



Habitat use, distribution, movement, and associated behavior of elk, Little Belt Mountains, Montana  
by Kenneth Joe Coop

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 was conducted during two summers and one fall on an area of 125,000 acres in the eastern Little Belt Mountains of central Montana to obtain data on use of habitat, distribution, movements, and associated behavior of elk prior to logging within this area. Three major habitat types; open park, broken park, and timber were delineated on the basis of tree crown densities of 0-15, 16-75, 76-100 percent, respectively.

The open park type was further separated into natural openings, burns, powerline strips, and clearcuts. Ground vegetation was determined for these types and subtypes from measurements within 2 x 5 dm plots spaced along linear transects. Habitat use in both the Douglas-fir and spruce-fir zones was determined by 5,720 observations of elk. During summer, use of open park types predominated over all others. Average size of 50 natural parks used by elk was 57 acres. Decreased use of these areas was noted in late summer through fall. The natural opening sub-type received the highest recorded use of all subtypes in both vegetation zones. Elk when disturbed in open parks ran an average distance of 374 feet to utilize escape timber. Escape cover timber stands were fully stocked with an average crown density of 85 percent. Use of timber types and zones varied in fall as related to hunting pressure and other factors. In summer 'elk distributed themselves across the heads of three major drainages from about 7,500-8,000 feet elevation, with distribution occurring at slightly lower elevations during fall.

Elk moved off the winter range through the transition range and onto summer range by the first week in July. This appeared to be correlated with green-up of vegetation and recession of snow. Movements of a radio-equipped cow indicated a summer home range of 3 square miles to be twice that of her late winter-early spring range. One radio-equipped male indicated more extensive movement by bulls than by cows.

A shift was noted in this animal's summer home range involving a movement of some 14 miles. Movements of up to 25 miles were noted for banded animals in one summer. Four yearlings banded on one winter range were observed to spend the next winter on a different range some 20 miles from the first. More than 36 percent of 84 elk banded in the winter of 1968-69 returned to the same winter range the following winter. One area was found to serve as summer range for elk wintering on two distinct and separate ranges, Clearcuts receiving greatest use were approximately 30 acres in size and 8-10 years of age. Observations of rutting behavior by bulls with harems indicated defense of a moving parameter type area around the harem instead of a fixed land area defense. Elk and cattle were observed to be generally compatible while elk were noted to avoid areas used currently or previously by sheep.

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HABITAT USE, DISTRIBUTION, MOVEMENT, AND ASSOCIATED  
BEHAVIOR OF ELK, LITTLE BELT MOUNTAINS, MONTANA

by

KENNETH JOE COOP

A thesis submitted to the Graduate Faculty in partial  
fulfillment of the requirements for the degree

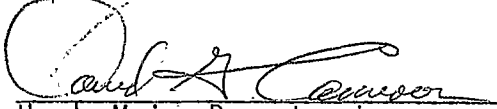
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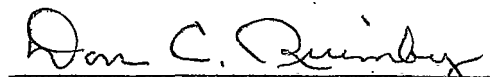
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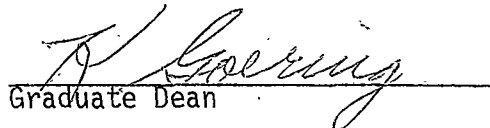
in

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## ABSTRACT

A study was conducted during two summers and one fall on an area of 125,000 acres in the eastern Little Belt Mountains of central Montana to obtain data on use of habitat, distribution, movements, and associated behavior of elk prior to logging within this area. Three major habitat types; open park, broken park, and timber were delineated on the basis of tree crown densities of 0-15, 16-75, 76-100 percent, respectively. The open park type was further separated into natural openings, burns, powerline strips, and clearcuts. Ground vegetation was determined for these types and subtypes from measurements within 2 x 5 dm plots spaced along linear transects. Habitat use in both the Douglas-fir and spruce-fir zones was determined by 5,720 observations of elk. During summer, use of open park types predominated over all others. Average size of 50 natural parks used by elk was 57 acres. Decreased use of these areas was noted in late summer through fall. The natural opening subtype received the highest recorded use of all subtypes in both vegetation zones. Elk when disturbed in open parks ran an average distance of 374 feet to utilize escape timber. Escape cover timber stands were fully stocked with an average crown density of 85 percent. Use of timber types and zones varied in fall as related to hunting pressure and other factors. In summer elk distributed themselves across the heads of three major drainages from about 7,500-8,000 feet elevation, with distribution occurring at slightly lower elevations during fall. Elk moved off the winter range through the transition range and onto summer range by the first week in July. This appeared to be correlated with green-up of vegetation and recession of snow. Movements of a radio-equipped cow indicated a summer home range of 3 square miles to be twice that of her late winter-early spring range. One radio-equipped male indicated more extensive movement by bulls than by cows. A shift was noted in this animal's summer home range involving a movement of some 14 miles. Movements of up to 25 miles were noted for banded animals in one summer. Four yearlings banded on one winter range were observed to spend the next winter on a different range some 20 miles from the first. More than 36 percent of 84 elk banded in the winter of 1968-69 returned to the same winter range the following winter. One area was found to serve as summer range for elk wintering on two distinct and separate ranges. Clearcuts receiving greatest use were approximately 30 acres in size and 8-10 years of age. Observations of rutting behavior by bulls with harems indicated defense of a moving parameter type area around the harem instead of a fixed land area defense. Elk and cattle were observed to be generally compatible while elk were noted to avoid areas used currently or previously by sheep.

