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BULL MOUNTAINS COAL FIELD STUDY

PROGRESS REPORT 1976

RESEARCH CONDUCTED BY:

MONTANA DEPARTMENT OF FISH AND GAME
ENVIRONMENT AND INFORMATION DIVISION

AND

CONSOLIDATION COAL COMPANY

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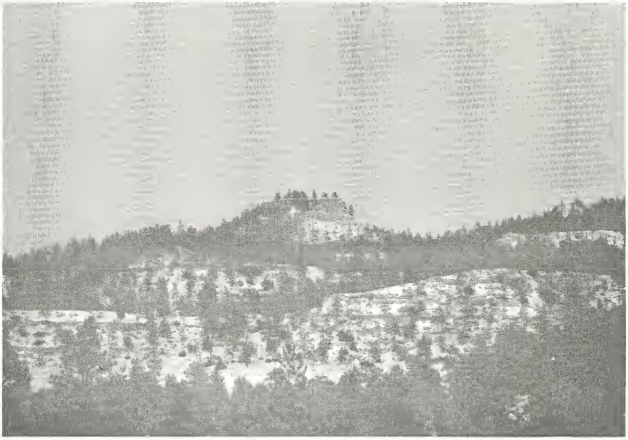

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INTRODUCTION

This study was the first of several coal/energy-related planning inventories to assess the potential impact of such development on wildlife in Montana. These studies resulted from a concern by resource managers during the early 1970's about the impact of large-scale surface mining for coal and associated on-site conversion plants on eastern Montana's wildlife resource. Before the inception of this study, large-scale mining and exporting of coal from the Bull Mountains appeared imminent. The threat of such an operation has diminished somewhat, due, at least in part, to a stricter federal leasing policy and a strict state mining and reclamation law. The two active surface mines in the Bull Mountains affect small acreages and supply a local market. A possibility does exist that the two companies may merge in the future and apply for a permit to expand the operation and mine coal for export.

This study was initiated with the following overall objectives:

(1) to determine the impact, or potential impact, of surface mining upon the wildlife resource in this area;
(2) to ensure that wildlife habitat values receive full recognition in any mining or reclamation effort; and,
(3) to investigate possible modifications or innovations in the reclamation process to avoid unnecessary loss of wildlife habitat.

This is the fourth interim report since inception of the project during January 1972. It covers the period beginning March 1, 1975 and ending February 29, 1976. As during previous years, major emphasis was placed on baseline data such as distribution and movements, range use, food habits, and population trends of the principal game species. Vegetational development was monitored on small acreages that had undergone mining and a reclamation attempt.

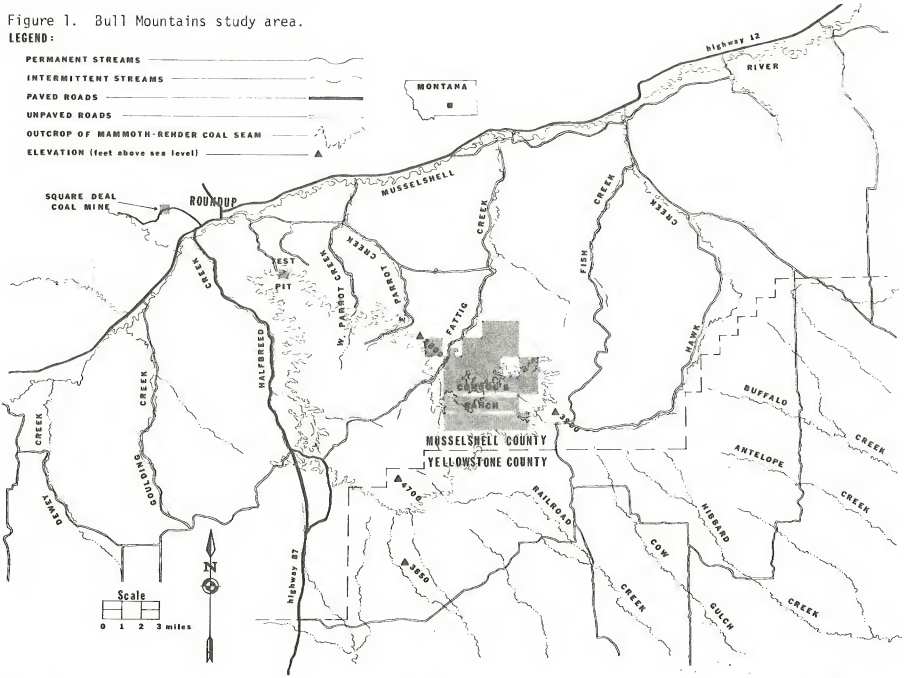
This study is scheduled for completion by June 30, 1976, and a final report will follow.

STUDY AREA

Location

The study area includes that part of Musselshell County which lies south of the Musselshell River as well as a portion of northern Yellowstone County (Figure 1). The area appears to be representative of the Bull Mountains ecosystem, and includes the entire Mammoth-Rehder coal seam. Livestock production is the principal industry, while some of the more gentle terrain is under cultivation. Other land uses include logging and homesite development. Underground mining for coal was an important part of the local economy in the past. The physiography of the study area was described previously (Dusek and McCann 1973 and 1974).

Figure 1. Bull Mountains study area.



Climate

Climatological data were taken from that recorded at Roundup (U. S. Dept. of Comm. 1972, 1973, 1974, 1975 and 1976) located on the northern edge of the study area. Monthly data appear in Table 1. The warmest monthly temperature normally occurs during July and the coldest during January. Annual precipitation averages nearly 11 inches, of which approximately half is received during May, June and July.

Total annual precipitation for 1975 was 18.48 inches. The May-July period accounted for 52 percent of the total. September was the only month during 1975 characterized by below normal precipitation.

January and February 1976 were characterized by above normal temperatures and monthly precipitation was nearly .2 inches below normal during that period (Table 1). These conditions were similar to those of the same period during 1974.

Vegetation

Six vegetation types were identified on the study area as follows: grassland, agricultural, sagebrush-grassland, deciduous shrub, ponderosa pine-grassland and ponderosa pine. Within each vegetation type, except for the ponderosa pine, two or three subtypes were identified. A quantitative or qualitative description of each type and subtype appeared in a previous report (Dusek and McCann 1974).

PHASES OF STUDY

The project was initially divided into four separate parts. This report is concerned only with the general wildlife ecology study and the revegetation study. The nongame mammal inventory was concluded during 1975 and the rest-rotation grazing study on the ranch owned by the Consolidation Coal Company (Consol) was discontinued because the company felt that improved grazing management would not bring in a desirable monetary return (pers. comm.).

General Wildlife Ecology Study

The purpose of this phase was to conduct an inventory of game animals in the Bull Mountains ecosystem and gather baseline data related to distribution and range use, food habits, and population characteristics of those species that appeared to be most abundant in the area. Such information will be used to identify potential conflicts between wildlife and coal development and help determine what reclamation procedures will best meet habitat requirements of wildlife.

Observations of game animals were facilitated by surveys from fixed-wing aircraft, by vehicle, or on foot. When practicable, observed animals were classified as to age and sex. Vegetation type and subtype, class of slope, gradient and exposure of each observed animal were noted. The estimated distance from the animal to the nearest stand of timber was also

Table 1. Climatological data for Roundup, Montana, covering the period of January 1972 through February 1976.

Month	Temperature Ave.	Temperature Dep. from Normal	Precipitation Total	Precipitation Dep. from Normal
January:				
1972	17.3	- 6.4	.58	.29
1973	26.7	.2	.06	- .26
1974	24.9	1.7	tr1/	- .35
1975	24.8	1.6	.72	.37
1976	29.6	6.4	.12	- .23
February:				
1972	29.5	3.0	.27	- .05
1973	26.7	.2	tr	- .32
1974	35.8	6.6	tr	- .30
1975	17.4	-11.8	.30	.00
1976	35.2	6.0	.13	- .17
March:				
1972	43.0	9.3	.29	- .27
1973	36.4	2.7	.29	- .27
1974	-	-	.17	- .29
1975	31.0	- 2.6	.24	- .22
April:				
1972	46.3	.6	1.64	.89
1973	42.4	- 3.3	1.18	.43
1974	50.6	4.7	1.40	.57
1975	39.5	- 6.4	1.37	.54
May:				
1972	56.0	.2	3.00	1.20
1973	55.7	- .1	1.65	- .15
1974	-	-	2.65	.55
1975	52.8	- 2.6	3.98	1.88
June:				
1972	68.4	5.2	.61	-1.92
1973	66.3	3.1	2.19	- .34
1974	67.5	4.6	1.13	-1.71
1975	60.5	- 2.4	3.14	.30
July:				
1972	68.0	- 4.1	1.50	.29
1973	71.1	- 1.0	.62	- .59
1974	-	-	.22	- 1.04
1975	-	-	2.51	1.25
August:				
1972	71.4	1.6	3.07	2.09
1973	71.9	2.1	1.73	.76
1974	65.1	- 5.0	3.00	1.91
1975	65.5	- 4.6	.66	- .43
September:				
1972	52.3	- 7.3	.81	- .15
1973	-	-	1.86	.90
1974	57.0	- 2.1	2.22	1.11
1975	58.3	- .8	.26	- .85
October:				
1972	41.8	- 7.4	.91	.09
1973	49.3	.1	2.06	1.24
1974	51.3	1.6	1.18	.57
1975	48.8	- .9	4.35	3.74
November:				
1972	31.7	- 4.4	tr	- .36
1973	30.1	- 6.0	.46	.10
1974	35.0	- 1.1	.14	- .22
1975	33.9	- 2.2	.44	.08
December:				
1972	15.8	-13.2	.53	.17
1973	32.2	3.2	.93	.57
1974	-	-	.08	- .25
1975	-	-	.51	.14

1/ tr - Trace (an amount too small to measure).

recorded. Observations of individually marked big game animals were plotted on a map to the nearest quarter section, or if possible, to the nearest 40 acres. All unmarked animals were located to the nearest section. Fall food habits of big game animals were estimated by rumen analysis, and foods eaten by turkeys were determined by crop analysis. Data from ground and aerial surveys were combined in the following analysis.

Mule Deer

Mule deer *(Odocoileus hemionus)* inhabit the entire study area. A total of 1,677 observations of individual deer was made during the report period, including 411 and 1,266 observations from ground and aerial surveys, respectively.

Distribution and Range Use

Distribution and Movements

Since January 1973, 32 mule deer were captured and fitted with color-coded collars. Included were three adult females marked during January 1976,

but none of these were observed before the end of the report period. Methods of trapping and marking appeared in a previous report (Dusek and McCann 1975). Data for individually marked deer that were relocated one or more times during the report period appear in Table 2.

A home range is defined as the area over which an animal travels while engaged in its daily activities (Dice 1952). A minimum home range (Mohr 1947) was calculated for each animal observed five or more times subsequent to its capture. This was facilitated by connecting the outermost observation points, thus forming a polygon, and calculating the area inside. The average annual home range for six adult females (Table 2) was 619 acres (.97 sq. mi.). An annual home range of 709 acres (1.11 sq. mi.) was calculated for the adult male.

A geometric center of activity was determined for each of the seven deer (Hayne 1949). The distance to each relocation from the center of activity was measured, including the distance to the capture site. The average of these distances is known as the average radius of activity. The average radius of activity for each of the seven deer appears in Table 2. When data from six adult females were pooled, the average radius of activity for all of these animals was .55 miles. Robinette (1966) reported that the proportion of activity of mule deer decreases as the distance from the center of activity increases. Sixty-four percent of all observations of the six adult females occurred within one standard radius while 98 percent occurred within two. An average radius of activity for the adult male was .67 miles. Dasman and Taber (1956) and Robinette *(op. cit.)* reported that mule deer males exhibited greater mobility than females.

Seasonal movements of a deer within its home range were perhaps related to changes in forage preference as suggested by Mackie (1970). For example, some individually marked deer were observed in the agricultural type along major drainage bottoms during spring and/or fall, but were observed in native vegetation types in the side drainages during the remainder of the year. Some marked deer were never observed in the agricultural type or along major drainages. It was assumed that such areas did not occur within their annual home range. Seasonal movements of individually marked deer are represented in Figures 2 and 3.

