



Use of vegetative types, migration, and hunter harvest of the Sun River elk herd, Montana
by Harold D Picton

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 at Montana State College

Montana State University

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Abstract:

A study of the summer usage of vegetative types, migration and harvest of the Sun River elk herd in Montana was conducted during 1957 and 1958. One hundred and ninety elk were individually tagged and marked to facilitate movement and harvest studies. Discussion of the usage of five vegetative types and three subtypes was based upon observations of 2,544 elk, during the summers of 1957 and 1958. Observations of elk movement as influenced by hunting and weather conditions were made. Some of the relationships regarding three hunting seasons, during which the elk of this herd were harvested each year, were discussed. Two types of colored plastic ear' markers were compared as to durability.

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OF THE

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HAROLD D. PICTON

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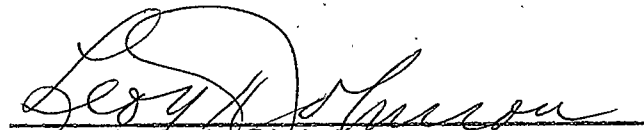
at

Montana State College

Approved:


Head, Major Department


Chairman, Examining Committee


Dean, Graduate Division

Bozeman, Montana
April, 1959

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The Author

Harold D. Picton was born October 6, 1932 in Bowman, North Dakota. In 1942 he moved to Red Lodge, Montana where he graduated from high school in 1950. From 1950 to 1954 he attended Montana State College, Bozeman, Montana, receiving a Bachelor of Science degree in Fish and Wildlife Management during June of 1954. During the summer of 1953 he was employed by the Montana Fish and Game Department as a student assistant. Following graduation he was again employed by the Montana Fish and Game Department as a Junior Biologist until he was called to active duty in the United States Air Force in 1955. While on active duty with the Air Force, he attended the School of Aviation Medicine and served as a hospital administrative officer. After release from the military service in 1957 he was employed by the Montana Fish and Game Department as a Biologist until January of 1958.

The writer began graduate studies at Montana State College in January 1958. This thesis fulfills part of the requirements for the Master of Science degree in Fish and Wildlife Management at Montana State College.

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ABSTRACT

A study of the summer usage of vegetative types, migration and harvest of the Sun River elk herd in Montana was conducted during 1957 and 1958. One hundred and ninety elk were individually tagged and marked to facilitate movement and harvest studies. Discussion of the usage of five vegetative types and three subtypes was based upon observations of 2,544 elk during the summers of 1957 and 1958. Observations of elk movement as influenced by hunting and weather conditions were made. Some of the relationships regarding three hunting seasons, during which the elk of this herd were harvested each year, were discussed. Two types of colored plastic ear markers were compared as to durability.

INTRODUCTION

One of Montana's largest elk herds ranges south of Glacier National Park in the upper drainage of the Sun River. Near to extinction at the turn of the century, the Sun River herd increased to its present level of about 3,000 by the 1930's (Rognrud, 1950). The harvest from this herd during the hunting seasons of 1957 and 1958 was about 850 and 650, respectively. In the summer, the elk range along the Continental Divide in the heart of the 990,000 acre Bob Marshall Wilderness area. The winter range utilized by most of the herd is located 14 miles west of Augusta in Lewis and Clark county. This winter range consists of about 18,000 acres of land purchased for the purpose ^{by} of the Montana Fish and Game Department.

To provide basic information for the continuing management of this herd, a study of its movements and relations to vegetative types was undertaken. This study was conducted on a full time basis from June to September of both 1957 and 1958 with supplemental observations made at other times during the period February 25, 1957 to November 26, 1958. The writer was employed by the Montana Fish and Game Department under project W-74R during the study.