## INTRODUCTION

During recent years logging in Montana has increased greatly. This has caused concern among wildlife managers because of the possible effects on wildlife habitats and various wildlife species. The Little Belt Mountains of central Montana, where extensive block clearcut logging of lodgepole pine (*Pinus contorta*) has occurred at least since 1951 and is continuing, are representative of areas in which concern has focused on the possible effects of logging on the habitats of elk. There is a paucity of published data pertaining to this subject. Most studies, such as those of Kirsch (1962) and Harper (1966), have reported on responses of elk during and after logging. Quantitative data on elk and elk use of a specific area prior to, as well as during, and following logging are apparently lacking. Possible effects of logging and related activities on the welfare of elk remain conjectural.

Logging in the eastern Little Belts has been confined mainly to the South Fork of the Judith River, adjacent areas to the south and west, and drainages between U. S. Highway 89 and the main divide from King's Hill north to the Big Baldy region (Figure 1). The Middle and Lost Fork drainages of the Judith River have remained in a relatively undisturbed condition, but logging operations are planned for these areas.

The purpose of this study, conducted from June-September, 1969 and June-December, 1970, was to obtain data pertaining to elk movements, distribution, habitat use, and associated behavior in the Middle

and Lost Fork drainages prior to logging. These data should prove valuable for comparison with data secured after logging has occurred. Work was also done in adjacent areas including the Judith Game Range which serves as a wintering area for elk in this region.

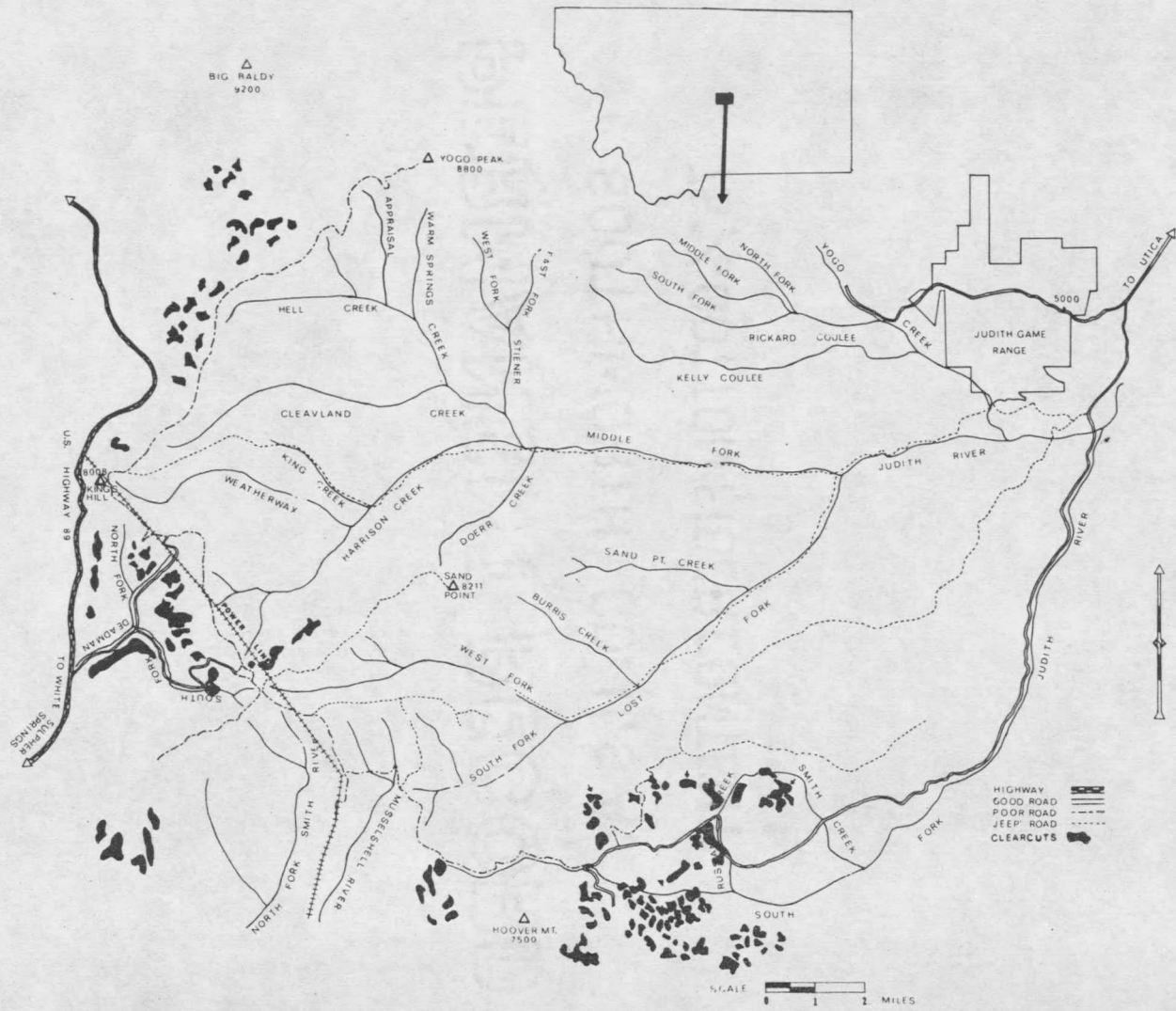


Figure 1. Map of study area and associated clearcuts. Arrows indicate three most used clearcuts within study area.

