaus, was most heavy in the winter season, 39 percent of mule deer observations. This was a mild winter and the uplands were relatively free of snow cover.

Use of slope: The only major shift during the course of the study was the increased usage of flat areas during the winter and spring of 1980 (Table 54) as discussed above. Gentle slope usage was at a low in the winter months, 9 percent. Medium and steep slope usage was practically unchanged throughout the study.

Table 53. Seasonal use of exposure by mule deer in the Prairie Dog Area.

Exposure	Spring 1979 38 ^{1/}	Summer 1979 19	Fall 1979 0 ^{3/}	Winter '79-80 46	Spring 1980 39	Summer 1980 1
North	55 ^{2/}	28	-	11	26	-
South	-	-	-	-	-	-
East	-	11	-	-	15	-
West	-	6	-	-	-	-
Northeast	13	17	-	15	-	-
Northwest	-	6	-	-	-	-
Southeast	5	28	-	35	15	-
Southwest	24	-	-	-	26	100
Flat	3	6	-	39	18	-

1/ Total observations

2/ Percent of observations rounded to nearest whole number

3/ No observations were made during the fall surveys

Table 54. Seasonal use of slope by mule deer in the Prairie Dog Creek area.

Slope	Spring 1979 38 ^{1/}	Summer 1979 18	Fall 1979 0 ^{3/}	Winter '79-80 46	Spring 1980 39	Summer 1980 1
Flat	3 ^{2/}	6	-	39	18	-
Gentle	42	33	-	9	38	-
Medium	24	28	-	26	15	100
Steep	32	33	-	26	28	-

1/ Total observations

2/ Percent of observations rounded to nearest whole number

3/ No observations were made during the fall surveys

Antelope

No antelope observations were made in the Prairie Dog Creek study area during this study (Table 9). The terrain is too rough and broken to suit antelope. It also has no large expanses of sagebrush (Figure 6).

Sharp-tailed Grouse

Only one sharp-tailed grouse dancing ground was located near the Prairie Dog Creek study area. It is located south of the area in the NE $\frac{1}{4}$ of Section 4, Township 7S, R41E. This dancing ground, which is in the Kirby study area, had 8 males attending it in the spring of 1979 and 10 present in 1980.

Waterfowl

The Prairie Dog Creek area had only one pond, located in the Jack Creek drainage, which had water in 1980 and Prairie Dog Creek did not flow water much of the duration of the study. Only one species of waterfowl, the mallard, was observed within the study area. No broods were observed either year.

Songbirds

Seventy species of birds, including game species, were observed on the study area (Table 55). The Cooper's hawk, prairie falcon, mountain bluebird, clay-colored sparrow, and Brewer's sparrow were listed by Flath (1979b) as species of special interest or concern. All were suspected or known breeders in the study area.

Two breeding bird census strips were located on the Prairie Dog Creek study area, one each in ponderosa pine-juniper and boxelder-ash riparian habitats (Figure 33). The sagebrush habitat in the study area was not sampled but supported most of the species found in sagebrush habitat on the Hanging Woman Creek study area. Tables 56 and 57 list the percent composition and average number of birds observed per census run for each of the bird species found on the two breeding bird census strips. The average number and highest number of singing males observed on each strip are also listed, along with breeding pair density estimates derived from them. Chipping sparrows dominated the bird population on the ponderosa pine census strip. Yellow warblers, house wrens, and lark sparrows dominated the breeding bird population on the riparian census strip. The riparian census strip supported the most species and the highest breeding pair density.

Table 55. Breeding status of the bird species observed on the Prairie Dog Creek study area.

Species	Breeding Status	Species	Breeding Status
1. Mallard	b ^{1/}	36. Red-breasted nuthatch	b
2. Turkey vulture	b	37. House wren	B
3. Cooper's hawk	b	38. Canyon wren	b
4. Red-tailed hawk	B	39. Rock wren	b
5. Marsh hawk	b	40. Gray catbird	b
6. Prairie falcon	B	41. Brown thrasher	b
7. American kestrel	B	42. American robin	b
8. Sharp-tailed grouse	B	43. Mountain bluebird	B
9. Killdeer	b	44. Townsend's solitaire	b
10. Mourning dove	b	45. Starling	b
11. Yellow-billed cuckoo	b	46. Solitary vireo	B
12. Black-billed cuckoo	b	47. Warbling vireo	b
13. Great-horned owl	B	48. Yellow warbler	b
14. Poor-will	b	49. Yellow-rumped warbler	b
15. Common nighthawk	b	50. Common yellowthroat	b
16. White-throated swift	b	51. Yellow-breasted chat	b
17. Common flicker	B	52. Western meadowlark	b
18. Red-headed woodpecker	b	53. Red-winged blackbird	B
19. Hairy woodpecker	b	54. Northern oriole	B
20. Eastern kingbird	B	55. Brewer's blackbird	b
21. Western kingbird	b	56. Common grackle	b
22. Cassin's kingbird	b	57. Brown-headed cowbird	b
23. Say's phoebe	b	58. Western tanager	b
24. Least flycatcher	b	59. Black-headed grosbeak	b
25. Dusky flycatcher	b	60. Lazuli bunting	b
26. Western wood pewee	b	61. Pine siskin	t
27. Violet-green swallow	b	62. American goldfinch	b
28. Tree swallow	b	63. Red crossbill	b
29. Barn swallow	b	64. Rufous-sided towhee	b
30. Cliff swallow	B	65. Vesper sparrow	b
31. Black-billed magpie	b	66. Lark sparrow	b
32. Pinyon jay	b	67. Dark-eyed junco	b
33. Clarks nutcracker	t	68. Chipping sparrow	b
34. Black-capped chickadee	b	69. Clay-colored sparrow	b
35. White-breasted nuthatch	b	70. Brewer's sparrow	b

