SARPY BASIN WILDLIFE ECOLOGY STUDY

MONTANA DEPARTMENT OF FISH AND GAME
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INTRODUCTION

During the past year, the Crow Tribe cancelled all coal leases in the Sarpy Creek area except those held by Westmoreland Resources. Also, Montana Power Company completed construction of its Colstrip to Broadview 230 kilovolt transmission line. This line, with its steel towers, can be converted to 500 kilovolts to accommodate electricity produced by proposed generation units 3 and 4. Westmoreland's "Absaloka" mine continued operation, producing approximately 4 million tons of coal which were transported over Burlington Northern's Sarpy Creek spur line. Construction of a new drag line is scheduled for 1977 along with extraction of over 4.5 million tons of coal. The Montana Highway Department has completed a substantial portion of its engineering survey for the new Sarpy Creek road. Construction will begin on the Bighorn County section in the spring of 1977.

This report contains information primarily from 1976 field observation with comparisons of trend data from the beginning of the study. Mule deer (*Odocoileus hemionus*), pronghorn antelope (*Antilocapra americana*), coyote (*Canis latrans*) and sharp-tailed grouse (*Pediocetes phasianellus*) received the most attention. The continuing objectives of the study, in addition to obtaining basic population data for the resident species, are:

(1) To determine the impact of existing and future surface mining operations on wildlife resources in the area.

(2) To ensure that fish and wildlife habitat values received full recognition in any surface reclamation efforts that follow surface mining operations.

(3) To investigate possible modifications, additions or innovations in the surface mining reclamation processes to avoid unnecessary loss of wildlife habitat and develop techniques and procedures to enhance habitat through reclamation.

PROCEDURES

The first two years of the study were devoted to familiarization with the vegetational composition, soil types, physical aspects and the historical and existing wildlife species population characteristics (Martin 1975, 1976). The objective of the third year of study was to continue monitoring population

characteristics of the primary species. Coyotes were included with mule deer and antelope in the year long data gathering process.

Observations of wildlife were made during low-level fixed-wing aerial flights. The entire area was covered once each season. A north-south flight following section lines at 1/2 mile intervals was used during each of the four seasons: winter (December 1975-February 1976), spring (March 1976-May 1976), summer (June 1976-August 1976) and fall (September 1976-November 1976). A helicopter was used on two occasions during the winter period. Observations made during vehicular surveys and while afoot were also recorded. At each observation the vegetation type being used, the activity, the type of terrain, the slope and exposure and the time of day were recorded. Each observation was plotted on a 1/2 inch to the mile map to the nearest quarter section. Starting with the fall season each observation was located on U.S.G.S. 7.5 minute series topographic maps to obtain elevation data. Weather conditions at the time of observation were also recorded.

Mule deer, antelope and coyote observations were overlain by a soils association transparency to determine seasonal soil association usage. A chi-square (X^2) value was calculated for each soil type in all seasons along with the yearly total to determine if there were any statistically significant preferences. The formula $x^2=\frac{4d^2}{n}$ (Snedecor and Cochran 1967), where d = the absolute value of the deviation between the number observed and the number expected and n = the total number observed, was used primarily because of its simplicity. The fact that this formula is less sensitive than others is not necessarily bad. Most biological data are not exact enough to readily lend themselves to extensive statistical evaluation. A less sensitive comparison greatly reduces the potential of calling a relationship significant when it really is not. Histograms showing the distribution of chi-square values were drawn to show the comparison between significant and other relationships.

STUDY AREA

The location, physiography and climate, edaphic characteristics and vegetation types of the Sarpy Creek study area were discussed in the two previous reports (Martin 1975, 1976). Some additions have been made during the past year.

Location

The study area (figure 1) was divided into three subunits. The two lower units were named Bear Creek and Horse Creek after prominent side drainages. The upper unit was named after Westmoreland's "Absaloka" coal mine. The subdivisions were made to facilitate comparisons of various wildlife population characteristics within the Sarpy drainage. Boundaries were arbitrarily placed to make the units approximately equal in area, to maintain rough vegetative type integrity and to follow easily identifiable terrain features.

Vegetation Characteristics

A new vegetation subtype was differentiated. It was the snowberry subtype and occurred within the larger ponderosa pine type. It was found primarily in coulee bottoms, creek-bottoms, north slopes and other mesic sites. Snowberry (*Symphoricarpos albus*) was the primary shrub species.

Climate

During the past study year 14.96 inches of precipitation were recorded at the Hysham 25 SSE weather station (appendix table 29). This is 0.56 inch less than what fell last year and 3.67 inches less than the first year of study. Like most other areas in the western United States, Sarpy Creek may be on the way to at least moderate drought conditions. The 1975-1976 winter was very severe in the study area. During the three winter months 47.3 inches of snowfall were measured. This compares to 22.2 inches in 1975 and 27.7 inches in 1974. When the November 1975 snowfall is included there were 66.7 inches of snow. This is a 189 percent increase from the 23.1 inches that fell during the same four months the previous year. Temperatures were not as cold with 26 days in which the maximum temperature remained below freezing. There were 32 such days in 1975. Spring was mild and dry with 3.63 inches of moisture. There were 5.58 inches the previous spring. Summer was very hot and continued dry. In spite of one storm which dumped 1.06 inches of rain in June, there were only 5.37 inches of rain in the 1976 summer months. There were 6.18 and 3.39 inches recorded in 1974 and 1975 summers, respectively. Temperatures were above 90 degrees Farenheit 39 days in 1976 compared to 34 days in 1974 and only 23 days in 1975. Fall, the Montana season of greatest variability as evidenced by the extremes of 96° and -24° in 1976, continued dry. Only 3.21 inches of moisture were recorded

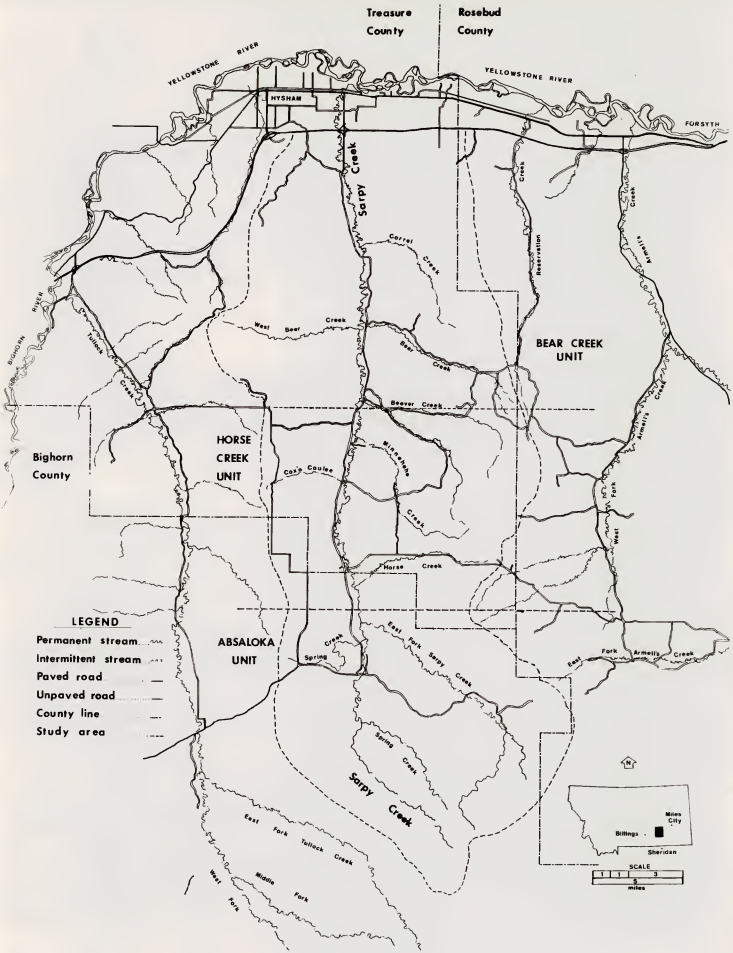

Figure 1. Sarpy Basin wildlife ecology study area.

compared to 4.18 and 4.03 inches in the falls of 1974 and 1975, respectively.

WILDLIFE ECOLOGY

Mule deer, pronghorn antelope and coyotes received year-long attention. Sharp-tailed grouse, sage grouse (*Centrocercus urophasianus*) and ringnecked pheasant (*Phasianus colchicus*) observations were emphasized during the spring breeding season. White-tailed deer (*Odocoileus virginiana*) and Merriam's turkey (*Meleagris gallopavo merriami*) sitings were made incidentally throughout the year.

Mule Deer

During 1976, 1417 mule deer were observed in 333 groups. This compares with 1467 mule deer in 301 observations in 1975 (Martin 1976). These total figures seem to indicate a relatively stable mule deer population. Examination of numbers of mule deer observed per unit of effort, in this case hours of fixed-wing aerial survey (table 1), suggest a different conclusion. Summer observations were similar in 1975 and 1976 with just over 6 deer per hour observed. However, a higher intensity search was made in 1976 with flight lines 1/2 mile apart compared to 1 mile separations in 1975. One-half mile separations were utilized during both fall periods. Thirty-six mule deer were observed per hour in 1975 while only 18.5 were observed in 1976. These figures indicate a possible population decrease.

Distribution

Seasonal mule deer observations are shown in figure 2. The basic pattern of movement from the ridges and plateaus of winter to the creekbottoms in spring and summer followed by fall dispersement was generally observed again in 1976.

Based on the number observed in each of the three subunits during the fall aerial survey (table 2), there is an equal distribution of mule deer over the entire study area. Inclusion of vehicular observations moves the Horse Creek subunit total from the lowest to the highest.

Winter observations were centered in the east-central portion of the Absaloka subunit and in the north-central portion of the Horse Creek subunit. Deer in these winter concentration areas were observed from a helicopter. Harsh early winter conditions apparently forced deer to congregate

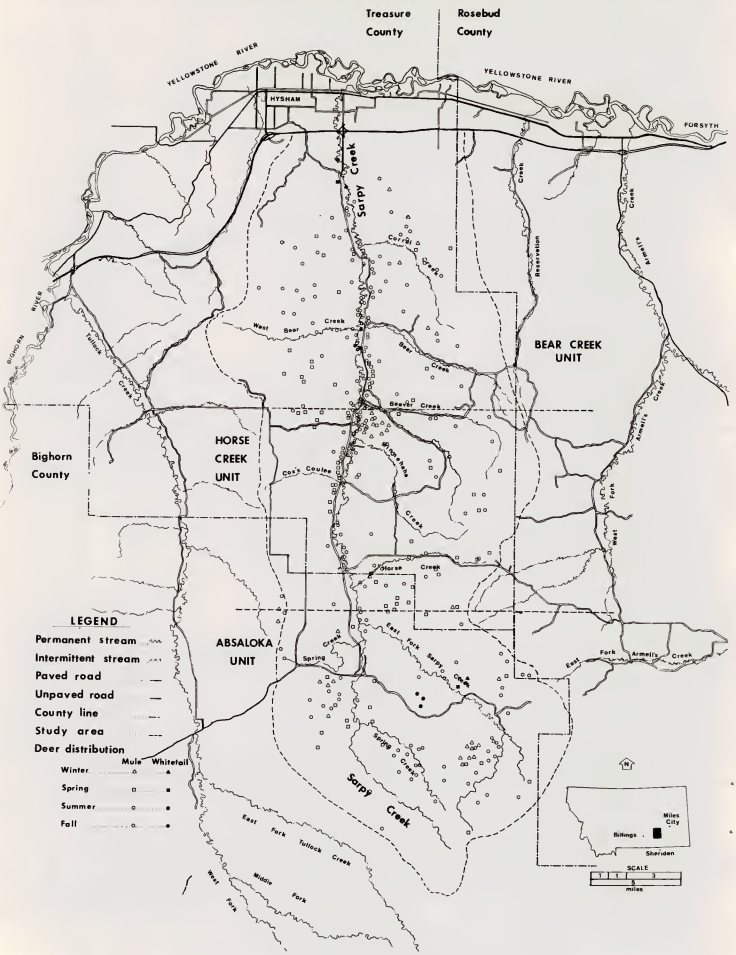

Figure 2. Mule deer and white-tailed deer observations in the Sarpy Creek study area in 1976.

Table 1. Mule deer, antelope and coyote aerial observations per hour in 1975 and 1976.

		Observations			Observations Per Hour		
Season	Hours 1/	Mule Deer	Antelope	Coyotes	Mule Deer	Antelope	Coyotes
Summer	7.9	49	197	3	6.2	24.9	0.4
Fall	15.8	569	235	30	36.0	14.9	1.9
1975	23.7	618	432	33	26.1	18.2	1.4
Winter	11.4	139	60	21	12.2	5.3	1.8
	5.0 2/	202	0	6	40.4	0	1.2
Spring	15.9	300	219	15	18.9	13.8	0.9
Summer	18.1	111	318	15	6.1	17.6	0.8
Fall	20.3	375	247	46	18.5	12.2	2.3
1976	65.7 3/	925	844	97	14.1	12.8	1.5

1/ Hours of fixed-wing flight.

2/ Helicopter hours (excludes ferry time)

3/ Excludes helicopter flights

Table 2. Fall 1976 mule deer population characteristics in the Sarpy Creek drainage.