## DESCRIPTION OF STUDY AREA

The study area (Figure 1), located in the eastern Little Belt Mountains of central Montana, encompasses approximately 125,000 acres and includes all of the headwaters of the Middle and Lost Forks of the Judith River, part of the headwaters of Yogo Creek, and about one-third of the head drainages of the South Fork of the Judith River. The area is bordered by ridges or divides along the north, west, and part of the south. The South Fork of the Judith served as a boundary for part of the southern and all of the eastern edges.

Four major vegetation zones (Figure 2): ponderosa pine-grassland (*Pinus ponderosa*), ponderosa pine, Douglas-fir (*Pseudotsuga menziesii*), and Engelmann spruce-subalpine fir (*Picea engelmannii-Abies lasiocarpa*) were described for this area by Kirsch (1962). Numerous seral lodgepole pine (*Pinus contorta*) stands are located throughout the Douglas-fir and spruce-fir zones. White bark (*Pinus albicaulis*) and limber pine (*Pinus flexilis*) are found along dry ridges and slopes. Big sagebrush (*Artemisia tridentata*) is the only large significant shrub occurring in the area with fairly extensive stands located on the slopes and bottoms adjacent to the Middle and Lost Forks in the Douglas-fir zone.

Of the 125,000 acres, a total of 108,000 were classified by personnel of the U. S. Forest Service according to timber types and classes. The remaining 17,000 acres were listed as forests of non-commercial value or were unclassified. Ponderosa pine, Douglas-fir, Engelmann spruce, subalpine fir, and lodgepole pine make up approxi-

mately 7.5, 40, 9, 1, and 26 percent, respectively of the classified timber types. Nonforested lands make up some 11.5 percent with less than 2 percent being listed as privately owned. White bark and limber pine were classified as making up some 3 percent of the timber but in addition to this, some of the non-commercial timber is also composed of these species.

Most of the parent material is limestone in nature with formation of drainages resulting in rounded and somewhat flattened ridge tops and divides. Several of the canyons have areas with steep, rugged, limestone outcroppings.

Approximately 800-1,200 elk which summer in the Judith River drainages at elevations up to 8,500 feet, winter primarily on the Judith Game Range and adjacent lands at about 5,000 feet elevation. Another 200-300 head winter in scattered groups along the foothills some 20 miles to the south and southwest of the Judith Game Range.

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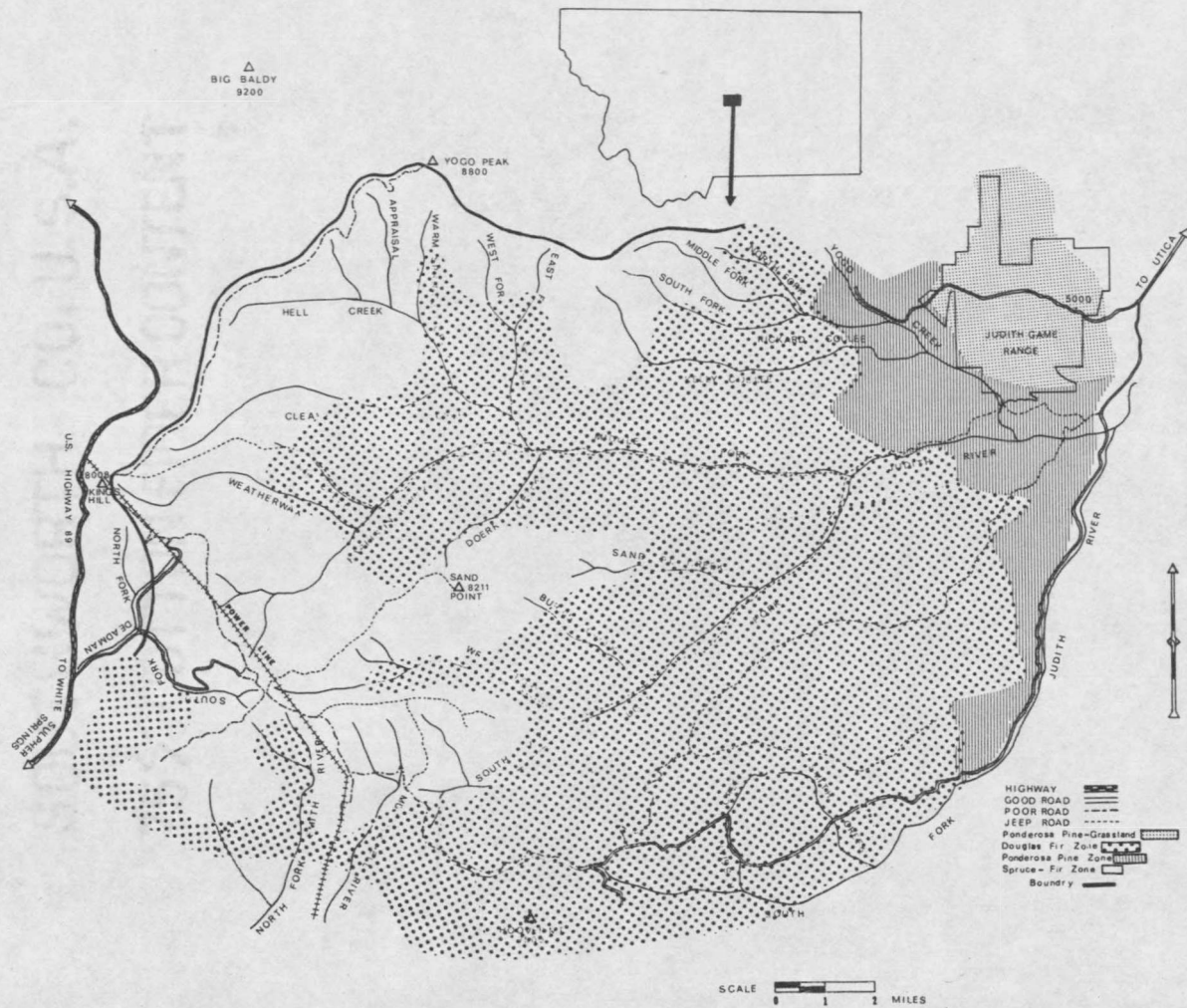


Figure 2. Map of study area and major vegetation zones.