Group Characteristics

Group sizes during the report period were smallest during summer, with a mean of 2.0 deer per group. Fifty-two percent of the groups observed during summer were those varying from 2-5 deer per group (Table 3). This category accounted for 70 percent of the total deer observed during summer. Solitary animals were commonly observed during early summer. This was perhaps related to fawning activity during June and July. Group sizes started to increase during August.

During fall and winter, group sizes continued to increase with seasonal means of 3.2 and 5.2, respectively. During fall most observed groups varied in size from 2-5 deer (Table 3). This category again accounted for 70 percent of the deer observed.

Table 2. Capture and movement data for 14 individually marked mule deer that were observed during the report period ending February 29, 1976.

Age & Sex	Date Marked	Drainage	Date of last Observation	No. of Relocations	Annual Home Range (acres)	Radius of Activity (mi.)
Adult F (D-1629)1/	1/31/73	Fattig Cr.	2/ 4/76	8 2/	550 (0.9) 3/	.56
Adult F (A-1714)	12/18/74	Halfbreed Cr.	2/ 5/76	10	533 (0.8)	.59
Adult F*(A-1715)	12/18/74	Halfbreed Cr.	2/ 5/76	11	581 (0.9)	.58
Adult F (A-1717)	12/31/74	Fattig Cr.	10/29/75	2	-	-
Adult F (A-1718)	1/ 2/75	Fattig Cr.	1/ 8/76	3	-	-
Adult F (A-1719)	1/ 9/75	Fattig Cr.	1/14/76	2	-	-
Adult F (A-1720)	1/10/75	Halfbreed Cr.	3/18/75	2	-	-
Adult F (A-1721)	1/10/75	Halfbreed Cr.	2/ 5/76	9	578 (0.9)	.50
Adult F (A-1722)	1/17/75	Halfbreed C.	2/19/76	11	952 (1.5)	.54
Adult F (A-1723)	1/27/75	Halfbreed Cr.	2/ 5/76	11	522 (0.8)	.52
Adult M (A-1724)	2/ 4/75	Fattig Cr.	12/30/75	3	-	-
Adult M (A-1729)	2/ 5/75	Fattig Cr.	9/23/75	5	709 (1.1)	.67
Adult F (A-1733)	2/10/75	Halfbreed Cr.	4/19/75	4	-	-
Adult F (A-1735)	2/16/75	Fattig Cr.	2/ 4/76	3	-	-

1/ Number on metal ear tag.
2/ Capture not included.
3/ Home range in square miles.
* The animal was a yearling when marked.

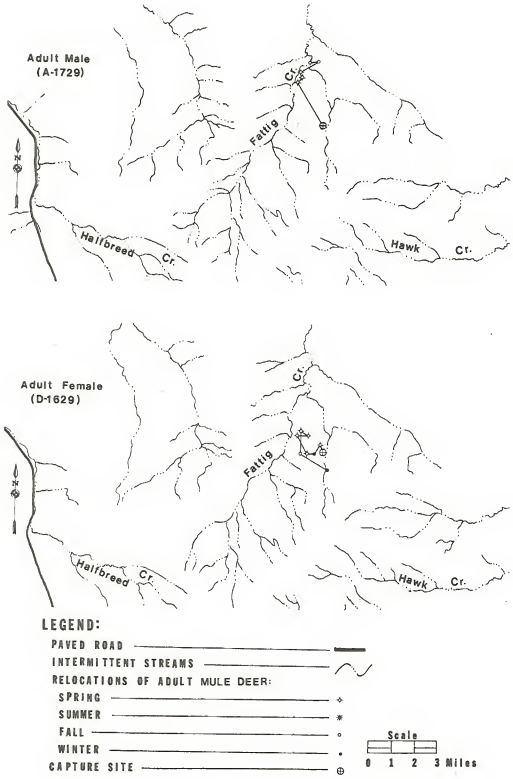


Figure 2. Seasonal distribution and movements of an adult male mule deer captured during February 1975 and an adult female captured during January 1973 in the Fattig Creek drainage.

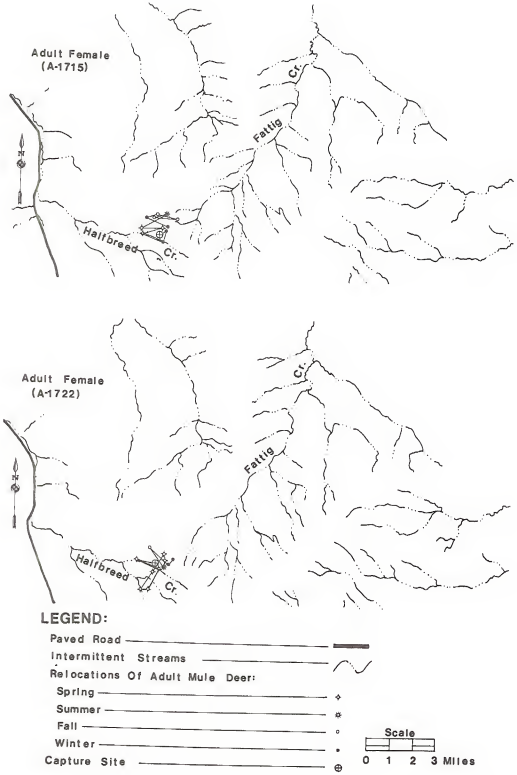


Figure 3. Seasonal distribution and movements of two adult female mule deer captured during December 1974 and January 1975 in the Halfbreed Creek drainage.

Table 3. Frequency among group sizes and average group size of mule deer by season during the report period.

Season	Groups of Mule Deer Number per Group 1	2-5	6-10	11-15	16 Plus	Ave. Size
Spring 1975	3/ 1[1/]	51/29	32/37	9/15	5/18	6.5
Summer 1975	46/23	52/70	2/ 7	-/-	-/-	2.0
Fall 1975	20/ 6	69/70	11/24	-/-	-/-	3.2
Winter 1975-76	8/ 1	57/35	25/36	6/15	4/12	5.2

1/ Percent of total groups observed during a respective season/Percent of total deer observed during a respective season.

During spring 1975, an average group size of 6.5 animals was recorded. The largest groups observed throughout the year were observed during spring. This is perhaps at least partly related to the concentration of deer on open vegetation types, particularly the agricultural type. Such areas appeared to green-up earlier than other vegetation types.

Although the size and composition of groups of mule deer change seasonally, the yearlong distribution of deer throughout the study area appeared to change very little, if at all (Dusek and McCann 1975). This, together with movement data from individually marked deer, tends to substantiate the conclusion that mule deer in the Bull Mountains ecosystem are nonmigratory.

Use of Vegetation Types

Observations of mule deer were facilitated by periods of activity such as feeding. Following these periods, or when alarmed, mule deer used stands of timber for escape cover. Since only the vegetation type and subtype that deer occupied when first observed were recorded, the actual importance of timbered types to deer was perhaps underestimated. Seasonal changes in relative use of vegetation types during this report period (Table 4) generally followed a pattern similar to that of previous years unless otherwise noted (Dusek and McCann 1973, 1974 and 1975).

Spring: The grassland and agricultural types, combined, accounted for 78 percent of the use during spring 1975. The grassland park and hay meadow subtypes received most of the use within their respective types (Table 4) during 1975, as opposed to the drainageway and cropland subtypes during 1974. During spring 1975 the agricultural type received its greatest seasonal use between April 21 and May 18, perhaps due to an earlier "green-up" on that type than on nonagricultural types. As succulent growth became abundant on the nonagricultural types, an abrupt shift to these types occurred. This pattern of use occurred approximately 1 month earlier during 1974, perhaps due to climatological differences between the 2 years (Table 1).

Table 4. Seasonal use of vegetational types by mule deer as determined by 1677 observations during the report period.

Vegetation Type	Season			
	Spring 1975 (600)1/	Summer 1975 (277)	Fall 1975 (386)	Winter 1975-76 (414)
Grassland Type:				
Grassland Park Subtype	16 2/	17	22	11
Drainageway Subtype	11	8	11	6
Burn Subtype	12	6	9	8
TOTAL	39	31	42	25
Agricultural Type:				
Cropland	15	8	28	27
Hay Meadow	24	21	14	6
TOTAL	39	29	42	33
Sagebrush-Grassland Type:				
Silver Sagebrush-Grassland Subtype	5	2	3	2
Big Sagebrush-Grassland Subtype	-	5	-	-
TOTAL	5	7	3	2
Deciduous Shrub Type:				
Skunkbush-Grassland Subtype	2	1	5	2
Snowberry Subtype	-	6	3	tr 3/
TOTAL	2	7	8	2
Ponderosa Pine-Grassland Type:				
Ponderosa Pine-Bunchgrass Subtype	15	24	5	34
Ponderosa Pine-Juniper Subtype	-	2	-	2
TOTAL	15	26	5	36
Ponderosa Pine Type:	-	-	-	1

1/ Sample size for a respective season.
2/ Percent of seasonal observations.
3/ Trace - a value less than 1 percent of seasonal observations.

Summer: Summer 1975 was characterized by decreased use of the grassland and agricultural types and increased use of the ponderosa pine-grassland type as compared to spring (Table 4). The grassland park, hay meadow and ponderosa pine-bunchgrass subtypes received the greatest use in the respective types. The combined use of the grassland and agricultural types accounted for 60 percent of the seasonal observations.

Fall: During fall 1975 the grassland and agricultural types received their greatest yearlong use, each accounting for 42 percent of the seasonal observations. The grassland park and cropland subtypes received most of the use within the respective types (Table 4). The ponderosa pine-grassland type received its lowest observed yearlong use during fall. Fall 1975 was characterized by cooler and wetter conditions than normally prevail during this time of year (Table 1). Resulting "green-ups" may have induced greater use by deer of the grassland and agricultural types, particularly the cropland subtype.

Winter: Winter 1975-76 was characterized by comparatively mild climatological conditions, similar to those of the winters of 1972-73 and 1973-74 (Dusek and McCann 1973 and 1974). The ponderosa pine-grassland type, which accounted for 36 percent of the seasonal observations, received the greatest seasonal usage. The grassland type received its lowest yearlong usage. The relatively high use of the agricultural type during this season reflected an increase in observations on that type during late February. Abnormally warm temperatures prior to and during that period caused a noticeable "green-up" in the cropland subtype and may have influenced the heavy use of the agricultural type during this winter. The sagebrush-grassland received abnormally low use during this winter as compared to other years.

Relation to Timber

Most of the deer observed occurred within 0-100 feet of the nearest stand of timber throughout the report period (Table 5). More than 60 percent occurred within 300 feet of the nearest stand of timber. During spring 60 percent of the observations were evenly distributed between the 100-300, 300-600 and 600 plus classes. This perhaps reflected seasonal preference for vegetation types. During summer, fall and winter, 8 percent of the seasonal observations occurred at distances greater than 600 feet, while 50 percent or more occurred within 0-100 feet of the nearest stand of timber. Generally these data reflect the same trend observed the previous year (Dusek and McCann 1975).

Table 5. Occurrence of mule deer at various distances from the nearest stand of timber, determined from 1677 ground and aerial observations.

Distance Class	Spring 1975 (600)1/	Summer 1975 (277)	Fall 1975 (386)	Winter 1975-76 (414)
0-100 ft.	42 2/	57	50	54
100-300 ft.	19	18	26	16
300-600 ft.	20	17	17	22
Over 600 ft.	19	8	8	8

1/ Sample size for a respective season.
2/ Percent of seasonal observations.

Use of Slopes

Seasonal use of six classes of topographical features by mule deer appears in Table 6. Coulee and creek bottoms, ridges and plateaus were collectively termed flatlands, while sidehills and coulee heads were separated into three classes based on degree of slope (Table 7).

Table 6. Seasonal use of various topographical features by mule deer as determined from 1677 ground and aerial observations during the report period.