Sub-Unit	Method[1/]	Bucks	Does	Fawns	Total	Fawns: 100 Does	Fawns: 100 Adults	Bucks 100 does	Population Structure (%) Bucks	Population Structure (%) Does	Population Structure (%) Fawns
Bear Creek	A	15	68	44	127	65 [2/]	53	22	12	54	35
	V	6	22	7	35	32	25	27	17	63	20
	T	21	90	51	162	57	46	23	13	56	31
Horse Creek	A	12	70	35	117	50	43	17	10	60	30
	V	12	51	30	93	59	48	24	13	55	32
	T	24	121	65	210	54	45	20	11	58	31
Absaloka	A	9	64	58	131	91	79	14	7	49	44
Sarpy Study Area	A	36	202	137	375	68	58	18	10	54	37
	V	18	73	37	128	51	41	25	14	57	29
	T	54	275	174	503	63	51	20	11	55	35

1/ A - aerial survey observations
V - vehicular survey observations
T - total observations

2/ All percentages rounded to nearest whole number

more than normal this year. This, followed by very warm weather in mid-January, made deer difficult to find during the fixed-wing aerial survey. Mule deer observations per hour of flight (table 1) were considerably higher with the helicopter (40.4) than with the super cub (12.2).

Population Characteristics

The trend toward lower fawn production continued in 1976 with 63 fawns per 100 does (table 3) observed during the fall survey. The percentage of adult females increased to 55 percent (figure 3) while the fawn portion dropped to 35 percent. Mule deer bucks increased slightly from 10 to 11 percent of the population. The fawn per 100 adult ratio which had been stable dropped from 60 in 1975 to 51 in 1976.

Examination of the three subunits (table 2) shows the Absaloka unit had 91 fawns per 100 does. That is good fawn production (Eustace 1974). The Bear Creek unit had 65 fawns per 100 does (aerial survey) followed by the Horse Creek unit with 50. These are fair and poor, respectively. Total observations indicate poor production with 57 and 54 fawns per 100 doe ratios for the two units. The reason for the difference between the Absaloka unit and the other two units is not evident at this time.

Eustace (1977) reports that fish and game hunting units 720 and 722 had 54 and 75 fawns per 100 does in 1976. Both of these units, as well as the Sarpy Creek study area with 63 fawns per 100 does, were below the 81 fawns per 100 does figure for all of Region 7. Hunting unit 722 has registered a sharp rise in fawn production since 1973 (figure 4), increasing from 23 fawns per 100 adults to 73 fawns per 100 adults in 1976. Unit 720 production has remained stable near 46 fawns per 100 adults all four years. Production in the Sarpy drainage remained above these figures during the four year period except for unit 722 in 1976.

Figure 5 shows mule deer harvest figures from 1956 through 1975. Unit 722 appears to have leveled off while 720 increased slightly, as did the entire Region 7 kill. The 1976 harvest figures, which are not yet compiled, will reflect the change from two deer, either sex to one deer, bucks only hunting. The total number of mule deer harvested will probably decrease as a substantial reduction in license sales accompanied the change in regulations and a license fee increase.

A decreasing production figure, which the Sarpy Creek deer herd exhibits, is treated biologically by increasing harvest. The production capability of a deer herd is lowered

Table 3. Fall mule deer population characteristics in the Sarpy Creek drainage from 1973 through 1976.

Year 1/	Bucks	Does	Fawns	Total	Fawns: 100 Does	Fawns: 100 Adults	Bucks: 100 Does	Population Structure(%) Bucks	Does	Fawns
1973 2/	8	21	18	47	86 3/	62	38	17	45	38
1974	31	104	80	215	77	59	30	14	48	37
1975	69	364	260	693	71	60	19	10	53	37
1976	54	275	174	503	63	51	20	11	55	35

1/ Calculations based on observations made during the fall season (September, October and November).

2/ Based on observations of Stephen J. Knapp, biologist, Montana Department of Fish and Game. All others observed by author.

3/ All percentages rounded to nearest whole number.

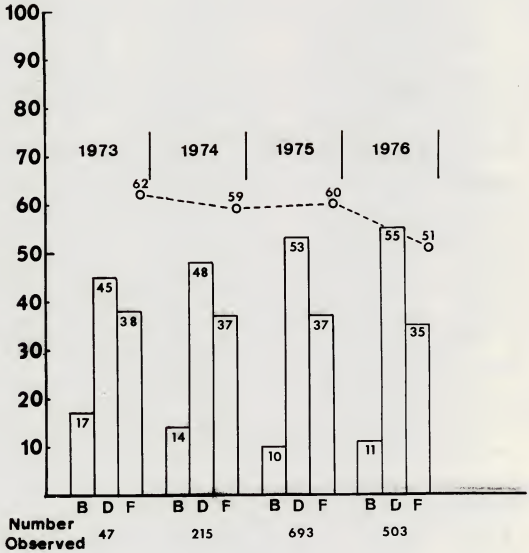

Figure 3. Fall mule deer population structure (percent bucks, does and fawns-bar graph) and production (fawns per 100 adults - line graph) in the Sarpy Creek drainage from 1973 through 1976.

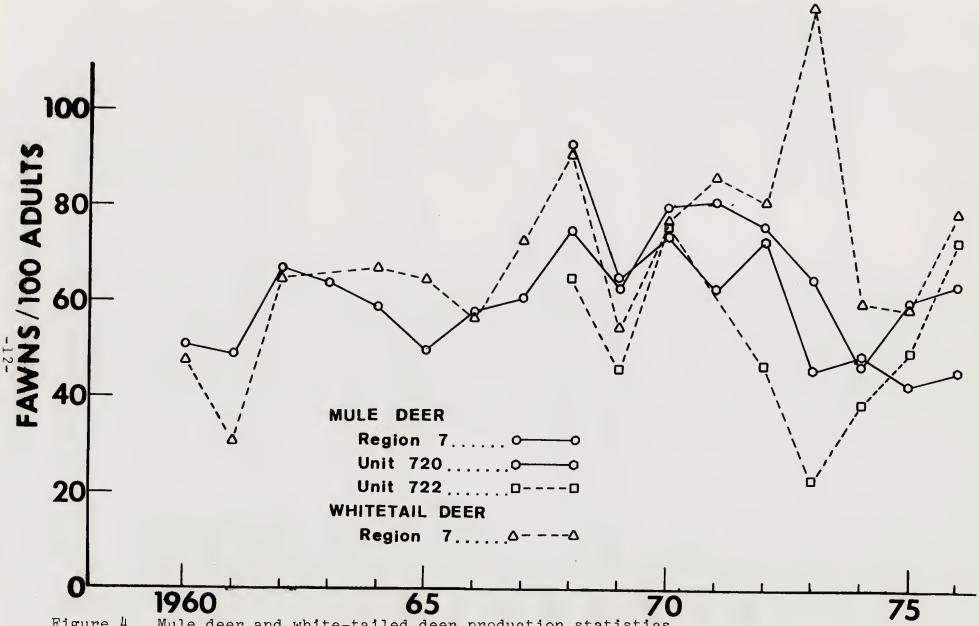

Figure 4. Mule deer and white-tailed deer production statistics.

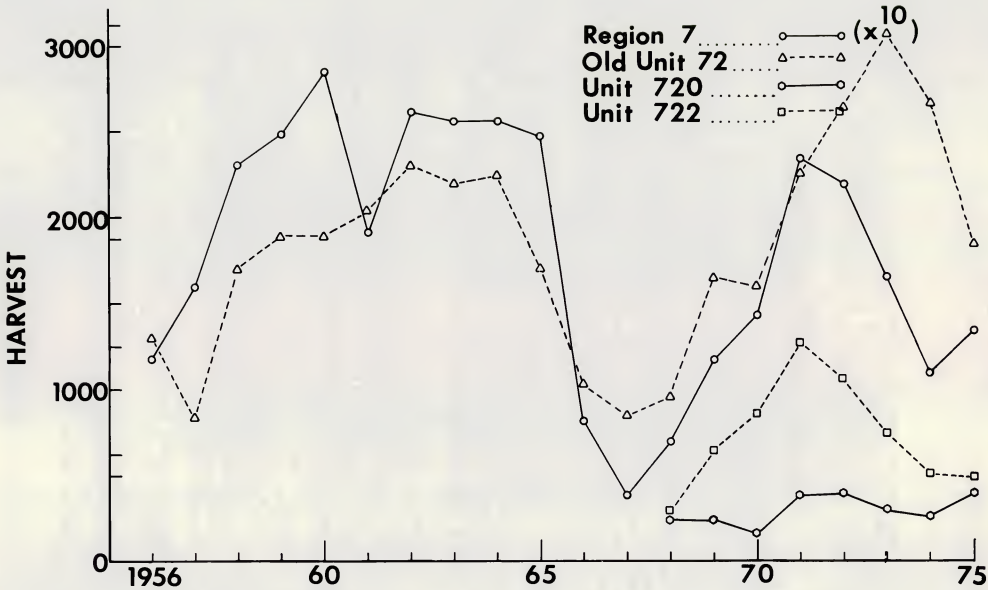

Figure 5. Mule deer harvest statistics.

when the herd becomes too large for its habitat to maintain the general good health of the herd. The increasing percentage of does in the herd will only contribute to the potential for increasing the population.

Seasonal Use of Soil Associations

Mule deer usage of the six different soil types found in the study area is shown by season in table 4. The Bainville-Midway/Thedalund-Midway (B-M/T-M) association continued to support the most deer with 73 percent of 1976 group observations. Seventy-five percent of the mule deer observed, a significantly (p=.05) higher than expected percentage, were on the B-M/T-M association. The Pierre-Lismas (P-L) and Wanetta-Hesper (W-H) associations had significantly fewer deer than expected. In 1975 the P-L and Wayden-Regent (W-R) associations demonstrated negative preference by mule deer (Martin 1976). Figure 6 shows the distribution of chi-square values for mule deer usage of soil associations during 1974, 1975 and 1976. Only those values with a probability of a higher value occurring less than 5 percent of the time were labeled as significant. The left portion of the graph approaches a random distribution pattern. The right side, which shows an increase in the number of chi-square values with low to very low probabilities of greater values, indicates that mule deer are defininitely selecting for and against certain soil associations.

Winter: There was more diverse usage of soil types in 1976 with 5 of the 6 types receiving some use. Last winter mule deer used only 3 associations. The B-M/T-M sustained by far the most deer with 87 percent of the total observed. It had only 75 percent in 1975. The P-L and Flasher-Bainville/Nelson-Alice (F-B/N-A) associations were the only two which deer selected against in significant numbers.

Spring: This was the only season in which mule deer were observed in all six soil associations. The B-M/T-M association had the highest percentage of observations (65) but it was not significant. The only association with significant usage was F-B/N-A. At 14 percent, it registered a significant positive deviation from the expected number of mule deer observed.

Summer: Again the B-M/T-M association received significant positive usage with 83 percent of the total observed. No other association received usage significantly different from the expected. Five of the six associations received usage, as it was last summer. In 1976 no observations were made in the W-H association while the W-R association had no observed usage in 1975.

Table 4. Seasonal use of soil associations by mule deer.

Soil Association	Winter '75-'76 40-341 1/		Spring 1976 100-424		Summer 1976 72-149		Fall 1976 121-503		Yearly Total 1976 333-1417	
1. Wanetta-Hesper (T) 2/	-	-	1 3/	2 4/	-	-	-	-	tr 5/	1 N
2. Pierre-Lismas (T)	5	2 N 6/	3	3	6	5	7	8	5	5 N
3. Flasher-Bainville (T) / Nelson-Alice (B)	2	1 N	13	14 P	4	4	6	6	7	7
4. Bainville-Midway (T)/ Thedalund-Midway (B)	80	87 P	63	65	85	83 P	73	73 P	73	75 P
5. Wayden-Regent (B)	2	1	5	4	3	5	4	2	4	3
6. Wibaux-Thedalund-Spearman (B)	10	9	15	12	3	3	10	11	10	10

1/ Number of group observations - total observed.

2/ (T) - Treasure County; (B) - Bighorn County.

3/ Percent of group observations.

4/ Percent of total.

5/ tr= Trace; a percent less than 0.5.

6/ N = negative usage significant at p=.05.
P = positive usage significant at p=.05.

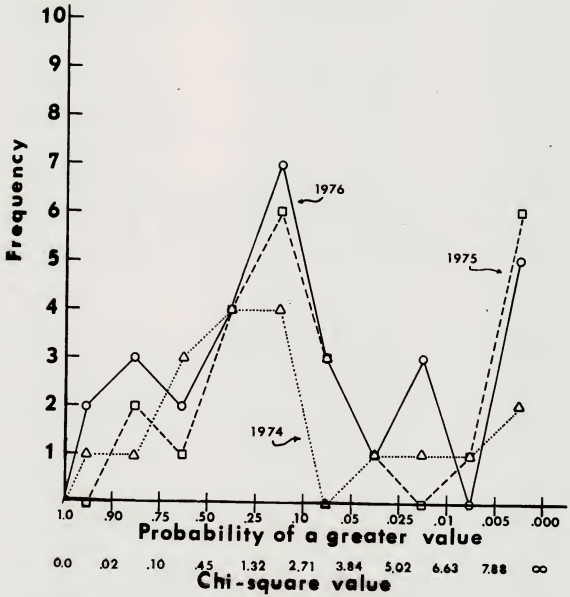

Figure 6. Histogram of chi-square values for mule deer seasonal distribution by soil association (1974-1976).

Fall: The fall usage pattern was very similar to summer. Mule deer were observed in the same five associations, the W-H being absent. The B-M/T-M association was again the only one with a significant deviation. Although its percentage dropped 10 points to 73, it remained positively significant.

Seasonal Use of Vegetation Types

The ponderosa pine vegetation type continues to be the most important to mule deer. Over 50 percent of all group observations were made in this type (table 5). Usage increased slightly in the ponderosa pine type during 1976. Forty-seven percent of the mule deer were observed in this type compared to 44 percent in 1975 (Martin 1976). Usage of the remaining types in 1976 was also very similar to the 1975 pattern. Both agricultural and sagebrush types had 17 percent of mule deer observations compared to 19 and 17 percent, respectively, in 1975. Native creekbottom and grassland types, with 10 and 8 percent of the mule deer usage in 1976 and 12 and 7 percent in 1975, received the least total usage.