## METHODS

### Vegetation

Scientific and common names of plants follow Booth (1950) and Booth and Wright (1959).

On the basis of tree crown density, Douglas-fir and spruce-fir zones were separated into three major habitat types; open park, broken park, and timber. Open park type was further separated into four subtypes. Fifty representative open parks were measured from aerial photographs with the aid of a planimeter and dot grid to determine approximate area. Crown density was determined from aerial photographs as described by the American Society of Photogrammetry (1960). Measurements taken from aerial photos were correlated with data collected in the field.

Composition and canopy coverage of low-growing vegetation in each of the three major habitat types were determined from a modification of the method described by Daubenmire (1959). Twenty, 2 x 5 dm plots were placed at 3-yard intervals in each of 15 representative sites for both open and broken park habitats and in five sites each for white bark-limber pine, Douglas-fir, lodgepole pine, and spruce-fir stands.

Each of 50 stands of timber which were used at least once by a group of elk for escape cover were evaluated according to the method of Cottam and Curtis (1956). Density, species composition, and size (dbh) of trees were secured by this method. The sample unit was a 200-foot line transect with center points established at 50-foot intervals.

Distances from the center of location of a group of elk in an open park to the edge of the closest timber and to the edge of the timber stand actually used for escape were measured in feet.

#### Marked Animals

During the winter of 1968-69 personnel of the Montana Fish and Game Department trapped and neck banded 84 individual elk on the Judith Game Range. In the winter of 1969-70 an additional 31 elk were trapped and neck banded on the Judith Game Range. Five elk wintering some 20 miles to the south of the game range were also trapped and neck banded. Four elk, three cows and one yearling male trapped on the game range, were each equipped with a radio transmitter. Transmitter units were similar to those described by Bayless (1967) while neck bands were similar to those described by Knight (1966).

#### Observations

Distribution, movements, and use of habitat types by marked and unmarked elk were determined by recording locations of animals observed. Ground observations were made by the author either from a vehicle or while on foot. A 150 Super Cub was used in making aerial observations and for locating elk with radios. A pair of 7 x 35 binoculars and a 15-60 x spotting scope were used to aid in making observations.

## RESULTS

### Vegetation

The three main habitat types were separated on the basis of timber crown density. Open park areas (Figures 3 and 4) were those having from 0-15 percent crown density, broken parks (Figures 3 and 5) 15-75 percent, and timber types (Figures 3 and 4) 75-100 percent. Measurements of ground vegetation for these three types is presented in Tables 1 and 2. Broken park and timber types in this study were similar to the areas designated by Knight (1967) and Picton (1960) as open and closed canopy conifer types, respectively. Open park types generally represented the kind of habitat described by Kirsch (1962) as open conifer-park type. Subtypes were designated only for the open park type, and combined, constituted less than 5 percent of the total habitat within the study area.

### Open and Broken Park Type

The open park type was separated into natural openings (Figures 3 and 4), clearcuts (Figures 3 and 6), burn (Figure 7), and powerline (Figures 3 and 8) subtypes. Except for clearcuts, no significant differences in low-growing vegetation were indicated between subtypes. Therefore all subtypes except clearcuts were included in the open park data (Table 1). Kirsch (1962) quantitatively described the clearcut subtype. The powerline subtype was represented by cleared

100-foot-wide strips in which high voltage powerline systems had been installed. These strips run in straight line segments through the Douglas-fir and spruce-fir zones.

