



Range relationships of elk and cattle on elk winter range, Crow Creek, Montana
by Floyd Albert Gordon

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE in Fish and Wildlife Management
Montana State University
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Abstract:

A study of food habits, range distribution, forage utilization, and interspecific relations of elk and cattle was made in 1967-1968 on 50 square miles -of the Crow Creek drainage, Elkhorn Mountains, Montana which was used by elk in winter and cattle in summer. The history of past elk and cattle use of the area was described, A description of the physiography and vegetation was given. One vegetation zone, the Fescue-Wheat-grass Zone, was composed of four types: Juniper-Fescue-Whea'tgrass, Fescue-Wheatgrass, Sagebrush, and Aspen-Willow. During 10 aerial and 37 ground observation trips, 4,077 observations of individual elk in 266 separate groups on the study area were recorded. All elk recorded during winter were on the Fescue-Wheatgrass Zone. Ninety percent remained through late winter and early spring. By mid-May in 1968 the majority of elk,had moved off this zone to the Douglas-fir Zone. During the same period in 1967 the Fescue-Wheatgrass Zone received 100 percent of the elk use.

Major concentrations of elk were noted: 130 animals north of Crow Creek, 175 south of Crow Creek, and 85 in the vicinity of Keating and Johnny Gulches. The majority of adult and yearling males were observed north of Crow Creek. Use of the Fescue-Wheatgrass Zone by cattle was described.

Elk food habits were determined by examination of 41 sites recently vacated by feeding elk. Forage availability was determined in March. The winter diet was made up of 72 percent grasses and 28 percent forbs. First use of new growth of forbs was noted during late May. Examination of 76 feeding sites recently vacated by cattle indicated that grasses made up 62 percent and forbs 38 percent of the summer diet. The forage species most. preferred by cattle were indicated. Two methods, use of agronomy cages and determination of percent of ungrazed grasses were used to determine forage and bunchgrass utilization, respectively on key elk winter ranges. Factors other than the influence of grazing animals apparently affected the values obtained by the use of agronomy cages, Agropyron spicatum made up a significant portion of elk and cattle diets. Under conditions of heavy snow cover elk were dependent on this grass. Results from measurements of bunchgrass utilization on areas used in common by both animals indicated two areas where potential or severe interspecific competition for Agropyron spicatum existed. Use on other areas did not appear excessive.

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FLOYD ALBERT GORDON

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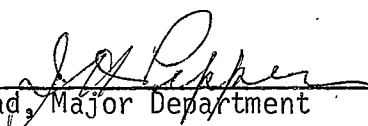
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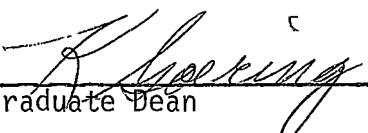
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ABSTRACT

A study of food habits, range distribution, forage utilization, and interspecific relations of elk and cattle was made in 1967-1968 on 50 square miles of the Crow Creek drainage, Elkhorn Mountains, Montana which was used by elk in winter and cattle in summer. The history of past elk and cattle use of the area was described. A description of the physiography and vegetation was given. One vegetation zone, the Fescue-Wheatgrass Zone, was composed of four types: Juniper-Fescue-Wheatgrass, Fescue-Wheatgrass, Sagebrush, and Aspen-Willow. During 10 aerial and 37 ground observation trips, 4,077 observations of individual elk in 266 separate groups on the study area were recorded. All elk recorded during winter were on the Fescue-Wheatgrass Zone. Ninety percent remained through late winter and early spring. By mid-May in 1968 the majority of elk had moved off this zone to the Douglas-fir Zone. During the same period in 1967 the Fescue-Wheatgrass Zone received 100 percent of the elk use. Major concentrations of elk were noted: 130 animals north of Crow Creek, 175 south of Crow Creek, and 85 in the vicinity of Keating and Johnny Gulches. The majority of adult and yearling males were observed north of Crow Creek. Use of the Fescue-Wheatgrass Zone by cattle was described. Elk food habits were determined by examination of 41 sites recently vacated by feeding elk. Forage availability was determined in March. The winter diet was made up of 72 percent grasses and 28 percent forbs. First use of new growth of forbs was noted during late May. Examination of 76 feeding sites recently vacated by cattle indicated that grasses made up 62 percent and forbs 38 percent of the summer diet. The forage species most preferred by cattle were indicated. Two methods, use of agronomy cages and determination of percent of ungrazed grasses were used to determine forage and bunchgrass utilization, respectively on key elk winter ranges. Factors other than the influence of grazing animals apparently affected the values obtained by the use of agronomy cages. *Agropyron spicatum* made up a significant portion of elk and cattle diets. Under conditions of heavy snow cover elk were dependent on this grass. Results from measurements of bunchgrass utilization on areas used in common by both animals indicated two areas where potential or severe interspecific competition for *Agropyron spicatum* existed. Use on other areas did not appear excessive.

INTRODUCTION

The elk (*Cervus canadensis nelsoni*) herd that winters on the Crow Creek drainage, Helena National Forest, West-central Montana, has been subject to controversy since the initial stocking of elk on this area in 1939. In the early 1940's range damage attributed to elk was reported by certain ranchers on some areas adjacent to the forest boundary (Montana Fish and Game Department, 1941-1952). Most of the herd presently winters within the National Forest.

Prior to the creation of Helena National Forest in 1906, Crow Creek drainage was utilized as free range for livestock. By 1948 the Forest Service had stabilized cattle numbers at approximately 1,240 for four to four and one-half months in the spring and summer (USDA, Forest Service, 1921-1968).

In the early 1960's elk numbered about 400 head (Stevens, 1966). Controversy developed over the range relationships of elk and cattle within the National Forest. An investigation of these relationships by Stevens (1966) did not indicate significant interspecific competition on spring and summer ranges but suggested that conditions which would increase cattle use on key elk wintering areas would be detrimental to elk. His study was primarily concerned with elk spring and summer ranges.

In 1967 I began an intensive study of elk winter range on National Forest land south of Crow Creek. Full time field studies were conducted during the summer of 1967 in conjunction with part time studies in the spring of 1967 and the winter of 1968. Supplementary data were col-

lected in autumn of 1967 and spring and summer of 1968. The main objectives were the determination of seasonal food habits, forage utilization, range distribution and interspecific relations of elk and cattle.

DESCRIPTION OF THE STUDY AREA

The general physiography of the Elkhorn Mountains, West-central Montana, was reviewed by Stevens (1966). The study area (Figure 1), located on the mountain's southeast slope, eight miles west of Townsend is confined to 50 square miles of rolling foothills within the Crow Creek drainage. Elevations range from 5,200 feet on Crow Creek to over 7,000 feet on the prominent ridges. The substratum, primarily sedimentary and volcanic in origin, is exposed as isolated rock outcrops along ridges and valley sides. Several small granitic intrusions are located south of Crow Creek. Klepper *et al.* (1957) reported evidence of two Pleistocene glaciation stages.

Average annual temperature at Townsend (elevation, 3,800 feet) is 43.1° F. Normal annual precipitation is approximately 11 inches. Precipitation appears to be greater on the study area. Depth of snow varies with elevation. Southern slopes and ridges are generally bare during winter and spring.