		Topographical Feature				
Season	Sidehill	Coulee Bottom	Creek Bottom	Ridge	Plateau	Coulee Head
Spring 1975 (600)1/	39 2/	12	18	7	15	9
Summer 1975 (277)	38	14	5	5	30	9
Fall 1975 (386)	22	9	14	4	42	9
Winter 1975-76 (414)	38	10	3	11	30	9

1/ Sample size for a respective season.
2/ Percent of seasonal observations.

Table 7. Seasonal use of gradients by mule deer during the report period.

Gradient	Spring 1975 (600) 1/	Summer 1975 (277)	Fall 1975 (386)	Winter 1975-76 (414)
Flat 2/	52 3/	56	69	53
Gentle (0-15°)	36	25	24	39
Medium 16-30°)	10	15	7	7
Steep (31-45°)	2	4	1	2

1/ Seasonal sample size.
2/ Includes coulee bottoms, creek bottoms, ridges and plateaus.
3/ Percent of seasonal observations.

Flatlands accounted for more than 50 percent of the deer observed during each season throughout the report period with the greatest usage occurring during fall (Table 7). During spring 1975 creek bottoms received their greatest yearlong usage (Table 6). Plateaus accounted for the greatest usage among flatlands during the remainder of the year, but received their greatest use during fall.

Steep slopes received only minor use throughout the report period. Use of gentle and medium slopes combined was greatest during spring and winter (Table 7). Forty-six percent of the observations occurred on these two classes of gradient during spring and winter. Sidehills accounted for more than one-third of the total usage during all seasons except fall (Table 6). The overall trend is similar to that observed during the previous year (Dusek and McCann 1975).

Use of Exposures

During winter 1975-76, 53 percent of the observations of mule deer associated with some degree of slope occurred on southerly exposures (Table 8). Those exposures also received considerable use during spring. During summer, no definite trend was apparent. Northerly and easterly exposures received considerable use during fall.

Table 8. Seasonal use of eight exposures by mule deer as determined from 734 observations during the report period.

Season	North	East	South	West	NE	NW	SE	SW
Spring 1975 (290)1/	12 2/	14	24	6	5	8	17	16
Summer 1975 (128)	20	15	11	6	18	8	11	11
Fall 1975 (120)	16	22	8	-	18	10	14	9
Winter 1975-76 (196)	19	-	33	2	5	20	14	6

1/ Sample size occurring on some degree of slope during a respective season.
2/ Percent of seasonal observations associated with some degree of slope.

Fall Food Habits

Food habits for fall 1975 were estimated from rumen samples from three deer taken by hunters during October and November (Table 9). Browse, forbs and grasses constituted 56, 41 and 1 percent, respectively, by volume. Snowberry *(Symphoricarpos* spp.*)*, which occurred in all three samples and averaged 41 percent by volume, was the most important single item used. Other browse included Oregon grape *(Berberis repens)*, wild rose *(Rosa* spp.*)*, and silver sagebrush *(Artemisia cana)*(Table 9). Alfalfa *(Medicago sativa)*, which occurred almost exclusively in the agricultural type, averaged 35 percent and was the most abundant forb in the samples. Other forbs included aster *(Aster* spp.*)* and common salsify *(Tragopogon dubius)*.

Population Characteristics

During spring 1975, a fawn:adult ratio of 24:100 was calculated. This compared closely with data collected during the previous winter (Dusek and McCann 1975).

Fawn:doe and fawn:adult ratios were not calculated from summer observations, since fawns were not readily observed until August. The buck:doe ratio of 70:100 calculated during summer 1975 was considerably higher than during the following fall and winter (Table 10), and may reflect an observability bias. One reason for this may be a differential use of vegetation types by bucks and does during summer. For example, the buck:doe ratio calculated from observations in the ponderosa pine-grassland type was 33:100, while that from deer observed in open vegetation types, combined, was 86:100. Many does were observed as solitary animals, especially

Table 9. Fall food habits of mule deer as determined from examination of rumen contents of three hunter-killed mule deer.

Taxa	October-November 1975 3 Rumens
Browse:	
Artemisia cana	67/ 1[1/]
Berberis repens	33/ 6
Pinus ponderosa	33/tr[2/]
Rhus trilobata	67/tr
Rosa spp.	100/ 4
Symphoricarpos spp.	100/41
Unidentified Browse	100/ 4
Total Browse	100/56
Forbs:	
Aster spp.	67/ 1
Medicago sativa	67/35
Tragopogon dubius	33/ 1
Unidentified Forbs	100/ 4
Total Forbs	100/41
Grasses:	
Triticum spp.	33/tr
Unidentified Grasses	100/ 1
Total Grasses	100/ 1

1/ Frequency (percent occurrence among rumens)/percent of diet.
2/ tr - Trace (a value less than .5 percent).

during June and July, while bucks were often observed in groups of two or more. Solitary animals were sometimes more difficult to spot, especially from aerial surveys, than were groups of two or more animals.

During fall, fawn:doe and fawn:adult ratios were 38:100 and 29:100, respectively (Table 10). The observed buck:doe ratio during this period was 33:100. The same ratio calculated for adult deer observed in open vegetation types was 35:100. Only 15 adult deer were observed in the ponderosa pine-grassland type during fall and all were does. Most fall observations were made prior to the hunting season.

There was no observed change in the fawn:doe ratio between fall and winter (Table 10). The fawn:adult ratio increased slightly to 30:100. The buck:doe ratio of 19:100 was considerably less than that observed during fall. During winter there did not appear to be any differential use of timbered and nontimbered types by bucks and does. Perhaps a larger proportion of unclassified adults and unclassified deer were adult bucks. Based on fall observations, the calculated annual increment, or proportion of the population consisting of fawns, was 22 percent. Based on winter observations, the increment was 23 percent.

Table 10. Population characteristics of mule deer as determined from 1675 ground and aerial observations from March 1975 through February 1976.

Season	Adults				Fawns	Uncl. Sex & Age	Total	Fawns: 100 Does	Fawns: 100 Adults	Bucks: 100 Does
	Does	Bucks	Uncl.	Total						
Spring 1975	26	6	328	360	87	153	600	-	24	-
Summer 1975	140	98	2	240	35	-	275	-	-	70
Fall 1975	225	75	-	300	86	-	386	38	29	33
Winter 1975-76	208	40	11	259	79	76	414	38	30	19

Elk

Prior to 1973, there had been no hunting season on elk *(Cervus canadensis)* in the Bull Mountains. Five archery permits were issued during fall 1973 for a portion of hunting district 590 which consisted of surface owned or leased by Consol. During 1974, the Consol property was again open to archers, and five rifle permits were also issued during the general big game season. No elk were reported killed during either year. Ten rifle permits were issued for the general season during 1975 for the same portion of hunting district 590. Three elk were taken, which included two bulls and one cow.

Distribution and Range Use

A total of 1,426 observations of individual elk were made during the report period. Most of these were obtained from aerial surveys.

Distribution and Movements

Elk occupy a portion of the Bull Mountains west of U. S. 87 which includes the upper portions of Pompey's Pillar, Railroad, Hawk, Fattig, Parrot and Halfbreed Creeks (Dusek and McCann 1975).

Seven adult cows were captured and equipped with individually identifiable collars during the winters of 1974 and 1975. Methods of capturing and marking were discussed in a previous report (Dusek and McCann 1975). Capture, relocation and home range data appear in Table 11. One hundred fifty-nine relocations were obtained subsequent to the capture of the seven animals.

Annual home ranges were calculated for five of the seven elk (Table 11) in the same manner as those of mule deer. The average annual home range for those animals was 35.4 square miles, which was comparable with that reported for adult cow elk in the Missouri breaks (Knowles 1975).

The portion of the Bull Mountains occupied by elk, as well as annual home ranges of individually marked adult cows, were differentially utilized throughout the year. It was also apparent that some portions of annual home ranges of adult cows were used very little, if at all (Figures 4, 5, 6, 7 and 8). The summer home range of adult cows was considered the portion of the annual home range where the animal was observed from June through mid-October (Table 11). Two adult cows (Nos. 1 and 2) occupied the same portion of their annual home range during that period of two consecutive years (Figures 4 and 5). The average summer home range size for five adult cows was 5.2 square miles.

Marked adult cows were generally observed on what was considered the winter home range from December through mid-April. Size of the winter home range varied considerably between the seven animals (Table 11), but averaged 11.5 square miles. Nos. 6 and 7, both marked in upper Pompey's Pillar Creek during January 1975, were observed in the same

Table 11. Capture and movement data for seven adult cow elk captured and individually marked during the winters of 1974 and 1975.

No.	Ear Tag Number	Date Marked	Drainage Where Marked	Date of Last Observation	Number of Relocations	Home Range (sq. mi.) Annual	Summer	Winter
1	-	2/ 4/74	Fattig Cr.	2/ 5/76	27	29.9	6.2	11.4
2	A-1709	2/ 6/74	Fattig Cr.	11/ 4/75	40	35.2	3.5	23.0
3	A-1708	1/ 8/75	Fattig Cr.	2/19/76	24	33.2	6.5	8.2
4	A-1707	1/ 8/75	Hawk Cr.	2/24/76	21	38.7	3.9	10.7
5	D-1635	1/ 9/75	Railroad Cr.	2/10/76	15	-	-	13.0
6	A-1711	1/10/75	Pompey's Pillar Cr.	2/24/76	19	40.0	6.1	7.4
7	A-1712	1/10/76	Pompey's Pillar Cr.	2/19/76	13	-	-	6.5

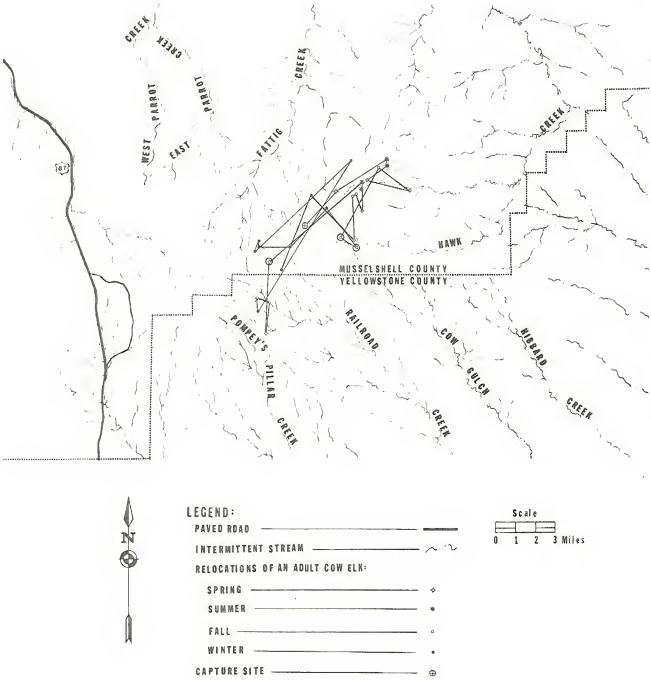


Figure 4. Seasonal distribution and movements of cow elk No. 1 from February 1974 through February 1976.

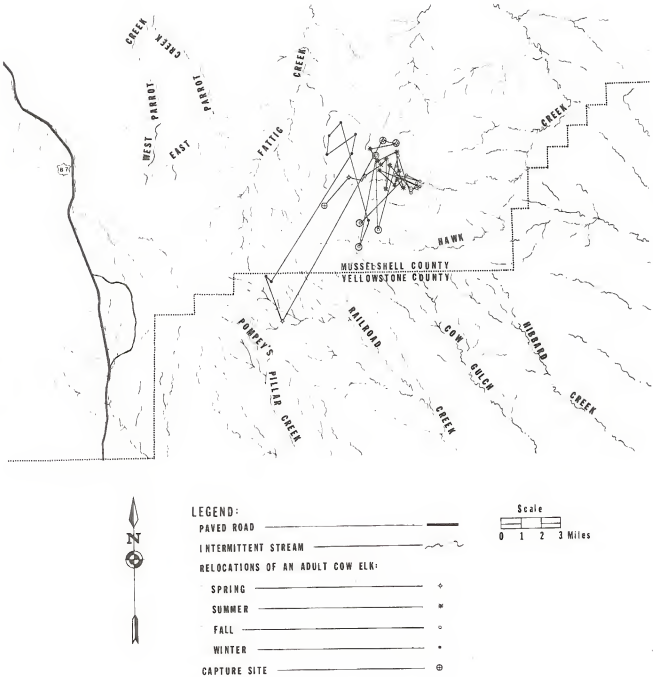


Figure 5. Seasonal distribution and movements of cow elk No. 2 from February 1974 through February 1976.