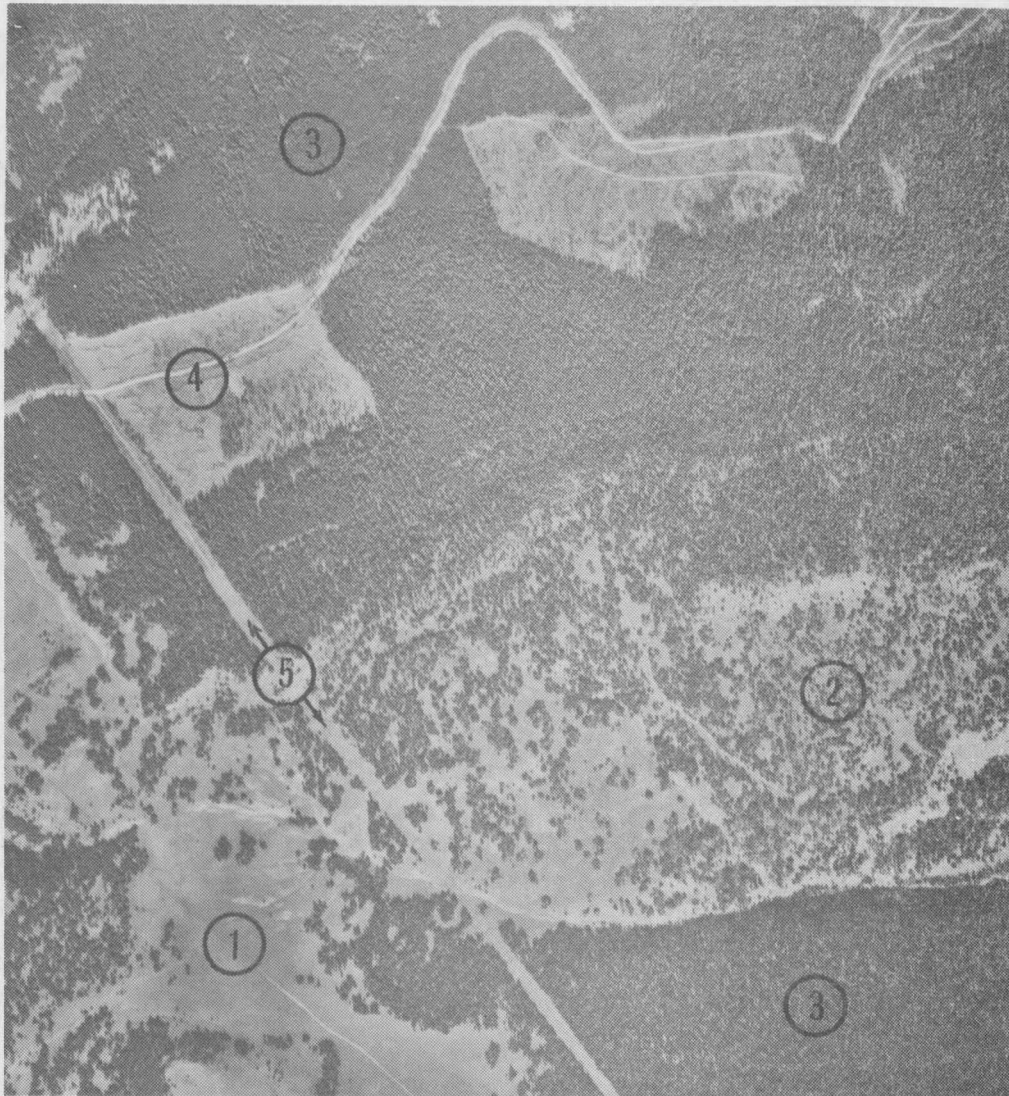
Data from the open and broken park habitats (Table 1) indicated no significant difference between the two on the basis of low-growing vegetation. A few species occurred in both types but were only recorded in the plots of one. Each of these constituted less than 1 percent of the cover and are included in Appendix, Table 10. All species which did not make up at least 1 percent of the ground cover in at least one type are recorded in this table. One species in each type was not observed to occur in the other. These were cudleaf sage-wort (*Artemisia ludoviciana*) in the open type and rough fescue (*Festuca scabrella*) in the broken type. Of the five forbs making up the greatest percentage of canopy coverage in each type, four were the same for both types: cinquefoil (*Potentilla* spp.), daisy (*Erigeron* spp.), western yarrow (*Achillea millefolium*), and dandelion (*Taraxacum officinale*). In the open park lupine (*Lupinus argenteus*) and clover (*Trifolium* spp.) each ranked fifth in canopy coverage, while in the broken park ball-head sandwort (*Arenaria congesta*) occupied this position. Forbs predominated over grasses in both types. Four of the five most abundant grasses were the same for both types. These were wheatgrasses (*Agropyron* spp.), bromes (*Bromus* spp.), timber oatgrass (*Danthonia intermedia*), and Idaho fescue (*Festuca idahoensis*). Idaho fescue was found

to be the most predominant grass throughout all types in the study area. The species ranking fifth in coverage for open and broken park types were bluegrasses (*Poa* spp.) and green needle grass (*Stipa viridula*), respectively.

### Timber Type

This type was represented by four timber type groups; Douglas-fir, lodgepole pine, Engelmann spruce-subalpine fir, and whitebark-limber pine. Ground vegetation was fairly sparse in these types except for the whitebark-limber pine. Litter cover averaged 85 percent for all four types. Whitebark-limber pine, spruce-fir, and Douglas-fir all had approximately the same number of species present in the low-growing vegetation (Table 2). Lodgepole was found to be somewhat lower in total species. Heartleaf arnica (*Arnica cordifolia*), clover, and sedges were the only plants recorded as occurring in all four types. Milkvetch (*Astragalus* spp.) was the most abundant forb in the Douglas-fir and whitebark-limber pine types. Heartleaf arnica was the most abundant for the spruce-fir and lodgepole pine types. Each of the grasses made up less than 1 percent of the canopy coverage in the four types except for Idaho fescue which made up 20 percent in the whitebark-limber pine type. More shrub species were recorded in the timber types than in the open and broken park types. Rose (*Rosa* spp.) was recorded in all timber types except whitebark-limber pine. Oregon

grape (*Berberis repens*) was recorded in all types except the spruce-fir although it probably occurred here also. Lodgepole pine was the only type where thinleaved huckleberry (*Vaccinium membranaceum*) and kinikinnick (*Arctostaphylos uva-ursi*) were recorded.



- |                |              |
|----------------|--------------|
| 1. Open Park   | 4. Clearcut  |
| 2. Broken Park | 5. Powerline |
| 3. Timber      |              |

Figure 3. Aerial photo of three major habitat types and two subtypes in the spruce-fir zone.



Figure 4. Open park type (foreground) and timber type (background) in spruce-fir zone.



Figure 5. Broken park habitat type in Douglas-fir zone.