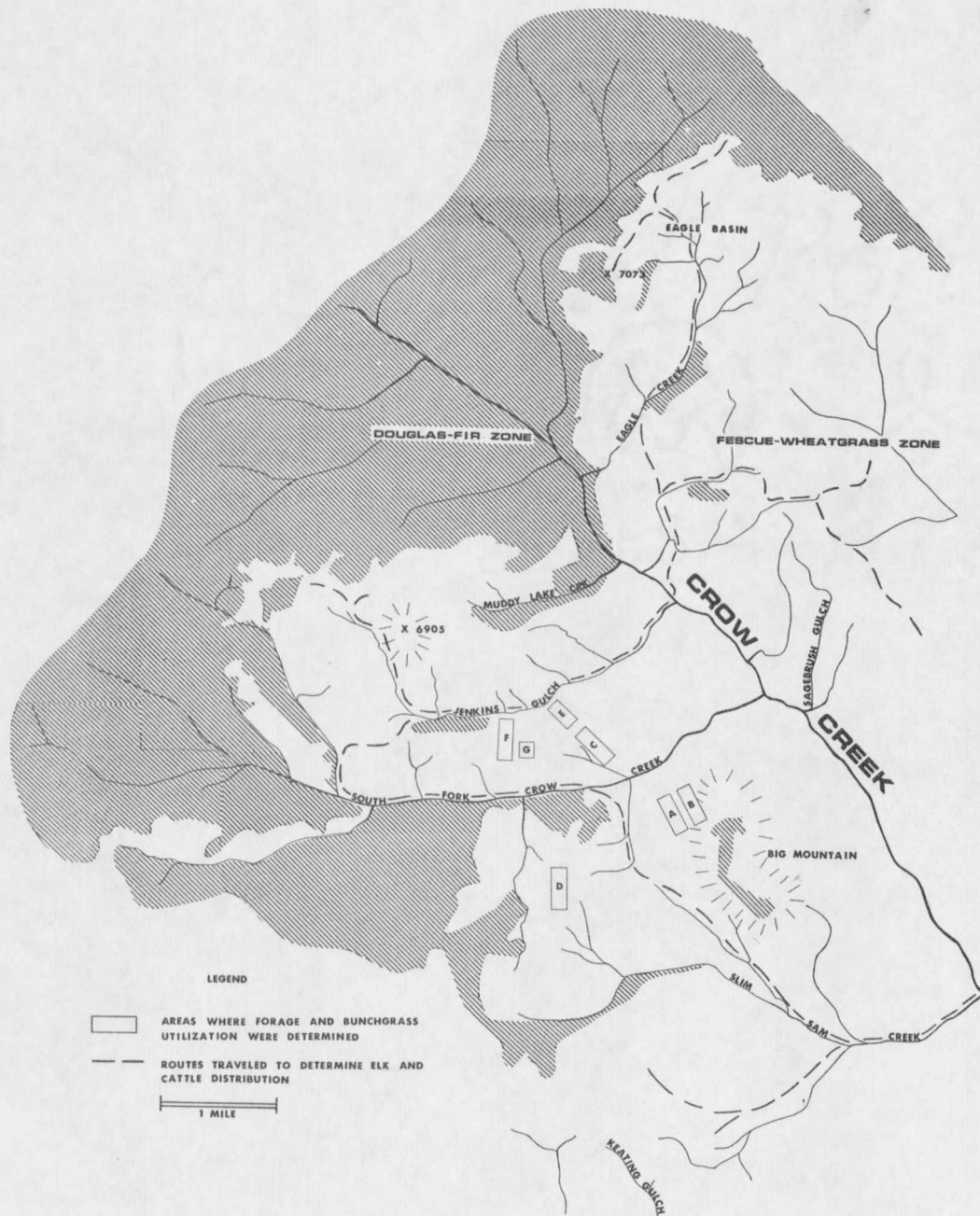


Figure 1. Map of the Crow Creek Study Area. (Modified from Stevens, 1966).

METHODS

Vegetation

I obtained quantitative data on the canopy coverages and frequencies of grasses, forbs and low-growing shrubs using the technique described by Daubenmire (1959). Twenty 2 x 5 decimeter plots, five paces apart, along a line were considered a sample unit. Each sample unit was placed within a representative stand of a vegetation type or subtype. Within each plot percent canopy coverage of individual plant species was estimated according to the following classes: Class 1 = 0-5 percent; Class 2 = 5-25 percent; Class 3 = 25-50 percent; Class 4 = 50-75 percent; Class 5 = 75-95 percent; and Class 6 = 95-100 percent. The midpoints of each class were used to calculate the average percent canopy coverage for each taxon on all plots in a sample unit.

Trees and tall shrubs were not quantitatively studied. Plant identification was verified by W. E. Booth. Scientific and common names follow Booth (1950) and Booth and Wright (1959).

Distribution

I systematically covered routes (Figure 1) within the study area with a vehicle or by foot generally on a weekly basis. I served as the observer during each of ten flights over the area in a fixed-wing aircraft. Elk and cattle observed with the aid of a 15X spotting scope and/or 7X binoculars were recorded as to numbers, time of observation, sex, age, behavior, and location relative to geographic areas, vegetation type, and slope exposure.

Aerial photographs and a topographic map were used to plot locations of animals. Observations were between April 1 and June 17, 1967 and January 9 and April 1, 1968 for elk and from June 10 to October 15, 1967 for cattle.

Food Habits

I determined the food habits of elk and cattle through examination of feeding sites recently vacated by feeding animals following the method of Cole (1956) and others. One bite on an individually rooted grass or forb stem, shrub leader, or bunchgrass plant was considered one instance of use. The aggregate percentage method described by Martin *et al.* (1946) was used to evaluate data. Instances of use for each food item was expressed as a percent of total use on each site. Percentages for all sites were averaged according to vegetation type or subtype and season of use.

To help evaluate food preferences, the canopy coverage (availability) of each plant species was estimated within five or ten 2 x 5 decimeter plots spaced along a line transect on each of several selected feeding sites in March for elk and during all summer months for cattle. Availability was compared with usage values.

Utilization

I determined utilization of bunchgrass by two techniques: use of agronomy cages and the ungrazed plant method. The agronomy cages which were approximately four feet square (Figure 2) and similar to those de-



Figure 2. An Agronomy Cage Placed on an Idaho Fescue Subtype North of South Fork Crow Creek.

scribed by Stevens (1966), were placed on key elk spring and winter ranges to protect the vegetation from grazing animals. Placement was prior to the use of the ranges by elk in winter and spring and by cattle in summer.

Following seasonal use by the respective animals an equal number of .96 square foot plots were selected within and outside each agronomy cage. Vegetation on each plot was clipped at ground level, sub-divided into grasses and forbs, and allowed to air dry before being weighed in grams. Utilization was calculated by finding the difference between the average weights of the unprotected and protected vegetation and expressing this figure as a percent.

Data obtained through the use of agronomy cages were supplemented by the ungrazed plant method. This method was also used on certain areas not sampled with the agronomy cages. It consisted of sampling 100 bunchgrass plants along a paced transect to find the percent of ungrazed plants. A utilization chart (Cole, 1963) was used to express percent of grazed plants as percent utilization. *Agropyron spicatum*, *Festuca idahoensis*, and *Festuca scabrella* were used as key species.

VEGETATION

The vegetation of the study area, described as part of the grass-land formation by Daubenmire (1943), was represented by the Fescue-Wheatgrass Zone (Stevens, 1966). There is interfingering between this zone and the adjacent Douglas-fir Zone (Figure 1) which typically occurs at higher elevations due to irregular terrain.

Fescue-Wheatgrass Zone

The Fescue-Wheatgrass Zone is composed of four types: Juniper-Fescue-Wheatgrass; Fescue-Wheatgrass; Sagebrush; and Aspen-Willow. The most prominent type south of Crow Creek is the Fescue-Wheatgrass Type. North of Crow Creek the Fescue-Wheatgrass and the Juniper-Fescue-Wheatgrass Types are important. Distribution of the Aspen-Willow Type is restricted.

Quantitative data on the vegetation characteristics for three of the types are shown in Table I.

FESCUE-WHEATGRASS TYPE

The Fescue-Wheatgrass Type was sub-divided into three subtypes. These are apparently related to slope exposure and soil moisture content.

Bluebunch Wheatgrass Subtype: This subtype (Figure 3), dominated by *Agropyron spicatum* (bluebunch wheatgrass), occurs on xeric southern exposures. It characteristically presents a bunchgrass appearance. *Festuca idahoensis* (Idaho fescue) shows local dominance on the upper slopes. *Koeleria cristata* (Junegrass) and *Poa secunda* (Sandberg bluegrass) are other common grasses. *Erigeron caespitosus* (tufted fleabane), *Artemisia*

TABLE I. CANOPY COVERAGES AND FREQUENCIES OF TAXA FOR GRASSES, FORBS AND LOW-GROWING SHRUBS ON THE FESCUE-WHEATGRASS ZONE AS DETERMINED BY MEASUREMENTS WITHIN TWENTY 2 X 5 DECIMETER PLOTS ON EACH OF TWENTY-FIVE STANDS.

Taxa ^{1/}	Fescue-Wheatgrass Type			Sagebrush	Aspen-Willow
	Bluebunch	Idaho Fescue-	Idaho	Type	Type
	Wheatgrass	Rough Fescue	Fescue		
	Subtype	Subtype	Subtype		
	5 Stands	4 Stands	7 Stands	3 Stands	6 Stands
GRASS AND GRASSLIKE PLANTS					
<i>Agropyron smithii</i>	-	-	-	-	1/18
<i>Agropyron spicatum</i>	28/96 ^{2/}	7/43	11/66	7/40	-
<i>Bromus marginatus</i>	-	-	-	-	13/44
<i>Carex</i> spp.	-	1/11	-	-	2/6
<i>Elymus</i> spp.	-	-	-	-	2/10
<i>Festuca idahoensis</i>	20/65	36/100	48/99	8/43	-
<i>Festuca scabrella</i>	-	19/55	-	5/12	-
<i>Koeleria cristata</i>	8/74	1/30	5/59	2/13	-
<i>Poa secunda</i>	7/46	-	1/9	-	-
<i>Poa</i> spp.	-	3/34	-	9/57	68/100
<i>Stipa comata</i>	2/11	-	-	-	-
<i>Stipa</i> spp.	-	-	-	-	1/8
Total Average Cover	65	67	65	31	87
FORBS					
<i>Achillea millefolium</i>	1/8	3/44	1/4	6/42	8/47
<i>Agoseris glauca</i>	1/6	2/14	1/2	3/23	-
<i>Antennaria rosea</i>	1/13	5/55	3/37	-	-
<i>Arenaria congesta</i>	-	2/34	-	-	-
<i>Arnica fulgens</i>	-	-	-	2/13	-
<i>Artemisia frigida</i>	5/41	1/8	1/18	-	-
<i>Astragalus striatus</i>	2/28	5/26	3/34	-	-
<i>Besseyia wyomingensis</i>	-	5/45	-	1/6	-

TABLE I. (CONTINUED).