^{1/} Breeding status:

- B - Hard evidence of breeding
- b - Circumstantial evidence of breeding
- t - Occurs, but no evidence of breeding

Table 56. Numbers per census run, percent composition, and breeding pair density of birds observed on the ponderosa pine census strip in the Prairie Dog Creek study area.

Species	Ave. No. Birds		Percent		Ave. No. Singing		Highest No.	
	Per Census		Composition		Males Per		Singing Males	
	Run	Run	1979	1980	Census Run	Census Run	in Any Census Run	Run
	1979	1980	1979	1980	1979	1980	1979	1980
Chipping sparrow	42.4	26.3	56	45	18.0	13.7	21	23
Yellow-rumped warbler	5.6	7.0	7	12	4.6	6.0	7	7
House wren	4.8	5.7	6	10	4.8	5.0	7	6
Dark-eyed junco	4.6	2.7	6	5	3.0	1.3	4	2
Rufous-sided towhee	3.4	0.7	4	1	2.8	0.3	7	1
Lark sparrow	2.4	0.7	3	1	1.0	0.7	2	2
Solitary vireo	2.2	1.0	3	2	1.0	1.0	2	2
Black-capped chickadee	1.6	2.3	2	4	0.2	1.0	1	2
Common flicker	1.4		2		0.6		1	
Mountain bluebird	1.2	3.7	2	6	0.6	2.0	3	3
White-breasted nuthatch	1.0	0.7	1	1	1.0	0.7	2	1
Brown-headed cowbird	1.0	0.7	1	1				
Western tanager	0.8	1.0	1	2		1.0		2
Vesper sparrow	0.6	1.0	1	2	0.6	1.0	1	2
American robin	0.4	0.3	+	+		0.3		1
American Kestrel	0.4	1.0	+	2	0.4	0.7	2	1
Western meadowlark	0.4		+		0.4		1	
Mourning dove	0.4	0.7	+	1	0.2	0.3	1	1
Red-headed woodpecker	0.4	0.3	+	+	0.6	0.3	1	1
Red-breasted nuthatch	0.2		+		0.2		1	
American goldfinch	0.2		+		0.2		1	
Brewer's blackbird	0.2		+					
Western wood pewee	0.2	2.0	+	3	0.2	2.0	1	4
Rock wren		0.3		+		0.3		1
Brewer's sparrow		0.3		+				
Townsend's solitaire		0.3		+		0.3		1
Red Crossbill	P	P						
Totals	75.8	58.7	95	98	40.4	37.9	66	63

+ = Less than one percent

P = Present, no counts obtained

Table 57. Numbers per census run, percent composition, and breeding pair density of birds observed on the riparian census strip in the Prairie Dog Creek study area.