Winter: Only 62 percent of the mule deer observations were made in the ponderosa pine type. This is down considerably from the 84 percent figure in 1975. The decline was most noticable in usage of skunkbush and sagbrush subtypes. Usage of the grassland type increased from 1 percent in 1975 to 15 percent in 1976. Perhaps the large amounts of snow forced deer away from their preferred habitat, the various browse fields near the protective cover of ponderosa pine trees, to windblown ridges and hilltops in search for forage.

Spring: Usage of vegetation types revealed a pattern unlike any observed in previous years of this study. Ponderosa pine usage, 43 percent, increased substantially for the 25 percent observed in 1975 but was far below the 70 percent figure observed in 1974. Mule deer use observed in the sagebrush type has increased each of the three years going from 16 percent in 1974 (Martin 1975) to 29 percent in 1976. The numbers of deer utilizing agricultural types were quite high in 1975, with 32 percent, and relatively low the other two years, 6 percent in 1974 and 11 percent this year, 1976.

Summer: Usage of sagebrush and grassland types declined from spring levels while creekbottom, agricultural and ponderosa pine levels of usage increased. This pattern reflects the normal situation in this area. That is, as the upland areas began to dry up and the vegetation desiccates,

Table 5. Seasonal use of vegetation types by mule deer.

Vegetation Types	Winter '75-'76 40 - 341 1/		Spring 1976 100-424		Summer 1976 72- 149		Fall 1976 121- 503		Yearly Total 333-1417	
Ponderosa pine	35 2/	23 3/	6	5	10	13	14	10	13	12
Sagebrush	15	12	9	10	14	11	8	7	10	10
Grassland	5	7	15	13	4	3	7	7	9	8
Skunkbush	18	13	7	6	11	9	9	10	10	9
Juniper	5	8	4	2	1	1	-	-	2	3
Snowberry	-	-	5	7	10	11	10	8	7	6
Total Ponderosa Pine	78	62	46	43	50	47	49	41	52	47
Sagebrush	8	10	27	27	14	17	12	10	16	16
Grassland	-	-	3	2	3	3	-	-	2	1
Total Sagebrush	8	10	30	29	17	20	12	10	18	17
Grassland	5	15	7	10	4	5	2	2	4	8
Sagebrush	-	-	1	2	-	-	-	-	tr 4/	1
Total Grassland	5	15	8	12	4	5	2	2	4	8
Cottonwood	-	-	2	2	4	5	2	3	2	2
Shrub	5	8	3	2	7	9	10	12	7	8
Total Creekbottom	5	8	5	4	11	13	12	15	9	10
Ponderosa pine	5	5	5	6	1	1	4	8	4	6
Sagebrush/grassland	-	-	2	3	-	-	1	1	1	1
Creekbottom	-	-	4	2	17	14	21	24	12	10
Total Agricultural	5	5	11	11	18	15	26	32	17	17

1/ Number of group observations - total observed
2/ Percent of group observations
3/ Percent of total
4/ tr= trace; a percentage less than .05

mule deer move to the mesic creekbottoms and associated agricultural fields, and to the wetter north slopes and coulee bottoms within the ponderosa pine type.

Fall: Ponderosa pine usage was very high at 41 percent of the mule deer observed. This compares with the 8 percent observed to use the ponderosa pine type in 1974 (Martin 1975). Thirty-two percent of the mule deer were observed in agricultural types, 24 percent in the creekbottom subtype. Only 21 percent of the observations were on agricultural types in 1975 (Martin 1976). Usage of the creekbottom vegetation type was 15 percent in 1976, down from 21 percent in 1975 and 58 percent in 1974.

Seasonal Activity

Table 6 contains the activities of mule deer at the moment of observation. As in the past, most deer were observed standing or feeding. This reveals the observability bias toward those vegetation types, slopes, exposures and topographic features which are used as feeding grounds. Eighty-one percent of the deer observed yearlong were in these two categories. Most deer were observed feeding during the spring season, 54 percent. This is down from 74 percent observed during the 1975 spring season. Mule deer observed lying down were only 7 percent of the total, down considerably from the 17 percent figure observed last year.

Seasonal Use of Topography

Usage of topographic features by mule deer is shown in table 7. The yearly pattern is basically similar to that observed last year (Martin 1975), with hillside, creekbottom and plateau usage being the most important at 34, 21 and 12 percent, respectively.

Winter: Mule deer were observed in all topographic types. Hillsides and ridges, with 25 and 21 percent, respectively, had the most usage. Plateau and coulee head usage followed closely at 19 and 16 percent, respectively. Valley floor (9 percent) and creekbottom (8 percent) usage increased considerably over 1975 when no deer were observed in the two types.

Spring: Hillside observations increased to 40 percent, the highest for any type during any season in 1976. The combined usage of creekbottoms, coulee bottoms and valley floors increased from 18 percent in winter to 40 percent

Table 6. Seasonal activity of mule deer.

Activity	Winter '75-'76 40 - 341 1/		Spring 1976 100 - 424		Summer 1976 72 - 149		Fall 1976 121 - 503		Yearly Total 333 -1417	
Standing	48 2/	45 3/	41	33	54	54	41	40	45	41
Running	18	9	10	8	11	13	21	17	15	12
Lying	12	8	6	6	6	5	12	8	9	7
Feeding	22	37	43	54	29	28	26	35	32	40

1/ Number of group observations - total observations

2/ Percent of group observations

3/ Percent of total

Table 7. Seasonal use of topography by mule deer.

Topography	Winter '75-'76 40 - 341 1/		Spring 1976 100 - 424		Summer 1976 72- 149		Fall 1976 121-503		Yearly Total 333-1417	
Hillside	25 2/	25 3/	45	40	38	38	36	36	38	34
Ridge	32	21	2	1	4	5	8	6	8	8
Plateau	20	19	14	18	7	4	6	5	10	12
Coulee Hd.	12	16	-	-	7	7	4	4	4	6
Coulee Btm.	2	1	14	13	10	13	7	5	9	7
Valley Flr.	2	9	16	19	6	3	6	5	8	10
Creekbottom	5	8	9	8	29	29	32	38	21	21

1/ Number of group observations - total observed

2/ Percent of group observations

3/ Percent of total

during spring. This is also an increase from the 25 percent observed utilizing the same three features in the 1975 spring season. Plateau usage remained stable at 18 percent but usage of ridges and coulee heads declined from 37 percent during winter to only 1 percent. These two types received similarily low usage in 1975 with 4 percent of the mule deer observed.

Summer: Again deer were observed on all features with hillsides maintaining preeminence at 38 percent. Creekbottom usage increased to 29 percent from the 8 percent observed during both winter and spring seasons. Plateau usage dropped from 18 percent in spring to 4 percent in summer as deer left the xeric uplands for greener pastures.

Fall: Hillside usage remained steady at 36 percent, an increase from the 29 percent observed during the 1975 fall season (Martin 1976). Creekbottom usage was the greatest with 38 percent of the total observed. It also received the most usage in 1975 at 35 percent. The five remaining features received virtually identical usage as percentages ranged from 4 to 6 among them.

Seasonal Use of Slope

Of the yearly total of 1417 mule deer observations, 36 percent were seen on flat land (table 8). This represents a slight increase over the 28 percent figure observed last year (Martin 1975). Usage of steep slopes remained low with 15 percent of the total.

Winter: Steep slopes received their greatest use of the year, 33 percent, during the winter season. Although use of flat areas increased from 1 percent in 1975 to 26 percent in 1976, the combined usage of flat and gentle slope increased only 6 percent, from 42 percent in 1975 to 48 percent in 1976. The steeper slopes continued to receive the most usage by mule deer during the winter months.

Spring: Use of lowland areas is apparent as flat and gentle slopes accounted for 60 percent of the observed mule deer. Use of steep slopes declined from 33 percent in winter to only 9 percent during spring time. The 39 percent figure was the highest recorded for gentle slope usage during the year.

Summer: The pattern of usage was markedly different from that observed last year when all slopes received similar usage.

Table 8. Seasonal slope usage by mule deer.

Gradient	Winter '75-'76 40 - 341 1/		Spring 1976 100 - 424		Summer 1976 72 - 149		Fall 1976 121-503		Yearly Total 333- 1417	
Flat	25 2/	26 3/	21	22	36	33	50	55	35	36
Gentle	22	22	37	38	17	11	16	13	23	23
Medium	28	19	30	32	40	52	20	21	28	27
Steep	25	33	12	9	7	3	13	11	13	15

1/ Number of group observations - total observed

2/ Percent of group observations

3/ Percent of total

In 1976 medium slopes received 52 percent, the highest figure recorded for that category, while only 3 percent were observed on steep slopes. Flat areas had 33 percent of the total.

Fall: The trend away from higher altitude and steeper slopes begun during the summer season continued as usage of flat lands reached its yearly high with 55 percent of the fall observations. Sixty-eight percent of the mule deer were observed on flat and gentle slopes. Usage of steep slopes increased from 3 percent in summer to 11 percent in fall but was still relatively low.

Seasonal Use of Exposure

The yearly distribution of mule deer throughout the study area is well exemplified by their usage of exposures in 1976 (table 9). Only two exposures fell outside the 9-11 percent range. They were the northwest (3 percent) and southeast (4 percent) exposures. There was considerable seasonal variation this year due to an exceptionally hard winter and a relatively dry summer and fall.

Winter: Only 20 percent of the mule deer observed were on north exposures (N, NE and NW). This compares to 42 percent observed on the same three exposures the previous year (Martin 1975). The large snow fall (appendix table 29) undoubtedly accounts for this pattern. The south exposures (S, SE and SW) had 41 percent, virtually the same as last year. The usage of flat lands increased from 1 percent in 1975 to 26 percent in 1976.

Spring: The spring pattern was very similar to that observed in 1975. North and south slopes received nearly identical usage, 5 percent each in 1975 and 14 and 15 percent, respectively, in 1976. East verses west slope usage mirrored that of last year. West slopes received 14 percent usage in winter decreasing to 6 percent in spring. East slopes received no usage in winter increasing to 20 percent during the spring season. This same flip-flop and degree of change was almost identical to that observed in 1975. Also deer were observed on every exposure.

Summer: An even distribution was observed during the summer season. Twenty-two percent of the observations were made on northern exposures while 20 percent were made on southern exposures. Easterly exposures (E, NE and SE) had 23 percent compared to 24 percent on the westerly exposures (W, NW, SW). Usage of flat lands, at 33 percent, was up from the 21 percent figure observed last year, indicating the dryness of the summer season.

Table 9. Seasonal use of exposure by mule deer.

Exposure	Winter '75-'76 40 - 341 1/		Spring 1976 100- 424		Summer 1976 72 - 149		Fall 1976 121- 503		Yearly Total 333-1417	
North	15 2/	6 3/	14	14	8	10	13	11	13	11
South	5	8	11	15	8	10	7	6	8	10
East	-	-	14	20	8	8	12	12	10	11
West	8	14	11	6	17	17	10	9	11	10
NE	18	13	8	6	10	10	8	8	10	9
NW	2	1	6	4	3	2	5	3	4	3
SE	5	3	9	8	3	5	1	1	4	4
SW	22	30	6	4	7	5	6	6	8	11
Flat	25	26	21	22	36	33	38	45	31	32

1/ Number of group observations - total observed.

2/ Percent of group observations

3/ Percent of total

Fall: Again the dry pattern asserts itself as 45 percent of all mule deer observations were made on flat lands. North exposures had 22 percent of the observations compared to 13 percent for the southerly exposures, further indication of mule deer movement to more mesic surroundings.

Pronghorn Antelope

A total of 906 antelope in 148 groups was observed during the third year of the Sarpy Creek study. The low number observed was 60 during the winter season while the high was 318 during the summer survey. This compares to 731 observed in 1975 and 345 observed in 1974. The number of antelope observed per hour of flight (table 1) decreased from 18.2 in 1975 to 12.8 in 1976. Fall observations decreased from 14.9 to 12.2 antelope per hour.

Distribution

Seasonal antelope observations are shown in figure 7. Only four winter observations were made, three in the Bear Creek unit and one in the Horse Creek unit. This lends further support to the theory that antelope migrate into the Tullock Creek drainage during the winter season. The three distinct antelope herds, one in each subunit, described last year (Martin 1976) are again apparent. The Horse Creek unit had by far the most observations. The southwestern portion of the Absaloka unit had several observations in 1976 while no observations were recorded there in previous years.