Taxa	Fescue-Wheatgrass Type			Sagebrush	Aspen-Willow
	Bluebunch	Idaho Fescue-	Idaho	Type	Type
	Wheatgrass Subtype 5 Stands	Rough Fescue Subtype 4 Stands	Fescue Subtype 7 Stands	3 Stands	6 Stands
<i>Crepis modocensis</i>	1/5	-	-	-	-
<i>Cruciferae</i>	-	-	-	1/3	10/38
<i>Delphinium bicolor</i>	-	-	-	1/7	-
<i>Dodecatheon pauciflorum</i>	-	4/46	-	-	-
<i>Douglasia montana</i>	1/9	-	1/11	-	-
<i>Erigeron caespitosus</i>	5/48	2/19	5/39	-	-
<i>Fragaria virginiana</i>	-	-	-	1/7	1/7
<i>Geum triflorum</i>	-	10/43	-	-	-
<i>Lomatium triternatum</i>	-	1/9	-	-	-
<i>Lupinus sericeus</i>	2/12	10/30	1/4	8/40	-
<i>Mertensia</i> spp.	-	-	-	-	7/28
<i>Musineon divaricatum</i>	3/17	1/20	-	-	-
<i>Potentilla</i> spp.	-	3/8	-	-	-
<i>Saxifraga montanensis</i>	-	2/19	-	-	-
<i>Taraxacum</i> spp.	-	4/38	1/9	5/41	70/99
<i>Viola praemorsa</i>	-	-	-	2/27	-
<i>Viola</i> spp.	-	-	-	-	7/21
<i>Zygadenus paniculatus</i>	-	3/31	-	-	-
Total Average Cover	22	63	17	30	103
SHRUBS					
<i>Artemisia tridentata</i>	-	-	-	33/77	-
<i>Chrysothamnus</i>	-	-	-	-	-
<i>viscidiflorus</i>	-	1/8	1/5	-	-
Total Average Cover	-	1	1	33	-

TABLE I. (CONTINUED).

Taxa	Fescue-Wheatgrass Type			Sagebrush	Aspen-Willow
	Bluebunch	Idaho Fescue-	Idaho	Type	Type
	Wheatgrass	Rough Fescue	Fescue		
	Subtype	Subtype	Subtype		
	5 Stands	4 Stands	7 Stands	3 Stands	6 Stands
Litter	54/97	49/73	34/96	75/100	79/96
Mosses	1/19	30/85	24/92	-	-
Soil	20/61	2/14	1/13	4/30	5/17
Rock	11/88	3/33	6/53	-	-

1/ Includes only those with more than one percent average canopy coverage for at least one vegetation type or subtype.

2/ Canopy coverage-mean percent of all plots covered by foliage.
Frequency-mean percent occurrence among plots.

frigida (fringed sagewort), *Musineon divaricatum*, *Lupinus sericeus* (silky lupine) and *Astragalus striatus* (prairie milkvetch) are important forbs.

Idaho Fescue-Rough Fescue Subtype: This subtype (Figure 4) is prevalent on mesic northern exposures and certain drainage basins. *Festuca idahoensis* is the dominant grass. *Festuca scabrella* (rough fescue) shows local dominance on the more mesic sites. Other common grasses are *Agropyron spicatum* and *Poa* spp. (bluegrasses).

The uniform appearance of the vegetation is due to the luxuriant growth of abundant forbs. The most prominent species are *Lupinus sericeus*, *Geum triflorum* (prairiesmoke), *Besseyia wyomingensis* (kittentail), *Antennaria rosea* (rose pussytoes), *Astragalus striatus*, *Dodecatheon pauciflorum* (southern shooting star), and *Taraxacum* spp. (dandelion). *Chrysothamnus viscidiflorus* (green rabbitbrush) is the only important shrub.

Idaho Fescue Subtype: The dominant species, *Festuca idahoensis*, gives a subdued bunchgrass appearance to this subtype (Figure 5) which commonly occurs on ridgetops. Other common grasses are *Agropyron spicatum* and *Koeleria cristata*.

Average canopy coverage of forbs is quite similar to that of the Bluebunch Wheatgrass Subtype and considerably less than in the Idaho Fescue-Rough Fescue Subtype. Important forbs are *Erigeron caespitosus*, *Antennaria rosea*, *Astragalus striatus*, and *Artemisia frigida*. The only common shrub is *Chrysothamnus viscidiflorus*.

SAGEBRUSH TYPE

This type (Figure 6), found primarily along stream drainages and on



Figure 3. Fescue-Wheatgrass Type (Bluebunch Wheatgrass Subtype) in the Fescue-Wheatgrass Zone Near Jenkins Gulch.



Figure 4. Fescue-Wheatgrass Type (Idaho Fescue-Rough Fescue Subtype) in the Fescue-Wheatgrass Zone Near Jenkins Gulch.



Figure 5. Fescue-Wheatgrass Type (Idaho Fescue Subtype) in the Fescue-Wheatgrass Zone Near Jenkins Gulch.



Figure 6. Sagebrush Type, Foreground, and Aspen-Willow Type, Background, in the Fescue-Wheatgrass Zone on Jenkins Gulch.

protected slopes, is interspersed throughout the Fescue-Wheatgrass Zone. *Artemisia tridentata* (big sagebrush) is the dominant plant. *Chrysothamnus nauseosus* (rubber rabbitbrush) is common on certain sites. Important understory grasses include *Poa* spp., *Festuca idahoensis* and *Agropyron spicatum*. *Lupinus sericeus*, *Achillea millefolium* (yarrow), *Taraxacum* spp., and *Agoseris glauca* (pale agoseris) are common forbs.

ASPEN-WILLOW TYPE

Most drainage bottoms and mesic sites are characterized by open or closed stands of *Populus tremuloides* (quaking aspen) and/or *Salix* spp. (willow) (Figure 6). Prominent understory shrubs include *Ribes setosum* (redshoot gooseberry) and *Alnus tenuifolia* (thin leaf alder). *Poa* spp. are the dominant grasses within and adjacent to stands of *Populus* spp. and *Salix* spp. *Bromus marginatus* (mountain brome) is important on scattered sites. *Taraxacum* spp. is the most common forb.

JUNIPER-FESCUE-WHEATGRASS TYPE

This type (Figure 7), dominated by *Juniperus scopulorum* (Rocky Mountain juniper), normally occurs on xeric southern slopes. On some sites *Juniperus scopulorum* is found interspersed with *Pseudotsuga menziesii* (Douglas-fir) and/or *Artemisia tridentata*. There are isolated stands of *Pinus flexilis* (limber pine) and *Purshia tridentata* (antelope bitterbrush) in this type adjacent to the south fork of Crow Creek. The grass-forb understory appears to be a continuation of the Bluebunch Wheatgrass Subtype.

Douglas-fir Zone

The Douglas-fir Zone is represented on the study area by isolated stands of *Pseudotsuga menziesii* (Figure 8) which vary in age. Most of the trees are on north-facing slopes at the upper limits of the Fescue-Wheatgrass Zone.



Figure 7. Juniper-Fescue-Wheatgrass Type in the Fescue-Wheatgrass Zone Near Jenkins Gulch.



Figure 8. Douglas-fir Zone as Represented by an Isolated Stand of Douglas-fir Near Jenkins Gulch.

DISTRIBUTION AND RANGE USE

Elk

I recorded 4,077 observations of individual elk in 266 separate groups on the study area during 10 aerial and 37 ground observation trips.

Aerial observations were used to determine percent distribution of elk within the Fescue-Wheatgrass and Douglas-fir Zones (Table II). During the winter of 1968 all elk recorded were on the Fescue-Wheatgrass Zone. A few animals were observed on the Douglas-fir Zone in late winter and early spring. By mid-May the majority of elk had moved off the Fescue-Wheatgrass Zone and were using snow-free openings within the Douglas-fir Zone. During the same period the previous year continuous snow cover in the Douglas-fir Zone apparently delayed the movement of elk from the Fescue-Wheatgrass Zone.

Distribution of elk within the Fescue-Wheatgrass Zone as determined during ground observations is shown in Table III. During April, 1967, I observed a majority of elk on the Fescue-Wheatgrass Type. These observations may be biased because I was in the process of becoming familiar with the area but the fact that even greater concentrations of elk occurred on this type during the winter months of 1968 suggests my observations for April were indicative of the types used. In May concentrations of elk on the Sagebrush Type were apparently related to the melting of snow and the resulting availability of green grass. The Fescue-Wheatgrass Type, adjacent to the Douglas-fir Zone, was observed to have the greatest use by elk during June.

TABLE II. PERCENT DISTRIBUTION OF ELK ON THE FESCUE-WHEATGRASS ZONE AND ADJACENT DOUGLAS-FIR ZONE BY MONTHS AS DETERMINED DURING AERIAL OBSERVATIONS IN 1967 AND 1968.

Year	Month	Number of Flights	Fescue-Wheatgrass Zone	Douglas-fir Zone	Number Elk Observed
1967	May	1	100	-	187
1968	January	2	100	-	686
	February	2	100	-	533
	March	2	90	10	537
	April	2	92	8	460
	May	1	45	55	200

TABLE III. PERCENT DISTRIBUTION OF ELK WITHIN THE FESCUE-WHEATGRASS ZONE BY MONTHS AS DETERMINED DURING GROUND OBSERVATION TRIPS IN 1967 AND 1968.

Year	Month	Fescue-Wheatgrass Type	Sage-brush Type	Aspen-Willow Type	Juniper-Fescue-Wheatgrass Type	Douglas-fir ^{1/}	No. Elk Observed
1967	April	82	-	-	6	12	178
	May	23	73	-	1	3	312
	June	72	28	-	-	-	43
	April-June	46	45	-	3	6	533
1968	January	94	-	-	-	6	144
	February	100	-	-	-	-	182
	March	87	10	-	-	3	615
	January-March	91	7	-	-	2	933

^{1/} Isolated stands within the Fescue-Wheatgrass Zone.

Elk were not evenly distributed over the Fescue-Wheatgrass Zone. Major groups of concentration were noted (Figure 9). Approximately 130 animals, including 13 adult and 15 yearling males, wintered between Eagle Basin and Sagebrush Gulch north of Crow Creek. Sagebrush Gulch was used primarily during periods of heavy snow cover. Approximately 175 elk wintered south of Crow Creek. Following a storm in early January I observed the majority using the bared ridges on Big Mountain. Increasingly mild temperatures allowed a general movement to the head of Muddy Lake Creek. Extensive use was made of ridges and predominantly southern slopes. Approximately 85 head wintered in the vicinity of Keating and Johnny Gulches adjacent to the southern forest boundary. A marked movement from Keating Gulch to Johnny Gulch during April, 1968, may have been partially related to disturbances created by extensive use of snowmobiles in the area. Few adult or yearling males were observed in either group south of Crow Creek. The lower limit of continuous snow cover appeared to coincide with the upper limit of elk distribution. At no time were elk observed more than one mile from a stand of Douglas-fir.