Thanks are extended to R. G. Janson, L. G. Casagrande and B. Goodman of the Montana Fish and Game Department for their administrative aid, field assistance and use of departmental records. The aid of D. Neal and E. Rundquist of the same department and interested sportsmen in tagging of elk is also acknowledged. Thanks are extended to the personnel of the U. S. Forest Service for their cooperation and the use of Forest Service

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METHODS

Two different types of colored plastic ear markers were used to permit the field recognition of individual animals in movement studies. During the winter of 1957, seventy-seven elk were captured in corral type traps on their winter range. Each of these was marked with a colored plastic streamer held in the ear with a metal stock tag. These markers were similar to those used by Egan (1957) on deer and Rouse (1957) on elk. Twenty-seven elk calves caught during the springs of 1957 and 1958 and 86 elk trapped in the winter of 1958 were marked with a plastic streamer in one ear and a colored sheet plastic marker (Johnson, 1951) in the other. Records of the Montana Fish and Game Department indicated a few animals in the herd that had been tagged and marked before 1957. The marked elk were "aged" into four groups (calves, yearlings, 2 1/2 years and older) by dentition (Quimby and Gaab, 1957).

The marked elk were identified in the field with the aid of binoculars and a 20-power spotting scope. Tag recoveries from hunter killed elk were made at checking stations.

The elk herd was followed to the summer range. Saddlehorses and a packstring were used to establish basecamps but the majority of observations were made while on foot. The passes used by elk to cross the Continental Divide were periodically checked for tracks during the summer and following the opening of the September hunting season west of the Continental Divide. An airplane was used to determine elk distribution and to check the passes along the divide for movement signs following early snowstorms. An index to the late fall migration of 1957 was provided by weekly ground trend counts on the winter range, which was closed to hunting.

The basis for the vegetative description of the study area was provided by aerial observations and ground travel. A more detailed study of certain vegetative features was made in the upper basin of Moose Creek drainage. Twenty, two by five decimeter plots were selected along two, 100-foot transects in each of three vegetative subtypes. Plant coverage in the plots was determined by ocular estimate (Daubenmire, 1959). These transects were intended to provide a rough illustration of the subtypes rather than a detailed analysis of species composition. As an indication of the elk use received by the area, pellet group counts were made on a four foot strip along each transect. All elk observations made during the study were recorded according to the vegetative type in which they were seen.

THE STUDY AREA

The known range of the Sun River elk herd includes about 1,200 square

miles of rugged terrain in the upper portions of the Sun River, and adjacent portions of the Dearborn, the South Fork of the Flathead, and the Middle Fork of the Flathead River drainages.

The typical mountain topography consists of parallel reefs or ridges running north and south. These reefs slope on the west and are abrupt on the east. The cliffs of the eastern faces are as much as a thousand feet in height. Because of this topography the elk migration, which is primarily east and west, is confined to certain routes determined by passes through the reefs.

The area selected for the summer studies consisted of about 350 square miles of the northwestern corner of the Sun River drainage as well as adjacent portions of the White River and Spotted Bear River drainages of the South Fork of the Flathead River system (Fig. 1). The eastern boundary is formed by the North Fork of the Sun River which flows in a broad valley at an elevation of about 5,300 feet. From this valley, the terrain slopes up on the west and south to the Continental Divide, formed by the 8,500 foot peaks and ridges of the Lewis and Clark Range. According to Deiss (1941) this range was formed by the Lewis overthrust which placed Proterozoic and Paleozoic shales and limestones on top of the much younger Mesozoic sediments. The eastern face of the Continental Divide is a row of glacially sculptured cliffs of Paleozoic limestone that underlies the White River basin to the west. In the southern half of the study area, these 1,000-foot cliffs are known as the Chinese Wall (Fig. 2) and form a barrier 15 miles long which can be crossed only through one minor pass. Major pass areas exist at each end of the Chinese Wall. In the northern