TABLE 1. CANOPY COVERAGE AND FREQUENCY OF TAXA FOR GRASSES, FORBS, AND SHRUBS OCCURRING IN THE OPEN AND BROKEN PARK HABITAT TYPES AS INDICATED BY MEASUREMENTS FROM 600, 2X5 DECIMETER PLOTS ON 30 DIFFERENT SITES.

Taxa <sup>1</sup>	Open Park Type 15 Sites 300 Plots	Broken Park Type 15 Sites 300 Plots
GRASS AND GRASS-LIKE PLANTS:	98/15/100 <sup>2</sup>	97/21/100
<i>Agrostis alba</i>	3/.5/13	6/ 1/13
<i>Agropyron</i> spp.	52/80/73	42/ 6/80
<i>Bromus marginatus</i>	11/ 2/40	1/.1/7
<i>Bromus</i> spp.	16/ 3/47	14/ 3/73
<i>Carex</i> spp.	56/15/100	33/ 9/100
<i>Danthonia intermedia</i>	10/ 3/26	32/ 9/73
<i>Festuca idahoensis</i>	75/23/86	80/32/87
<i>Koeleria cristata</i>	14/ 2/47	12/ 2/47
<i>Melica spectabilis</i>	9/ 2/33	2/.4/27
<i>Phleum alpinum</i>	8/ 1/33	.6/.2/7
<i>Phleum pratense</i>	11/ 2/33	5/.7/20
<i>Poa</i> spp.	18/ 3/47	13/ 2/67
<i>Stipa viridula</i>	10/ 2/27	26/ 5/87
<i>Trisetum spicatum</i>	13/ 2/33	17/ 2/33
FORBS:	97/27/100	98/31/100
<i>Achillea millefolium</i>	67/10/93	73/13/100
<i>Agoseris glauca</i>	28/ 4/73	32/ 5/73
<i>Anemone multifida</i>	1/.1/7	13/ 2/60
<i>Antennaria parvifolia</i>	7/ 2/33	25/ 7/73
<i>Antennaria rosea</i>	1/.3/7	10/ 3/13
<i>Arenaria congesta</i>	17/ 2/40	46/ 8/100
<i>Arnica cordifolia</i>	9/.3/7	9/ 2/13
<i>Aster</i> spp.	7/ 1/20	3/.6/7
<i>Campanula rotundifolia</i>	6/.5/27	10/ 1/60
<i>Cerastium arvense</i>	27/ 3/73	16/ 2/73
<i>Cirsium</i> spp.	3/.8/20	4/ 1/33
<i>Collomia linearis</i>	5/.6/20	9/ 1/40
<i>Delphinium bicolor</i>	10/.9/20	13/ 2/60
<i>Dodecatheon conjugens</i>	12/ 2/47	14/.6/73
<i>Erigeron</i> spp.	45/ 8/60	72/15/100
<i>Fragaria virginiana</i>	7/ 1/33	7/ 1/47
<i>Galium boreale</i>	19/ 2/60	18/ 2/60
<i>Geum triflorum</i>	11/ 4/20	14/ 3/60
<i>Geranium viscosissimum</i>	17/ 2/33	28/ 5/73
<i>Helianthus nuttallii</i>	7/.1/7	6/ 1/20

TABLE 1. (continued)

Taxa	Open Park Type	Broken Park Type
	15 Sites 300 Plots	15 Sites 300 Plots
<i>Lupinus argenteus</i>	27/ 7/53	9/ 2/27
<i>Mertensia</i> spp.	12/ 2/33	2/ 3/27
<i>Polygonum bistortoides</i>	24/ 3/60	30/ 3/93
<i>Potentilla</i> spp.	59/18/86	40/ 9/100
<i>Taraxacum officinale</i>	45/ 9/80	44/13/87
<i>Trifolium</i> spp.	38/ 7/87	23/ 3/60
SHRUBS:	12/ 3/100	11/ 2/87
<i>Vaccinium scoparium</i>	1/.7/13	6/ 2/13

<sup>1</sup>All plant species which made up at least 1 percent canopy coverage in at least one type.

<sup>2</sup>Frequency of occurrence/mean canopy coverage/constancy.

TABLE 2. CANOPY COVERAGE AND FREQUENCY OF TAXA FOR GRASSES, FORBS, AND SHRUBS OCCURRING IN THE TIMBER HABITAT TYPES AS INDICATED BY MEASUREMENTS FROM 400, 2X5 DECIMETER PLOTS ON 20 DIFFERENT SITES.