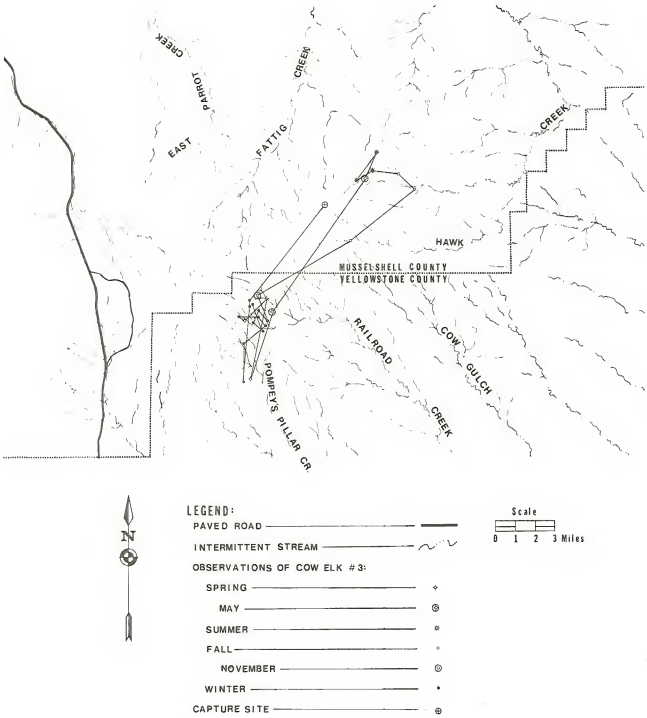


Figure 6. Seasonal distribution and movements of cow elk No. 3 during the period of January 8, 1975 through February 29, 1976.

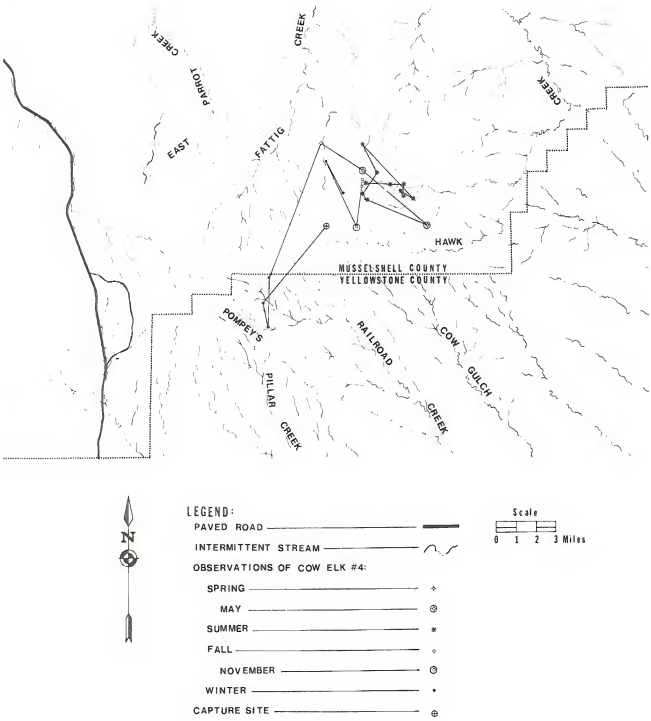


Figure 7. Seasonal distribution and movements of cow elk No. 4 during the period of January 8, 1975 through February 29, 1976.

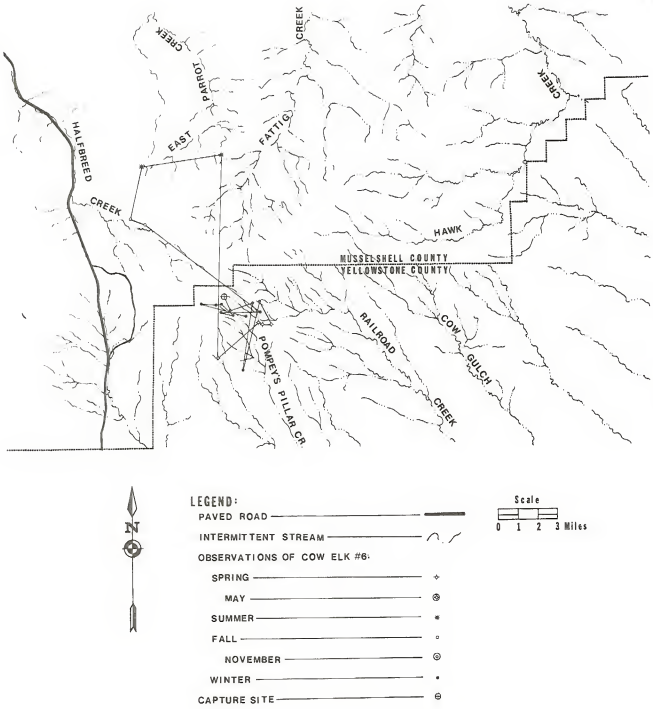


Figure 8. Seasonal distribution and movements of cow elk No. 6 during the period of January 10, 1975 through February 29, 1976.

general area, which also included Railroad Creek, during that and the following winter (Figure 8). Those marked on Consol's property (Nos. 1 through 5) had larger winter home ranges and their use appeared more variable. Marked cows occurred almost anywhere within their annual home range during May and November. These appeared to be periods of movement between summer and winter home ranges.

Centers of activity (Hayne 1949) were calculated for summer and/or winter home ranges of the seven marked cows. May and November data were not used for these calculations. The average distance traveled between summer and winter home ranges, expressed as the average straight line distance between the two centers of activity for each of five cows, was 6.1 miles (Table 12).

The average radius of activity for five and seven cows during the June-October and December-April periods, respectively, appears in Table 12. During the June-October period, 76 percent of the observed activity occurred within 1.5 miles of the center of activity of each animal, while 96 percent occurred within 3.0 miles. Fifty-eight percent of the observed activity occurred within 2.1 miles of centers of activity during the December-April period, while 91 percent occurred within 4.2 miles. This also suggested that adult cow elk exhibited greater mobility and areas of activity were greater during winter and early spring than during summer and early fall. The fact that mean consecutive distances as well as mean maximum distances between observations of individual animals were smallest during summer and fall and greatest during winter and spring further substantiates that conclusion (Table 12). These data compare closely to that of Mackie (1970), Knowles (1975) and Komberec (1976) for the Missouri breaks.

It was previously determined that two distinct elk summer ranges occurred in the Bull Mountains (Dusek and McCann 1975). Based on sightings of both marked and unmarked elk during the report period, it is my opinion that these summer ranges are occupied by two separate segments of the population. One, including at least four marked adult cows (Nos. 1, 2, 3 and 4), occurred on the upper east side of Hawk Creek during the June-October period (Figures 4, 5, 6 and 7). No. 5 is perhaps part of this segment, but summer data for that animal were lacking and fall data were sparse. The other segment, which included Nos. 6 and 7, occupied upper Halfbreed and Parrot Creeks as well as the upper west side of Fattig Creek (Figure 8). No. 7 was only observed once during the summer-fall period, but it occurred in Halfbreed Creek.

During the December-April period, the situation was more complex. As mentioned previously, Nos. 6 and 7 were observed exclusively in upper Pompey's Pillar and Railroad Creeks in northern Yellowstone County during the winters of 1975 and 1975-76. On several occasions during those winters, between 40 and 60 head of elk were observed in that area. Nos. 1, 2, 3 and 4, which represented the Hawk Creek segment, were all marked in the Fattig and Hawk Creek drainages on Consol's property (Figure 1). All were observed in the Railroad Creek drainage several times between February and April, 1975 and No. 3 was observed several times in Pompey's Pillar Creek. No. 5 was marked along the divide between Fattig and Railroad Creeks, and observed in that area until mid-February 1975. It then moved further

Table 12. Seasonal radius of activity, distances between consecutive observations, mean maximum distances between observations, and distances between centers of activity of seven individually marked adult cow elk in the Bull Mountains.

No.	Radius of Activity (mi.)		Consecutive Distances Between Observations (mi.)				Maximum Distances Between Observations (mi.)				Distance Between Centers of Activity
	Jun.-Oct.	Dec.-Apr.	Spr.	Sum.	Fall	Win.	Spr.	Sum.	Fall	Win.	Miles
1	1.2 (11)1/	2.5 (14)	1.6	2.4	1.7	3.3	3.50	6.25	4.00	8.50	5.3
2	1.0 (22)	3.0 (11)	2.9	1.0	1.9	2.2	10.25	1.75	4.50	6.50	4.0
3	1.6 (6)	1.4 (16)	3.5	1.3	3.2	1.6	8.00	1.75	5.50	6.00	9.0
4	1.1 (12)	3.6 (7)	4.6	1.6	.8	2.8	7.00	4.00	1.75	5.00	4.6
5	-	1.8 (15)	2.4	-	-	2.0	5.00	-	-	6.00	-
6	2.4 (4)	1.3 (16)	1.2	3.2*	1.6	3.2	2.75	3.25*	2.50	7.00	7.4
7	-	1.2 (12)	1.6	3.7*	-	1.8	3.00	3.75*	-	3.25	-
Ave.	1.5	2.1	2.5	2.2	1.8	2.4	5.6	3.5	3.6	6.00	6.1

1/ Number of relocations during a respective period.
* Only one measurement was available.

south into Railroad Creek. During the winter of 1975-76 (Dec.-Feb.): No. 1 was observed in both the Fattig and Railroad Creek drainages, No. 2 was not observed at all, Nos. 3 and 5 spent the entire winter in Railroad and Pompey's Pillar Creeks with Nos. 6 and 7, and No. 4 remained in the Fattig and Hawk Creek drainages.

Specific sites where elk were observed throughout the year were those where cattle were few in number or absent. When large groups of cattle were turned into areas that elk had previously occupied, especially during fall, elk were no longer observed in such areas.

Consol's property, in the Fattig and Hawk Creek drainages, received rather heavy use by livestock during the winter of 1974-75, but this usage was much lighter during the following winter of 1975-76. The portions of Pompey's Pillar and Railroad Creeks, were elk occurred, received little or no use by livestock during either winter. This may partially explain differences in winter home range size and movements between elk marked in Pompey's Pillar Creek and those marked on Consol's property (Tables 11 and 12). Knowles (1975) and Komberec (1976) reported livestock distribution to be a major factor influencing elk distribution within a rest-rotation grazing system in the Missouri breaks. The mobility of elk appeared to allow them to seek out the most favorable range and forage conditions.

Group Characteristics

Average group sizes were largest during fall and winter and smallest during spring and summer (Table 13). This trend was similar to that observed during previous years (Dusek and McCann 1974 and 1975). Elk were quite gregarious throughout the year, although a greater proportion of solitary animals was observed during spring and summer than during fall or winter (Table 13). This was largely influenced by observations of adult cows during May and June and was perhaps related to calving. Calves were first observed on June 12.

Table 13. Frequency among group sizes and average group sizes of elk by season during the report period.

	Groups of Elk						
Season	1	2-5	6-10	11-15	16-20	21+	Average Size
Spring 1975	27/ 5 1/	43/29	20/30	4/10	3/10	3/16	5.0
Summer 1975	22/ 4	49/30	18/25	4/ 9	4/14	3/17	5.1
Fall 1975	15/ 2	40/18	13/13	15/23	13/28	4/16	8.0
Winter 1975-76	10/ 2	45/27	31/37	12/25	-/-	2/ 8	6.0

1/ Percent of total groups observed during a respective season/Percent of total elk observed during a respective season.