Cattle

The study area was grazed from June 10 to October 15, 1967 by approximately 1,035 cattle. A rider was employed by the cattle association to distribute the cattle evenly over the range. Areas of concentration are shown in Figure 9.

The range had been divided into two cattle allotments: the North Crow and the South Crow (Figure 9). The South Crow Cattle Allotment,

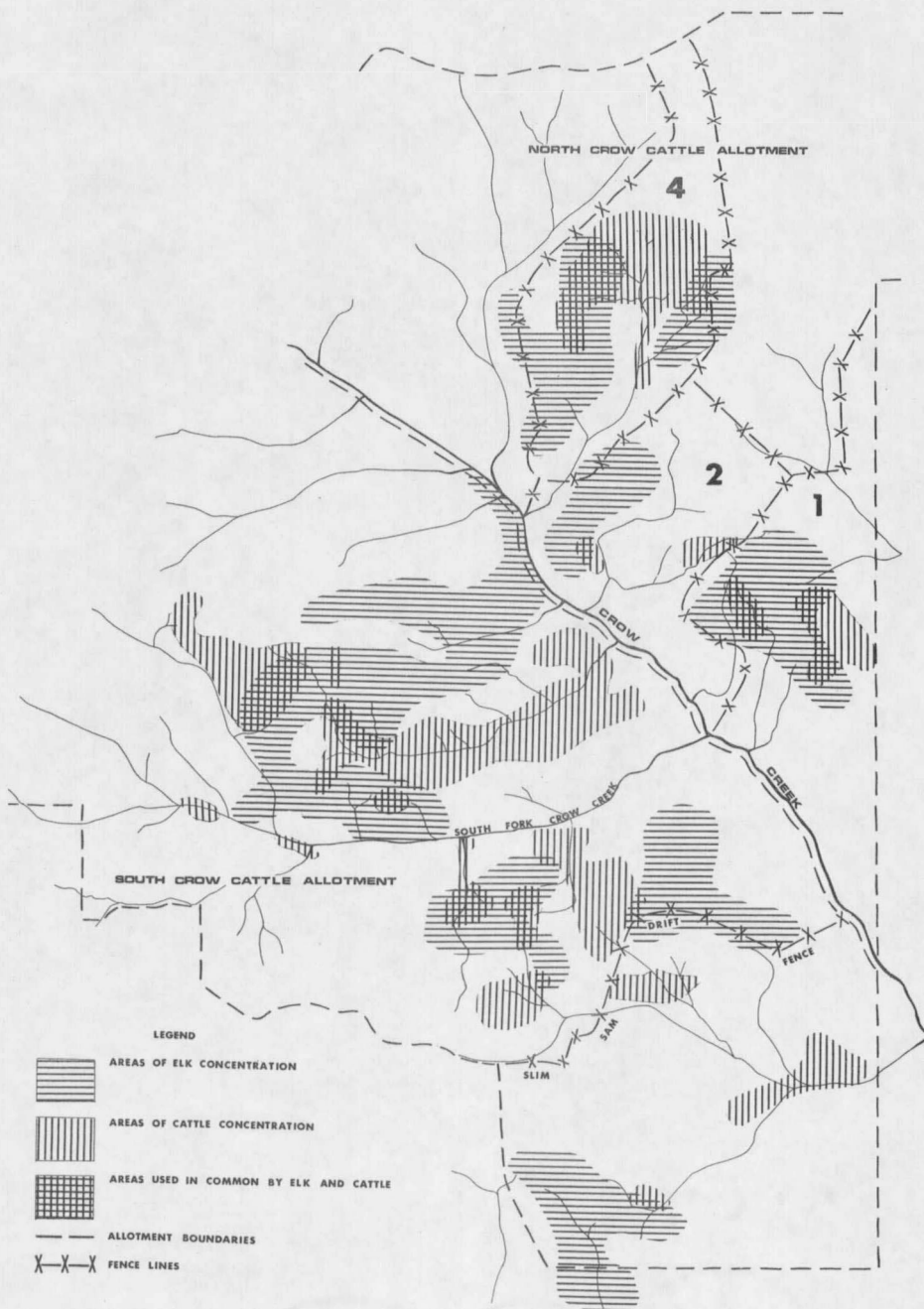


Figure 9. Study Area Showing Areas of Concentration of Elk and Cattle on the North and South Cattle Allotments. (Modified from Stevens, 1966.)

which, in general, was important winter and early spring elk range, was divided into spring and summer ranges for cattle by the Slim Sam "drift" fence. Six-hundred and five cows with calves and approximately eight bulls were placed on the spring range June 10 for about one month. Most used the Sagebrush and Juniper-Fescue-Wheatgrass Types and the Bluebunch Wheatgrass Subtype (Table IV). Cool and cloudy weather allowed them to feed throughout the day.

In mid-July a majority of animals was placed above Slim Sam "drift" fence on the summer range which lies primarily in the Fescue-Wheatgrass Zone and extends into the Douglas-fir Zone. Maximum use was made of slopes in the cooler periods of the day with cattle retiring to the Aspen-Willow Type during mid-day. Due to the availability of lush forbs and grasses most of the use in July occurred on the Aspen-Willow Type and Idaho Fescue-Rough-Fescue Subtype. There was a significant increase in use of the Bluebunch Wheatgrass Subtype in August. This change was correlated with the drying of succulent forbs on the bottoms and north slopes.

During September a pattern of use similar to that of August was observed. In October a decrease in cattle use on the Idaho Fescue-Rough Fescue Subtype was noted with an accompanying increase in use of the Idaho Fescue and Bluebunch Wheatgrass Subtypes.

The North Crow Allotment, located primarily within the Fescue-Wheatgrass Zone, consists of six pastures managed under a rest-rotation system of grazing. Pastures one, two, and four, (Figure 9) used as winter

TABLE IV. PERCENT DISTRIBUTION OF CATTLE BY SEASON AND/OR MONTH ON VEGETATION TYPES AND/OR SUBTYPES AS DETERMINED BY OBSERVATIONS DURING THE SUMMER OF 1967.

Fescue-Wheatgrass Zone										
		Fescue-Wheatgrass Type			Sage-brush Type		Aspen-Willow Type		Juniper-Fescue-Wheatgrass Type	
		1/	2/	3/	Type	Type	Type	Type	Douglas-fir 4/	Percent
SOUTH CROW										
CATTLE ALLOTMENT										
Spring Range:										
June 10-	Cows	31	-	3	30	1	33	2	433 ^{6/}	54
July 10	Calves	34	-	3	27	2	33	t ^{5/}	358	44
	Bulls	46	-	-	23	-	23	8	13	2
	Total	33	-	3	28	2	33	1	804	
Summer Range:										
July 10-31	Cows	7	26	11	14	38	1	3	1,190	55
	Calves	7	26	13	14	36	1	3	959	44
	Bulls	15	8	15	8	46	-	8	13	1
	Total	7	26	12	14	37	1	3	2,162	
August	Cows	42	14	15	2	27	-	t	2,100	53
	Calves	42	14	14	2	27	-	t	1,845	46
	Bulls	18	23	3	5	51	-	t	39	1
	Total	42	14	14	2	27	-	t	3,984	
September	Cows	39	17	15	-	28	t	1	818	53
	Calves	41	16	14	-	28	t	1	717	46
	Bulls	45	35	5	-	15	t	-	20	1
	Total	40	17	14	-	28	t	1	1,555	
October 1-15	Cows	50	3	20	-	26	1	-	343	50
	Calves	46	1	20	-	32	1	-	340	49
	Bulls	14	-	29	-	57	-	-	7	1
	Total	48	2	20	-	29	1	-	690	

TABLE IV. (CONTINUED).

		Fescue-Wheatgrass Zone								
		Fescue-Wheatgrass Type			Sage-brush Type	Aspen-Willow Type	Juniper-Fescue-Wheatgrass Type	Douglas-fir	Percent	
		<u>1/</u>	<u>2/</u>	<u>3/</u>						
NORTH CROW CATTLE ALLOTMENT										
June 10-	Cows	34	11	8	34	12	1	-	894	52
October 15	Calves	31	9	7	39	12	1	-	803	47
	Bulls	<u>16</u>	<u>16</u>	<u>8</u>	<u>48</u>	<u>12</u>	<u>-</u>	<u>-</u>	<u>25</u>	1
	Total	32	11	8	36	12	1	-	1,722	

1/ Bluebunch Wheatgrass Subtype.2/ Idaho Fescue-Rough Fescue Subtype.3/ Idaho Fescue Subtype.4/ Isolated stands within the Fescue-Wheatgrass Zone.5/ t indicates that less than one percent were observed.6/ Total number of cattle observations.

and spring range by elk, were important to this study (Table V).

On June 10, 1967 approximately 7 bulls and 429 cows with calves were placed on pastures one and two. Cattle on pasture two were moved in early July to pasture four for the remainder of the season. In August cattle on pasture one were removed.

The majority of cows observed during the grazing season were on slopes and ridges within the Fescue-Wheatgrass Type (Table IV), principally on the Bluebunch Wheatgrass Subtype. Important use was also observed on the Sagebrush Type, especially during the cool, rainy period of June when use on this type exceeded use on all others. As the days became warmer use of those types other than the Aspen-Willow Type occurred only in the early morning and late evening hours or on cool, cloudy days.