Species	Average No. Birds Per Census Run		Percent Composition		Average No. Singing Males Per Census Run		Highest No. Sing. Males in any Census Run	
	1979	1980	1979	1980	1979	1980	1979	1980
	Yellow warbler	25.6	29.7	20	19	18.2	22.3	28
American robin	17.6	9.0	13	6	3.2	2.0	5	4
Lark sparrow	13.6	16.7	10	11	7.2	5.7	15	9
Northern oriole	8.4	7.3	6	7	4.6	4.7	7	7
Eastern kingbird	8.4	10.3	6	7	5.6	6.3	7	10
House wren	8.2	13.0	6	8	6.2	9.7	12	14
Red-winged blackbird	6.0	5.0	5	3	3.2	2.0	7	3
Gray catbird	3.4	1.7	3	1	1.0		3	
Western meadowlark	3.4	2.7	3	2	1.2	0.7	3	2
Cassin's kingbird	3.4	5.3	3	3	2.4	2.3	5	4
Mountain bluebird	2.8	4.3	2	3	1.0	1.2	3	3
Common flicker	2.8	1.3	2	1	2.4	1.0	3	2
Western wood pewee	2.4	6.0	2	4	1.6	5.7	2	9
Common yellowthroat	2.4	0.7	2	+	2.0	0.7	4	1
American goldfinch	2.4	2.7	2	2	0.2	1.0	1	1
Black-headed grosbeak	1.6	1.7	1	1	1.6	1.3	3	2
Lazuli hunting	1.6	2.7	1	2	1.4	2.7	4	3
Yellow-breasted chat	1.6		1		1.2		2	
Mourning dove	1.2	2.0	1	1	0.8	1.0	2	2
Rufous-sided towhee	0.8	3.0	+	2	0.8	2.7	3	4
Vesper sparrow	0.8	5.3	+	3	0.8	5.3	2	6
Killdeer	0.8		+					
Brown thrasher	0.4	0.3	+	+	0.4	0.3	2	1
American kestrel	0.4	0.7	+	+				
Brewer's sparrow	0.4	1.0	+	+	0.4	0.7	1	2
Warbling vireo	0.2	1.0	+	+	0.2	1.0	1	3
Black-capped chickadee	0.2		+		0.2		1	
Solitary vireo	0.2		+		0.2		1	
Black-billed cuckoo	0.2	1.3	+	1	0.2	0.3	1	1
Yellow-billed cuckoo	0.2		+		0.2		1	
Western tanager	0.2		+		0.2		1	
Chipping sparrow	0.2		+		0.2		1	
Clay-colored sparrow		0.3		+		0.3		1
Least flycatcher		0.7		+		0.7		2
Western kingbird		1.3		1		1.3		2
Common grackle		1.7		1				
Brown-headed cowbird	1.0	3.0	1	2				
Yellow-rumped warbler		0.7		+		0.7		2
Brewer's blackbird	7.2	11.0	5	7				
Red-breasted nuthatch		0.3		+		0.3		1
Pine siskin		3.0		2				
Starling		0.7		+				
Tree swallow		0.3		+		0.3		1
Hairy woodpecker		0.3		+		0.3		1
Mallard	0.4		+					
Red crossbill	P	P						
TOTALS	130.4	158.0	95	100	68.8	84.6	131	130