Yearling, or "spike," bulls were often observed with cow/calf groups throughout the summer, but older bulls were not observed accompanying these groups until the last week of August. Mature bulls were observed with cow/calf groups throughout fall and were observed showing aggressive behavior toward other bulls during September. During winter 1975-76 bulls were generally not observed with cow/calf groups.

Based on observations of groups containing one or more individually marked cows, composition of individuals within groups appeared to change quite often. Cow/calf groups were generally closely associated on seasonal herd ranges.

Use of Vegetation Types

Relative use among vegetation types throughout the report period was similar to that observed during the previous year (Dusek and McCann 1975). Results appear in Table 14.

Spring: The grassland type accounted for 59 percent of the observed use among vegetation types during spring 1975. This was confined almost exclusively to the grassland park subtype. The agricultural type received only 8 percent of the seasonal use as compared to 27 percent during the previous year. Elk were not observed using that type until about mid-May 1975 as compared to early April 1974. Abnormally cool and wet climatological conditions during spring 1975 perhaps retarded growth of succulent vegetation and such areas were not attractive to elk until mid-May 1975. The ponderosa pine-grassland type also received considerable use, all of which was observed in the ponderosa pine-bunchgrass subtype (Table 14).

Summer: The agricultural type, which accounted for 42 percent of the seasonal observations, received its greatest yearlong use during summer 1975. This was followed by the grassland and ponderosa pine-grassland types (Table 14).

Fall: Seventy-two percent of the seasonal use was quite evenly distributed among the grassland and agricultural types (Table 14). The grassland park and cropland subtypes received most of the use within the respective types. Use of the deciduous shrub type increased over spring and summer, all of which occurred in the snowberry subtype.

Winter: The grassland type accounted for its greatest yearlong use during winter 1975-76, accounting for 66 percent of the seasonal observations. The grassland park subtype accounted for most of this use. The only other types where use was observed during this winter were the ponderosa pine-grassland and sagebrush-grassland types (Table 14). This was the only season when elk were not observed in the agricultural type.

Relation to Timber

More than half the elk observed occurred within 0-100 feet of the nearest stand of timber during all seasons (Table 15). The greatest use within this class occurred during winter, when it accounted for 83 percent

Table 14. Seasonal use of vegetation types by elk as determined from 1426 observations during the report period.

Vegetation Type	Season			
	Spring 1975 (372)1/	Summer 1975 (372)	Fall 1975 (375)	Winter 1975-76 (307)
Grassland Type:				
Grassland Park Subtype	59 2/	21	29	65
Drainageway Subtype	tr 3/	8	10	-
Burn Subtype	-	-	-	1
TOTAL	59	29	39	66
Agricultural Type:				
Cropland	3	13	24	-
Hay Meadow	5	29	9	-
TOTAL	8	42	33	-
Sagebrush-Grassland Type:				
Silver Sagebrush-Grassland Subtype	12	-	-	12
Big Sagebrush-Grassland Subtype	tr	-	1	-
TOTAL	12	-	1	12
Deciduous Shrub Type:				
Skunkbush-Grassland Subtype	2	-	-	-
Snowberry Subtype	-	2	6	-
TOTAL				
Ponderosa Pine-Grassland Type:				
Ponderosa Pine-Bunchgrass Subtype	18	27	21	21
Ponderosa Pine-Juniper Subtype	-	-	-	1
TOTAL	18	27	21	22
Ponderosa Pine Type:	-	1	-	-

1/ Sample size for a respective season.
2/ Percent of seasonal observations.
3/ Trace - a value less than 1 percent of seasonal observations.

of the observations. A greater proportion of seasonal elk observations occurred in the 300-600 and 600 feet plus classes during fall than during other seasons. This was perhaps related to use by elk of large open areas such as the agricultural type. This trend was similar to that observed during the previous year (Dusek and McCann 1975).

Table 15. Occurrence of elk at various distances from the nearest stand of timber as determined from 1426 observations during the report period.

Distance Class	Spring 1975 (372)1/	Summer 1975 (372)	Fall 1975 (375)	Winter 1975-76 (307)
0-100 ft.	51 2/	66	63	83
100-300 ft.	40	33	14	16
300-600 ft.	8	1	13	-
Over 600 ft.	1	-	10	1

1/ Sample size for a respective season.
2/ Percent of seasonal observations.

Use of Slopes

Seasonal use by elk of six classes of topographical features appears in Table 16. More than 50 percent of the elk observations occurred on flatlands during all seasons, but the greatest yearlong use occurred during fall (Table 17). This was influenced largely by use of plateaus, coulees and creek bottoms which was apparently related to use by elk of the agricultural type. Plateaus received considerable use during all seasons except winter, but the heaviest use occurred there during fall (Table 16). Creek bottoms received their only significant use during fall. Coulee bottoms received their greatest use during spring and summer, while ridges were most important during winter. This was similar to the trend of the previous year (Dusek and McCann 1975).

Gentle slopes received the greatest use of all three classes throughout the report period with the greatest use occurring during spring and winter (Table 17). The only use observed on steep slopes occurred during summer. Sidehills received greater use than coulee heads during all seasons, although their greatest use occurred during spring and winter. Coulee heads received their greatest use during summer and fall.

Table 16. Seasonal use of various topographical features by elk as determined from 1426 observations during the report period.

Season	Topographical Features					
	Sidehill	Coulee Bottom	Creek Bottom	Ridge	Plateau	Coulee Head
Spring 1975 (372)1/	32 2/	40	-	6	15	7
Summer 1975 (372)	29	35	3	2	19	11
Fall 1975 (375)	20	18	14	8	26	13
Winter 1975-76 (307)	44	24	-	24	5	3

1/ Sample size for a respective season.
2/ Percent of seasonal observations.

Table 17. Seasonal use of gradients by elk during the report period.

Gradient	Spring 1975 (372)1/	Summer 1975 (372)	Fall 1975 (375)	Winter 1975-76 (307)
Flat2/	61 3/	60	67	53
Gentle (0-15°)	36	27	24	35
Medium (16-30°)	3	10	10	11
Steep (31-45°)	-	3	-	-

1/ Sample size for a respective season.
2/ Includes coulee bottoms, creek bottoms, ridges and plateaus.
3/ Percent of seasonal observations

Use of Exposures

During winter 1975-76, 86 percent of elk observations associated with some degree of slope occurred on southerly exposures (Table 18). Those exposures also received most of the observed use during spring and fall. During summer, northerly exposures received 65 percent of the observed use.

Table 18. Seasonal use of each of eight exposures by elk as determined from 568 observations during the report period.

Season	North	East	South	West	NE	NW	SE	SW
Spring 1975 (141)1/	3 2/	13	35	8	7	-	24	10
Summer 1975 (158)	24	2	5	3	21	20	17	8
Fall 1975 (125)	11	9	51	-	12	-	17	-
Winter 1975-76 (144)	3	3	45	6	2	-	13	28

1/ Sample size occurring on some degree of slope during a respective season.
2/ Percent of seasonal observations associated with some degree of slope.

Fall Food Habits

Food habits of elk during October and November 1975 were determined by analysis of four rumen samples: three from hunter-killed elk in the Hawk and Fattig Creek drainages and one from an animal killed illegally in Halfbreed Creek.

Grasses, browse and forbs accounted for 61, 25 and 11 percent, by volume, of the four rumens (Table 19). Most grass material in the rumens was not identifiable, but wheat *(Triticum* spp.*)* accounted for most of that which was. Wheat and western wheatgrass *(Agropyron smithii)* constituted 22 and 4 percent of the diet, respectively.

Snowberry occurred in all four samples and accounted for 18 percent of the seasonal diet. Other important browse included silver sagebrush, wild rose and rubber rabbitbrush *(Chrysothamnus nauseosus)*. Ponderosa pine *(Pinus ponderosa)* in the diet during fall consisted of dried needles, perhaps picked up incidentally while elk were feeding on other plants. Important forbs included cud-leaf sagewort *(Artemisia ludoviciana)* and fringed sagewort *(A. frigida)*.

Population Characteristics

Calf:cow ratios for summer and fall 1975 were 53:100 and 52:100, respectively. The same ratio was 55:100 during winter 1975-76 (Table 20).

Table 19. Fall food habits of elk as determined from examination of rumen contents of four elk.

Taxa	Oct.-Nov. 1975 4 rumens
Browse:	
Artemisia cana	75/ 3[1/]
Chrysothamnus nauseosus	25/ 1
Pinus ponderosa	75/ 2
Rhus trilobata	25/tr[2/]
Rosa spp.	50/ 1
Symphoricarpos spp.	100/18
Unidentified Browse	75/tr
Total Browse	100/25
Forbs:	
Artemisia frigida	75/ 1
Artemisia ludoviciana	25/ 2
Aster spp.	50/tr
Tragopogon dubius	25/tr
Yucca glauca	25/tr
Unidentified Forbs	100/ 8
Total Forbs	100/11
Grasses:	
Agropyron smithii	50/ 4
Andropogon scoparious	25/tr
Koeleria cristata	25/tr
Triticum spp.	75/22
Unidentified Grass	100/35
Total Grass	100/61

1/ Frequency (percent occurrence among rumens)/percent of diet.
2/ tr - trace (a value less than .5 percent).

"Spike" bulls were observed with cow/calf groups throughout summer and fall 1975, but older bulls were rarely observed with these groups except during fall. For this reason, the calf:adult ratio of 37:100, calculated for fall observations, was perhaps the most accurate. The ratio of older bulls:cow, which was 21:100, was also most accurate during fall (Table 20).

Table 20. Population characteristics of elk as determined from 938 observations during summer and fall 1975 and winter 1975-76.

Season	Cows	"Spike" Bulls	Older Bulls	Total	Calves	Uncl. Sex & Age	Total	Calves: 100 Cows	Calves: 100 Adults	Spikes: 100 Cows	Older Bulls: 100 Cows
Summer 1975 (Jul.-Aug.)	144	27	9	180	76	-	256	53	42	19	6
Fall 1975 (Sept.-Nov.)	176	30	37	243	91	41	375	52	37	17	21
Winter 1975-76 (Dec.-Feb.)	175	11	2	188	96	23	307	55	51	6	1

The annual increment, calculated from fall observations, was 27 percent. Production data during this report period were similar to that of the past 2 years (Dusek and McCann 1974 and 1975).

Various observability bias' precluded an estimate of a total elk population by direct count. An estimate of the cow segment (yearlings and older) was computed from ratios of marked to unmarked cows. This was accomplished by use of a modified Lincoln Index (Martinka 1969) as follows:

$$PE = M/PM$$

where PE is the estimated cow population, M is the number of marked cows present, and PM is the percent of the cows that were marked. A total population was estimated from this, as well as summer calf:cow and "spike":cow ratios and fall older bull:cow ratio.

All seven marked cows were observed during the summer-fall period during 1975. The estimated cow segment was 67 animals. From this the estimated numbers of calves, "spike" bulls, and older bulls were 36, 13 and 14, respectively. Thus, the estimated population of elk in the Bull Mountains during the summer-fall period of 1975 was 130 animals.

Turkeys

Merriam's turkeys *(Meleagris gallopavo merriami)* were introduced in the Bull Mountains in 1958 using wild trapped stock from the Long Pines area of southeastern Montana (Greene and Ellis 1971). Annual fall hunting seasons for turkeys in the Bull Mountains were initiated in 1962. The area has subsequently provided the greatest turkey hunting potential in Department of Fish and Game administrative region 5 in terms of numbers of hunters afield and birds harvested (Compton 1975).

Distribution and Range Use

The following analysis resulted from 712 observations of turkeys during the report period, including 326 and 386 ground and aerial observations, respectively. Trends in range use were similar to those of previous years (Dusek and McCann 1973, 1974 and 1975) unless otherwise noted. Most of the observations during the report period occurred in southern Musselshell County.

Flocking Characteristics

Gobbler flocks were prevalent throughout the year, but were largest in number during spring and winter (Table 21). Flocks consisting only of hens were rarely observed. Hens were generally associated with some other type of flock.

During April, mixed flocks gave way to courtship flocks consisting of several displaying males accompanied by hens and averaging 4.2 birds/flock. Brood flocks, consisting of one to three hens with poults, were observed during summer and fall. The mixed flocks observed during late fall and winter perhaps resulted from aggregation of brood flocks during fall.