Taxa	Douglas-fir	Lodgepole Pine	Spruce-fir	Whitebark-Limber Pine
	5 Sites 100 Plots	5 Sites 100 Plots	5 Sites 100 Plots	5 Sites 100 Plots
GRASS AND GRASS-LIKE PLANTS:	18/ 5/100 <sup>1</sup>	--	2/.2/100	12/ 3/100
<i>Agropyron</i> spp.	--	--	--	1/.2/20
<i>Bromus</i> spp.	1/.9/25	--	--	--
<i>Danthonia intermedia</i>	1/.8/25	--	1/.2/20	--
<i>Festuca idahoensis</i>	1/.5/25	--	1/.1/20	3/20/60
<i>Koeleria cristata</i>	--	--	--	2/.5/40
<i>Carex</i> spp.	20/12/100	10/ 4/100	34/15/100	40/16/100
<i>Stipa comata</i>	3/.2/50	--	--	--
<i>Stipa viridula</i>	5/ 1/25	--	--	--
FORBS:	83/36/100	41/13/100	47/19/100	65/24/100
<i>Achillea millefolium</i>	1/.2/25	--	7/ 1/60	7/ 1/60
<i>Agoseris glauca</i>	3/.4/50	--	--	--
<i>Allium textile</i>	3/.2/25	--	--	--
<i>Anemone multifida</i>	1/.3/25	--	--	--
<i>Antennaria racemosa</i>	10/ 2/50	2/.2/20	3/.5/20	--
<i>Arenaria congesta</i>	--	--	14/ 5/40	8/ 3/20
<i>Arnica cordifolia</i>	31/ 6/75	22/ 6/80	34/ 8/60	14/ 5/40
<i>Aster foliaceus</i>	--	--	--	1/.2/20
<i>Astragalus</i> spp.	24/ 8/75	--	2/.2/20	19/ 7/40
<i>Campanula rotundifolia</i>	1/.2/25	--	1/.2/20	2/.3/40
<i>Chimaphila umbellata</i>	--	3/.7/40	--	--
<i>Epilobium angustifolium</i>	--	5/.3/60	--	4/.5/20
<i>Epilobium</i> spp.	--	--	4/.8/60	3/.3/40
<i>Erigeron</i> spp.	31/ 5/75	--	7/ 1/40	8/ 1/60
<i>Eriogonum flavum</i>	--	2/.5/40	--	--
<i>Eriogonum ovalifolium</i>	--	2/.5/100	--	--
<i>Eriogonum</i> spp.	--	--	--	4/.6/20

TABLE 2. (continued)

Taxa	Douglas-fir	Lodgepole Pine	Spruce-fir	Whitebark-Limber Pine
	5 Sites 100 Plots	5 Sites 100 Plots	5 Sites 100 Plots	5 Sites 100 Plots
<i>Erythronium grandiflorum</i>	--	--	6/.7/40	2/.3/20
<i>Fraseria speciosus</i>	6/ 3/25	--	--	--
<i>Fragaria virginiana</i>	19/ 3/75	--	8/ 3/40	7/ 2/60
<i>Galium boreale</i>	23/ 4/75	--	1/.2/20	10/.8/20
<i>Geranium viscosissimum</i>	--	--	--	2/.3/20
<i>Glycyrrhiza lepidota</i>	2/.2/50	--	5/.6/60	--
<i>Helianthus nuttallii</i>	--	--	3/ 1/20	--
<i>Linnaea borealis</i>	10/ 5/75	5/ 1/20	--	--
<i>Lupinus argenteus</i>	--	2/.5/20	--	7/ 2/40
<i>Mertensia</i> spp.	1/.2/25	--	2/.5/20	2/.3/20
<i>Pedicularis</i> spp.	--	--	3/.7/40	--
<i>Polygonum bistortoides</i>	--	--	1/.1/20	5/.8/60
<i>Potentilla</i> spp.	5/.1/25	--	5/.7/40	16/ 2/100
<i>Pyrola</i> spp.	11/ 2/75	4/.2/40	3/.1/40	--
<i>Sedum stenopetalum</i>	--	--	--	1/.2/20
<i>Taraxacum officinale</i>	8/ 1/25	--	1/.1/20	1/.1/20
<i>Thalictrum</i> spp.	13/ 4/75	--	22/ 7/60	--
<i>Trifolium</i> spp.	63/10/25	4/ 1/20	1/.2/20	1/.2/20
<i>Valeriana dioica</i>	--	--	4/ 1/20	--
<i>Valeriana sitchensis</i>	3/.37/50	--	5/.4/60	--
SHRUBS:	31/ 5/100	80/42/100	13/ 2/100	78/42/100
<i>Arctostaphylos uva-ursi</i>	--	1/.4/20	--	--
<i>Berberis repens</i>	14/ 2/75	1/.2/20	--	6/ 1/20
<i>Rosa</i> spp.	16/ 2/100	4/ 1/60	2/.6/20	--
<i>Spiraea densiflora</i>	1/.2/25	--	--	--
<i>Spiraea</i> spp.	6/.5/25	10/ 2/20	--	--
<i>Vaccinium membranaceum</i>	--	12/ 5/20	--	--
<i>Vaccinium scoparium</i>	--	15/ 5/60	14/ 2/60	66/38/80

<sup>1</sup>Frequency of occurrence/mean canopy coverage/constancy.



Figure 6. Clearcuts in lodgepole pine -- head of Smith Creek.

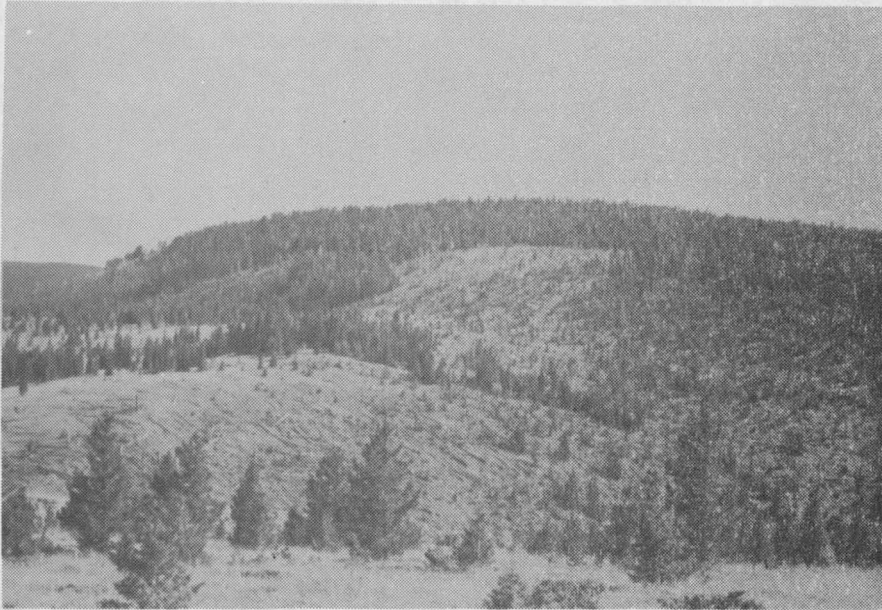


Figure 7. Burn subtype.