Population Characteristics

Table 10 shows the antelope population characteristics of the three subunits of the Sarpy Creek study area for summer and fall during 1976. The Horse Creek subunit had the most observations during both seasons but decreased from 193 in the summer to 128 in the fall survey. It had the worst production figures with 18 and 10 fawns per 100 does in summer and fall, respectively. Bear Creek subunit observations increased from 49 to 75 and the fawn/100 doe ratio increased from 28 to 51. Observations in the Absaloka unit decreased from 76 in the summer season to 44 in fall. The fawn/100 doe ratio also decreased from 53 to 26. For the entire study area the percentage of fawns in the population decreased from 18 percent during the summer months to 15 percent in the fall (figure 8). Fawn production measured in terms of fawns/100 adults decreased from 21 in summer to 18 in fall. This is a decrease from 32 fawns/100 adults observed in the 1975 fall and 44 fawns/100 adults in

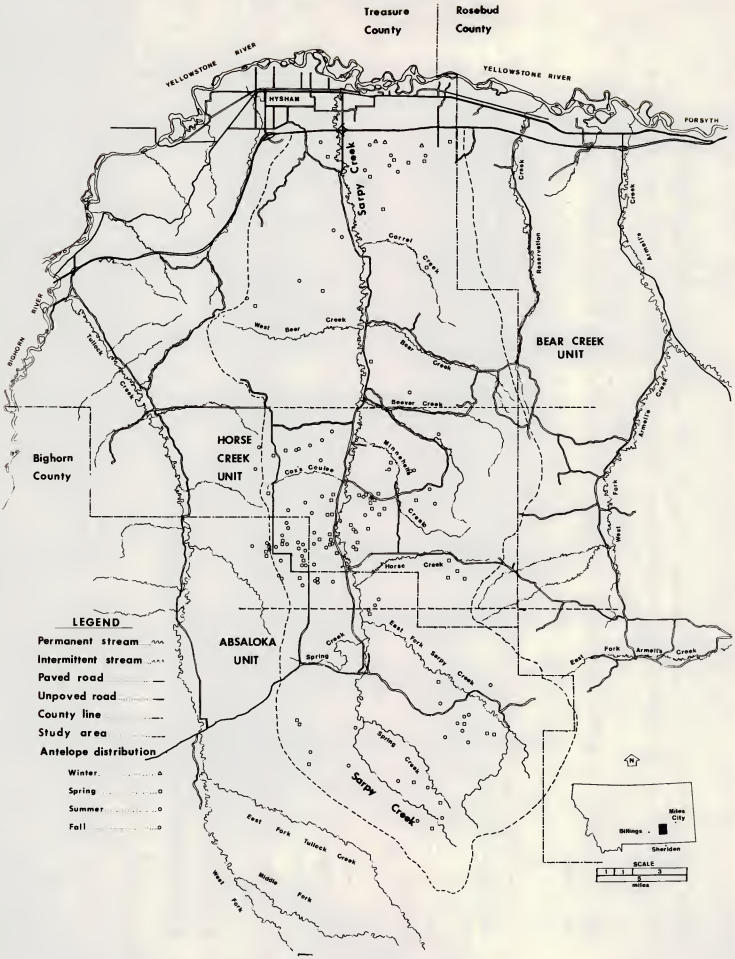

Figure 7. Antelope observations in the Sarpy Creek study area in 1976.

Table 10. Antelope population characteristics in the Sarpy Creek drainage, 1976.

Sub-Unit	Season	Bucks	Does	Fawns	Total	Fawns: 100 Does	Fawns: 100 Adults	Bucks: 100 Does	Population Structure (%) Bucks	Does	Fawns
Bear Creek	S1/	3	36	10	49	28 3/	26	8	6	74	20
	F2/	13	41	21	75	51	39	32	17	55	28
Horse Creek	S	51	120	22	193	18	13	43	26	62	11
	F	30	89	9	128	10	8	34	23	70	7
Absaloka	S	7	45	24	76	53	46	16	9	59	32
	F	5	31	8	44	26	22	16	11	71	18
Sarpy Study Area	S	61	201	56	318	28	21	30	19	63	18
	F	48	161	38	247	24	18	30	19	65	15

1/ Summer observations (June-August)

2/ Fall observations (September-November)

3/ All percentages rounded to nearest whole number.

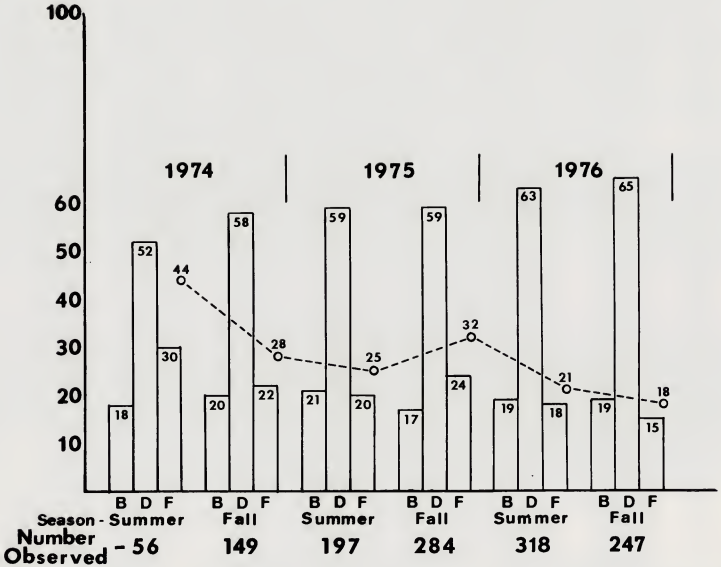

Figure 8. Summer and fall antelope population structure (percent bucks, does, and fawns - bar graph) and production (fawns per 100 adults - line graph) in the Sarpy Creek drainage from 1973 through 1976.

the 1974 summer (table 11). The percentage of bucks in the population has remained fairly stable over the study period at approximately 19 percent. The percentage of does has increased from the low 50's in 1974 to 59 percent in 1975 and about 64 percent in 1976. Fawn percentages have decreased from a high of 30 percent in the 1974 summer to a low of 15 percent in the fall of 1976.

Antelope harvest (figure 9) remains steady in the two hunting units. Harvest increased in unit 720 slightly while unit 722 harvest decreased slightly.. Both Fish and Game Region 7 and "old" unit 72 seem to be sustaining harvest at relatively high levels.

Seasonal Use of Soil Associations

The total years usage pattern deviated from that observed in the two previous years which were similar (Martin 1976). The Bainville-Midway/Thedalund-Midway (B-M/T-M) association maintained the most usage all three years with the 60 percent figure observed in 1976 being the highest (table 12). This usage is still below the expected level based on the X^2 analysis described earlier in this report. The Flasher-Bainville/Nelson-Alice (F-B/N-A) and Wanetta-Hesper (W-H) associations with 17 and 10 percent of the antelope observations, respectively, received significant positive usage by antelope in 1976. Usage of the F-B/N-A association decreased from 27 percent observed in 1975. The 10 percent figure observed in the Pierre-Lismas association was only a slight decrease from the 13 percent observed in 1975, but with the increased number of antelope observed (731 in 1975 to 906 in 1976) it was enough to drop below the level of significant preference. The Wayden-Regent association with no observations and the Wibaux-Thedalund-Spearman association with only 4 percent of the observed antelope received significant negative usage.

The distribution of X^2 values (figure 10) reveals a large number of significant values, those situated on the right portion of the graph. There are more of these values than observed on the mule deer histogram (figure 6). This indicates that the antelope are more selective than mule deer.

Winter: Antelope were observed on only two associations, the W-H which had 88 percent and the B-M/T-M with 12 percent, Last year there were no observations on W-H soil while P-L sustained the most antelope with 48 percent of the total. The usage of the B-M/T-M association decreased from 22 percent in 1975 to 12 percent in 1976. Both years usage was significantly lower than expected.

Table 11. Antelope population characteristics in the Sarpy Creek drainage, 1974-1976.

Season	Year	Bucks	Does	Fawns	Total	Fawns:100 Does	Fawns:100 Adults	Bucks: 100 Does	Population Structure (%) Bucks	Population Structure (%) Does	Population Structure (%) Fawns
Summer June-Aug.	1974	10	29	17	56	59 1/	44	34	18	52	30
Fall Sept.-Nov.	1974	30	86	33	149	38	28	35	20	58	22
Summer June-Aug.	1975	42	115	40	197	35	25	37	21	59	20
Fall Sept.-Nov.	1975	47	168	69	284	41	32	28	17	59	24
Summer June-Aug.	1976	61	201	56	318	28	21	30	19	63	18
Fall Sept.-Nov.	1976	48	161	38	247	24	18	30	19	65	15

1/ All percentages rounded to nearest whole number.

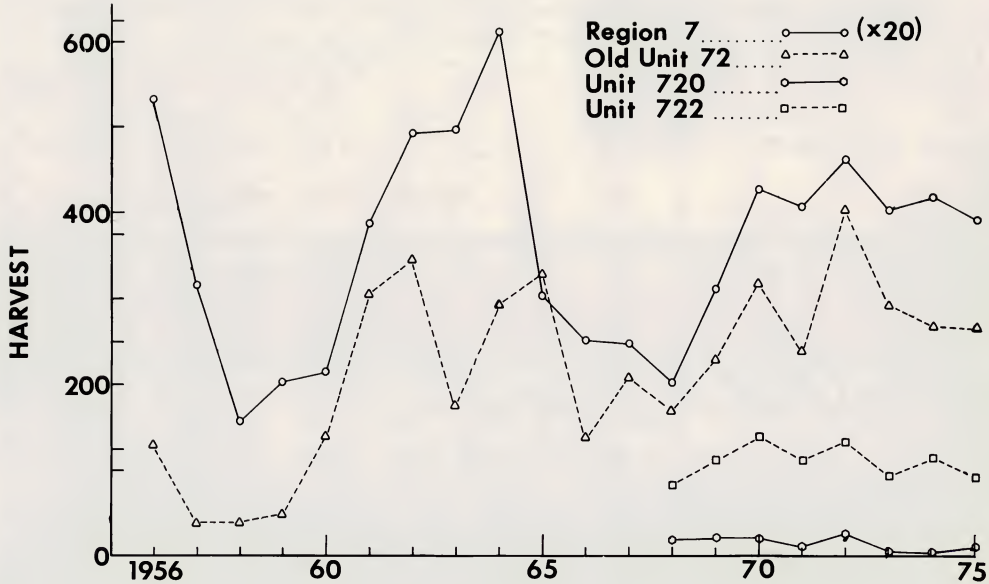

Figure 9. Antelope harvest statistics

Table 12. Seasonal use of soil associations by antelope.

Soil Association	Winter '75-'76 4 - 60 1/		Spring 1976 64 - 281		Summer 1976 53 - 318		Fall 1976 27- 247		Yearly Total 1976 148- 906	
1. Wanetta-Hesper (T) 2/	75 3/	88 4/ P 5/	3	4	2	2	7	9	5	10 P
2. Pierre-Lismas (T)	-	-	8	7	4	6	15	21 P	7	10
3. Flasher-Bainville (T)/ Nelson-Alice (B)	-	-	20	13	23	19 P	26	21 P	22	17 P
4. Bainville-Midway (T)/ Thedalund-Midway (B)	25	12 N	67	76 P	68	69	48	41 N	63	60 N
5. Wayden-Regent (B)	-	-	-	-	-	-	-	-	-	- N
6. Wibaux-Thedalund-Spearman (B)	-	-	2	tr 6/ N	4	4	4	8	3	4 N

1/ Number of group observations - total observed
2/ (T) - Treasure County; (B) - Bighorn County
3/ Percent of group observations
4/ Percent of total
5/ N - Negative usage significant at p= .05
P - Positive usage significant at p= .05
6/ tr= trace; a percentage less than 0.5

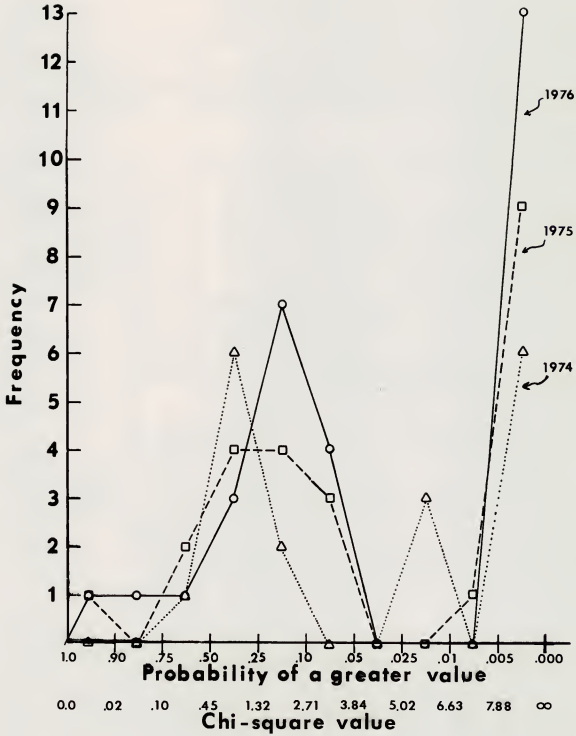

Figure 10. Histogram of chi-square values for antelope seasonal distribution by soil association (1974-1976).

Spring: Usage of the B-M/T-M association increased to 76 percent. This was positive selection by antelope for that soil association. A trace was observed in the W-T-S assocation demonstrating negative preference. The W-H association usage decreased from 26 percent in 1975 to only 4 percent in 1976.

Summer: The summer usage pattern was very similar to that observed in spring with the only changes being a slight drop in the percentage observed on the B-M/T-M association and a nearly equal rise in the F-B/N-A percentage. The 19 percent observed in the F-B/N-A association was the only summer season figure which showed significant preference. It was also the only one with significant positive preference in 1975.

Fall: The same five associations on which antelope were observed during the spring and summer months again supported antelope. The B-M/T-M had the highest percentage of utilization, 41 percent, but demonstrated negative preference. The P-L and F-B/N-A associations, each with 21 percent, were positively selected for by antelope. This pattern was more diversified than that observed last year when the B-M/T-M had 59 percent of the observations and the W-H and W-R associations received no use.

Seasonal Use of Vegetation Types

The grassland vegetation type was the most important to antelope in 1976. Fifty percent of the years observations were made on this type (table 13). This is an increase from 45 percent in 1975 (Martin 1976) and 38 percent in 1974 (Martin 1975). The sagebrush type was also important with percentages of 38, 42, and 49 in 1976, 1975, and 1974, respectively. The two types together consistently account for 87 percent of all antelope observations.

Winter: Antelope were observed only on the grassland and sagebrush subtypes of the grassland vegetation type. In 1975, 78 percent of the antelope observed were on the sagebrush vegetation type. Only 4 group observations were made which severely limits the validity of any conclusions drawn from the data.

Spring: Grassland and sagebrush types received the most usage, each with 42 percent of the group observations. The grassland type had more antelope with 49 percent compared to 38 percent observed in the sagebrush type. Usage of the ponderosa pine type increased from zero in 1974 and 1975 to 10 percent this year. At the same time creekbottom usage

Table 13. Seasonal use of vegetation types by antelope.