TABLE V. STOCKING RATE ON PASTURES ONE, TWO AND FOUR OF THE NORTH CROW CATTLE ALLOTMENT UNDER THE REST-ROTATION GRAZING SYSTEM DURING THE SUMMER OF 1967.

Pasture	Period	Stocking Rate
1	June 10 - August 10	234 cows
2	June 10 - July 10	195 cows ^{1/}
4	July 10 - October 15	195 cows ^{1/}

^{1/} Same animals for the periods indicated.

FOOD HABITS

Elk

I recorded 9,312 instances of use on 41 feeding sites within the Fescue-Wheatgrass Zone during the winter of 1968 and spring of 1967 (Table VI). During winter all feeding sites were on the Fescue-Wheatgrass Type. Grasses constituted 72 percent, forbs 26 percent, and browse 2 percent of the diet. Three grasses, *Agropyron spicatum*, *Festuca idahoensis*, and *Poa* spp. together made up 66 percent of the diet. Among forbs, *Lupinus sericeus*, and *Artemisia frigida* were significant items. In January *Agropyron spicatum* and *Lupinus sericeus* were used more extensively than other grasses or forbs, respectively, on those sites where low-growing vegetation was covered by crusted snow. Use was on the previous year's growth. *Festuca idahoensis* was apparently preferred when available on ridgetops and where the snow lacked a hard crust. During February, as compared to January, use on *Agropyron spicatum* decreased while use on *Poa* spp. increased. This was apparently related to increased availability of new growth of the latter which became available as the snow melted. *Festuca idahoensis* continued to be an important item in the diet on ridgetops as did *Lupinus sericeus* on snow covered slopes. In March major use of grasses and forbs was on new growth. Among the grasses *Agropyron spicatum* continued to decline in importance as *Poa* spp., *Festuca idahoensis*, and *Koeleria cristata* increased in relative abundance and use. A decrease in snow cover was followed by a significant reduction of *Lupinus sericeus* in the diet.

During the spring of 1967 when feeding sites were examined on the

TABLE VI. FOOD HABITS OF ELK BY VEGETATION TYPE AND MONTH AS DETERMINED FROM 9,312 INSTANCES OF USE ON 41 FEEDING SITES IN THE WINTER OF 1968 AND THE SPRING OF 1967.

Taxa ^{1/}	Fescue-Wheatgrass				Fescue-Wheatgrass		Sagebrush		
	Type				Type		Type	Total Spring	
	Jan.	Feb.	March	Total	April	May	May		
	11 ^{2/} (2518) ^{3/}	5 (1279)	18 (4503)	34 (8300)	2 (164)	2 (410)	3 (438)		
	% of Diet	% of Diet	% of Diet	% of Commun- ity	% of Diet	% of Diet	% of Diet		
GRASS AND GRASSLIKE PLANTS									
<i>Agropyron spicatum</i>	32	20	10	9 ^{4/}	21	8	2	1	5
<i>Carex</i> spp.	1	-	-	-	t	-	-	-	-
<i>Elymus</i> spp.	-	1	-	1	1	-	-	-	-
<i>Festuca idahoensis</i>	25	25	31	7	27	49	3	33	34
<i>Festuca scabrella</i>	t ^{5/}	1	t	1	1	-	48	31	20
<i>Koeleria cristata</i>	1	1	9	1	4	-	-	-	-
<i>Poa</i> spp.	5	18	32	4 ^{5/}	18	t	39	17	14
<i>Stipa comata</i>	-	-	1	* ^{5/}	*	-	-	-	-
Unknown grasses	-	-	t	*	t	t	-	2	1
Total Grasses	64	66	83		72	57	92	84	73
FORBS									
<i>Achillea millefolium</i>	t	1	t	*	t	-	t	1	t
<i>Agoseris glauca</i>	-	-	t	*	t	-	t	t	t
<i>Antennaria rosea</i>	-	-	2	*	1	-	-	-	-
<i>Arenaria congesta</i>	-	-	-	1	-	-	-	-	-
<i>Artemisia frigida</i>	4	7	3	1	5	-	-	-	-
<i>Astragalus striatus</i>	2	t	t	*	1	-	-	-	-
<i>Chrysopsis villosa</i>	2	2	1	*	2	-	-	-	-
<i>Cirsium</i> spp.	-	-	-	-	-	-	2	-	1
<i>Delphinium bicolor</i>	-	-	-	-	-	-	-	2	1
<i>Dodecatheon pauciflorum</i>	-	-	-	-	-	-	3	6	3

TABLE VI. (CONTINUED).

Taxa	Fescue-Wheatgrass				Fescue-Wheatgrass		Sagebrush	Total Spring
	Type				Type		Type	
	Jan.	Feb.	March	Total Winter	April	May	May	
	11 (2518)	5 (1279)	18 (4503)	34 (8300)	2 (164)	2 (410)	3 (438)	7 (1012)
	% of Diet	% of Diet	% of Diet	% of Community	% of Diet	% of Diet	% of Diet	% of Diet
<i>Erigeron caespitosus</i>	5	2	t	t	2	-	-	-
<i>Geum triflorum</i>	-	-	2	1	1	-	-	-
<i>Lupinus sericeus</i>	16	19	8	1	14	-	-	7
<i>Tragopogon dubius</i>	t	t	t	*	t	16	-	8
Unknown forbs	-	t	t	-	t	13	3	9
Total Forbs	29	31	16	26	43	8	13	28
SHRUBS								
<i>Chrysothamnus</i>								
<i>viscidiflorus</i>	5	t	t	*	2	-	-	-
<i>Tetradymia canescens</i>	t	t	-	1	t	-	-	-
Total Shrubs	5	t	t	2	-	-	-	-

1/ Only taxa constituting at least one percent of the diet for at least one month and/or one percent of the canopy coverage in March are included.

2/ Number of feeding sites.

3/ Total instances of use.

4/ Percent of community as determined during measurements of canopy coverages in March.

5/ t or * indicates values are less than one percent.

Fescue-Wheatgrass and Sagebrush Types the diet was made up of 73 percent grasses and 28 percent forbs. This correlates with the findings of Stevens (1966). Three grasses, *Festuca idahoensis*, *Festuca scabrella* and *Poa* spp. together composed 68 percent of the diet. During April *Festuca idahoensis* apparently was the preferred plant species on the Fescue-Wheatgrass Type. A significant use of dry forbs on this type was recorded on one snow covered site in early April even though ridges and south slopes were relatively free of snow. The indicated minor use on *Poa* spp. was probably related to retarded "green up" due to a late spring and the limited number of feeding sites taken during the period. In May extensive use on the new growth of *Festuca scabrella* and *Poa* spp. was recorded on mesic sites within the Fescue-Wheatgrass Type. First use on new growth of forbs was noted during late May. On the Sagebrush Type the grasses, *Festuca idahoensis*, *Festuca scabrella*, and *Poa* spp. were used extensively.

Cattle

I recorded 19,405 instances of use on 76 feeding sites during the summer of 1967. Food habits by month are shown in Table VII. Grasses made up 62 percent and forbs 38 percent of the total summer diet. The grasses, *Agropyron spicatum* and *Poa* spp. together made up 39 percent of the total seasonal diet. *Erigeron caespitosus* and *Taraxacum* spp. were the forbs used most extensively. *Agropyron smithii* and *Poa* spp., the two grasses utilized most in June were apparently preferred by cattle. *Taraxacum*

TABLE VII. FOOD HABITS OF CATTLE BY MONTH AS DETERMINED FROM 19,405 INSTANCES OF USE ON 76 FEEDING SITES IN THE SUMMER OF 1967.

Taxa ^{1/}	June 8 Feeding Sites (2854) ^{2/}		July 31 Feeding Sites (6976)		August 23 Feeding Sites (6115)		September 14 Feeding Sites (3460)		June-September 76 Feeding Sites (19,405)
	% of Diet	% of Commun- ity	% of Diet	% of Commun- ity	% of Diet	% of Commun- ity	% of Diet	% of Commun- ity	% of Diet
GRASS AND GRASSLIKE PLANTS									
<i>Agropyron smithii</i>	25	13 ^{4/}	2	2	5	3	1	*	8
<i>Agropyron spicatum</i>	4	2	17	12	26	15	40	22	22
<i>Bromus marginatus</i>	t ^{3/}	* ^{3/}	1	1	-	*	-	3	t
<i>Bromus tectorum</i>	12	12	1	*	-	-	-	-	3
<i>Carex</i> spp.	t	*	2	3	2	1	1	*	1
<i>Festuca idahoensis</i>	1	5	1	20	2	28	9	27	3
<i>Festuca scabrella</i>	t	2	2	3	2	*	-	*	1
<i>Koeleria cristata</i>	t	1	t	3	t	1	3	3	1
<i>Poa secunda</i>	1	1	1	2	t	1	-	*	2
<i>Poa</i> spp.	22	16	29	25	13	8	5	3	17
<i>Stipa comata</i>	6	1	t	1	t	*	6	*	3
Unknown grasses	<u>2</u>	-	<u>t</u>	-	<u>t</u>	-	<u>2</u>	-	<u>1</u>
Total Grasses	73		56		50		67		62
FORBS									
<i>Achillea millefolium</i>	t	1	t	5	t	2	-	1	t
<i>Agoseris glauca</i>	t	*	9	6	2	2	-	-	3
<i>Antennaria rosea</i>	-	2	-	2	-	3	-	2	-
<i>Arenaria congesta</i>	-	-	-	1	-	1	-	*	-
<i>Arnica fulgens</i>	-	-	t	1	-	t	-	-	t
<i>Artemisia frigida</i>	-	2	t	1	t	1	-	2	t
<i>Aster</i> spp.	-	-	t	1	t	*	t	*	t
<i>Astragalus striatus</i>	t	*	8	3	16	3	2	*	7
<i>Campanula rotundifolia</i>	-	-	1	*	t	*	-	*	t

TABLE VII. (CONTINUED).