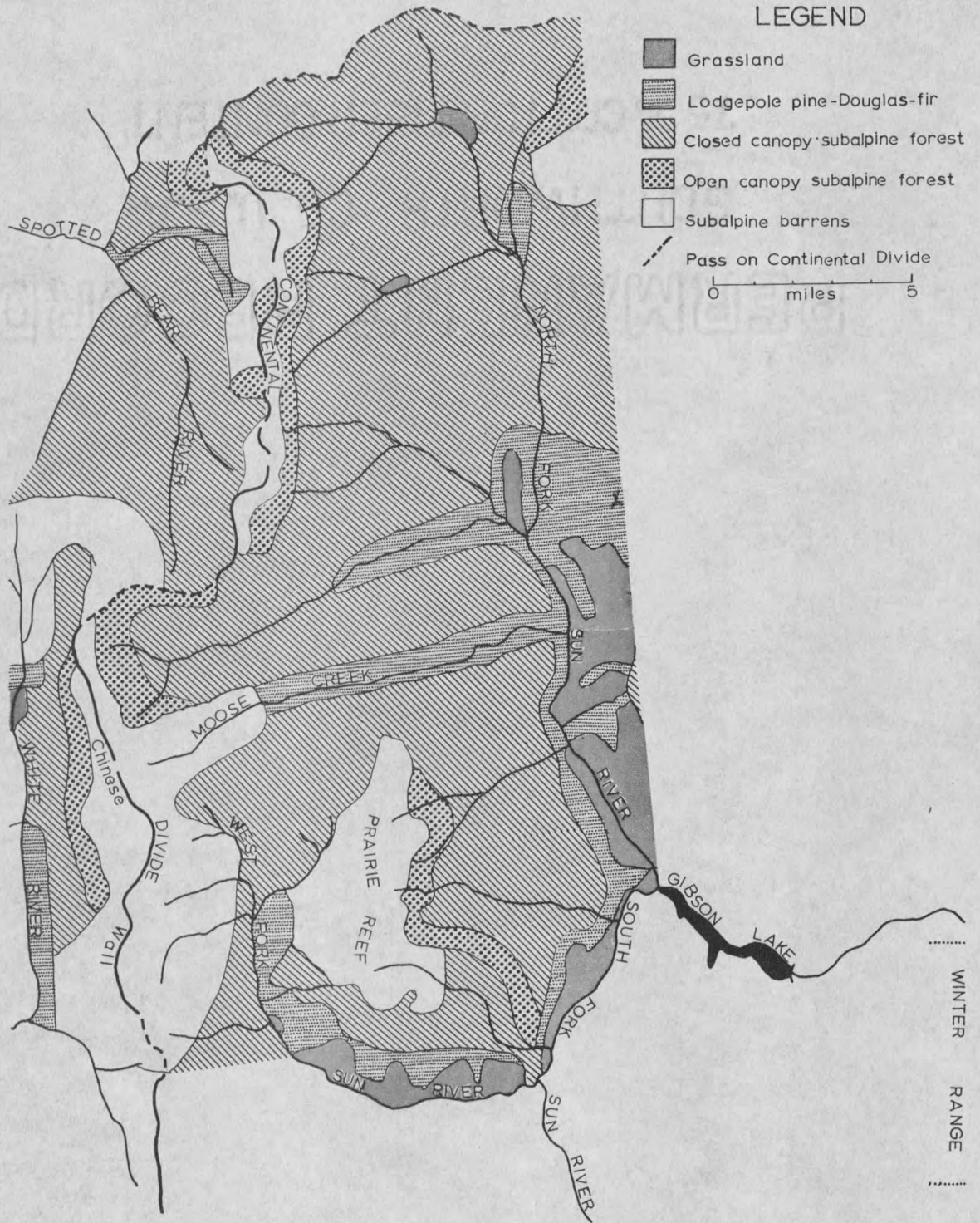


Fig. 1. The study area showing vegetative types.

half of the study area, the Continental Divide continues as a series of cliffs which can be crossed through four major and two minor passes. The section of the Continental Divide which forms the northern edge of the study area is a forested ridge which can be readily crossed by elk (Fig. 1).

The entire study area lies within the Bob Marshall Wilderness Area from which motor driven and wheeled vehicles have been excluded. The area lying between the North and South Forks of the Sun River and the Continental Divide is in the Sun River Game Preserve, established in 1913 to protect the Sun River elk herd.

The described winter range of the herd is located at an elevation of about 5,000 feet in the warm chinook belt along the eastern edge of the mountains, where they rise abruptly from the Great Plains.

Records of the weather station at Gibson Dam, about midway between the winter range and the summer study area, indicated an average annual precipitation of 17.24 inches. The long term annual mean temperature at the 4,590 foot elevation was 41.7 degrees with a high of 88 and a low of -42 degrees Fahrenheit.