Vegetation Types	Winter '75-'76 4 - 60 1/		Spring 1976 64- 281		Summer 1976 53- 318		Fall 1976 27 -247		Yearly Total 148-906	
Ponderosa pine	-	-	2	tr 4/	-	-	-	-	1	tr
Sagebrush	-	-	3	1	8	8	4	3	5	4
Grassland	-	-	5	7	-	-	4	4	3	3
Skunkbush	-	-	3	2	4	2	-	-	3	1
Juniper	-	-	-	-	-	-	-	-	-	-
Snowberry	-	-	-	-	-	-	-	-	-	-
Total Ponderosa pine	-	-	12	10	11	10	7	7	11	9
Sagebrush	-	-	38	33	36	37	30	40	34	34
Grassland	-	-	5	5	2	3	11	4	5	4
Total Sagebrush	-	-	42	38	38	40	41	44	39	38
Grassland	50 2/	65 3/	38	44	47	49	37	39	41	46
Sagebrush	50	35	5	5	-	-	-	-	3	4
Total Grassland	100	100	42	49	47	49	37	39	45	50
Cottonwood	-	-	-	-	-	-	-	-	-	-
Shrub	-	-	-	-	-	-	4	tr	1	tr
Total Creekbottom	-	-	-	-	-	-	4	tr	1	tr
Ponderosa pine	-	-	-	-	-	-	-	-	-	-
Sagebrush/grassland	-	-	3	2	4	1	11	10	5	4
creekbottom			-	-	-	-	-	-	-	-
Total Agricultural	-	-	3	2	4	1	11	10	5	4

1/ Number of group observations - total observed
2/ Percent of group observations
3/ Percent of total
4/ tr= trace; a percentage less than .05

decreased from 13 percent (1975) to zero (1976). Usage of agricultural fields also showed a substantial decrease going from 18 percent in 1975 to only 2 percent in 1976.

Summer: The pattern of usage was similar to that observed last year. Grassland was the most important (49 percent), followed closely by sagebrush (40 percent), with ponderosa pine next at 10 percent. The number of antelope using agricultural lands was very small (1 percent) and non-existant on creekbottoms.

Fall: The year long domination of grassland importance was broken as the percentage of antelope observed on sagebrush was highest at 44 percent. Grassland observations were second with 39 percent of the total. Usage of the agricultural type reached its highest level of the year at 10 percent. The only observations of antelope in a creekbottom vegetation type were made during the fall period.

Seasonal Activity

As last year, most observations were made of antelope either running or standing alert. Eighty-two percent (table 14) of all antelope observed were in one of these two modes. The other two categories were also very similar to last year (Martin 1976). Thirteen percent of the antelope observed in 1976 were feeding compared to 12 percent in 1975. The figures for reclining antelope were 6 percent in 1976 and 9 percent in 1975.

Seasonal Use of Topography

Of the 906 year long observations, 78 percent were recorded as being on hillsides (table 15). This is more than the 68 percent figure observed in 1975. Coulee bottoms and valley floors received identical usage in 1975 and 1976. Coulee bottoms had 7 percent of the total in 1975 and 6 percent in 1976. Valley floors had 8 percent usage both years. Use of plateaus decreased from 13 percent in 1975 to only 3 percent this year. Four percent of the observations were made on ridges. Only a trace were seen on creekbottoms and no observations were made on coulee heads.

Winter: The hillside category contained 77 percent of the antelope observed. This was up from 48 percent observed last year. Valley floor usage comprised the remaining 23 percent. Thirty percent of the antelope observed in 1975 were on valley floors. No antelope were observed in any of the other categories. In 1975, 22 percent were observed on plateaus (Martin 1976).

Table 14. Seasonal activity of antelope.

Activity	Winter '75-'76 4 - 60 1/		Spring 1976 64 -281		Summer 1976 53 - 318		Fall 1976 27 -247		Yearly Total 148-906	
Standing	-	-	52	49	49	47	44	54	48	46
Running	100 2/	100 3/	14	15	36	42	41	36	29	36
Lying	-	-	8	7	8	6	11	5	8	6
Feeding	-	-	27	30	8	6	4	4	15	13

1/ Number of group observations - total observed

2/ Percent of group observations

3/ Percent of total

Table 15. Seasonal use of topography by antelope.

Topography	Winter '75-'76 4	-60 1/	Spring 1976 64-	281	Summer 1976 53-	318	Fall 1976 27-	247	Yearly Total 148-	906
Hillside	75 2/	77 3/	69	65	75	79	89	93	75	78
Ridge	-	-	5	3	8	10	-	-	5	4
Plateau	-	-	3	3	2	tr	7	7	3	3
Coulee Hd.	-	-	-	-	-	-	-	-	-	-
Coulee Btm.	-	-	6	7	13	10	-	-	7	6
Valley Flr.	25	23	17	22	-	-	-	-	8	8
Creekbottom	-	-	-	-	2	1	4	tr	1	tr

1/ Number of group observations - total observed

2/ Percent of group observations

3/ Percent of total

Spring: This years usage pattern is similar to that observed last year. No observations were made in the coulee head or creekbottom categories and hillside usage was the most important, increasing to 65 percent in 1976 from 48 percent in 1975. This figure (65 percent) was the lowest for the hillside category during any season in 1976. Valley floor usage remained quite high at 22 percent.

Summer: The only major difference between 1975 and 1976 usage of topography by antelope was the increase to 10 percent of the observations on ridges in 1976 from zero in 1975. Hillside usage remained high at 79 percent. Creekbottom, valley floor, coulee head and plateau types received 1 percent or less use in 1976.

Fall: In 1975 all but one of the topographic categories received antelope usage. In 1976 observations were made on only three types: the hillside type, with 93 percent; the plateau type, with 7 percent; and creekbottoms, with only a trace. This may be indicative of the dryness of the fall season causing stress on the herd, perhaps forcing them on to their wintering areas earlier than normal.

Seasonal Use of Slope

The 1976 yearly total percentage of usage (table 16) is identical to that observed last year in all four categories. Medium slopes accounted for 50 percent of the observations. Steep slopes accounted for 3 percent.

Winter: Fifty-seven percent of the antelope observations were on gentle slopes, followed by flat and medium slopes with 23 and 20 percent, respectively. No observations were made on steep slopes. This pattern is essentially the same as that observed in 1975.

Spring: Usage of flat areas remained steady (21 percent) while medium slope usage increased to 57 percent and gentle slope usage decreased to 27 percent. Only a trace was observed on steep slopes.

Summer: The medium slopes continued to support the highest number of antelope (54 percent). The rise in usage of gentle slopes to 41 percent was nearly off set by the decline in usage of flat lands to 1 percent. The summer months of 1975 also had the least amount of antelope usage on flat areas.

Table 16. Seasonal slope usage by antelope.

Gradient	Winter '75-'76 4 - 60 1/		Spring 1976 64 -281		Summer 1976 53 -318		Fall 1976 27- 247		Yearly Total 148- 906	
Flat	25 2/	23 3/	16	21	4	1	7	7	10	10
Gentle	50	57	33	27	40	41	37	40	36	37
Medium	25	20	50	52	53	54	52	49	51	50
Steep	-	-	2	tr	4	4	4	5	3	3

1/ Number of group observations - total observations

2/ Percent of group observations

3/ Percent of total

Fall: Gentle slopes received higher usage in 1976 than in 1975 with 40 and 31 percent respectively. Medium slopes continued to attract the highest number of antelope with 49 percent of the total observed.

Seasonal Use of Exposure

Antelope usage of the various exposures is shown in table 17. East and north slopes had the highest number of antelope observations with 20 and 16 percent, respectively. Northerly slopes (N, NE and NW) supported 38 percent of observed antelope compared to 29 percent on southerly slopes (S, SE and SW).

Winter: Seventy-seven percent of the observations were on north slopes. Twenty-three percent were on flat land. This is a big deviation from 1975 when 48 percent of the observations were on south slopes. Again, the number of group observations is very small.

Spring: During spring and the remainder of the year, antelope were observed on all exposures. The northeast exposure, with 18 percent of the observations, had the most antelope and the southeast exposure, with 2 percent, had the least. The combined northerly exposures had 35 percent of the observations as did the combined easterly exposures. The combined southern and western exposures had 25 and 22 percent, respectively.

Summer: Southeast and east exposures each had 20 percent of the summer antelope observations. The combined eastern exposures accounted for 53 percent of the antelope observations. This compares with 52 percent observed on eastern exposures in 1975 (Martin 1976). Use of flat areas decreased to 1 percent, the yearlong low. Usage of flat lands was also lowest last summer.

Fall: Again east exposure usage was the highest, 32 percent. Northern and southern exposures each received 31 percent of the antelope observations. This compares with 36 percent each received in 1975.

White-tailed Deer

Only 11 white-tailed deer group observations were made in 1976 (figure 2): 2 winter, 6 spring, 2 summer and 1 fall. Although many white-tailed deer died in some portions of eastern Montana during the early fall months, none were found on this study area.

Table 17. Seasonal use of exposure by antelope.

Exposure	Winter '75-'76 4 -	60[1/]	Spring 1976 64-	281	Summer 1976 53-	318	Fall 1976 27 -	247	Yearly Total 148-	906
North	75[2/]	77[3/]	12	11	17	13	15	11	16	16
South	-	-	12	13	8	8	15	15	11	11
East	-	-	16	15	21	20	22	32	18	20
West	-	-	6	6	4	3	4	tr	5	3
NE	-	-	20	18	11	13	15	10	16	13
NW	-	-	5	6	13	14	7	10	8	9
SE	-	-	3	2	17	20	11	6	9	9
SW	-	-	9	10	6	9	4	10	7	9
Flat	25	23	16	21	4	1	7	7	10	10

1/ Number of group observations - total observed
2/ Percent of group observations
3/ Percent of total

Whitetail harvest for southeastern Montana and the hunting units which include Sarpy Creek is shown in figure 11. Unit 720 harvest decreased in 1974 while harvest in unit 722 increased. Total harvest in Fish and Game Region 7 increased.

Coyotes

Coyotes are a part of the ecosystem. Unfortunately they have been either ignored or maligned by most of the human population over the years. In an attempt to determine the effects of coyotes on other wildlife species in the Sarpy Creek study area, coyote observations were given the same attention as the primary big game species, mule deer, and antelope. During 1976, 109 coyotes were observed in 71 group observations. The highest number, 49, was observed during the fall survey. Spring and summer were the lowest with 16 and 17 coyotes observed, respectively.

Distribution

Seasonal coyote observations are shown in figure 12. Coyotes were seen in all three subunits in every season. The highest concentration of winter observations was in the open portions of the Absaloka unit, especially in the Sarpy Basin area. A good share of the observations in all seasons were on Sarpy Creek bottom and tributary creekbottoms.

Seasonal Use of Soil Associations

Of the six associations, only the Wayden-Regent (W-R) association seemed to be selected for by coyotes and it supported only 13 percent of the years observations (table 18). The Bainville-Midway/Thedalund-Midway (B-M/T-M) Association had 68 percent of the observations while at the other extreme the Wanetta-Hesper association percentage was zero.

The histogram of X2 values (figure 13) shows a pattern much different from that observed for mule deer and antelope (figure 6 and 10). There are no significant deviations at the p= .05 level and only two at the p= .10 level. It would seem from this analysis that coyotes are not dependent on any particular soil type for their survival. The fact that mule deer and antelope do seem to select for and against certain associations and coyotes seem to be spread all over may indicate that coyotes are not using either big game species as specific prey.

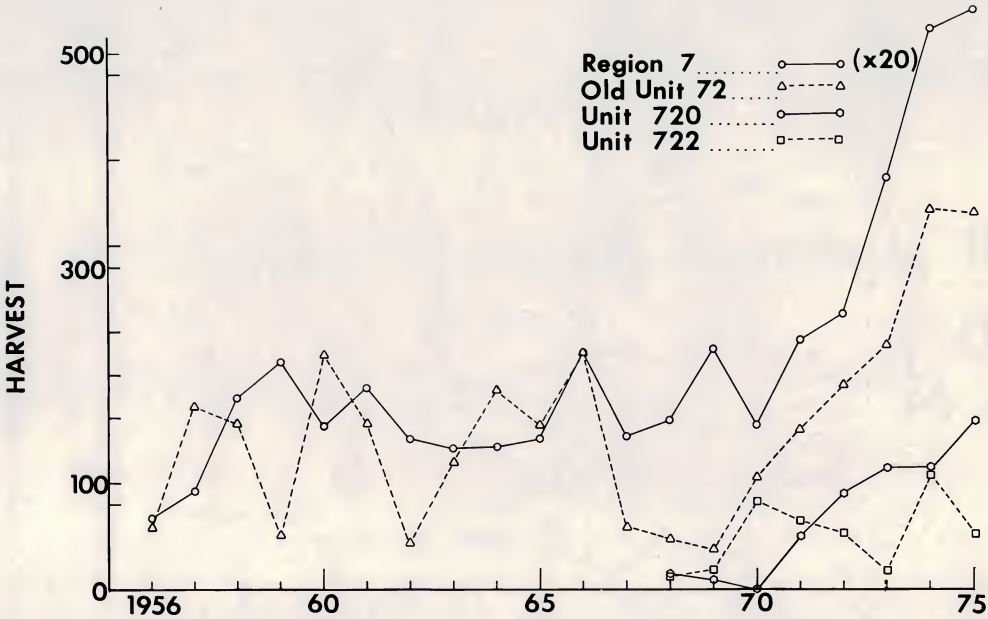

Figure 11. White-tailed deer harvest statistics.