+ = Less than one percent

P = Present no counts obtained

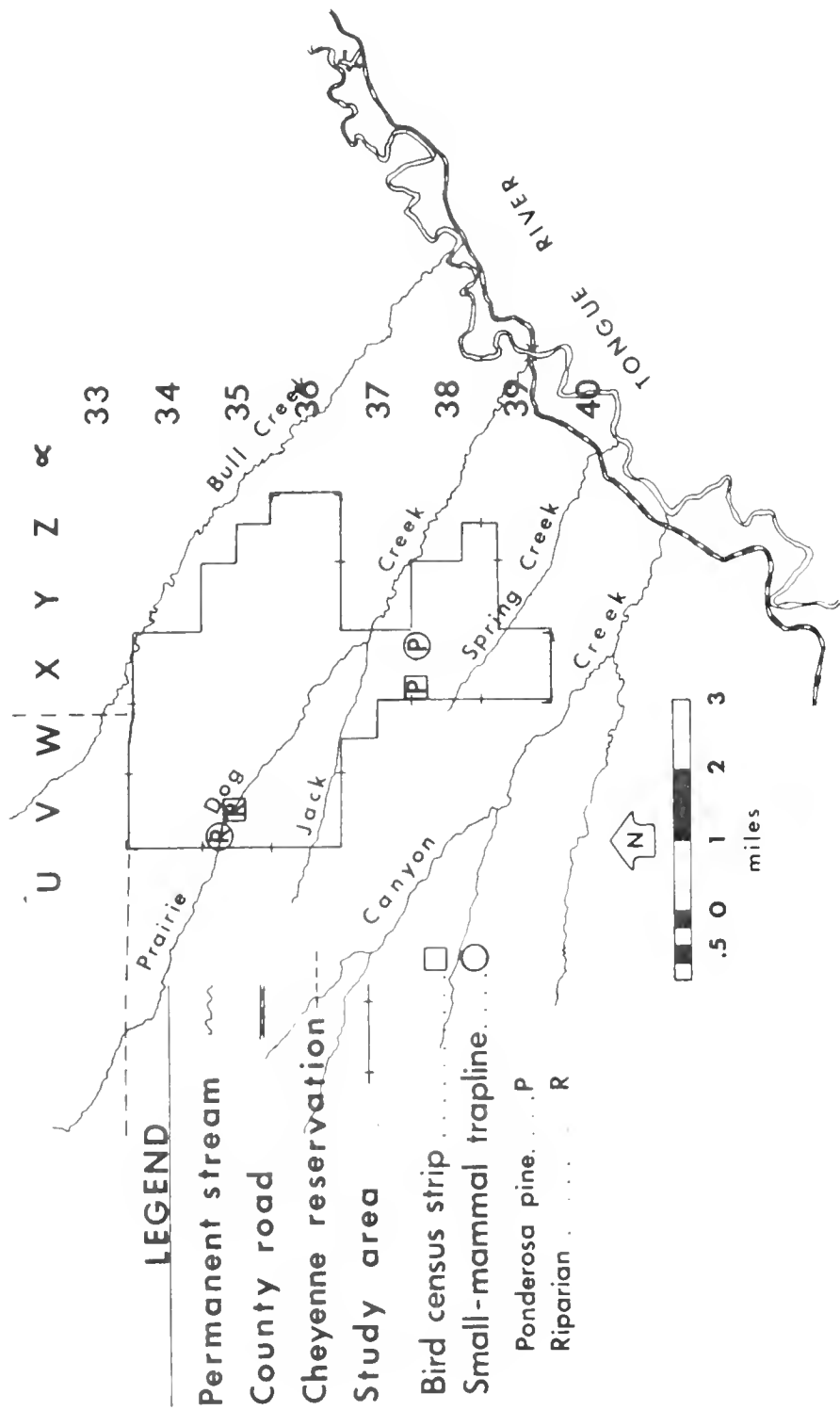


Figure 36. Locations of bird census strips and small mammal traplines on the Prairie Dog Creek study area.

Raptors

Six species of hawks and one species of owl were observed on the study area. Inconspicuous species such as screech owls and saw-whet owls may have been overlooked. Goshawks and sharp-shinned hawks were observed within ten miles of the study area, and suitable nesting habitat for them was present in the study area.

Turkey vultures were common, and there were many suitable nesting areas for them in the study area.

Accipters: One Cooper's hawk was seen just outside the study area boundary on 11 June 1980 (Figure 37). It was nesting on or near the study area.

Buteos: Two active red-tailed hawk nests were found on the study area in 1979. One of these was also active in 1980 (Figure 37). One nest was in a ponderosa pine tree and the other nest was in a cottonwood tree (Table 58).

Harriers: Marsh hawks were seen several times hunting over sagebrush habitat. They may have nested in the study area.

Falcons: Kestrels were the most common raptor in the study area (Figure 37). One was active in 1979 and the other was active both in 1979 and 1980 (Table 58). Suitable nest potholes are present on several other cliffs in the study area.

Owls: Great horned owls were occasionally seen in the study area. One nest was found in a pothole on a cliff in 1979.

Table 58. Raptor nest sites on the Prairie Dog Creek study area.

Nest No.	Species	Substrate	Activity	
			1979	1980
1.	Red-tailed hawk	Cottonwood tree	1 young fledged	1 young fledged
2.	Red-tailed hawk	Ponderosa pine tree	2 young fledged	Status unknown
3.	Prairie falcon	Cliff	Active - no production data	Inactive
4.	Prairie falcon	Cliff	Fledged 4 young	Fledged 4 young