Use of Vegetation Types

Spring: The grassland type, which accounted for 57 percent of observations, received the greatest use during spring 1975. The grassland park and drainageway subtypes received considerable use during this season (Table 22). The ponderosa pine-grassland type also received considerable use during spring. The agricultural type received only minor use which was in contrast to other years.

Summer: As during spring, the grassland type received the greatest seasonal use accounting for 59 percent of the observations. Nearly all of this occurred in the grassland park subtype (Table 22). The ponderosa pine-grassland and agricultural types were also important during summer.

Fall: Use of the grassland type decreased slightly from summer, but still received the greatest seasonal usage (Table 22). Use of the drainageway subtype increased from summer. The agricultural type accounted for 45 percent of fall observations, representing a marked increase over summer. Most of this usage occurred in the cropland subtype.

Table 21. Seasonal flocking characteristics of turkeys based on 712 observations during the report period.

	Spring 1975 (121)1/			Summer 1975 (114)			Fall 1975 (220)			Winter 1975-76 (241)		
	No.	Fl.	Avg.	No.	Fl.	Avg.	No.	Fl.	Avg.	No.	Fl.	Avg.
Gobbler	75	11	6.8	80	17	4.7	67	12	5.6	71	11	6.5
Hen	2	1	2.0	-	-	-	-	-	-	21	2	10.5
Brood	-	-	-	32	4	8.0	100	7	14.3	-	-	-
Mixed	35	3	11.7	-	-	-	53	2	26.5	149	8	18.6
Courtship	25	6	4.2	-	-	-	-	-	-	-	-	-

1/ Sample size for a respective season.

Table 22. Seasonal use of vegetation types by turkeys as determined from 712 observations during the report period.

Vegetation Type	Spring 1975 (137)1/	Summer 1975 (114)	Fall 1975 (220)	Winter 1975-76 (241)
Grassland Type:				
Grassland Park Subtype	37 2/	58	31	2
Drainageway Subtype	20	1	20	1
Burn Subtype	-	-	-	-
TOTAL	57	59	51	3
Agricultural Type:				
Cropland	4	13	42	54
Hay Meadows	2	4	3	17
TOTAL	6	17	45	71
Sagebrush-Grassland Type:				
Silver Sagebrush-Grassland Subtype	4	4	-	-
Big Sagebrush-Grassland Subtype	-	-	-	-
TOTAL	4	4	-	-
Deciduous Shrub Type:				
Skunkbush Subtype	-	-	-	-
Snowberry Subtype	-	1	-	-
TOTAL	-	1	-	-
Ponderosa Pine-Grassland Type:				
Ponderosa Pine-Bunchgrass Subtype	31	20	2	18
Ponderosa Pine-Juniper Subtype	2	-	-	-
TOTAL	33	20	2	18
Ponderosa Pine Type:	-	-	2	-
Feedlots and Farms:	-	-	-	7

1/ Sample size for a respective season.
2/ Percent of seasonal observations.

Table 21. Seasonal flocking characteristics of turkeys based on 712 observations during the report period.

	Spring 1975 (121)1/			Summer 1975 (114)			Fall 1975 (220)			Winter 1975-76 (241)		
	No.	Fl.	Avg.	No.	Fl.	Avg.	No.	Fl.	Avg.	No.	Fl.	Avg.
Gobbler	75	11	6.8	80	17	4.7	67	12	5.6	71	11	6.5
Hen	2	1	2.0	-	-	-	-	-	-	21	2	10.5
Brood	-	-	-	32	4	8.0	100	7	14.3	-	-	-
Mixed	35	3	11.7	-	-	-	53	2	26.5	149	8	18.6
Courtship	25	6	4.2	-	-	-	-	-	-	-	-	-

1/ Sample size for a respective season.

Table 22. Seasonal use of vegetation types by turkeys as determined from 712 observations during the report period.

Vegetation Type	Spring 1975 (137) 1/	Summer 1975 (114)	Fall 1975 (220)	Winter 1975-76 (241)
Grassland Type:				
Grassland Park Subtype	37 2/	58	31	2
Drainageway Subtype	20	1	20	1
Burn Subtype	-	-	-	-
TOTAL	57	59	51	3
Agricultural Type:				
Cropland	4	13	42	54
Hay Meadows	2	4	3	17
TOTAL	6	17	45	71
Sagebrush-Grassland Type:				
Silver Sagebrush-Grassland Subtype	4	4	-	-
Big Sagebrush-Grassland Subtype	-	-	-	-
TOTAL	4	4	-	-
Deciduous Shrub Type:				
Skunkbush Subtype	-	-	-	-
Snowberry Subtype	-	1	-	-
TOTAL	-	1	-	-
Ponderosa Pine-Grassland Type:				
Ponderosa Pine-Bunchgrass Subtype	31	20	2	18
Ponderosa Pine-Juniper Subtype	2	-	-	-
TOTAL	33	20	2	18
Ponderosa Pine Type:	-	-	2	-
Feedlots and Farms:	-	-	-	7

1/ Sample size for a respective season.
2/ Percent of seasonal observations.

Winter: During winter 1975-76 the agricultural type received the greatest use, accounting for 71 percent of the observations. This pattern was in contrast to that of the previous winter (Dusek and McCann 1975) when most of the observed use occurred in the ponderosa pine-grassland type. Use of farmsteads and feedlots by turkeys during winter 1975-76 was minor (Table 22).

Relation to Timber

During spring, summer and fall of 1975, two-thirds or more of the turkeys observed occurred within 0-100 feet of the nearest stand of timber (Table 23). All observations were within 300 feet of the nearest stand of timber during spring and summer. Only during winter were turkeys observed at a distance from timber of greater than 600 feet. Throughout the report period the proportion of turkeys observed at distances greater than 100 feet increased as use of the agricultural type increased.

Use of Slopes

Seasonal use by turkeys of the six classes of topographical features appears in Table 24. More than 75 percent of the observations occurred on flatlands during all seasons except summer (Table 25). Coulee bottoms and plateaus accounted for the greatest use of flatlands during spring and fall, while creek bottoms received the heaviest use during winter. The greatest use of sidehills by turkeys occurred during summer. Turkeys were not observed on steep slopes during the report period.

Fall Foods

Turkeys are omnivorous feeders and demonstrate distinct food preferences (Edminster 1954). Animal foods eaten by turkeys include a variety of arthropods, while plant material includes mainly fruits and seeds with some minor use of leaves (Martin *et al.* 1951).

Crop contents were examined from two turkeys killed by hunters during fall 1975 (Table 26). The most abundant item used was barley seeds *(Hordeum vulgare)*, but occurred in only one sample. Seeds from prairie coneflower *(Ratibida columnifera)* were abundant in both samples. Fruits from shrubs included those from wild rose, skunkbush sumac *(Rhus trilobata)* and snowberry. Animal matter in the diet consisted of insects and included grasshoppers (Orthoptera) and beetles (Coleoptera). These findings are similar to those of Jonas (1966) in the Long Pines. The absence of ponderosa pine seeds in the two crops may indicate poor pine mast production in the Bull Mountains during 1975, since that item, when available, was found to be preferred by turkeys during the study in the Long Pines. This might explain the heavy use of the agricultural type during fall and winter of this report period.

Table 23. Occurrence of turkeys at various distances from the nearest stand of timber as determined from 712 observations during the report period.

Distance Class	Spring 1975 (137)1/	Summer 1975 (114)	Fall 1975 (220)	Winter 1975-76 (241)
0-100 ft.	64 2/	81	70	38
100-300 ft.	36	19	28	32
300-600 ft.	-	-	2	20
Over 600 ft.	-	-	-	11

1/ Sample size for a respective season.
2/ Percent of seasonal observations

Table 24. Seasonal use of the various topographical features by turkeys as determined from 712 observations during the report period.

Season	Sidehill	Coulee Bottom	Creek Bottom	Ridge	Plateau	Coulee Head
Spring 1975 (137)1/	11 2/	36	-	10	30	13
Summer 1975 (114)	34	9	11	12	23	11
Fall 1975 (220)	10	46	2	-	42	-
Winter 1975-76 (241)	20	11	39	2	28	-

1/ Sample size for a respective season.
2/ Percent of seasonal observations.

Table 25. Seasonal use of gradients by turkeys during the report period.

Gradient	Spring 1975 (137)1/	Summer 1975 (114)	Fall 1975 (220)	Winter 1975-76 (220)
Flat2/	76 3/	55	90	80
Gentle (0-15°)	24	39	2	17
Medium (16-30°)	-	5	8	3
Steep (31-45°)	-	-	-	-

1/ Sample size for a respective season.
2/ Includes coulee and creek bottoms, ridges and plateaus.
3/ Percent of seasonal observations.

Table 26. Fall foods of turkeys as determined from analysis of crops from two hunter-killed turkeys.

Taxa	October 1975 2 Crops
Shrubs:	
Rhus trilobata	50/ 4[1/]
Rosa spp.	50/ 9
Symphoricarpos spp.	100/ 2
Total Shrubs	100/15
Forbs:	
Camelina dentata	50/ 1
Ratibida columnifera	100/17
Tragopogon dubius	50/ 2
Total Forbs	100/20
Grasses:	
Hordeum vulgare	50/43
Unidentified Grasses	50/ 1
Total Grasses	50/44
Insects:	
Orthoptera	50/15
Coleoptera	50/ 4
Total Insects	50/19

1/ Frequency (percent occurrence among crop samples)/Percent of diet.

Population Characteristics

Twenty-three broods, including 108 poults, were observed from August through early October 1975. The average brood size, or poults/adult hen, was 4.7 (Table 27). The number of poults/adult was .8. Except during winter, the number of males occurring in seasonal observations exceeded females. For this reason the poult:adult ratio may have been underestimated.

Table 27. Population characteristics of turkeys during the period August-October based on 251 observations.

Period Covered	No. Broods	No. Young	Avg.Br. Size	Adults M	Adults F	Adults Total	Young: Adult F.	Young: Adult
August-October 1975	23	108	4.7	120	23	143	4.7	.8

Other Game Species

Antelope

Only during spring and summer were antelope *(Antilocapra americana)* distributed throughout the entire study area. During fall and winter they occurred primarily in portions of the study area lying in northern Yellowstone County and at the west end of southern Musselshell County in the vicinity of Dewey Creek. Such areas are characterized by extensive stands of big sagebrush-grassland whereas big sagebrush is rare throughout much of southern Musselshell County. Results from studies in central and southeastern Montana indicated big sagebrush to be the mainstay of the winter diet of antelope (Bayless 1969 and Freeman 1971).

Portions of hunting districts 540 and 550 occur within the study area. During July 1975, 121 antelope were classified in hunting district 540. Fawn:doe and fawn:adult ratios were 23:100 and 19:100, respectively, and compared closely with those from the previous year (Dusek and McCann 1975).

White-tailed Deer

White-tailed deer *(Odocoileus virginiana)* were observed primarily in the deciduous tree/shrub and agricultural areas associated with the Musselshell River floodplain which is typical of whitetail habitat in eastern Montana (Allen 1971). They were occasionally observed in the Bull Mountains ecosystem just adjacent to the floodplain. Several sightings were also made in a portion of the Hawk Creek drainage approximately 20 miles south of the river. Observations of white-tailed deer in the study area were not numerous enough to provide meaningful range use and population data.

Sharp-tailed Grouse

Sharp-tailed grouse *(Pedioecetes phasianellus)* were rarely sighted in the Bull Mountains during the report period, or, for that matter, since initiation of the study. Optimum sharptail habitat includes open and brushy areas and not the forest proper (Edminster *Op. cit.*). The absence of a deciduous tree/shrub habitat type in the Bull Mountains may serve as a limiting factor. Intensive grazing may also be limiting, since standing grasses provide shelter and night roosting sites for sharptails (Brown 1971).

Revegetation Studies

The purpose of this phase was to monitor development of vegetational cover on areas that were recently mined, graded and reseeded to assess their value as wildlife habitat. Included are two areas: Consol's test pit and the Square Deal Mine (Figure 1). The two areas affect 12 and 7 acres, respectively.