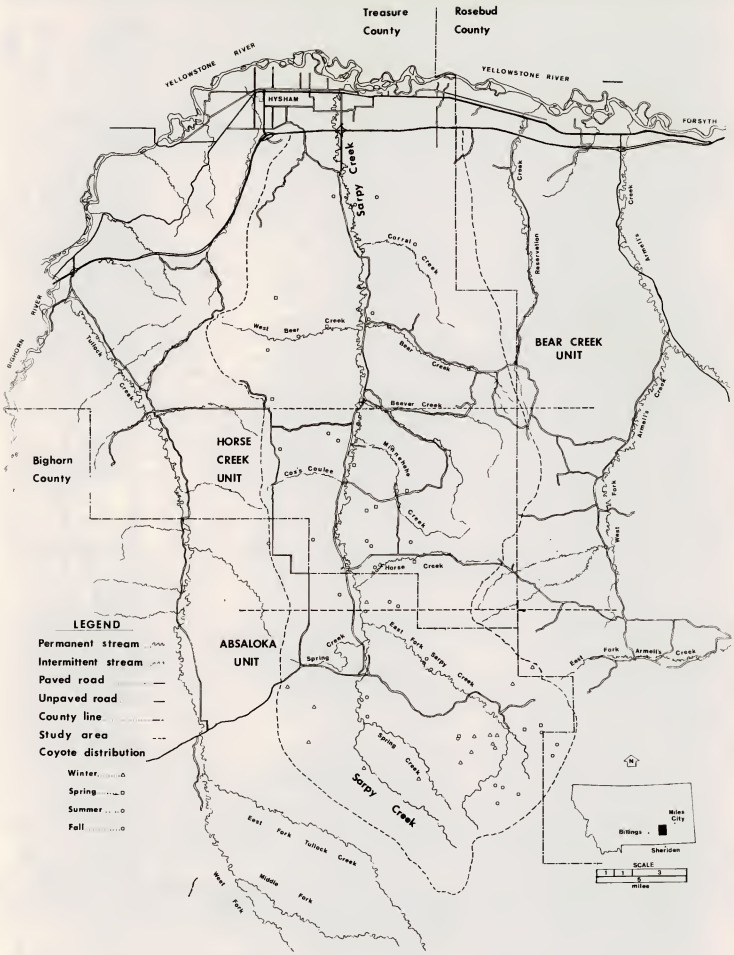

Figure 12. Coyote observations in the Sarpy Creek study area in 1976.

Table 18. Seasonal use of soil associations by coyotes.

Soil Association	Winter '75-'76		Spring 1976		Summer 1976		Fall 1976		Yearly Total 1976	
	20	- 27 1/	13	- 16	13	- 17	25	- 49	71	- 109
1. Wanetta-Hesper (T) 2/	-	-	-	-	-	-	-	-	-	-
2. Pierre-Lismas (T)	5 3/	4 4/	-	-	-	-	8	4	4	3
3. Flasher-Bainville (T)/ Nelson-Alice (B)	10	11	8	6	8	6	8	4	8	6
4. Bainville-Midway (T)/ Thedalund-Midway (B)	70	74	77	81	62	70	44	59	61	68
5. Wayden-Regent (B)	10	7	15	12	15	12	20	16 P 5/	15	13 P
6. Wibaux-Thedalund-Spearman (B)	5	4	-	-	15	12	20	16	11	10

1/ Number of group observations - total observed
2/ (T) - Treasure County; (B) - Bighorn County
3/ Percent of group observations
4/ Percent of total
5/ N - negative usage significant at p= .10
P - positive usage significant at p= .10

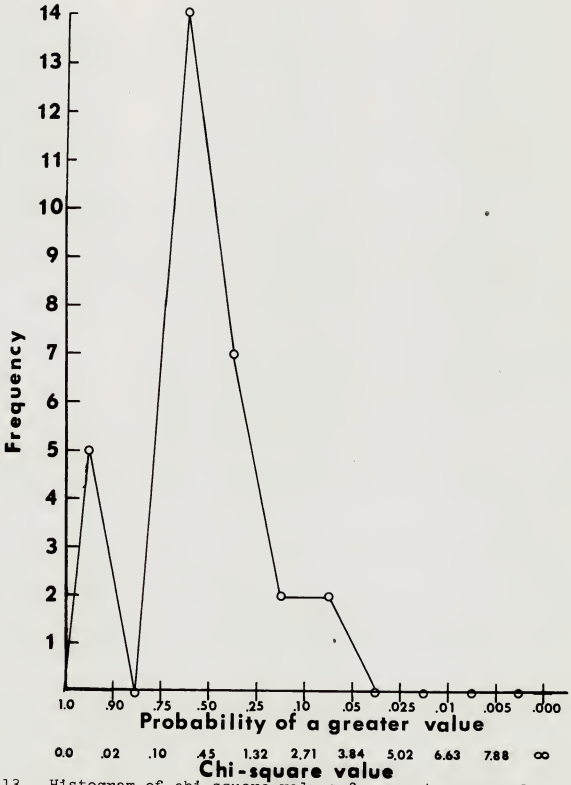

Figure 13. Histogram of chi-square values for coyote seasonal distribution by soil association in 1976.

Winter: Five of six associations received coyote usage. The B-M/T-M was highest at 74 percent. None of the associations percentages deviated significantly from expected values.

Spring: Observations were made on only 3 associations the B-M/T-M with 81 percent; the W-R with 12 percent; and the Flasher-Bainville/Nelson-Alice (F-B/N-A) with 6 percent. Again there were no significant preferences demonstrated by the coyotes.

Summer: The B-M/T-M association continued to support the highest percentage of coyote observations (70 percent). The W-R was again second with 12 percent, but was joined by the Wibaux-Thedalund-Spearman association (W-T-S) which also had 12 percent of the coyote observations.

Fall: The B-M/T-M association, although it still received the highest usage at 59 percent, registered its lowest figure of the year. The W-R and W-T-S associations each had 16 percent of the observations. The W-R figure represented the only significant deviation for any association over the entire year.

Seasonal Use of Vegetation Types

On a yearly basis, the ponderosa pine type seems to be most important to coyotes as it sustained 37 percent of the recorded coyote observations (table 19). The sagebrush type followed at 28 percent. The remaining three types received roughly equal usage. Grassland, creekbottom and agricultural types had 15, 12 and 9 percent of the coyote observations, respectively.

Winter: Ponderosa pine, with 44 percent of the observations, received the most usage. The grassland type had 33 percent of the coyote observations. Eleven percent of the coyotes were observed on each of the grassland and agricultural types. No coyotes were observed on creekbottoms.

Spring: The relatively open sagebrush vegetation type increased in importance to 31 percent of the observed coyotes. Grassland usage remained relatively stable and also sustained 31 percent of the coyote observations. Agricultural and creekbottom usage increased to 19 and 12 percent, respectively. Usage of the ponderosa pine type decrease substantially from the winter level to only 6 percent in spring.

Table 19. Seasonal use of vegetation types by coyotes.

Vegetation Types	Winter '75-'76 20 - 27[1/]		Spring 1976 13 - 16		Summer 1976 13 - 17		Fall 1976 25 - 19		Yearly Total 71 - 109	
Ponderosa pine	30[2/]	26[3/]	8	6	-	-	4	2	11	8
Sagebrush	5	4	-	-	31	47	4	6	8	11
Grassland	5	7	-	-	-	-	16	14	7	8
Skunkbush	5	7	-	-	8	6	12	6	7	6
Juniper	-	-	-	-	-	-	-	-	-	-
Snowberry	-	-	-	-	15	12	4	4	4	4
Total Ponderosa pine	45	44	8	6	54	65	40	33	38	37
Sagebrush	15	11	31	25	15	12	24	39	21	26
Grassland	-	-	8	6	-	-	4	2	3	2
Total Sagebrush	15	11	38	31	15	12	28	41	24	28
Grassland	25	33	15	31	-	-	8	4	13	15
Sagebrush	-	-	-	-	-	-	-	-	-	-
Total Grassland	25	33	15	31	-	-	8	4	13	15
Cottonwood	-	-	8	6	-	-	-	-	1	1
Shrub	-	-	8	6	8	6	20	20	10	11
Total Creekbottom	-	-	15	12	8	6	20	20	11	12
Ponderosa pine	-	-	-	-	-	-	-	-	-	-
Sagebrush/grassland	-	-	-	-	-	-	-	-	-	-
Creekbottom	15	11	23	19	23	18	4	2	14	9
Total Agricultural	15	11	23	19	23	18	4	2	14	9

1/ Number of groups observed - total observed
2/ Percent of group observations
3/ Percent of total

Summer: Ponderosa pine usage increased to its highest point of the year, 65 percent. At the same time grassland usage dropped to its yearly low, zero percent. Agricultural usage remained steady at 18 percent while sagebrush and creekbottom usage decreased to 12 and 6 percent, respectively.

Fall: The sagebrush type was the most important to coyotes as 41 percent of the observations were recorded in that type. Ponderosa pine usage followed at 33 percent, a substantial decrease from the summer level. Creekbottom percentage reached its yearly high at 20 percent. The percentage of coyotes observed on grassland and agricultural types was very low at 4 and 2 percent, respectively.

Seasonal Activity

The activity of coyotes at the time of observation is presented in table 20. Sixty percent of the yearly observations were of coyotes either running or standing. Twenty-eight percent of the coyotes were observed feeding and 12 percent were observed lying down. The highest percentage of coyotes observed feeding was 49 percent during the fall season.

Seasonal Use of Topography

Hillsides and creekbottoms received the most usage by coyotes in 1976 (table 21) with 58 and 22 percent of the observations, respectively. The remaining topographic features received little use.

Winter: Coulee heads and coulee bottoms received no use. Ridges, plateaus and valley floors each had 7 percent of the total observations. Creekbottoms had 11 percent and hillsides had the most usage with 67 percent of the coyote observations.

Spring: Hillsides remained in the lead position but decreased substantially to 38 percent. Creekbottom and coulee bottom usage increased to 31 and 12 percent, respectively. Ridge, plateau and valley floor usage remained equal and constant with 6 percent each.

Summer: Hillside usage increased to 47 percent while ridge and coulee head usage also increased to 12 and 6 percent, respectively. Creekbottom and coulee bottom usage decreased to 29 and 6 percent, respectively. The two relatively flat topographic features, plateaus and valley floors, received no observed usage.

Table 20. Seasonal activity of coyotes.

Activity	Winter '75-'76		Spring 1976		Summer 1976		Fall 1976		Yearly Total	
	20	27 1/	13	16	13	17	25	49	71	109
Standing	40 2/	30 3/	38	31	31	47	20	10	31	24
Running	45	44	46	56	54	41	28	22	41	36
Lying	5	4	15	12	8	6	32	18	17	12
Feeding	10	22	-	-	8	6	20	49	11	28

1/ Number of group observations - total observed

2/ Percent of group observations

3/ Percent of total

Table 21. Seasonal use of topography by coyotes.

Topography	Winter '75-'76 20	- 27[1/]	Spring 1976 13	- 16	Summer 1976 13	- 17	Fall 1976 25	- 49	Yearly Total 71	-109
Hillside	55[2/]	67[3/]	23	38	31	47	60	63	46	58
Ridge	10	7	8	6	15	12	4	2	8	6
Plateau	10	7	8	6	-	-	4	6	6	6
Coulee Hd.	-	-	-	-	8	6	4	4	3	3
Coulee Btm.	-	-	15	12	8	6	4	2	6	4
Valley Flr.	10	7	8	6	-	-	-	-	4	3
Creekbottom	15	11	38	31	38	29	24	22	27	22

1/ Number of group observations - total observed

2/ Percent of group observations

3/ Percent of total

Fall: The fall pattern was very similar to the yearlong total. Hillsides, with 63 percent, and creekbottoms, with 22 percent, were the most used by coyotes. No observations were made on valley floors. The remaining features received approximately equal usage as each had 4 percent of the coyote group observations.

Seasonal Use of Slope

Coyotes seem to prefer flat and gentle slopes as 63 percent of the yearly total of coyotes observed were on these two slopes (table 22). Only 15 percent were observed on steep slopes.

Winter: Medium, gentle and flat slopes received nearly equal use by coyotes with observation percentages ranging from 33 to 26 percent. Steep slope observations accounted for 11 percent of the total number observed.

Spring: Flat areas had the highest number of coyotes with 44 percent of the total. Medium and gentle slopes had 31 and 25 percent, respectively. No observations were made on steep slopes.

Summer: Steep slope usage increased to 35 percent, its high point of the year. Flat and medium slopes each had 29 percent and gentle slopes received their lowest seasonal usage, 6 percent.

Fall: Gentle slope usage, 43 percent, was at the seasonal high during the fall period while medium slope usage was at the seasonal low, 10 percent. Flat land usage increased slightly from the summer level to 33 percent. The percentage observed on steep slopes declined to 14 percent.

Seasonal Use of Exposure

Coyotes used flat lands more than any individual exposure. Thirty-one percent of all observations were on flat areas (table 23). Southern exposures (S, SE and SW) supported 35 percent of the coyote observations. Twenty-one percent of the observations were on northern exposures.

Winter: Southernly exposures had 45 percent of the observations while 26 percent were recorded on northern exposures. Eastern exposures (E, NE and SE) contained 23 percent compared to 15 percent on western (W, NW and SW)

Table 22. Seasonal slope usage by coyotes.

Gradient	Winter '75-'76 20 - 27		Spring 1976 13 - 16		Summer 1976 13 - 17		Fall 1976 25 - 49		Yearly Total 71 - 109	
Flat (0-15°)	35	26	54	44	38	29	36	33	39	32
Gentle (16-30°)	25	30	31	25	8	6	20	43	21	31
Medium (31-45°)	30	33	15	31	38	29	20	10	25	22
Steep (45° +)	10	11	-	-	15	35	24	14	14	15

Table 23. Seasonal use of exposure by coyotes.