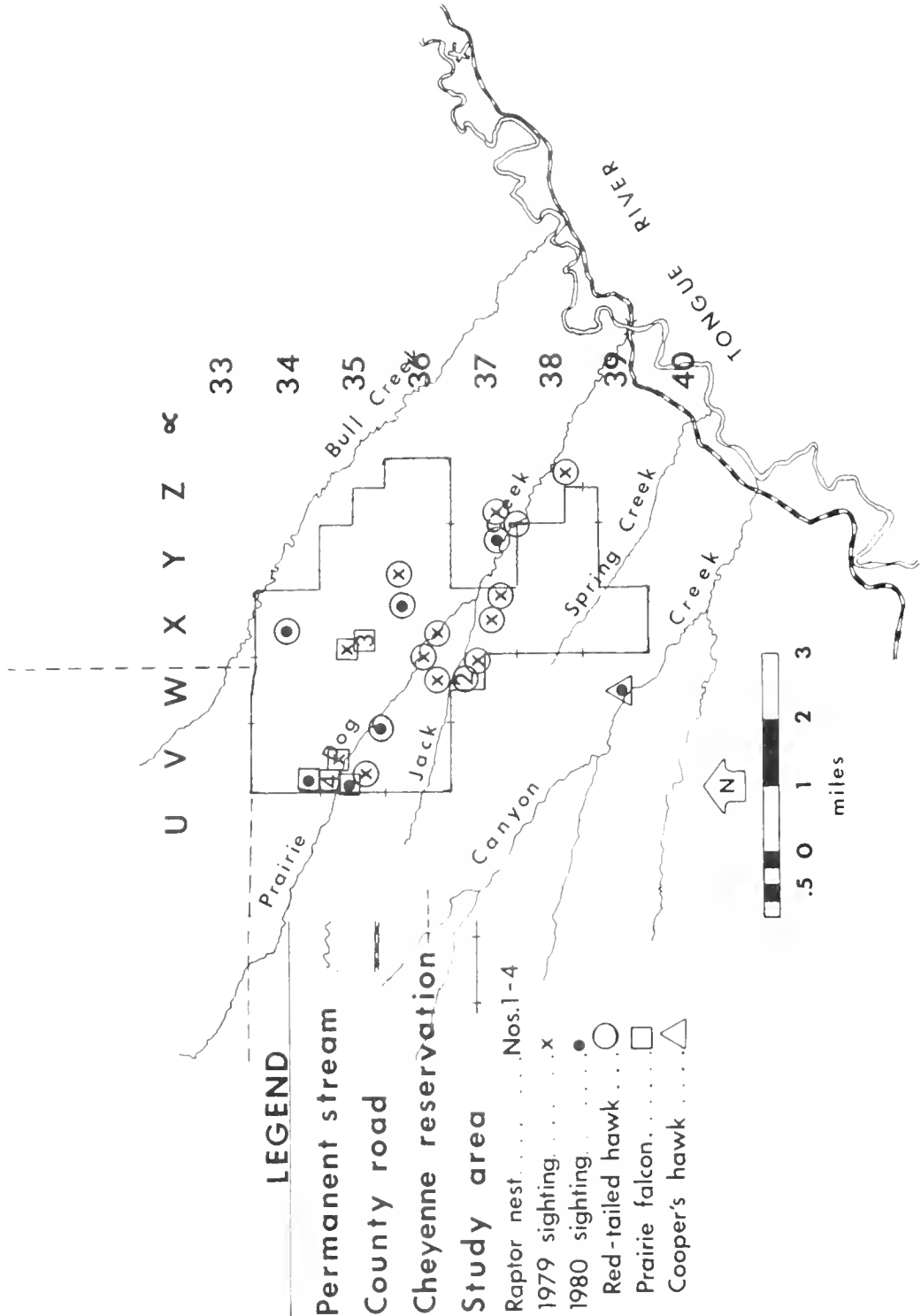


Figure 37. Locations of red-tailed hawks, prairie falcons and Cooper's hawks on the Prairie Dog Creek study area.

Non-game Mammals

Ten species of mammals were observed in the study area (Table 59). Desert cottontails (*Sylvilagus audubonii*) and yellow-bellied marmots (*Marmota flaviventris*) were observed within ten miles of the study area and probably occurred in the study area.

Two small-mammal traplines were located in the study area, one in ponderosa pine-juniper habitat and the other in box-elder-ash riparian habitat (Figure 36). Table 60 lists the total trap nights, trapping success, and numbers of each species caught in each habitat. The highest number of species and trapping success were on the trapline in riparian habitat. This trapline was in an area with a heavy infestation of grasshoppers. The grasshoppers cleaned the bait off and tripped manysnap traps, and clogged the pitfall traps. This may have lowered the trapping success.

Table 59. Mammals observed on the Prairie Dog Creek study area.

1. Common or masked shew	<i>Sorex cinereus</i>
2. Striped skunk	<i>Mephitis mephitis</i>
3. Coyote	<i>Canis latrans</i>
4. Least chipmunk	<i>Eutamias minimus</i>
5. Red squirrel	<i>Tamiasciurus hudsonicus</i>
6. Northern pocket gopher	<i>Thomomys talpoides</i>
7. Deer mouse	<i>Peromyscus maniculatus</i>
8. Prairie vole	<i>Microtus ochrogaster</i>
9. Porcupine	<i>Erethizon dorsatum</i>
10. Mule deer	<i>Odocoileus hemionus</i>

Table 60. Results of small-mammal trapping on the Prairie Dog Creek study area.

	Ponderosa Pine Juniper	Deciduous Tree Riparian
Total captures	11	12
Trap nights	470	406
Captures/100 trap nights	2.3	3.0
Number of species caught	1	3
Species:		
<i>Peromyscus maniculatus</i>	11	1
<i>Microtus ochrogaster</i>		4
<i>Sorex cinereus</i>		7

Amphibians and Reptiles

Three species of amphibians and two species of reptiles were observed on the study area (Table 61). All were common to abundant. Other species were probably present, but not encountered.

Table 61. Amphibians and reptiles observed on the Prairie Dog Creek study area.

1. Eastern toad	<i>Bufo boreas</i>
2. Woodhouse toad	<i>Bufo woodhousei</i>
3. Northern chorus frog	<i>Pseudachris triseriata</i>
4. Racer	<i>Coluber constrictor</i>
5. Bull snake	<i>Pituophis catenifer</i>

SUMMARY AND RECOMMENDATIONS

The Hanging Woman Creek study area has the most abundant populations of big game animals, mule deer and antelope. Both species are quite dense and in good condition. Both species seem to be non-migratory and spend most of the year on relatively small home ranges. The Hanging Woman Creek area is excellent sage grouse habitat and supports a thriving sage grouse population. Sharp-tailed grouse and ring-necked pheasants are also present in fair numbers.

While mule deer and antelope numbers in the Otter Creek area do not approach the levels in Hanging Woman, they are more than adequate. Many deer seem to commute into the Otter Creek study area from the surrounding Custer National Forest to feed, returning to the forest for cover and rest. The lack of ample expanses of sagebrush severely limit antelope numbers and distribution in the Otter Creek area. The lack of sagebrush is further evidenced by the fact that no sage grouse grounds were located in the study area. Otter Creek does provide excellent habitat for sharptail grouse and ring-necked pheasants and has large populations of these two bird species.