Big game animals other than elk found in the study area were mule deer, white-tailed deer, bighorn sheep, mountain goats, black bear and grizzly bear.

The Vegetation

In this study, five vegetative types and three subtypes were recognized (Fig. 1).

Grassland: This type covered a relatively small portion of the study area at elevations of 4,800 to 5,300 feet. The southern half of the area adjacent to the North Fork of the Sun River was the most extensive area covered. Usually the type consisted of grassy flats with scattered aspen (Populus tremuloides) and lodgepole pine (Pinus contorta). Several large areas had been seeded to timothy (Phleum pratense) as an erosion control measure following the elimination of cattle grazing in the early 1930's (Cooney, 1939). Resembling the bunchgrass prairie of the winter range, some of the characteristic native plants were bluebunch wheatgrass (Agropyron spicatum), Idaho fescue (Festuca idahoensis) and shrubby cinquefoil (Potentilla fruticosa).

Lodgepole pine-Douglas-fir: In general this type formed a belt surrounding the grasslands. As mentioned by Larsen (1930) it intergraded at higher elevations into the spruce-fir subalpine forest. Englemann spruce (Picea englemanni) and alpine fir (Abies lasiocarpa) occupied the more mesic sites. The lodgepole pine-Douglas-fir (Psuedotsuga menziesia) type occupied relatively little area but was found in scattered stands throughout the study area. The chief character used in its recognition was the presence of an understory of pinegrass (Calamagrostis rubescens). It was previously classified by Cooney and Redman (1934) as "coniferous timber with food".

Subalpine forest-closed-canopy: To permit the differentiation of use by elk, the subalpine forest was divided by means of the understory into the closed-canopy type (Fig. ³2) and the open-canopy type (Fig. ⁴3).



Fig. 2. Burned-over areas of subalpine barrens in the foreground with the Chinese Wall of the Continental Divide in the background.

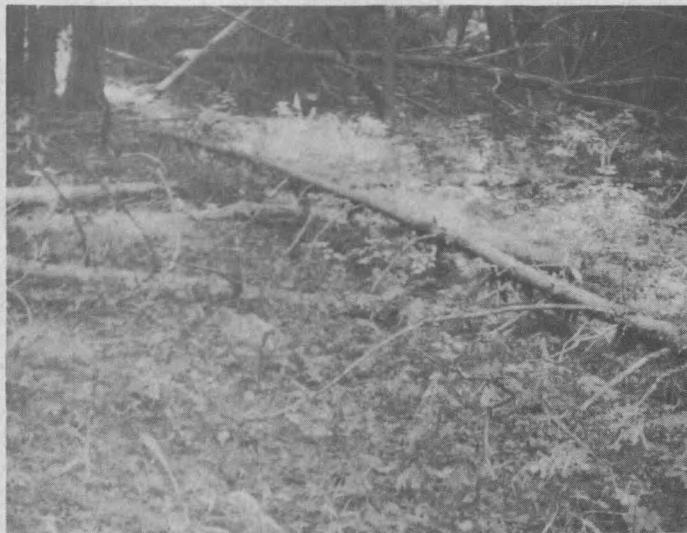


Fig. 3. The forest floor of the closed-canopy subalpine forest.

The closed canopy subalpine forest was the predominant vegetative type of the study area. It consisted of Englemann spruce and alpine fir with whitebark pine (Pinus albicaulis) on the high exposed slopes. The understory was characterized by a paucity of both plant numbers and species. Heartleaf arnica (Arnica cordifolia) was scattered through the forest and on some sites shrubs of wild gooseberry (Ribes inermiss) and smooth menziesia (Menziesia glabella) were found. This type was classified by Cooney and Redman (Ibid.) as "coniferous timber without food".