Exposure	Winter '75-'76 20	27 1/	Spring 1976 13 - 16		Summer 1976 13 - 17		Fall 1976 25 - 49		Yearly Total 71 -109	
North	10 2/	11 3/	-	-	-	-	8	4	6	5
South	15	26	15	13	8	6	8	4	11	11
East	5	4	8	6	-	-	20	35	10	17
West	-	-	8	6	-	-	8	4	4	3
NE	20	15	-	-	23	18	12	10	14	11
NW	-	-	8	25	8	6	-	-	3	5
SE	5	4	-	-	8	6	8	4	6	4
SW	10	15	8	6	15	35	4	8	8	14
Flat	35	26	54	44	38	29	32	31	38	31

1/ Number of group observations - total observed

2/ Percent of group observations.

3/ Percent of total

exposures. South exposures and flat lands, each with 26 percent of the observations, received the most usage. No observations were made on west and northwest exposures.

Spring: No observations were made on north, northeast or southeast exposures. Flat lands again recorded the highest number of coyotes with 44 percent. Western slopes had 37 percent of the observations compared to only 6 percent on all eastern exposures.

Summer: The number of coyotes observed on southern slopes increased to 47 percent, approximately equal to the percentage observed during the winter period. Twenty-four percent were observed on the northern slopes. Flat land usage decreased to 29 percent, again nearly equal with the winter percentages. Western slope usage remained high, 41 percent, with the SW exposure accounting for 35 percent of all coyote observations. Eastern slopes had 24 percent of the observations.

Fall: Flat land usage was up slightly to 31 percent. The 35 percent observed on east exposures topped all categories. Usage of easterly slopes increased to nearly half of all coyotes observed, 49 percent. Only 12 percent were observed on western slopes, a substantial decrease from the previous two seasons.

Predator-Prey Relationships

Coyotes undoubtedly had some effect on the other wildlife species in the study area. Although coyotes were not observed to be feeding on or stalking any game species, either mammal or bird, during the past year, they were observed feeding on cattle carcasses. They were also observed stalking small rodents and prairie dogs.

An attempt was made to determine if coyote numbers are increasing or decreasing in relation to mule deer. Table 24 gives the number of coyotes and mule deer observed during the four seasons of 1975 and 1976. The number of coyotes per 100 deer was calculated for comparisons. It appears that coyote numbers vis-a-vis deer are lowest during the spring season and highest in the summer time. This pattern would be expected as coyotes are heavily harvested for their pelts during winter then give birth to their young in April or May. Litters range in size from 5 to 10 (Burt and Grossenheider 1964). The number of coyote observations per 100 deer increased from 4.4 in 1975 to 7.7 in 1976. Either coyote numbers increased or deer numbers decreased. Most likely a combination of the two possibilities occurred. Table 1 throws some light on

Table 24. Coyote and mule deer observations in the Sarpy Creek drainage during 1975 and 1976.

Season	Coyotes		Mule Deer		Coyotes/100 Deer	
	1975	1976	1975	1976	1975	1976
Winter	16	27	312	341	5.1	7.9
Spring	15	16	387	424	3.8	3.8
Summer	4	17	75	149	5.3	11.4
Fall	31	49	693	503	4.4	9.7
Total	66	109	1497	1417	4.4	7.7

the subject. The number of coyotes observed per hour of flight increased slightly from 1.4 to 1.5 while mule deer and antelope observations decreased. Mule deer observations decreased from 26.1 per hour to 14.1 and antelope observations decreased from 18.2 to 12.8 per hour. From this it seems that deer and antelope populations decreased while coyote numbers held relatively steady. The principle of diminishing returns, i.e. and increase in effort resulting in ever decreasing return per unit of effort, probably exaggerates the actual loss in deer numbers. However, the fact that 194 less deer were observed during the 1976 fall flights than in 1975 in spite of 4.5 additional hours of flying time indicates the deer population may indeed be down.

Prairie Grouse

Four additional sharptail dancing grounds were located in 1976 bringing the number of documented sharptail dancing grounds within or near the Sarpy study area to thirty-six (appendix table 28). The number of male birds observed on dancing grounds decreased from 413 in 1975 to 309 in 1976 (table 25). Thirty-nine male sage grouse were observed on 3 strutting grounds. Banding of sharp-tailed grouse on several dancing grounds in the Sarpy Creek and Colstrip vicinities was again conducted with employees of the Montana Fish and Game Department and personnel of Ecological Consulting Service.

Distribution

The thirty-six sharptail dancing grounds are shown in figure 14. Birds were observed on only 30 grounds in 1976. The Absaloka unit had the highest number of active grounds with 13, one more than last year (table 25). The Horse Creek unit had 11 active grounds, down from 14 observed in 1975. Six active grounds were observed in the Bear Creek unit.

Only three sage grouse strutting grounds were attended in 1976. These are the same three that were attended last year (table 25). Ground number 2 (figure 14) apparently has become inactive. It is unlikely that the male birds observed there in 1974 were moving from ground number 3 to 4 or vice versa since both are at least 4 miles distant from ground number 2. Wallestad (1975) reported that 1.1 miles was the maximum distance radio-equipped cocks moved from strutting grounds in central Montana.

Population Characteristics

Breeding population data for prairie grouse are shown in table 25. The number of male birds on individual grounds is

Table 25. Prairie grouse breeding ground data.

Species	Sub Unit	Number of Active Grounds 1974	1975	1976	Male Birds 1974	1975	1976	Male Birds / Active Ground 1974	1975	1976
Sharptail	Bear Creek	2	4	6	26	49	71	13.0	12.3	11.8
	Horse Creek	8	14	11	108	208	124	13.5	14.9	11.3
	Absaloka	6	12	13	69	156	114	11.5	13.0	8.8
	Sarpy Study Area	16	30	30	203	413	309	12.7	13.8	10.3
Sage Grouse	Bear Creek	0	1	1	0	5	2	0.0	5.0	2.0
	Horse Creek	3	2	2	35	37	37	11.7	18.5	18.5
	Sarpy Study Area	3	3	3	35	42	39	11.7	14.0	13.0

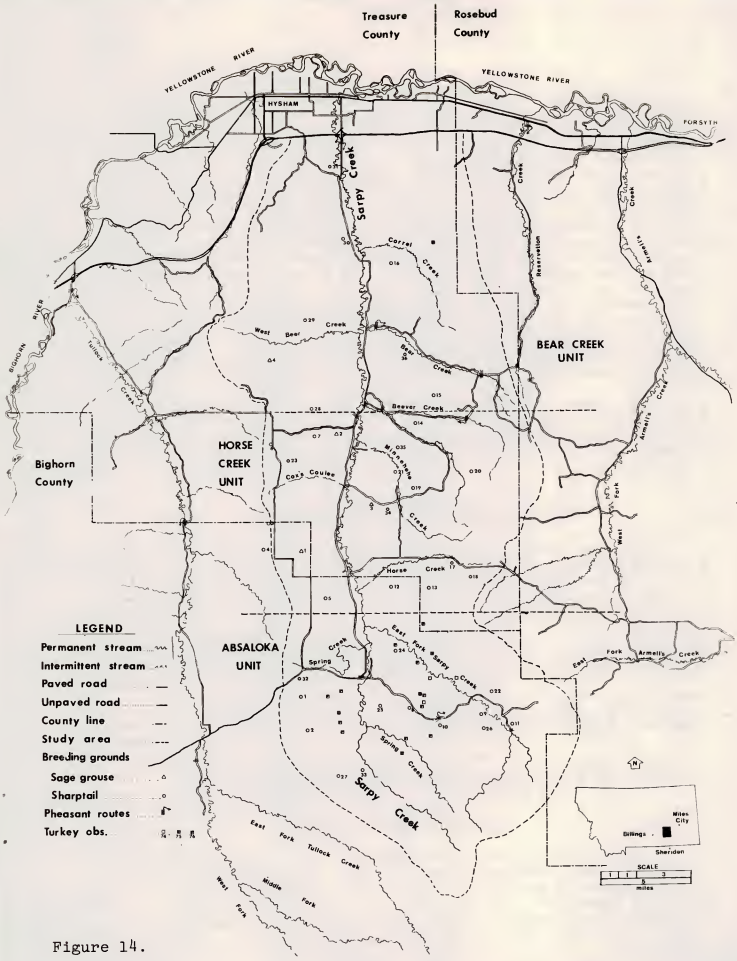

Figure 14.

Prairie grouse breeding grounds, pheasant crow count routes and turkey observations (1974-1976) in the Sarpy Creek study area.

given in appendix table 28. The average number of sharptail males per ground was 10.3 in 1976, a considerable decrease from the level of the previous two years. The deep snow and cold weather of the early winter months (appendix table 29) is most likely responsible for that decrease. This becomes more evident when the relative decreases within the three subunits are examined. The Absaloka unit decreased 4.2 birds per active ground, a 32 percent reduction. It being the southernmost and having the highest average elevation, had more snow than the other two subunits. The Horse Creek unit suffered a 24 percent decline, from 14.9 to 11.3 birds per active ground. The unit with the lowest average elevation and the least amount of snow. The Bear Creek unit, lost only 0.5 birds per ground, a 4 percent reduction. Only two sharptail broods were observed during the summer period. The 7.5 young per brood is an increase from the 6.6 observed in Sarpy Creek last year (Martin 1976) and above the average for southeast Montana of 6.7 young per brood (Wallestad 1974).

The number of male sage grouse per active strutting ground also decreased in 1976. The 13.0 birds per ground represents a 7 percent decrease from the 14.0 birds per ground observed in 1975 (table 25). No sage grouse broods were observed.

Use of Soil Associations

Dancing grounds have been located on four of the six soil associations. All four new grounds located in 1976 were on the Bainville-Midway/Thedalund-Midway (B-M/T-M) association. It had the most active grounds, 16 (table 26). The Pierre-Lisma association with only two active grounds had the highest average number of male birds per active ground, 16.0. The B-M/T-M association, which had the highest average last year at 15.1 (Martin 1976), decreased to only 9.8 birds per active ground in 1976. The Wibaux-Thedalund-Spearman association again supported the lowest average number of male birds per active ground. No grounds have been found on Wanetta-Hesper or Wayden-Regent associations.

All sage grouse strutting grounds were located in the Bainville-Midway/Thedalund-Midway association.

Sharptail Banding Study

The sharp-tailed grouse banding study initiated in the spring of 1975 was continued in 1976. Personnel of Westmoreland Resources, Ecological Consulting Service and the Montana Department of Fish and Game cooperated in the trapping operation. A total of 44 birds were banded on

Table 26. Sharptail dancing ground distribution by soil association.

Soil Association	All Grounds	1976 Active Grounds	Male Birds	Male birds/ Active Ground
1. Wanetta-Hesper (T)	-	-	-	-
2. Pierre-Lismas (T)	2	2	32	16.0
3. Flasher-Bainville (T)/ Nelson-Alice (B)	8	6	66	11.0
4. Bainville-Midway (T)/ Thedalund-Midway (B)	20	16	156	9.8
5. Wayden-Regent (B)	-	-	-	-
6. Wibaux-Thedalund-Spearman (B)	6	6	55	9.2
Total	36	30	309	10.3

eight different dancing grounds. Nine birds on two dancing grounds were banded in the Sarpy study area. Thirty-five birds on 6 grounds were banded in the Colstrip vicinity (appendix table 30). Work on this study will continue in both areas in 1977.

Sarpy Creek. Of the 31 birds banded in the spring of 1975, only 6 were observed on grounds in spring 1976. Three birds, tag numbers 26 and 33 with one unidentified, were observed on ground number 10 (figure 14). Two birds, with tag numbers 29 and 36, were observed on dancing ground number 8. One bird, tag number 15, was observed on dancing ground number 25. These represent mortality rates of 77, 82 and 86 percent for the three grounds, respectively. Overall, the returns indicate a mortality figure of 81 percent for sharp-tailed grouse from the spring of 1975 to the spring of 1976. The harsh weather and deep snow of the 1975-76 winter was undoubtedly responsible for most of this high mortality rate.

Of course some of the mortality occurred before winter. Five marked birds were observed on dancing ground number 8 on October 30, 1975 (Austin 1977). Tag number 36 was not among those observed. At least 6 of the 11 banded the previous spring were still alive at that time. The maximum mortality rate from spring through fall would be 45 percent. One bird, number 15 from ground number 25, was taken by a hunter in early October 1976. Since this bird was classified as an adult (Martin 1976) in the spring of 1975, it would have been over three years old, hatching in 1973 at the latest.

No birds were observed on dancing grounds other than the one on which they were marked.

Colstrip. Five birds banded in 1975 returned to their respective dancing grounds in 1976 (Schwarzkoph 1977). This 90 percent mortality rate is slightly higher than that recorded in the Sarpy Creek area. Three birds were known to die of unnatural causes. Two were shot and one was killed by a dog. One adult male was observed to move from the ground on which it was banded to another miles away.

Recordings of sharp-tailed grouse mating activities were used to attempt establishment of new dancing grounds on reclamation areas as well as undisturbed native habitat. The results of this experiment are inconclusive at this time. More should be known after the 1977 mating season.

Ring-necked Pheasants

Pheasant crow count routes are shown in figure 14. The results of three years work are shown in table 27. The total spring breeding population appeared to be slightly higher in the Sarpy Study area in 1976 than 1975 while the total for all routes was slightly lower, decreasing from 15.9 calls per stop in 1975 to 14.9 in 1976. While the lower Sarpy route retained the highest population density, calls per mile in 1976 were still below the 1974 level. The upper Sarpy route has increased from 7.9 in 1974 to 21.0 in 1976. This respresents a 166 percent increase in the two year period. The levels recorded on the East Fork Sarpy Creek route decreased slightly from the 1975 level but were still considerably higher than that observed in 1974. The only two routes which decreased measurably were the East Bear and North Fork Beaver Creek routes. Two routes outside the Sarpy drainage were done for comparison. Calls per mile on both routes, lower Tullock Creek and Yellowstone River, were up from previous surveys. The apparent decline shown in the total for surrounding area calls per mile (table 27) is misleading because a route through a low density area along the Yellowstone River replaced a high density route on upper Tullock Creek.