Consol's Test Pit

Mining and grading of the site (Figure 9) were completed during 1971 and the entire area was seeded during May 1972. Approximately half of the disturbed area was reworked, refertilized and reseeded where the initial seeding attempt had failed (Consol pers. comm.) during November 1974. This included the entire portion of the south spoils ridge covered with shale, the level portion and steep south exposure of the north spoils ridge covered with the sandstone-shale mixture, and the south exposure of the north spoils ridge covered with sandstone (Figure 9). The steep slopes were mulched with straw and covered with netting. Vegetational analysis sites affected are those circled in Figure 9. During late April 1975, 2,500 ponderosa pine seedlings were planted by hand on the reworked steep slopes. By early fall 1975 no live seedlings were observed.

Vegetational Analysis

Vegetational cover was evaluated during early July 1975. This was facilitated by a canopy coverage method (Daubenmire 1959) whereby 20 2x5 decimeter plots were sampled along a 100-foot transect line at each of 19 permanent sites (Figure 9). Lines were placed parallel to the contour where practicable and the site marker was used as a midpoint. Seven coverage classes were used to estimate the percent of bare ground, litter and canopy coverage of vegetation by forage class and species. Unless otherwise noted, trends observed during 1975 were similar to those of previous years (Dusek and McCann 1973, 1974 and 1975).

Soil Mixture

The following analysis compares data by soil mixture, regardless of slope or exposure. Data for 1975 appear in Table 28.

Topsoiled portions exhibited the greatest canopy of grasses and residual vegetation and the smallest percentage of bare ground of all soil mixtures (Table 28). The canopy of grasses increased on all soil mixtures from 1974 to 1975, but the greatest increase occurred on sandstone-shale and shale portions. This was attributed to the reseeding and mulching work done during fall 1974 on those sites.

Crested wheatgrass *(Agropyron cristatum)* was by far the most abundant grass on both topsoil and sandstone sites, but the greatest increase in canopy from 1974 to 1975 occurred on topsoil. Orchard grass *(Dactylis glomerata)* and ryegrass *(Lolium multiflorum)* were the most abundant grasses on sandstone-shale sites, whereas smooth brome *(Bromus inermis)* was the most abundant on shale sites (Table 28).

Topsoil sites exhibited the least canopy of forbs of all soil mixtures (Table 28) which was in contrast to data from previous years. The canopy of yellow sweetclover *(Melilotus officinalis)* increased from 1974 to 1975 on all soil mixtures and accounted for the bulk of the forb canopy on topsoil and sandstone sites. Russian thistle *(Salsola kali)*

Table 28. Constancy, canopy coverage and frequency of low-growing vegetation on various types of soil on spoils material as determined by examination of 20 2x5 decimeter plots on each of 19 sites at Consol's test pit.

	Soil			
Taxa	Topsoil 7 Sites	Sandstone 7 Sites	Sandstone & Shale 3 Sites	Shale 2 Sites
GRASSES:				
*Agropyron cristatum**	100/63/ 99[1/]	100/26/ 74	67/ 8/ 65	100/ 6/ 22
*Agropyron elongata**	71/ 3/ 16	100/ 7/ 36	100/ 2/ 15	50/ 4/ 22
*Agropyron smithii**	57/ 1/ 9	86/ 1/ 11	100/ 3/ 38	100/ 1/ 20
Agropyron spicatum	14/tr/ 1[2/]	-	-	-
Agropyron spp.*	14/tr/ 1	100/ 1/ 16	67/ 5/ 42	100/ 2/ 75
*Bromus inermis**	100/16/ 61	100/14/ 56	100/ 8/ 58	100/ 9/ 52
Bromus tectorum	100/ 8/ 35	100/10/ 39	100/ 5/ 35	100/ 3/ 27
*Dactylis glomerata**	43/ 4/ 11	86/ 4/ 26	100/10/ 52	50/ 1/ 2
*Lolium multiflorum**	14/tr/ 1	57/tr/ 4	67/ 9/ 38	-
*Poa compressa**	86/ 1/ 8	43/tr/ 4	67/ 1/ 13	100/ 2/ 15
*Sporobolis airoides**	-	29/tr/ 1	33/tr/ 3	50/ 1/ 7
*Stipa viridula**	57/tr/ 4	14/tr/ 1	-	-
Triticum spp.*	-	-	33/ 1/ 12	50/ 2/ 25
Unidentified Grasses	14/tr/ 1	29/tr/ 1	-	-
TOTAL GRASSES	100/86/100	100/55/ 99	100/45/ 97	100/25/ 97
FORBS:				
Achillea millefolium	14/tr/ 1	-	-	-
Artemisia frigida	29/tr/ 2	-	-	-
Artemisia ludoviciana	-	14/tr/ 1	-	-
Astragalus spp.*	43/tr/ 2	14/tr/ 1	-	-
Atriplex spp.*	14/ 1/ 1	43/ 1/ 4	33/ 1/ 7	50/tr/ 2
CHENOPODIACEAE	-	-	33/tr/ 2	-
Cirsium arvense	-	14/tr/ 1	-	-
CRUCIFERAE	29/ 1/ 6	14/tr/ 1	67/tr/ 7	100/ 1/ 15
Kochia scoparia	-	29/tr/ 2	33/tr/ 2	100/36/ 95
Lactuca serriola	14/tr/ 1	14/tr/ 1	-	50/ 1/ 7
*Melilotus officinalis**	100/17/ 86	100/12/ 69	100/ 7/ 70	100/ 4/ 55
Salsola kali	-	57/ 8/ 24	67/13/ 52	100/15/ 50
Taraxicum officinale	-	43/tr/ 3	-	-
TOTAL FORBS	100/19/ 91	100/22/ 84	100/20/ 80	100/55/100
TREES AND SHRUBS:				
Pinus ponderosa(live)	-	14/tr/ 1	33/tr/ 2	-
Pinus ponderosa(dead)	-	14/tr/ 1	-	-
Symphoricarpos spp.	43/tr/ 2	-	-	-
TOTAL SHRUBS	43/tr/ 2	14/tr/ 1	33/tr/ 2	-
Bare Ground	100/12/ 74	100/47/ 96	100/50/100	100/34/ 92
Rock	100/ 4/ 30	100/24/ 82	100/15/ 97	100/ 6/ 77
Lying Litter	100/69/ 99	100/33/ 92	100/25/100	100/28/ 67
Standing Litter	86/26/ 74	100/20/ 68	33/ 3/ 22	50/ 1/ 7

1/ Constancy (percent occurrence among sites)/canopy coverage (percent of area covered)/frequency (percent occurrence among plots).
2/ tr - trace (a value less than .5 percent).
* Included in the seed mixture used at the test pit.

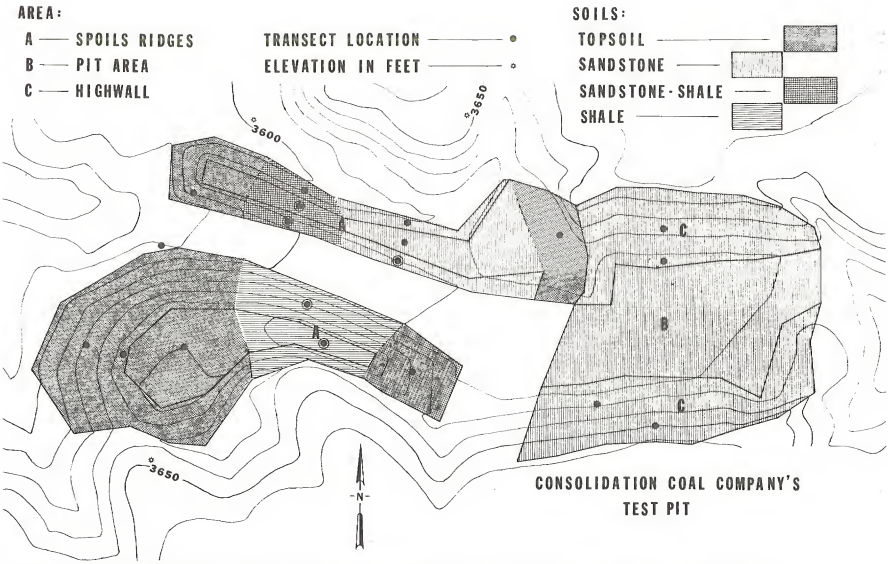


Figure 9. Map of Consol's test pit showing respective areas, soil mixtures and location of 19 permanent vegetational analysis sites.

an annual, was the most abundant forb on sandstone-shale sites. On shale sites, where forbs were the dominant forage class, summer cypress *(Kochia scoparia)* was the most abundant forb, followed by Russian thistle. Saltbush *(Atriplex* spp.*)* occurred on more sites and in a greater percent of the plots on sandstone and sandstone-shale than on other soil mixtures.

Ponderosa pine seedlings occurring in plots on sandstone and sandstone-shale sites resulted from the planting during April 1975. Snowberry, a native shrub, occurred only on topsoiled sites.

Gradient

When the 1975 data were evaluated by gradient, regardless of soil mixture or exposure, sites varying from 2.5:1 to 3:1 (medium) exhibited the greatest canopy of grasses and residual vegetation, whereas sites varying from 1.25:1 to 2:1 (steep) exhibited the lowest (Table 29). Crested wheatgrass was the most abundant grass on all classes of gradient, followed by smooth brome. Ryegrass exhibited a decrease in canopy on steep slopes from 1974 to 1975.

Yellow sweetclover was by far the most abundant forb on medium and nearly level gradients. Russian thistle and summer cypress, both annuals, were the most abundant forbs on steep slopes. Saltbush was abundant on medium slopes.

Exposure

Slopes having a northerly exposure exhibited a greater canopy of grasses and residual vegetation and a lesser canopy of forbs than did southerly exposures (Table 30). Both yellow sweetclover and Russian thistle were more abundant on southerly exposures than on northerly exposures. All of this perhaps reflects more xeric conditions on southerly exposures resulting from longer periods of direct sunlight throughout the year.

Use by Wildlife

Mule deer were the only game species known to have used the disturbed site to any extent since it was seeded during 1972. Deer were not actually observed within the enclosure during the report period, although tracks and pellet groups indicated their presence. Yellow sweetclover, an important item in the summer diet of deer, was abundant on the site during summer 1975, although not as abundant as it was during summer 1973. During winter 1975-76, saltbushes which occurred primarily on sandstone and sandstone-shale sites appeared to be the major item on the disturbed site used by mule deer. Nearly all the annual leader growth was utilized on some plants. During late January and February 1976 there was no evidence of deer using the site following fresh snowfall, suggesting that the area may not have been used by deer during late winter. Little or no evidence of deer was observed on topsoiled sites.

Table 29. Constancy, canopy coverage, and frequency of low-growing vegetation on various classes of gradient on spoils material as determined by examination of 20 2x5 decimeter plots on each of 19 sites at Consol's test pit.