Subalpine forest - open-canopy: Trees were present in some locations at all elevations in the study area. The scattered Englemann spruce and alpine fir of this vegetative type formed the upper border of the forest. Where a burn was being reforested, it was regarded as forest when trees were tall and frequent enough to hamper view beyond a hundred feet. Limber pine (Pinus flexilis), lodgepole pine and whitebark pine were common on old burns. The understory consisted of a beargrass (Xerophyllum tenax)/low red huckleberry (Vaccinium scoparium) union, with a lush forb type in the wetter areas. The characteristic plants of the forb areas were profuse amounts of butterweed (Senecio triangularis) and scattered plants of green false hellebore (Veratrum viride).

Subalpine barrens: This type extended as low as 6,500 feet and occupied the high ridges above the forest. Included in this type were the natural treeless areas of the ridges and high basins as well as several large burns, 40 to 50 years of age, of the southern half of the study area which had not grown back into forest (Fig. 2). These were the "non-restocking burns" of Rognrud (Ibid.).

To study the three subtypes of the barrens, a special area was selected in the burned over upper basin of Moose Creek. This appeared to be typical of the barrens and the vegetative groupings similar to the unburned as well as the burned areas. The Moose Creek area was reported to have been burned in 1918 (Hazel, 1957) but very little forest reproduction was present in spite of this 40 year interim. The results of the vegetative analysis are presented in Table I. Daubenmire (1952) presented evidence that soil pH may be one of the major ecologic factors influencing the gross vegetational features of this type as well as the open canopy forest.

Beargrass subtype: The beargrass subtype (Fig. 5) was the most extensive one found in the barrens and it also formed the understory of the open canopy forest. What forest reproduction there was in the burned areas usually occurred on this subtype. Beargrass and low red huckleberry were the predominant species, almost to the exclusion of everything else. This subtype covered large areas in the burns, on the benches under cliffs of the divide and on ridgetops.

Mixed subtype: The mixed subtype (Fig. 6) was second to the beargrass union in area covered. It was most common on south or west slopes and contained quite high percentages of forbs, grasses and sedges. The beargrass plants were widely scattered and low red huckleberry as well as the milkvetch of the forb community were absent. Plants common in this subtype were beargrass, yarrow (Achillea lanulosa), Townsendia sp., bluebunch wheatgrass, Bromus marginatus, alpine bluegrass (Poa alpina) and sedges (Carex sps.).

Table I. Vegetative composition and use by elk of the Moose Creek study area.

Vegetative components	Subalpine barrens subtypes					
	Beargrass		Mixed		Forb	
	C ^{1/}	F ^{2/}	C	F	C	F
Beargrass	35	90	27	50	5	5
Low red huckleberry	16	70	--	--	-	-
Forbs	16	95	34	100	80	100
Grasses	1	10	13	70	--	--
Sedges	10	55	9	35	--	--
Bare ground	13	55	23	75	15	95
Per cent of Moose Creek study area covered by subtype	50		30		25	
Total elk pellet groups along two 100 ft. transects	7		40		26	
Elk observed on subtype 1957 and 1958 combined						
June	3		53		69	
July	1		76		213	
August	1		42		98	
September	-		40		--	

^{1/} Average coverage of 20, two by five decimeter plots in per cent ($\pm 10\%$).

^{2/} Frequency of occurrence in 20, two by five decimeter plots in per cent.



Fig. 4. The open canopy subalpine forest.

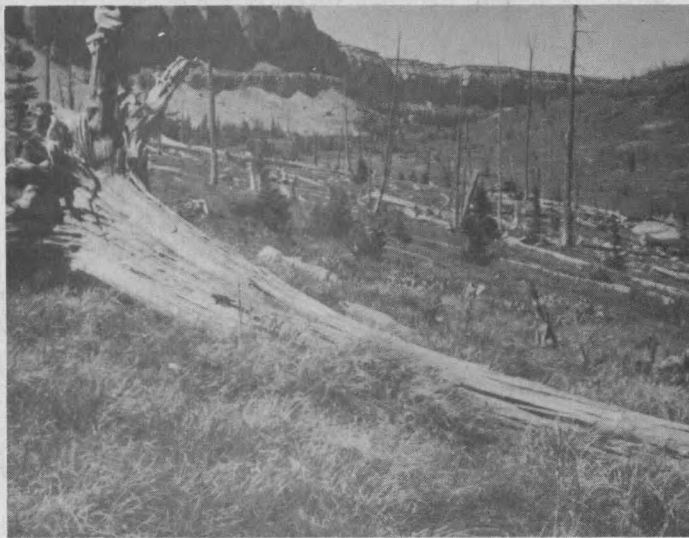


Fig. 5. The beargrass subtype in upper Moose Creek.