Taxa	June 8 Feeding Sites (2854)		July 31 Feeding Sites (6976)		August 23 Feeding Sites (6115)		September 14 Feeding Sites (3460)		June-September 76 Feeding Sites (19,405)	
	% of Diet	% of Commun- ity	% of Diet	% of Commun- ity	% of Diet	% of Commun- ity	% of Diet	% of Commun- ity	% of Diet	
<i>Crepis modocensis</i>	-	-	2	2	1	*	-	-	1	
<i>Cruciferae</i>	2	2	t	3	t	*	-	*	1	
<i>Erigeron caespitosus</i>	t	1	1	2	17	7	27	5	11	
<i>Erigeron</i> spp.	-	t	-	1	t	*	t	*	t	
<i>Helianthus</i> spp.	-	-	2	2	4	3	-	*	2	
<i>Hieracium</i> spp.	-	-	-	-	1	1	-	-	t	
<i>Lomatium triternatum</i>	-	-	t	1	3	*	-	-	1	
<i>Lupinus sericeus</i>	-	1	-	11	t	6	1	9	t	
<i>Oxytropis sericea</i>	-	-	-	-	t	1	1	t	t	
<i>Musineon divaricatum</i>	-	1	-	*	-	*	-	-	-	
<i>Potentilla</i> spp.	-	-	t	1	t	1	-	2	t	
<i>Taraxacum</i> spp.	21	30	16	26	4	13	t	6	10	
<i>Tragopogon dubius</i>	t	*	2	*	t	*	1	*	1	
<i>Trifolium</i> spp.	-	-	t	*	2	*	1	*	1	
<i>Viola</i> spp.	t	*	t	2	-	*	-	-	t	
Unknown forbs	<u>1</u>	-	<u>t</u>	-	<u>t</u>	-	<u>2</u>	-	<u>1</u>	
Total Forbs	24		41		50		35		38	
SHRUBS										
<i>Artemisia tridentata</i>	-	2	-	*	-	-	-	-	-	
<i>Chrysothamnus</i>										
<i>viscidiflorus</i>	-	1	-	1	-	1	-	1	-	
<i>Tetradymia canescens</i>	-	-	-	1	-	1	-	4	-	
Total Shrubs	-		-		-		-		-	

1/ Only taxa constituting at least one percent of the diet for at least one month and/or one percent of the canopy coverages for at least one month.

2/ Total instances of use. 3/ t or * indicates values are less than one percent.

4/ As determined by canopy coverage.

spp., although not taken in proportion to its abundance, was the forb utilized to the greatest extent. During July and the following two months changes in the relative abundance of plant taxa available to cattle resulting from shifts in cattle distribution accounted partially for differences in plant species used. Of the grasses *Agropyron smithii* decreased significantly in relative abundance and resulting use. Use as well as relative abundance on *Poa* spp. and *Agropyron spicatum* showed a marked increase. *Festuca idahoensis*, although common, was little utilized during July or during the remainder of the grazing season. This lack of use on *Festuca idahoensis* contrasts with the results described by Eustace (1967) for a similar range. Among the forbs, use on *Taraxacum* spp. was slightly less in July than during the previous month. In August a decline in the relative abundance of *Poa* spp. due to cattle distribution and to drying as a result of hot weather was reflected in decreased use of this plant. *Agropyron spicatum* became the preferred grass in the diet. The forbs, *Astragalus striatus* and *Erigeron caespitosus*, showed increases in use which were out of proportion to their relative abundances. *Taraxacum* spp. was a minor food item even though it was the most abundant forb. During September the trends observed during July and August continued except for the forb, *Astragalus striatus*, which was taken at a level considerably below that of the previous month. Observations during this month indicated that nearly 100 percent of all available *Astragalus striatus* plants had been grazed during previous months and were in the stages of drying out.

Summer food habits of cattle, classified by vegetation type and/or

subtype are shown in Table VIII. On the Bluebunch Wheatgrass Subtype within the Fescue-Wheatgrass Type, *Agropyron spicatum* made up more than 50 percent of the diet and was used in a proportion greater than its relative abundance. *Festuca idahoensis* was common on this and the other two subtypes but apparently was not relished by cattle during the 1967 grazing season. *Erigeron caespitosus*, although relatively minor in abundance, was the forb most actively sought by cattle. On the Idaho Fescue-Rough Fescue Subtype, *Poa* spp. and *Agropyron spicatum* were the grasses used to the greatest extent by cattle. Both were taken at levels apparently above their relative abundances. *Taraxacum* spp., the leading forb in the diet, was taken at a level approximating its relative abundance. On the Idaho Fescue Subtype, *Agropyron spicatum* was the leading grass item in the diet and apparently was the most preferred. Among the forbs *Astragalus striatus* and *Erigeron caespitosus* were used in proportions apparently greater than their relative abundances. On the Sagebrush Type *Agropyron smithii* was the leading grass item in the diet and apparently the most preferred. Significant use was also made on *Agropyron spicatum* and *Poa* spp. Forbs were relatively unimportant on this type. On the Aspen-Willow Type, *Poa* spp. was utilized to a greater extent than any other plant. *Agropyron smithii* received significant use on a level apparently in proportion to its relative abundance. *Taraxacum* spp., although heavily utilized was not used in proportion to its availability.

TABLE VIII. FOOD HABITS OF CATTLE BY VEGETATION TYPE OR SUBTYPE AS DETERMINED FROM 19,405 INSTANCES OF USE ON 76 FEEDING SITES IN THE SUMMER OF 1967.

Taxa ^{1/}	Fescue-Wheatgrass Type						Sagebrush Type		Aspen-Willow Type	
	Bluebunch Wheatgrass Subtype	Idaho Rough Fescue Subtype	Fescue-Idaho Fescue Subtype	Idaho Fescue Subtype						
	19 Feeding Sites (4363) ^{2/}	25 Feeding Sites (5190)	14 Feeding Sites (2693)	2 Feeding Sites (821)	16 Feeding Sites (6338)					
	% of Diet	% of Com-munity	% of Diet	% of Com-munity	% of Diet	% of Com-munity	% of Diet	% of Com-munity	% of Diet	% of Com-munity
GRASS AND GRASSLIKE PLANTS										
<i>Agropyron smithii</i>	1	* ^{3/}	1	*	5	1	54	21	10	11
<i>Agropyron spicatum</i>	54	28 ^{4/}	17	11	20	14	10	2	t	1
<i>Bromus marginatus</i>	-	*	t	*	-	-	-	-	3	7
<i>Bromus tectorum</i>	-	5	-	-	-	-	-	-	7	*
<i>Carex</i> spp.	-	*	3	3	2	*	1	*	1	2
<i>Danthonia</i> spp.	-	*	1	*	-	-	-	-	-	-
<i>Festuca idahoensis</i>	3	14	4	28	3	36	6	5	t	3
<i>Festuca scabrella</i>	t ^{3/}	*	4	4	t	*	t	8	-	-
<i>Koeleria cristata</i>	3	2	t	3	1	1	1	1	t	*
<i>Poa secunda</i>	1	2	-	1	1	2	-	-	3	*
<i>Poa</i> spp.	-	-	20	15	-	-	23	10	51	50
<i>Stipa comata</i>	8	3	t	3	-	1	-	-	t	1
<i>Stipa</i> spp.	t	1	t	1	-	-	-	-	t	1
Unknown grasses	t	-	1	-	-	-	1	-	t	-
Total Grasses	70		51		32		96		75	
FORBS										
<i>Achillea millefolium</i>	-	2	-	5	-	*	t	6	t	4
<i>Agoseris glauca</i>	3	2	11	7	t	2	1	1	1	5
<i>Antennaria rosea</i>	-	1	-	2	-	2	-	1	-	4
<i>Arenaria congesta</i>	-	*	-	2	t	*	-	-	-	*
<i>Arnica fulgens</i>	-	*	t	1	-	-	-	-	-	-

TABLE VIII. (CONTINUED).

Taxa	Fescue-Wheatgrass Type						Sagebrush Type		Aspen-Willow Type	
	Bluebunch Wheatgrass Subtype		Idaho Fescue- Rough Fescue Subtype		Idaho Fescue Subtype					
	19 Feeding Sites		25 Feeding Sites		14 Feeding Sites		2 Feeding Sites		16 Feeding Sites	
	(4363)		(5190)		(2693)		(821)		(6338)	
	% of Diet	% of Com-munity	% of Diet	% of Com-munity	% of Diet	% of Com-munity	% of Diet	% of Com-munity	% of Diet	% of Com-munity
<i>Artemisia frigida</i>	t	4	t	1	-	2	-	-	t	*
<i>Aster</i> spp.	t	1	t	*	t	*	-	-	-	-
<i>Astragalus striatus</i>	4	1	5	3	33	5	-	*	-	*
<i>Besseyia wyomingensis</i>	-	-	-	1	t	*	t	*	-	-
<i>Campanula rotundifolia</i>	1	*	1	*	-	-	-	-	-	-
<i>Chrysopsis villosa</i>	t	*	t	*	1	*	-	-	-	-
<i>Crepis modocensis</i>	1	*	2	2	t	1	-	-	-	-
<i>Cruciferae</i>	t	*	t	*	-	-	-	2	1	7
<i>Erigeron caespitosus</i>	11	3	8	4	28	10	-	-	t	1
<i>Erigeron</i> spp.	t	*	1	1	t	1	-	-	-	-
<i>Geranium viscosissimum</i>	-	-	-	1	-	-	-	-	-	-
<i>Geum triflorum</i>	-	*	-	1	-	*	-	-	-	-
<i>Helianthella</i> spp.	3	2	4	4	-	-	-	-	-	-
<i>Hieracium</i> spp.	1	1	t	1	t	*	-	-	-	-
<i>Lomatium triternatum</i>	t	*	t	*	-	-	-	-	-	1
<i>Lupinus sericeus</i>	1	11	t	13	-	5	-	3	-	*
<i>Potentilla</i> spp.	t	1	t	1	t	*	-	-	t	-
<i>Taraxacum</i> spp.	2	*	13	14	4	3	t	2	21	53
<i>Tragopogon dubius</i>	-	-	1	*	-	-	-	-	t	*
<i>Trifolium</i> spp.	-	-	*	*	-	-	-	-	-	8
<i>Viola</i> spp.	-	1	-	1	-	-	-	1	-	1
Unknown forbs	t	-	2	-	2	-	-	-	t	-
Total Forbs	27		48		66		1		23	

TABLE VIII. (CONTINUED).