Prairie Dog Creek has no antelope or sage grouse populations. Only one sharp-tailed grouse dancing ground was found within one mile of the study area, none actually on the area. Mule deer were the most common game species observed and they were not seen in nearly half of the monthly aerial surveys. Prairie Dog Creek is easily the poorest of the three study areas in terms of game species diversity and density.

The study areas currently support good populations and numbers of species of raptors, songbirds, and small-mammals. Fifteen species of special interest or concern currently breed on or adjacent to the study areas. Efforts should be made to minimize the impacts of coal development on nongame wildlife through protection, restoration, and enhancement of habitat. Protection of feeding and roosting areas was important as well as protection of nesting areas.

The following measures should be undertaken whenever possible to maintain, enhance or protect wildlife populations:

1. Exclude from leasing all sharptail and sage grouse breeding areas and appropriate buffer zones. These buffer zones should be at least one-half mile in radius or more to include nesting cover and wintering areas.
2. Exclude from leasing all major mule deer and antelope winter ranges.
3. Exclude from leasing all creekbottoms and associated "riparian" habitat types. Protection of "riparian habitat" which is defined as mesic areas with deciduous trees and shrubs, is very important. A large proportion of the riparian vegetation on the study areas is found on side drainages that are not currently protected as floodplains. Two very important examples are Home Creek (on the Otter Creek study area) and Prairie Dog Creek. Many other small patches of riparian vegetation are scattered on smaller drainages and by stockponds.

Riparian vegetation comprises the smallest area of native vegetation types on the study areas. Its importance cannot be understated. It plays an extremely important role during the hot and dry summer and fall seasons in eastern Montana. In most instances, these riparian areas are the only source of water to both wildlife and domestic livestock. All of the animals congregate on these bottom lands at this time. During this period of intra and interspecific competition for forage and water, all might be lost if this habitat type were altered or destroyed.

Riparian vegetation supports the highest densities and diversity by far, of songbird and small mammals, and supported nearly a third of the raptor nests. This habitat was also heavily used by migrating songbirds, and roosting raptors. Restoration of riparian habitat after mining may be difficult due to the slow growth of trees and shrubs (compared to grasses) and high sensitivity to damage from livestock grazing. Most of the riparian habitat on the study areas are already

being damaged by livestock. Riparian habitat should be excluded from mining until its restoration has been demonstrated and assured.

4. Cliffs and rock formations, especially those made of sandstone, should be protected or enhanced during mining. All cliffs with suitable potholes and ledges for raptor nests should be protected, even if they are not presently being used by nesting raptors. These cliffs are being used as roosting areas for raptors, and may be used in the future for nesting. Cliffs often support a large number of snags which are heavily used as nest trees by mountain bluebirds.
5. Preserve nests that are regularly used by golden eagles or other special interest raptors. Raptors commonly build several nests within their territories and alternate between them from year to year (Call 1978). A nest may be "active" even though it hasn't been used in several years.

All known raptor stick nests, even those originally built by red-tailed hawks, should be monitored for use by special interest raptors until mining actually takes place. Raptors often rebuild nests originally built by other species.