Forb subtype: This community (Fig. 7) had a low growth form and consisted mostly of forbs. A sharp ecotone between it and the beargrass subtype was characteristic. It occurred in scattered patches throughout the beargrass areas and was the major community on talus slopes. The characteristic plant of the forb subtype was a milkvetch, Astragalus miser. Other abundant plants were yarrow, dandelion (Taraxacum sp.) and in the wetter areas, siberian chive (Allium sibericum).

USE OF VEGETATIVE TYPES

The numbers of elk observed in the various vegetative types is presented in Tables I and II. Along with observations of fresh elk sign in forested areas, this indicated certain patterns of vegetative use. In June, during the calving season, the majority of elk utilized the grassland areas at lower elevations, although some use of all vegetative types was noted. In late June and early July elk moved through the forest types, until by mid July many were found in the subalpine barrens and along the upper edges of the subalpine forest. In the subalpine barrens the forb subtype was favored. In late August there was a downward movement into the forested areas and by September these types were heavily utilized. All harems and sexually active males observed were seen in the forest types. A few scattered elk were present in all vegetative types throughout the summer.

The apparent lower level of use of the subalpine barrens during June 1957 as compared to June 1958 was probably the result of severe weather conditions which favored the use of types with cover during the obser-

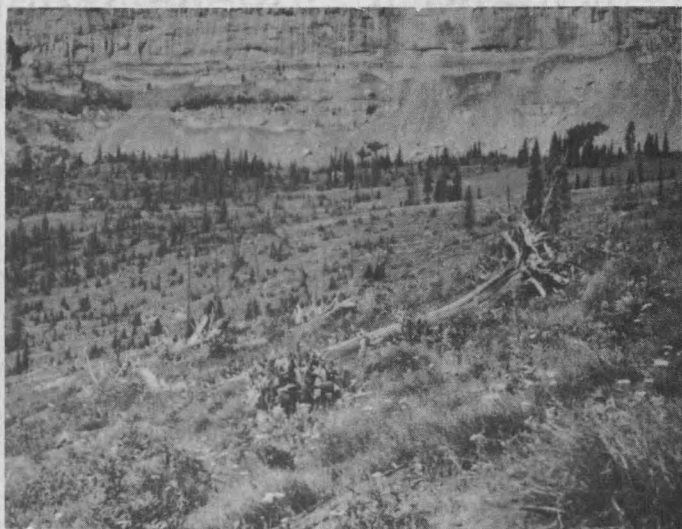


Fig. 6. The mixed subtype in upper Moose Creek.



Fig. 7. The forb subtype in upper Moose Creek.

Table II. Per cent of elk seen on various vegetative types.

Months	Subalpine barrens			Subalpine forest		Lodgepole-douglas fir	Grassland	Number of elk
	Beargrass	Mixed	Forb	Open	Closed			
June 1957	0.2	6.2	6.4	--	0.2	1.0	86.0	471
June 1958	1.0	21.2	6.8	1.2	0.2	3.5	66.1	576
July 1957	0.4	7.8	43.8	10.6	1.0	7.6	28.8 ^{1/}	801
July 1958	3.0	24.0	52.8	10.4	0.3	7.4	2.1 ^{2/}	337
August 1957	4.0	47.0	30.0	19.0	--	4.0	1.0	101
August 1958	--	1.7	82.6	15.7	--	--	--	121
September 1957	5.7	2.8	5.7	22.9	5.7	8.6	48.6	35
September 1958	--	39.3	8.8	21.6	17.6	8.8	3.9	102

^{1/} Seen during the first two weeks of July.

^{2/} Vegetative type not covered during the first two weeks of July.

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vation period.