Taxa	Fescue-Wheatgrass Type						Sagebrush Type		Aspen-Willow Type	
	Bluebunch	Idaho Fescue-	Idaho							
	Wheatgrass	Rough Fescue	Fescue							
	Subtype	Subtype	Subtype							
	19 Feeding Sites (4363)	25 Feeding Sites (5190)	14 Feeding Sites (2693)				2 Feeding Sites (821)		16 Feeding Sites (6338)	
	% of Diet	% of Com-munity	% of Diet	% of Com-munity	% of Diet	% of Com-munity	% of Diet	% of Com-munity	% of Diet	% of Com-munity
SHRUBS										
<i>Artemisia tridentata</i>	-	-	-	-	-	*	-	8	-	-
<i>Chrysothamnus viscidiflorus</i>	-	1	-	2	-	1	-	-	-	-
<i>Tetradymia canescens</i>	-	3	-	1	-	3	-	-	-	-
Total Shrubs	-	-	-	-	-	-	-	-	-	-

1/ Only taxa constituting at least one percent of the diet for at least one vegetation type or subtype and/or one percent of the canopy coverages for at least one vegetation type or subtype.

2/ Total instances of use.

3/ t or * indicates values are less than one percent.

4/ As determined by canopy coverage.

UTILIZATION

Two methods, use of agronomy cages and determination of percent of ungrazed grasses, were used to determine forage and bunchgrass utilization, respectively, on key elk winter ranges south of Crow Creek (Figure 1). The ungrazed plant method was also used on certain other areas.

During the fall of 1966 an agronomy cage, used to determine elk use through the winter, was placed on each of the upper slopes of areas A, B, C, and D. More than 50 percent of the grasses was used on areas A and B by elk during the winter but, no use was indicated for areas C and D (Table IX). Use on forbs for the four areas ranged from 0 to 100 percent. Twenty-six agronomy cages were used to determine forage utilization during the winter of 1967-68 (Table IX). Use of grasses on upper and middle slopes ranged from 0 to 38 percent. In early July, prior to cattle use in summer, grasses within circular plots located near the sites of former agronomy cages were clipped and weighed. Regrowth of grasses following the departure of elk and prior to cattle use appears to be significantly less in 1968 as compared to the same areas in 1967. This difference is probably related to the greater abundance of grasses remaining after the departure of elk in 1968.

During early July, 1967, prior to use by cattle, 29 agronomy cages were placed on areas A through G. Three of these cages each numbered seven, were used to determine year-long forage production (Table X). One of the three cages was placed on the upper slope of areas A, B, and C, respectively. Combined data for the three suggested that approximately 750 pounds per acre of forage were produced on the upper slopes and ridges sampled. Nine even numbered agronomy cages, equally

TABLE IX. FORAGE UTILIZATION BY ELK DURING THE WINTER AND EARLY SPRING OF 1967 AND 1968 AND SUBSEQUENT REGROWTH OF GRASSES PRIOR TO USE BY CATTLE ON AREAS A THROUGH G AS DETERMINED FROM PLACEMENT OF AGRONOMY CAGES.

Range Unit	Area	Location On Slope	No. Cages	1967			Grass Re-growth	No. Cages	1968			Grass Re-growth
				Grasses	Forbs				Grasses	Forbs		
Big Mountain	A	Upper	1	300/100/67 <u>1</u> /	0/0/0	1150 <u>2</u> /	2	550/650/ - <u>3</u> /	50/ 50/ 0			150
		Middle		- - -	- - -	-	2	650/450/31	50/100/ -			150
		Lower		- - -	- - -	-	2	200/300/ -	500/350/30			300
	B	Upper	1	200/100/50	100/0/100	850	2	750/650/13	50/100/ -			150
		Middle		- - -	- - -	-	2	650/550/15	250/150/40			350
		Lower		- - -	- - -	-	2	250/300/ -	300/250/17			400
Jenkins Ridge	C	Upper	1	100/300/ -	0/0/0	450	2	700/550/21	100/ 50/50			450
		Middle		- - -	- - -	-	2	450/600/ -	150/400/ -			-
		Lower		- - -	- - -	-	2	250/500/ -	300/ 50/83			250
Slim Sam Point	D	Upper	1	400/400/ 0	0/0/0	400	1	800/500/38 <u>1</u> /	100/100/ 0			200
		Lower	-	- - -	- - -	-	1	800/500/38	100/100/ 0			-
Jenkins Ridge	E	Middle	-	- - -	- - -	-	1	600/500/17	700/500/29			100
		Lower	-	- - -	- - -	-	1	300/300/ 0	300/100/67			-
	F	Upper	-	- - -	- - -	-	1	500/500/ 0	0/200/ -			400
		Middle	-	- - -	- - -	-	1	300/200/33	300/300/ 0			300
		Lower	-	- - -	- - -	-	1	300/300/ 0	400/300/25			200
	G	Upper	-	- - -	- - -	-	1	800/500/38	100/100/ 0			100

1/ Pounds per acre within cage/pounds per acre outside cage/percent utilization.

2/ Pounds per acre in excess of that present at the time of the departure of elk in the spring.

3/ Average pounds per acre within cages/average pounds per acre outside cages/average percent utilization.

TABLE X. GRASS AND FORB UTILIZATION BY CATTLE AS DETERMINED ON AREAS A THROUGH G BY THE PLACEMENT OF AGRONOMY CAGES DURING THE SUMMER OF 1967.

Range Unit	Area	Location On Slope	Cage No.	Total Pro-duction	July 10-August 10			August 10-September 10		
					Grasses			Grasses		
Big Mountain	A	Upper	1		-	-	-	-	-	-
			2		500/	300/40 ² /	300/	300/	0	500/500/
			7	750 ¹ /	-	-	-	-	-	300/200/33
		Middle	3		-	-	-	-	-	-
			4		800/	700/13	100/	100/	0	900/700/22
		Lower	5		-	-	-	-	-	100/100/
			6		400/	500/	-	1600/2000/	-	700/400/43
	B	Upper	1		-	-	-	-	-	-
			2		700/	700/	0	0/	0/	0
			7	825	-	-	-	-	-	-
		Middle	3		-	-	-	-	-	-
			4		600/	700/	-	400/	100/75	400/500/
		Lower	5		-	-	-	-	-	-
Jen-kins Ridge	C	Upper	1		-	-	-	-	-	-
			2		1800/1000/44		400/	100/75		400/400/
			7	700	-	-	-	-	-	0/300/
		Middle	3		-	-	-	-	-	-
			4		700/	600/14		400/	500/	-
		Lower	5		-	-	-	-	-	-
			6		800/	700/13		900/	800/11	800/600/25
	D	Upper	1		-	-	-	-	-	-
			2		-	-	-	-	-	-
		Lower	1		-	-	-	-	-	-
			2		-	-	-	-	-	-
Jen-kins Ridge	E	Middle	1		-	-	-	-	-	-
		Lower	2		-	-	-	-	-	-
	F	Upper	1		-	-	-	-	-	-
		Middle	2		-	-	-	-	-	-
		Lower	3		-	-	-	-	-	-
	G	Upper	1		-	-	-	-	-	-

TABLE X. (CONTINUED).

Range Unit	Area	Location on Slope	Cage No.	September 10-October 15		July 10-October 15	
				Grasses	Forbs	Grasses	Forbs
Big Mountain	A	Upper	1	- - -	- - -	400/400/ 0	300/200/33
			2	700/500/29	100/100/ 0	- - -	- - -
			7	- - -	- - -	- - -	- - -
		Middle	3	- - -	- - -	700/700/ 0	0/ 0/ 0
			4	300/300/ 0	200/200/ 0	- - -	- - -
		Lower	5	- - -	- - -	600/100/83	1300/400/69
			6	200/100/50	200/200/ 0	- - -	- - -
	B	Upper	1	- - -	- - -	600/400/34	0/100/ -
			2	700/700/ 0	200/100/50	- - -	- - -
			7	- - -	- - -	- - -	- - -
		Middle	3	- - -	- - -	600/500/17	200/200/ 0
			4	600/400/33	100/100/ 0	- - -	- - -
		Lower	5	- - -	- - -	500/200/60	400/200/50
			6	200/300/ -	400/100/75	- - -	- - -
Jenkins Ridge	C	Upper	1	- - -	- - -	600/200/67	300/100/67
			2	800/500/38	200/200/ 0	- - -	- - -
			7	- - -	- - -	- - -	- - -
		Middle	3	- - -	- - -	800/500/37	100/100/ 0
			4	500/900/ -	200/400/ -	- - -	- - -
		Lower	5	- - -	- - -	500/200/60	600/100/83
			6	400/400/ 0	1100/400/64	- - -	- - -
Slim Sam Point	D	Upper	1	- - -	- - -	600/800/ -	100/100/ 0
		Lower	2	- - -	- - -	400/500/ -	300/100/66
Jenkins Ridge	E	Middle	1	- - -	- - -	600/600/ 0	100/200/ -
		Lower	2	- - -	- - -	600/200/67	200/200/ 0
Jenkins Ridge	F	Upper	1	- - -	- - -	800/1000/-	200/ 0/100
		Middle	2	- - -	- - -	600/200/67	0/100/ -
		Lower	3	- - -	- - -	600/200/67	600/200/67
	G	Upper	1	- - -	- - -	200/300/ -	400/100/75

1/ Indicates total year-long forage production in pounds per acre.