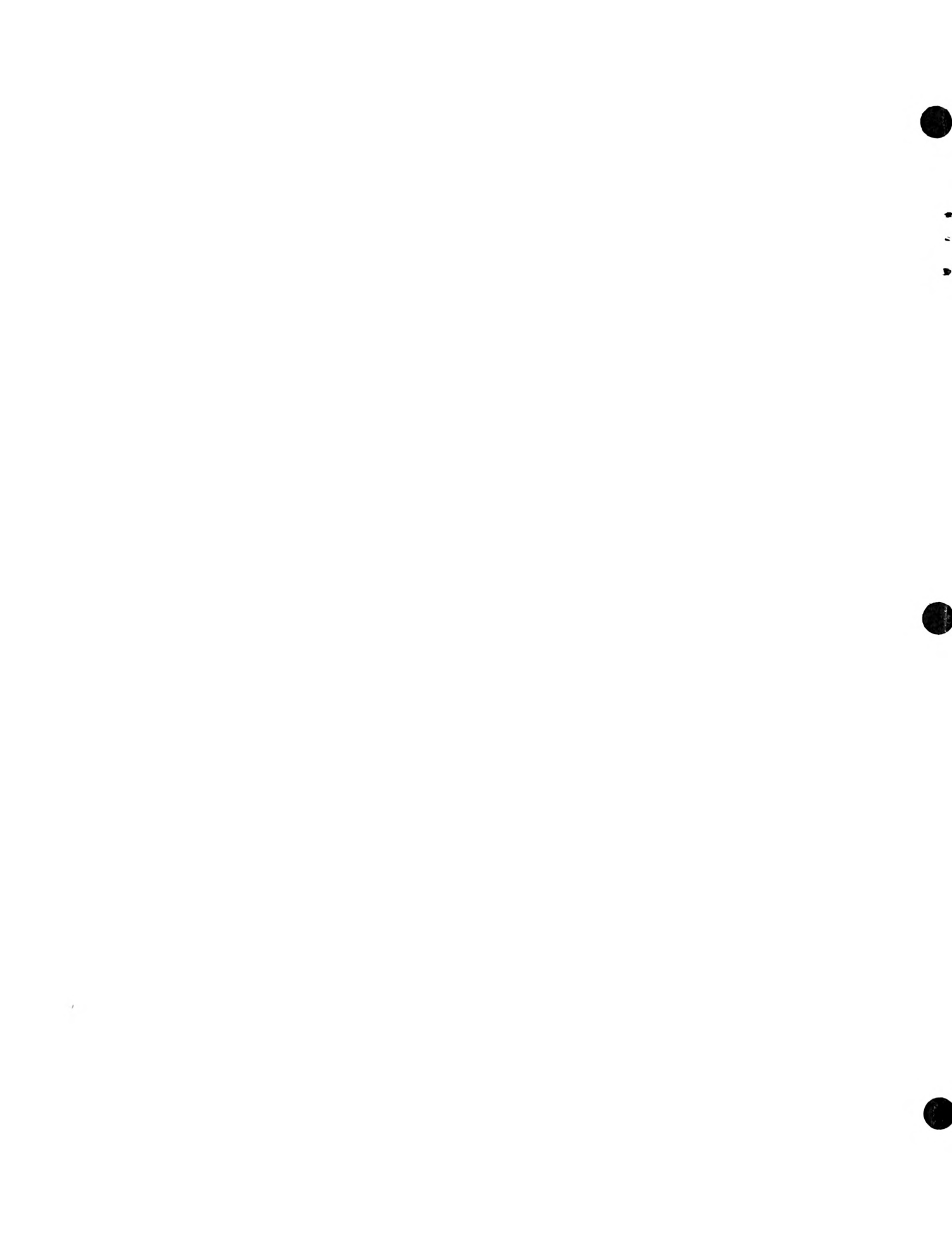
6. Minimize disturbance of active raptor nests during the breeding season (April-July). Disturbance during incubation can cause egg mortality from predation or exposure when the incubating bird is flushed, or total abandonment of the nest. Disturbance of nests with nestlings can cause mortality from exposure, interrupted feedings, and premature fledging.

Literature Cited

- American Ornithologist's Union. 1957. Checklist of North American Birds. 5th ed. American Ornithologist's Union, Ithaca, New York, 691 pp.
-
- _____ 1973. 32nd supplement to the American Ornithologist's Union checklist of North American birds. Auk. 90(2):411-419.
-
- _____ 1976. 33rd supplement to the American Ornithologist's Union checklist of North American birds. Auk. 93(4):875-879.
- Call, M.W. 1978. Nesting habitats and surveying techniques for common western raptors. Tech. Note No. TN-316. U.S. Bureau of Land Management., Denver Service Center, Denver, Colorado. 115 pp.
- Dusek, G.L. 1978. Bull Mountains Coal Field Study. Mont. Dept. of Fish and Game and Consolidation Coal Co. Final Report. 120 pp.
- Flath, D.L. 1979a. Evaluation of sampling techniques for small mammal community species composition. Paper presented at the 59th annual meeting of the American Society of Mammalogists. Corvallis, Oregon. June 1979.
-
- _____. 1979b. Nongame species of special interest or concern. Wildlife Division, Mont. Fish and Game. 73 pp.
- Hickey, J.J. and S. Mikol. 1979. Estimating breeding bird densities on coal lands in Montana and Wyoming. U.S. Fish and Wildlife Service, Biological Services Program. FWS/WELUT-79/03. March 1979.
- Kimball, J.W. 1949. The crowing count pheasant census. J. Wildl. Manage. 13(1):101-120.
- Knapp, S.J. 1977. Birney-Decker wildlife study. Mont. Dept. of Fish and Bureau of Land Management final report. 163 pp.
-
- _____ 1979. Upland game bird surveys and inventory - Region 7. Proj. W-130-R-10. Job No. II-7. Rept. Mont. Dept. of Fish, Wildlife and Parks. Unpubl. 13 pp.
- Knowles, C.J. 1975. Range relations of mule deer, elk and cattle in a restoration grazing system during summer and fall. M.S. Thesis, Mont. St. Univ., Bozeman. 79 pp.
- Martin, P.R. 1980. Sarpy Basin Wildlife Ecology Study. Mont. Dept. of Fish, Wildlife and Parks and Cormorant Corp. Final Report. 125 pp.