The July grassland data for the two years is not strictly comparable. The July use of the mixed subtype differed considerably between the two years as did the August use of both mixed and forb subtypes (Table II). This may have reflected the unusually cool and wet July of 1958 (Table III) which favored prolonged succulence of the forbs. The elk food habit studies of Rouse (Ibid.) and others report a high consumption of grass in the spring and fall with a high forb use during the summer.

The beargrass areas received little use. Although Smith (1930) indicated use of beargrass by the Sun River elk under severe winter conditions and White (1958) reported use of the flowers by deer during the summer months, this coarse member of the lily family is poorly suited to be forage. In both the burned and unburned regions, the beargrass areas appeared similar to the understory of the open canopy subalpine forest. Daubenmire (Ibid.) when speaking about the open canopy subalpine forest remarked, "The grazier will find the Picea-Abies / Xerophyllum habitat type practically worthless either in climax condition or after burning, for the undergrowth dominants are unpalatable and retain dominance by sprouting promptly after burning." This situation appeared to prevail in the present study area and it is considered unlikely that the burned over beargrass areas supported appreciably more elk than its equivalent of unburned subalpine forest. An average of 25 elk were seen per day in the burned habitat as compared with 15 for the unburned areas. This difference probably had little meaning as the elk could be spotted at a much greater range in the burned areas.

Table III. Weather records, July 1957 and 1958.

Year	Precipitation		Temperature	
	Total inches	Days on which rain fell	Average maximum	Average minimum
1957	0.51	5	79.3° F.	45.7
1958	3.66	11	70.8	44.1

Source: Gibson Dam; Climatological Data, Montana. U. S. Weather Bureau LX(7) and LXI (7).

Used as an index to group size, the number of elk seen per observation was found to be consistently higher for the open areas of grassland and barrens than for the timbered areas. Undoubtedly much of this differential was due to the poor visibility in forested areas, however no groups of over 20 were observed in forested areas while groups larger than this were common in open areas. The overall averages for the study were 7.2 elk per observation (304 observations) for the open areas and 2.5 (114 observations) in the forested areas. Dasmann and Taber (1956) indicated that animals which inhabit dense cover usually form small groups or are solitary, while herds are characteristic of open areas. This does not contradict the above mentioned relationships between burned and unburned habitat which refer to the number of animals present in the area rather than the size of groups.

The maximum of 119 elk in a summering group recorded for this study is considerably less than the 300 reported by Murie (1951) and the 1,500 reported by Altman (1956) for the Jackson Hole elk herd in Wyoming.

MIGRATION

During the last week of April, 1957 a considerable reduction in the number of elk on the winter range became apparent (Table IV). Some of the elk were observed leaving the winter range by way of a well used trail which crossed from one canyon to the next over passes in the upper portions of the drainages bordering the winter range rather than crossing through the reefs along the Sun River near human habitation. These and other passes also assumed considerable importance in the fall when 67 per cent of the tag returns were from kills made in the vicinity of passes.

That much of this early movement was into the areas along the lower North, South and West Forks of the Sun River is suggested by data in Table IV. Elk number five (Table V) was observed on the winter range April 4, 1957 and in the grassland areas of the North Fork on May 28, 1957. Elk number seven (Table V) was observed on the winter range May 8, 1957 and with a calf in the grassland areas of the North Fork on May 28, 1957. Elk numbers 3 and 22 (Table V) also moved from the winter range to the North Fork. These observations indicate that the spring elk population of the lower North Fork is made up of animals from the winter range in addition to, presumably, the group of elk which had wintered in the North Fork (Table IV). Four elk (3, 17, 18, 19; Table V) returned in subsequent years to the same general portion of the North Fork as that on which they had been marked as calves. That calves born on the North Fork do not necessarily winter there is indicated by two marked elk (3, 33; Table V).

Table IV. Distribution of elk as indicated by aerial and ground observations.