2/ Pounds per acre within cage/pounds per acre outside cage/percent utilization.

divided between areas A, B, and C, were moved twice after initial placement in July to provide an indication of cattle use on forage as the summer progressed. In Table X it is apparent that utilization values vary considerably among the three one-month periods with no definite patterns of use being readily detected.

The remaining 17 agronomy cages were used to provide data for the total summer utilization by cattle of grasses and forbs. Overall light use of grasses and forbs occurred on upper and middle slopes of areas A and B while heavy use occurred on lower slopes. This pattern of utilization coincides with the known distribution of cattle. It disagrees, however, with values obtained monthly throughout the summer on the same areas. Data from areas C, E, F, and G gave variable results for the entire summer period when compared with known cattle distribution and with cattle food habits as they relate to the relative abundance of plant species. Factors other than the influence of grazing animals apparently affected the values obtained by the use of agronomy cages. The most obvious factor appears to be the difficulty in selecting suitable sites for placement of the cages for comparison with sites outside the cages. This is due to the heterogeneous nature of the vegetation. A large number of cages would minimize this, but the number of cages and time available during my study were limiting factors.

The results from measurements of bunchgrass utilization on areas A through G during 1967 and 1968 are shown in Table XI. Approximately 50 percent was considered the allowable level of bunchgrass utilization on

TABLE XI. UTILIZATION OF *AGROPYRON SPICATUM*, *FESTUCA IDAHOENSIS* AND *FESTUCA SCABRELLA* AS DETERMINED BY THE UNGRAZED PLANT TECHNIQUE ON AREAS A THROUGH G DURING 1967 AND 1968.

Range Unit	Area	Location On Slope	1967						1968		
			August		September		October		February	April	
			AGSP	FESC	AGSP		AGSP	FESC	AGSP	AGSP	FEID
Big Mountain	A	Upper	0 ^{1/}	-	0		0	-	4	5	7
		Middle	0	-	0		0	-	0 ^{2/}	0	0
		Lower	0	-	9		37	-	X	X	X
	B	Upper	0	-	0		0	-	0	0	0
		Middle	0	-	0		0	-	0	0	0
		Lower	3	-	20		33	-	X	X	X
Jenkins Ridge	C	Upper	0	-	0		7	-	12	17	0
		Middle	0	-	0		0	-	0	0	-
		Lower	0	-	0		32	-	X	X	X
Slim Sam Point	D	Upper	0	-	0		5	-	38	36	15
		Lower	0	-	0		34	-	X	X	X
Jenkins Ridge	E	Middle	0	-	0		1	-	X	X	X
		Lower	0	2	-		8	-	X	X	X
	F	Upper	0	-	0		0	-	5	3	4
		Middle	0	-	0		8	8	X	X	X
		Lower	18	-	40		58	-	X	X	X
	G	Upper	0	-	0		0	-	4	15	8

^{1/} Indicates total utilization in percent.

^{2/} X indicates inability to measure utilization due to snow coverage or breakage of mature grasses.

elk winter ranges (Cole, 1963). During the summer of 1967 little cattle use of *Agropyron spicatum* occurred on the upper and middle slopes. No measurements of *Festuca idahoensis* were undertaken during this period. Direct observation of cattle as well as data concerning their food habits indicated only minor use on this relatively abundant grass. On lower slopes, adjacent to bottoms used extensively by cattle, utilization levels on *Agropyron spicatum* increased from light use in August to moderate or heavy use by October. The overall pattern of light utilization on ridge-tops and heavy utilization on the lower slopes corresponds to the known cattle distribution for this period. During the following winter and spring measurements of bunchgrass utilization were confined primarily to snowfree upper and middle slopes. Elk use through the winter of *Agropyron spicatum* and *Festuca idahoensis* on such slopes was light on areas A, B, C, F, and G while moderate use of *Agropyron spicatum* was recorded for the upper slopes of area D.

During the winter and early spring of 1968 additional areas which showed heavy use by elk were sampled by the ungrazed plant method. Utilization figures represent combined 1967-1968 cattle and elk use. On the upper north end of Big Mountain east of area B, use on *Agropyron spicatum* averaged 28 percent (7-45) among eight transects. Utilization of *Festuca idahoensis* averaged 20 percent (1-39) among five transects. On the upper end of Jenkins Ridge west of area F use on *Agropyron spicatum* as determined by four transects averaged 41 percent (25-50). A cattle bedding ground is located on this area. Two transects on the high ridge northwest

of Muddy Lake Creek indicated heavy use of *Agropyron spicatum* (78-80+). Most of this was considered winter elk use although salt was placed high on this ridge to aid in the distribution of cattle. The 6,900 foot ridge immediately south of the head of Muddy Lake Creek had utilization levels on *Agropyron spicatum* ranging from 10 to 67 percent and averaging 31 percent as determined by six transects. On the south perimeter of Eagle Basin adjacent to a 7,000 foot ridge heavy use (80+) of *Agropyron spicatum* as determined by use of two transects was found on south slopes and ridge-tops adjacent to a salting area. Extensive use of the area by cattle was indicated by the large number of cattle droppings. There was heavy spring use by elk on new growth of *Festuca scabrella*. On certain south slopes and ridges adjacent to Sagebrush Gulch use on *Agropyron spicatum* averaged 47 percent (15-73) among three transects.

RANGE RELATIONSHIPS

Four conditions necessary for forage competition between big game and livestock have been described by Cole (1958) and others as follows: (1) that both animals graze the same range, (2) that both animals use the same plants, (3) that the plant species used are important sources of forage for at least one of the animals, and (4) that important sources of forage are in limited supply or deteriorating in production. Utilization of ranges or forage plants by big game and livestock need not occur during the same season for competition to exist. Forage availability during any one season may be related to use during a previous season (Blood, 1966).

The Fescue-Wheatgrass Zone was grazed from December to May and from early June to mid-October by elk and cattle, respectively. Grasses constituted approximately 73 percent of the winter elk diet and 62 percent of the summer cattle diet. Of the four grasses used significantly by elk during the winter and/or spring (Table VI) only *Poa* spp. and *Agropyron spicatum* were important in the summer diet of cattle (Table VII). *Poa* spp. made up approximately 17 percent of cattle and elk diets. Each animal used new growth of this grass rather than mature growth. Little interspecific competition for *Poa* spp. appeared to exist.

Agropyron spicatum constituted 21 and 5 percent of the winter and spring diets of elk, respectively, and 22 percent of the summer cattle diet. Under conditions of heavy snow cover elk were dependent on this grass. Measurements taken on areas used extensively by elk and cattle indicated potential interspecific competition for *Agropyron spicatum*

on the ridge northwest of Muddy Lake Creek. Utilization was considered primarily elk use, however, the continued placement of salt high on the ridge may lead to increased cattle use and thus a significant degree of interspecific competition. Severe competition for *Agropyron spicatum* was indicated on Eagle Basin. Heavy utilization was a result of combined use by elk and cattle. Moderate use of *Agropyron spicatum* on other areas used in common was not believed significant. Any increase, however, in use by cattle may limit the available supply for elk.

APPENDIX

TABLE XII. PLANT SPECIES WITH LESS THAN ONE PERCENT AVERAGE CANOPY COVERAGE IN VEGETATION TYPES OR SUBTYPES AS DETERMINED BY MEASUREMENTS WITHIN 2 X 5 DECIMETER PLOTS ON EACH OF TWENTY-FIVE STANDS.

Taxa	Bluebunch Wheatgrass Subtype 5 Stands	Idaho Fescue- Rough Fescue Subtype 4 Stands	Idaho Fescue Subtype 7 Stands	Sagebrush Type 3 Stands	Aspen-Willow Type 6 Stands
GRASSES					
<i>Bouteloua gracilis</i>	X				X
<i>Danthonia</i> spp.					
FORBS					
<i>Allium</i> spp.	X				
<i>Castilleja</i> spp.		X	X		
<i>Cirsium</i> spp.	X	X			X
<i>Erigeron compositus</i>	X	X	X		
<i>Eriogonum umbellatum</i>		X			
<i>Fritillaria pudica</i>		X			
<i>Geranium viscosissimum</i>		X		X	
<i>Hydrophyllum capitatum</i>					X
<i>Iris missouriensis</i>					X
<i>Lewisia rediviva</i>	X				
<i>Tragopogon dubius</i>		X	X		
<i>Trifolium</i> spp.					X
SHRUBS					
<i>Chrysothamnus nauseosus</i>				X	X
<i>Rosa</i> spp.					X
<i>Prunus virginiana</i>		X			
<i>Tetradymia canescens</i>	X	X	X		

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