Taxa	Slope 1.25:1-2:1 6 Sites	2.5:1-3:1 7 Sites	Nearly Level 6 Sites
GRASSES:			
*Agropyron cristatum**	83/14/ 48[1/]	100/47/ 90	100/41/ 77
*Agropyron elongata**	83/ 2/ 19	71/ 6/ 31	100/ 5/ 20
*Agropyron smithii**	100/ 1/ 20	57/ 1/ 6	83/ 2/ 23
Agropyron spicatum	17/tr/ 1[2/]	-	-
Agropyron spp.*	67/ 3/ 26	71/ 1/ 9	50/ 1/ 14
*Bromus inermis**	100/10/ 53	100/19/ 66	100/ 9/ 53
Bromus tectorum	100/ 7/ 50	100/12/ 38	100/ 3/ 18
*Dactylis glomerata**	100/ 6/ 33	43/tr/ 4	67/ 8/ 33
*Lolium multiflorum**	67/ 3/ 12	14/tr/ 1	33/ 1/ 12
*Poa compressa**	67/ 1/ 10	57/tr/ 4	83/ 1/ 11
*Sporobolis airoides**	33/ 1/ 4	14/tr/ 1	17/tr/ 1
*Stipa viridula**	-	43/tr/ 2	33/tr/ 2
Triticum spp.*	33/ 1/ 14	-	-
Unidentified Grasses	17/tr/ 1	29/tr/ 1	17/tr/ 2
TOTAL GRASSES	100/44/ 96	100/76/100	100/62/100
FORBS:			
Achillea millefolium	-	-	17/tr/ 1
Artemisia frigida	17/tr/ 1	-	17/tr/ 2
Artemisia lucoviciana	-	14/tr/ 1	-
Astragalus spp.*	-	14/tr/ 1	50/ 1/ 2
Atriplex spp.*	17/tr/ 3	43/ 2/ 4	33/tr/ 2
CHENOPODIACEAE	-	-	17/tr/ 1
Cirsium arvense	-	14/tr/ 1	-
CRUCIFERAE	67/ 1/ 12	14/tr/ 1	33/tr/ 3
Kochia scoparia	33/ 9/ 17	-	50/ 4/ 17
Lactuca serriola	17/tr/ 2	29/tr/ 1	-
*Melilotus officinalis**	100/ 6/ 46	100/15/ 84	100/16/ 90
Salsola kali	50/13/ 35	29/tr/ 6	50/ 7/ 28
Taraxicum officinale	17/tr/ 1	29/tr/ 2	-
TOTAL FORBS	100/29/ 75	100/18/ 91	100/26/ 97
TREES AND SHRUBS:			
Pinus ponderosa (live)	33/tr/ 2	-	-
Pinus ponderosa (dead)	17/tr/ 1	-	-
Symphoricarpos spp.	-	14/tr/ 1	33/tr/ 2
TOTAL	33/tr/ 2	14/tr/ 1	33/tr/ 2
Bare Ground	100/45/ 97	100/27/ 82	100/29/ 85
Rock	100/21/ 89	100/14/ 54	100/ 5/ 45
Lying Litter	100/30/ 95	100/54/ 99	100/47/ 86
Standing Litter	83/ 6/ 40	86/25/ 72	67/20/ 54

1/ Constancy (percent occurrence among sites)/canopy coverage (percent of area covered)/frequency (percent occurrence among plots).
2/ tr - trace (a value less than .5 percent).
* Included in the seed mixture used at the test pit.

Table 30. Constancy, canopy coverage, and frequency of low-growing vegetation on northerly and southerly exposures on spoils material as determined by examination of 20 2x5 decimeter plots on each of 14 sites at Consol's test pit.

Taxa	Exposure: Northerly 8 Sites	Exposure: Southerly 6 Sites
GRASSES:		
*Agropyron cristatum**	100/34/ 81[1/]	83/30/ 62
*Agropyron elongata**	75/ 4/ 22	100/ 5/ 28
*Agropyron smithii**	75/ 1/ 12	100/ 1/ 19
Agropyron spicatum	-	17/tr/ 2[2/]
Agropyron spp.	50/ 1/ 13	67/ 3/ 18
*Bromus inermis**	100/17/ 57	100/11/ 57
Bromus tectorum	100/14/ 54	100/ 3/ 29
*Dactylis glomerata**	62/ 6/ 24	100/ 3/ 18
*Lolium multiflorum**	25/ 3/ 8	50/tr/ 2
*Poa compressa**	87/ 1/ 9	33/tr/ 5
*Sporobolis airoides**	25/tr/ 3	17/tr/ 1
*Stipa viridula**	25/tr/ 1	17/tr/ 1
Triticum spp.*	12/ 1/ 6	17/ 1/ 6
Unidentified Grasses	25/tr/ 1	17/tr/ 1
TOTAL GRASSES	100/73/ 99	100/49/ 97
FORBS:		
Achillea millefolium	-	-
Artemisia frigida	-	17/tr/ 1
Artemisia lucoviciana	-	17/tr/ 2
Astragalus spp.*	25/tr/ 1	17/tr/ 1
Atriplex spp.*	12/tr/ 2	33/ 1/ 3
CHENOPODIACEAE	-	-
Cirsium arvense	12/tr/ 1	-
CRUCIFERAE	12/tr/ 2	50/ 1/ 9
Kochia scoparia	12/ 7/ 12	17/tr/ 2
Lactuca serriola	12/tr/ 2	17/tr/ 1
*Melilotus officinalis**	100/ 9/ 59	100/15/ 84
Salsola kali	12/ 1/ 2	67/13/ 40
Taraxicum officinale	37/tr/ 2	-
TOTAL FORBS	100/18/ 76	100/30/ 98
TREES AND SHRUBS:		
Pinus ponderosa (live)	-	33/tr/ 2
Pinus ponderosa (dead)	-	17/tr/ 1
Symphoricarpos spp.	25/tr/ 2	-
TOTAL SHRUBS AND TREES	25/tr/ 2	33/tr/ 2
Bare Ground	100/21/ 82	100/48/ 97
Rock	100/14/ 56	100/19/ 87
Lying Litter	100/59/ 97	100/30/ 96
Standing Litter	100/27/ 78	83/12/ 52

1/ Constancy (percent occurrence among sites)/canopy coverage (percent of area covered)/frequency (percent occurrence among plots).
2/ tr - trace (a value less than .5 percent).
* Included in the seed mixture used at test pit.

Square Deal Mine

This site, a gentle southerly exposure, was seeded during the late winter-early spring period of 1974. A layer of topsoil had been placed over the spoils prior to seeding.

Vegetational Analysis

Vegetational cover was evaluated during July 1975 at each of three permanent sites: one at the bottom of the slope, one at mid-slope and one near the top. Each was evaluated by a canopy coverage method described previously. Data from the three sites were averaged and appear in Table 31.

Forbs and grasses exhibited a canopy of 58 and 46 percent, respectively, during 1975. The canopy of both forage classes more than doubled over the previous year (Table 31). Yellow sweetclover was by far the most abundant forb. The canopy of annual forbs, which included Russian thistle as well as other members of the goosefoot family (CHENOPODIACEAE), decreased from 1974 to 1975. Western wheatgrass and unidentified wheatgrasses showed a marked increase in canopy from 1974 to 1975 (Table 31). Both green needlegrass *(Stipa viridula)* and needle-and-thread *(S. comata)* occurred in plots on this disturbed site for the first time during 1975.

Table 31. Constancy, canopy coverage and frequency of low-growing vegetation on a gently sloping southeast exposure as determined by examination of 20 2x5 decimeter plots on each of three sites at the Square Deal Mine.

Taxa	3 Topsoiled Sites July 1974	July 1975
GRASSES:		
Agropyron smithii	100/13/ 92[1/]	100/24/100
Agropyron spp.	100/10/ 73	100/14/ 67
Stipa comata	-	67/ 2/ 7
Stipa viridula	-	100/ 3/ 27
TOTAL GRASSES	100/20/100	100/46/100
FORBS:		
Atriplex spp.	67/ 1/ 12	100/ 5/ 28
CHENOPODIACEAE	100/ 4/ 17	67/ 1/ 7
Kochia scoparia	-	33/tr/ 2[2/]
Lappula redowskii	33/tr/ 2	-
Medicago sativa	33/ 4/ 23	-
Melilotus officinalis	100/ 8/ 77	100/52/ 93
Salsola kali	100/ 9/ 23	100/ 3/ 30
Unidentified Forbs	67/tr/ 5	-
TOTAL FORBS	100/24/ 98	100/58/100
Bare Ground	100/81/100	100/54/100
Rock	100/ 2/ 12	100/ 2/ 22
Lying Litter	-	100/16/ 97
Standing Litter	-	100/ 5/ 57

1/ Constancy (percent occurrence among sites)/canopy coverage (percent of area covered)/frequency (percent occurrence among plots).
2/ tr - trace (a value less than .5 percent).

SUMMARY AND DISCUSSION

1. Seasonal use by mule deer of the grassland and agricultural types, combined, varied from 58 to 84 percent throughout the report period with these extremes occurring during winter and fall, respectively. All subtypes within the two types received considerable use. The ponderosa pine-grassland type received its greatest use during winter and summer which was confined to the ponderosa pine-bunchgrass subtype almost exclusively. The sagebrush-grassland type received considerably less use during winter 1975-76 than during previous winters. Differences in relative use of vegetation types between years appeared related to climatological differences. Relative use of the various topographical features appeared related to preferences for vegetation types. Since most observations were made when deer were active and feeding, it was assumed that these seasonal patterns were related to changes in preference for forage.

Mule deer fawn production has been comparatively poor since the study was initiated during 1972. Production during this report period was no exception. Evaluation of winter browse species during previous years did not indicate heavy use of silver sagebrush and skunkbush sumac, important winter browse species. Rubber rabbitbrush showed extremely heavy use during the past 3 years, but this species is not widely distributed in the Bull Mountains. As compared to elk, mule deer have rather limited mobility and are less able to avoid unfavorable habitat conditions. This may partially explain low fawn production.

2. The grassland type received considerable use by elk throughout the report period, but was by far the most important type during spring and winter. Except during fall, the grassland park subtype accounted for nearly all of the use within this type. The agricultural type was important during summer and fall, but received no observed use during winter. The heavy use of that type by elk during summer may have resulted from such areas being devoid of livestock during that period. The ponderosa pine-grassland type received considerable use during summer, fall and winter. Over 90 percent of the elk observed throughout the report period, except during fall, occurred within 300 feet of the nearest stand of timber, perhaps

reflecting the importance of timber as escape cover. As with mule deer, the relative use of topographical features was related to seasonal preferences for vegetation types.

Elk exhibited considerable mobility, moving an average of 6 miles from summer to winter home ranges. Home ranges were larger during winter than during summer. Livestock appeared to be a major factor influencing distribution of elk within their seasonal herd ranges. The mobility of cow elk perhaps allowed them to seek out the most favorable habitat conditions. Evaluation of fall food habits suggested that elk forage among a wider range of vegetation than do mule deer. The major difference was reflected by the greater amount of grass in the fall diet of elk. This would perhaps allow elk to be more adaptive in their feeding habits than deer. This mobility and adaptability may account for the good calf production of elk.

3. Over 50 percent of the seasonal use of vegetation types by turkeys occurred on the grassland type during spring, summer and fall of this report period. The grassland park and drainageway subtypes accounted for all of the use in that type. Use of the agricultural type increased throughout the report period and accounted for the greatest use among types during winter 1975-76. The ponderosa pine-grassland received considerable use during all seasons except fall. Except during winter, nearly all observations of turkeys occurred within 300 feet of the nearest stand of timber, reflecting the importance of timber as escape cover. Seasonal use of topographical features also reflected seasonal preferences for vegetation types.

4. The study area provided primarily spring and summer habitat for antelope. During winter antelope were observed on the margins of the study area where big sagebrush was abundant.

The Bull Mountains ecosystem appeared to provide only marginal habitat for white-tailed deer and sharp-tailed grouse. One important limiting factor may be the lack of suitable deciduous tree/shrub cover in the drainages.

5. During 1975 at Consol's test pit, grasses exhibited an increase in canopy over previous years, with crested wheatgrass showing the most marked increase, followed by smooth brome. The forb cover appeared inversely related to that of grasses when data were evaluated by soil mixture, gradient and exposure. The canopy of yellow sweetclover increased from 1974 but did not occur in the abundance observed during 1973, especially on topsoiled sites. As the canopy of grasses continues to increase while that of forbs decreases, the habitat value, as it concerns mule deer, will perhaps decrease also. Systematic grazing by livestock may reverse this trend.

6. At the square Deal Mine, forbs were the most abundant forage class during 1975. Yellow sweetclover was the most abundant forb as well as the most abundant single species on the disturbed area. The relative

abundance of grasses and forbs during 1975 was similar to that exhibited on topsoiled portions of Consol's test pit during summer 1973. The two summers represented the second growing season following seeding on the respective areas. Western wheatgrass and green needlegrass, important range grasses in the Bull Mountains, were more abundant at the Square Deal Mine during summer 1975 than they were at Consol's test pit during summer 1973. Crested wheatgrass was not used in the seed mixture at the Square Deal Mine.

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