Figure 8. Powerline subtype in the spruce-fir zone.

### Population Characteristics of Elk

A total of 5,720 observations of elk from the air and ground, were classified according to categories as listed in Table 3. July of both 1969 and 1970 was the month of highest observations. The cow:calf ratio for July of both years combined was 100:57. Because of the increased activity of the calves and the high number of observations made in open areas during July the cow:calf ratios for this period were felt to best represent this segment of the population during summer. Winter cow:calf ratios for elk wintering on the Judith Game Range and adjacent areas were 100:55 in the winter of 1960 (Picton 1960) and 100:58 in the winter of 1966 (Schallenberger 1967). Average group size generally decreased from June until September and increased from October through December. The smallest average group size was recorded during September of both years. Knight (1970) reported the same. Observations of yearling males dropped by one-half or more from July and August, 1970 to September and mid-October while observations of older bulls with six or more antler points doubled from August and early September to late September and mid-October (Table 3). These changes occurred during the breeding season.

TABLE 3. CLASSIFICATION OF 5,720 OBSERVATIONS OF ELK BY SEX, AGE, AVERAGE GROUP SIZE, AND AVERAGE ELEVATION BY MONTH FOR THE SUMMERS OF 1969-70 AND FALL OF 1970.

	Average Elevation	Cows	Calves	Yrlg. Males	2-Year- Old Males	Older Males	Uncl.	Total	Number Groups	Average Group Size
<u>1969:</u>										
June 20-30	7,250	40	18	3	1	-	43	105	9	11.5
July 1-31	7,400	158	93	39	11	-	141	442	56	7.9
August 1-31	7,363	128	78	36	14	5	135	392	62	6.3
September 1-14	7,266	40	25	5	5	1	33	109	22	4.5
<u>1970:</u>										
June 20-30	7,513	20	15	-	-	-	24	59	6	9.8
July 1-31	7,550	680	386	87	32	2	518	1,705	163	10.5
August 1-31	7,334	519	283	57	10	6	178	1,053	128	8.2
September 1-14	7,055	129	54	28	6	5	52	274	60	7.5
September 15-31	7,166	208	90	26	22	10	91	447	43	6.3
October 1-17	7,150	280	86	24	23	14	258	685	78	8.7
October 18-31	7,355	56	21	8	4	1	5	95	9	10.5
November 1-30	7,356	121	36	17	8	1	66	249	27	9.2
December 1-5	6,187	25	10	2	-	-	68	105	4	26.2

### Use of Habitat Types

For the periods of June 20-September 14, 1969-70 and September 15-December 5, 1970 a total of 6,881 associations of elk with the three main habitat types were recorded from the ground and air (Table 4). All habitat types used by each of 5,720 elk while under observation were recorded.

One observation flight was made each month during July, August, and September, 1969. During 1970, 35 flights were made from July through December; the monthly average was seven except for December when only one flight was made. Ground observations were made throughout the study. Aerial observations were superior to ground observations in determining relative use of broken park and timber type habitats as compared to open areas (Table 4).

### *SUMMER*

The percentage of total summer observations for the Douglas-fir zone for late June, July, August and early September for both years were 1, 12, 16, and 6. For the spruce-fir zone the percentages were 2, 38, 21, and 4. This indicates that use of the two zones was quite similar for June and September with more use occurring in the spruce-fir zone during July and August.

The trend of use for the three habitat types was the same for July and September in the Douglas-fir zone and for July and August in the spruce-fir zone (Figures 9 and 10). Open parks received the

greatest use for all months in both zones except for early September when usage of broken parks slightly exceeded that of open parks in the spruce-fir zone. August showed a reduction in the usage of open and broken park types in the Douglas-fir zone and an increase in the use of timber types for both zones (Figures 9 and 10).

TABLE 4. PERCENTAGES BY MONTH AND HABITAT TYPE FOR 6,881 SIGHTINGS OF ELK FROM THE AIR AND GROUND FOR THE PERIODS JUNE 20 THROUGH SEPTEMBER 14, 1969-70 AND SEPTEMBER 15 THROUGH DECEMBER 5, 1970.

	AIR			GROUND		
	Open Park	Broken Park	Timber	Open Park	Broken Park	Timber
<u>1969-70:</u>						
June 20-30	-	-	-	162/98 <sup>1</sup>	-	3/2
July 1-31	574/53	451/42	54/5	782/67	364/31	25/2
August 1-31	443/52	189/22	226/26	531/80	105/16	26/4
September 1-14	165/37	98/31	53/17	69/66	24/23	11/11
<u>1970:</u>						
Sept. 15-31	345/49	260/37	93/13	78/66	30/25	11/9
October 1-17	381/43	204/23	303/34	58/56	32/30	14/13
October 18-31	43/50	3/3	40/47	49/36	49/36	37/7
November 1-30	126/38	115/35	90/27	17/50	-	17/50
December 1-5	68/51	64/49	-			

<sup>1</sup>Number of observations/percentage of observations for month.











































