Nine pheasant broods were observed during the summer months. This is 3 times as many as were observed in 1975 (Martin 1976). The dryness of the season probably accounts for the higher observability of pheasant broods. Seventy-six young were observed, an average of 8.4 per brood. In 1975, the average was 8.7 young per brood (Martin 1976).

Merriam's Turkey

Turkey observations from 1974 through 1976 are shown in figure 14. The turkeys appear to occupy the area from East Fork Sarpy Creek south to Sarpy Creek and up to the Sarpy-Tullock Creek divide on the west. This area also coincides with the very area planned for exploitation by Westmoreland's Absaloka coal mine. The turkey population seems to be stable at this time.

SUMMARY

Baseline data collection on mule deer and antelope continued with increased effort. Coyotes were included in the comprehensive data gathering process for the first time. Nineteen seventy-six distribution, population characteristics, activities and seasonal use of soil associations, vegetation

Table 27. Ring-necked pheasant crowing count survey data in the Sarpy Creek and adjacent drainages.

Route	Length 1/	Calls Per Mile		
		1974	1975	1976
* Lower Sarpy Creek	20	27.7	24.7	25.6
* Upper Sarpy Creek	15	7.9	11.8	21.0
Lower Tullock Creek	15	4.7	11.7	16.7
Upper Tullock Creek	15	10.7	17.6	-
* North Fork Beaver Cr.	6	1.8	8.0	7.2
* East Bear Creek	9	9.8	14.2	9.4
Armell's Creek	21	2.7	-	-
Yellowstone River	23	3.8	-	6.9
Reservation Creek	16	3.7	-	-
* East Fork Sarpy Cr.	7	3.4	11.5	11.4
* Sarpy Study Area	58	13.3	16.7	17.9
Surrounding Area	89	4.7	14.6	10.8
Total	147	8.1	15.9	14.9

1/ Number of stops each 1 mile apart.

* Routes within the Sarpy Study area.

types, topography, slopes and exposures along with apparent trends, were discussed for the three primary species. Sharp-tailed grouse banding studies in the Sarpy Creek and Colstrip vicinities were discussed. Four more sharptail dancing grounds were located bringing the total number of documented grounds in the study area to 36. Sage grouse and pheasant population characteristics were discussed.

Observations and trends derived from the first 3 years of study follow:

(1) The winter of 1975-76 was the harshest since the study began. In spite of the greatly increased snow fall, overall precipitation for the third year of study was considerably below that recorded in 1974, the first year. The beginning of a drought pattern is well established.

(2) Mule deer production continued its downward trend as fawn/100 does ratios decreased for the fourth year in a row. The percentage of does in the population has increased all four years reaching 55 percent in 1976. The previously declining percentage of bucks appears to have bottomed out last year as it increased slightly in 1976 to 11 percent.

(3) Antelope production, though never good compared to other areas of eastern Montana, was very poor decreasing to only 24 fawns/100 does in the fall of 1976.

(4) The number of coyotes in the study area appears to have remained steady while deer and antelope numbers declined. Coyote numbers vis-a-vis mule deer are lowest in the spring and highest in the summer.

(5) The harsh winter, especially in the Absaloka sub-unit, resulted in a fairly large drop in the number of sharp-tailed grouse attending the spring breeding grounds. Band returns indicate an 81 percent mortality from spring 1975 to spring 1976. The average number of male birds per active dancing ground dropped 3.5 birds from 13.8 in 1975 to 10.3 in 1976.

(6) Ring-necked pheasant populations increased to high levels throughout the drainage. This increase also occurred in areas adjacent to Sarpy Creek.

(7) The Bainville-Midway/Thedalund-Midway soil association received the most usage by deer (75%), antelope (60%), and coyotes (68%). Mule deer and antelope seem to be more selective of soil types than are coyotes. Statistical analysis revealed 9 significant deviations in numbers of mule deer observed from the number expected throughout the year. There were 13 significant deviations in antelope

numbers but only 2 observed in coyote numbers. The smaller number of coyote observations may have biased this analysis.

(8) The ponderosa pine vegetation type was most important to mule deer as 47 percent of all observations were in that type. The grassland type, with 50 percent of the observations, was used most by antelope. The highest number of coyotes (37%) was observed in the ponderosa pine type.

(9) The previously mentioned shift of mule deer to lower elevations in the summer and fall was again apparent. The upland topography features (ridges, plateaus and coulee heads) supported 56 percent of mule deer during the winter season. These same three features had 16 percent in summer and 15 percent during the fall survey. The lowland types increased from 18 percent usage in winter to 45 percent in summer and 48 percent in fall.

(10) Mule deer and coyotes are dispersed throughout the study area. Antelope are separated into three distinct groups, one in each subunit.

(11) The southern antelope herd apparently migrates into the Tullock drainage during the winter months. The northern herd may move back and forth across Sarpy Creek but remains within the drainage throughout the year. The Horse Creek herd apparently moves into the Tullock drainage during inclement weather in the winter, returning to Sarpy Creek at the earliest possible moment.

LITERATURE CITED

Austin, R. 1977. Pers. comm. Biologist. Ecological Consulting Service. Helena, Montana.

Burt, William H. and Richard P. Grossenheider. 1964. A field guide to the mammals, 2nd edition. The Riverside Press. pp. 73-75.

Eustace, D.C. 1974. Big game survey and inventory (deer). Job. Prog. Rept. Mont. Dept. of Fish and Game. Unpubl. 11 pp.

_____. 1977. Pers. comm. Biologist. Mont. Dept. of Fish and Game. Forsyth, Montana.

Martin, Peter R. 1975. Sarpy Basin wildlife ecology study. Mont. Dept. of Fish and Game and Cormorant Corp. Prog. Rept. 58 pp.

_____. 1976. Sarpy Basin wildlife ecology study. Mont. Dept. of Fish and Game and Cormorant Corp. Prog. Rept. 62 pp.

Schwarzkoph, W. 1977. Pers. comm. Biologist. Ecological Consulting Service. Forsyth, Montana.

Snedecor, G.W. and W.G. Cochran. Statistical methods. 6th edition. Iowa St. Univ. Press, Ames. 593 pp.

Wallestad, R. 1974. Upland game bird surveys and inventory. Job. Prog. Rept. Mont. Dept. of Fish and Game. Unpubl. 13 pp.

_____. 1975. Montana sage grouse. Life history and habitat requirements of sage grouse in Central Montana. Mont. Dept. of Fish and Game. 66 pp.

APPENDIX

Appendix Table 28. Location of prairie grouse breeding grounds and male birds attending in 1974, 1975 and 1976.

Species	Ground Number	Location T	Location R	Location S	Date Located	Hunting District	Method[1/]	Male Birds Attending 1974	Male Birds Attending 1975	Male Birds Attending 1976
Sage Grouse	1	2N	36E	12	4-9-74	720	A	16	23	19
	2	3N	37E	8	4-9-74	720	A	3	-	-
	3	3N	37E	27	3-25-74	722	V	16	14	18
	4	4N	36E	22	4-23-75	720	A	-	5	2
Sharp-Tailed Grouse	1	1N	36E	24	4-16-74	720	A	6	7	7
	2	1N	36E	36	4-16-74	720	A	20	9	14
	3	2N	36E	3	4-23-74	720	V	6	8	1
	4	2N	36E	10	4-23-74	720	V	15	17	15
	5	2N	37E	30	3-29-74	720	V	16	13	5
	6	3N	36E	10	4-1-74	720	V	14	11	9
	7	3N	37E	7	4-9-74	720	A	16	20	-
	8	1N	37E	25	3-26-74	722	V	12	14	9
	9	1N	38E	27	3-26-74	722	F	9	15	7
	10	1N	38E	31	3-26-74	722	V	7	15	4
	11	1N	38E	36	3-26-74	722	V	15	20	17
	12	2N	37E	14	3-27-74	722	A	13	26	32
	13	2N	38E	30	3-27-74	722	A	12	9	13
	14	3N	37E	1	3-27-74	722	A	16	20	-
	15	4N	38E	30	3-27-74	722	A	10	-	6
	16	5N	37E	27	3-27-74	722	A	16	-	-
	17	2N	38E	17	3-31-74	722	A	-	12	7
	18	2N	38E	22	3-31-74	722	A	-	8	-
	19	3N	37E	25	3-31-74	722	A	-	16	10
	20	3N	38E	22	3-31-74	722	A	-	12	2
	21	3N	37E	23	4-3-75	722	A	-	18	-
	22	1N	38E	23	4-10-75	722	V	-	8	3

Table 28 Continued.

Species	Ground Number	Location T	R	S	Date Located	Hunting District	Method1/	Male Birds Attending 1974	1975	1976
Sharp-Tailed Grouse	23	3N	36E	14	4-15-75	720	V	-	18	-
	24	1N	37E	13	4-12-75	722	A	-	9	2
	25	1N	37E	27	4-12-75	722	A	-	9	8
	26	1N	38E	34	4-12-75	722	A	-	30	15
	27	1S	37E	9	4-12-75	720	A	-	8	6
	28	4N	37E	31	4-23-75	720	A	-	10	9
	29	4N	36E	12	4-23-75	720	A	-	10	10
	30	5N	37E	18	4-23-75	720	A	-	16	14
	31	6N	36E	25	4-23-75	720	A	-	13	18
	32	1N	36E	13	5-5-75	720	F	-	12	15
	33	1S	37E	11	4-7-76	720	A	-	-	7
	34	3N	37E	35	4-7-76	722	A	-	-	20
	35	3N	37E	14	4-8-76	722	A	-	-	10
	36	4N	37E	13	4-8-76	722	A	-	-	14

1/ A= Airplane; V = Vehicle; F = Foot

Appendix Table 29. Climatological data from the Hysham 25 55E weather station during the third year of the study.

			Temperature					Precipitation	
Season	Month	Year	Average	High	Low	Number Days Below 32	Maximum over 90	Total	Snow
Winter	Dec.	1975	23.0	56	-21	11	0	1.17	25.8
	Jan.	1976	20.3	50	-28	11	0	0.67	15.7
	Feb.	1976	32.1	61	-8	4	0	0.91	5.8
Spring	Mar.	1976	30.5	65	-22	7	0	0.41	5.0
	Apr.	1976	46.3	80	17	0	0	1.29	4.0
	May	1976	55.0	86	23	0	0	1.93	0.0
Summer	June	1976	61.0	90	36	0	1	4.14	0.0
	July	1976	71.8	106	39	0	18	0.27	0.0
	Aug.	1976	69.3	103	36	0	15	0.96	0.0
Fall	Sept.	1976	58.9	96	20	0	5	0.92	0.0
	Oct.	1976	42.2	85	8	1	0	1.52	9.3
	Nov.	1976	30.5	67	-24	4	0	0.77	12.5

Appendix Table 30. Sharp-tailed grouse neckbanded in the Sarpy Creek and Colstrip vicinities in 1976.

Area	Dancing Ground	Date Banded	Neckband Number[3]	Leg Band Number	Age Class	Sex
Sarpy Creek[1]	25	5-17-76	YB 13	F 66147	Juvenile	Male
			YB 19	F 66144	Juvenile	Male
			YB 20	F 66148	Juvenile	Male
			YB 21	F 66146	Juvenile	Male
			YB 22	F 66145	Juvenile	Male
			YB 23	F 66150	Adult	Male
	8	5-17-76	Three birds banded; information unavailable.			
Colstrip[2]	3	5-4-76	RB 14	F 66106	Adult	Male
			RB 15	F 66117	Adult	Male
			RB 16	F 66118	Juvenile	Male
			RB 17	F 66119	Juvenile	Male
			RB 18	F 66120	Juvenile	Male
			RB 19	F 66121	Adult	Male
			RB 20	F 66122	Adult	Male
			RB 21	F 66123	Adult	Male
	4	5-4-76	WR 9	F 66124	Adult	Male
			WR 10	F 66125	Juvenile	Male
			WR 14	F 66126	Juvenile	Male
			WR 15	F 66110	Juvenile	Male
			WR 16	F 66111	Adult	Male
	7	5-4-76	YB 15	F 66112	Adult	Male
			YB 16	F 66113	Juvenile	Male
			YB 17	F 66114	Adult	Male
			YB 18	F 66115	Adult	Male
	8	5-3-76	OW 14	F 66101	Juvenile	Male
			OW 15	F 66102	Juvenile	Male
			OW 16	F 66103	Juvenile	Male
			OW 17	F 66104	Juvenile	Male
			OW 18	F 66105	Juvenile	Male
			OW 19	F 66106	Juvenile	Male
	16	5-4-76	WB 17	F 66107	Adult	Male
			WB 18	F 66108	Juvenile	Male
			WB 19	F 66109	Juvenile	Male

Appendix Table 30 continued.

Area	Dancing Ground	Date Banded	Neckband Number 3/	Leg Band Number	Age Class	Sex
Colstrip (continued)	19	5-5-76	BB 13	F 66131	Juvenile	Male
			BB 14	F 66132	Juvenile	Male
			BB 15	F 66133	Adult	Male
			BB 16	F 66134	Juvenile	Male
			BB 17	F 66135	Adult	Male
			BB 18	F 66136	Juvenile	Male
			BB 19	F 66137	Adult	Male
			BB 20	F 66138	Adult	Male
			BB 21	F 66139	Juvenile	Male

1/ Austin R. 1977

2/ Schwarzkoph W. 1977

3/ YB - yellow band with black numbers
RB - red band with black numbers
WR - white bands with red numbers
OW - orange bands with white numbers
WB - white bands with black numbers
BB - blue bands with black numbers