- Odum, E.P. 1959. Fundamentals of ecology. Second edition. Press of W.B. Saunders Company. Philadelphia. 546 pp.
- Schwarzkopf, W.F. 1980. Pers. Comm. Biologist. Western Energy Company. Colstrip.
- Swenson, J.E. 1978. Big game survey and inventory (deer) - Region 7, including an analysis of deer production data, 1960-1977. Proj. No. W-130-R-9, Job No. I-7. Rept. Mont. Dept. of Fish and Game. Unpubl. 35 pp.
- _____. and S.J. Knapp. 1979. Big game survey and inventory (deer) - Region 7. Proj. No. W-130-R-10, Job No. I-7. Rept. Mont. Dept. of Fish, Wildlife and Parks. Unpubl. 32 pp.
- United States Department of Interior (U.S.D.I.). 1978. Wildlife habitat thematic map - Birney Quadrangle and Lame Deer Quadrangle. Western Energy and Land Use Team, Fish and Wildlife Service and HRB - Singer Inc., Contract No. 14-16-009-73-011.
- _____. 1979. Unsuitability criterion 14 guidelines for the Powder River coal production region. Inst. Memo. No. 80-126. Bureau of Land Management, Washington, D.C.
- Wallestad, R. 1975. Montana sage grouse. Life history and habitat requirements of sage grouse in Central Montana. Mont. Dept. of Fish and Game. 66 pp.
- Wentland, H.J. 1979. Big game surveys and inventory - Region 7. Proj. No. W-130-R-10. Job No. 7. Rept. Mont. Dept. of Fish, Wildlife and Parks. Unpubl. 28 pp.

APPENDIX



Appendix Table 1. Parameters recorded at each observation.

A. Vegetation type and subtype

1. Ponderosa pine
 - a. ponderosa pine
 - b. sagebrush
 - c. grassland
 - d. skunkbush
 - e. juniper
 - f. snowberry
2. Sagebrush/grassland
 - a. sagebrush
 - b. deciduous shrub
 - c. grassland
3. Creek bottom
 - a. tree
 - b. shrub/grass
4. Agricultural
 - a. ponderosa pine
 - b. sagebrush/grassland
 - c. creek bottom

B. Activity

1. Standing
2. Running
3. Lying
4. Feeding

C. Topography

1. Mesa-butte top
2. Mesa-butte steep sides
3. Dissected mid-slopes
4. Alluvium/terrace
5. Current flood plain

D. Exposure

1. North
2. South
3. East
4. West
5. Northeast
6. Northwest
7. Southeast
8. Southwest
9. Flat

E. Slope

1. Flat
2. Gentle
3. Medium
4. Steep



Appendix Figure 1. Ponderosa pine vegetation subtype.



Appendix Figure 2. Ponderosa pine-sagebrush vegetation subtype.



Appendix Figure 3. Ponderosa pine-grassland vegetation subtype.



Appendix Figure 4. Ponderosa pine-skunkbush vegetation subtype.



Appendix Figure 5. Ponderosa pine-juniper vegetation subtype.



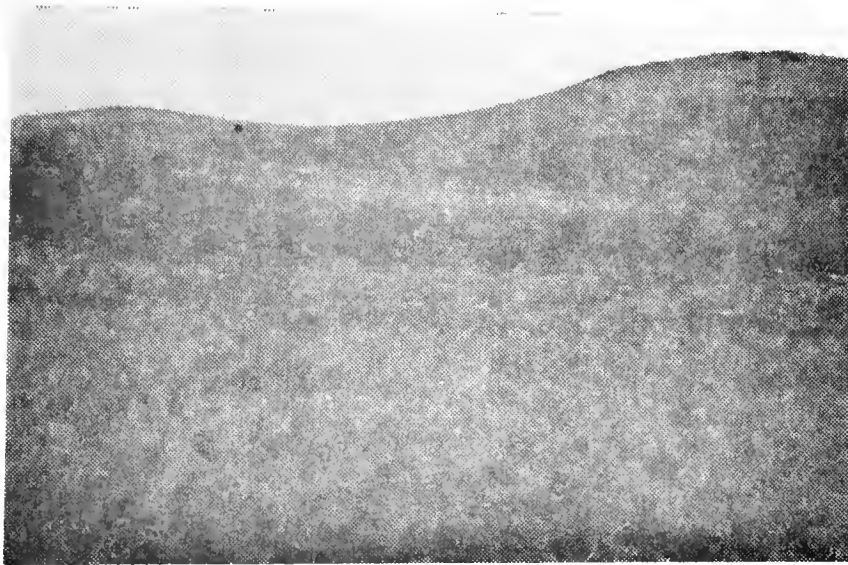
Appendix Figure 6. Ponderosa pine-snowberry vegetation subtype.



Appendix Figure 7. Sagebrush/grassland-big sagebrush vegetation subtype.



Appendix Figure 8. Sagebrush/grassland-silver sagebrush vegetation subtype.



Appendix Figure 9. Sagebrush/grassland-grassland vegetation subtype.



Appendix Figure 10. Sagebrush/grassland-deciduous shrub vegetation subtype.



Appendix Figure 11. Creekbottom-deciduous tree vegetation subtype.



Appendix Figure 12. Creekbottom-deciduous shrub vegetation subtype.



Appendix Figure 13. Agricultural-grassland vegetation subtype.



Appendix Figure 14. Agricultural-creekbottom vegetation subtype.



1
2
3