Date	Winter range	Forks of the Sun River	Summer range ^{1/}
March 1, 1957 ^{2/}	2,000+	350	not covered
April 27, 1957 ^{2/}	500+	900	"
June 15-30, 1957 ^{3/}	100†	410	60
July 15-31, 1957 ^{3/}	very few	60	500
Nov. 5-10, 1957 ^{2/}	150	565	tracks along divide
Dec. 31, 1957 ^{4/}	525	not covered	not covered
March 26, 1958 ^{4/}	1500+	not covered	not covered
June 15-30, 1958 ^{3/}	100†	400	170
June 15-31, 1958 ^{3/}	very few	30	300

^{1/} Prairie reef and the portion of the continental divide in the study area.

^{2/} Aerial counts.

^{3/} Number of elk observed during vegetative study.

^{4/} Ground trend counts.

Table V. Localities of tagging and relocations for 71 elk as determined by sight records and hunter kills.

Elk No.	Date and locality of tagging	Relocations	Miles from where tagged
1 ^F _c 1/2	Winter range Jan. 1957	Prairie Creek July 1957 Killed Home Gulch Dec. 1957	19 2
2 ^F _o	" " " "	Prairie Creek July 1957	19
3 ^F _o	Winter range Feb. 1957 recapture	First tagged N. F. Sun River June 1948 N. F. Sun River June 1957	14 14
4 ^F _y	Winter range Feb. 1957	Killed White River Oct. 1958	28
5 ^F _o	" " " "	Winter range April 4, 1957 N. F. Sun River May 28, 1957 N. F. Sun River June 1957	0 18 20
6 ^M _c	" " " "	Killed 6 miles SW winter range Nov. 1958	6
7 ^F _o	" " " "	Winter range May 8, 1957 N. F. Sun River May 28, 1957 Glenn Creek July 1958	0 14 19
8 ^F _o	Winter range Mar. 1957	Winter range March 1958	0
9 ^F _o	" " " "	Red Shale Creek July 1957 Winter range Jan. 1958 Red Shale Creek July 1958	27 0 27
10 ^F _o	" " " "	Killed Hannon Gulch Nov. 1957	11
11 ^F _o	" " " "	Winter range Dec. 1957	0
12 ^F _o	Winter range Apr. 1957	Killed winter range Oct. 1957	0
13 ^F _y	" " " "	Winter range March 1958	0

1/ M - male; F - female

2/ Age when tagged: c - calf; y - yearling; o - older.

Table V, continued.

Elk No.	Date and locality of tagging	Relocations	Miles from where tagged
14 ^F _y	Winter range Feb. 1957	Winter range March 1958	0
15 ^F _o	Winter range Jan. 1957	Winter range March 1958	0
16 ^F _y	Winter range Apr. 1957	Killed 8 miles S. of winter range Dec. 1957	8
17 ^F _c	N.F. Sun River May 1957	N.F. Sun River June 1958 Killed N.F. Sun River Nov. 1958	7 3
18 ^M _c	N.F. Sun River May 1957	Red Shale Creek July 1957 N. F. Sun River June 1958	11 5
19 ^F _c	N.F. Sun River June 1956	N. F. Sun River June 1957	6
20 ^M _c	Winter range Feb. 1958	Moose Creek June 1958	25
21 ^F _o	" " " "	Moose Creek June 1958 Moose Creek Aug. 1958 Killed S. Gibson Lake (route 1) Nov. 1958	25 25 6
22 ^F _c	" " " "	N.F. Sun River June 1958	16
23 ^F _y	" " " "	Killed White River Oct. 1958	28
24 ^M _y	Winter range April 1958	Glenn Creek July 1958 Glenn Creek Aug. 1958	20 19
25 ^F _o	Winter range Feb. 1958	Killed 2 miles SW winter range Nov. 1958	2
26 ^F _o	" " " "	Killed 2 miles SW winter range Nov. 1958	2
27	Winter range ---	Killed Camp Creek Oct. 1958	26

1/ M - male; F - female

2/ Age when tagged: c - calf; y - yearling; o - older.

Table V, continued.

Elk No.	Date and locality of tagging	Relocations	Miles from where tagged
28 ^F _O	Winter range Feb. 1957	Glenn Creek. July 1957	19
29 ^F	" " " "	Glenn Creek. July 1957	19
30 ^F	Winter range ---	Wrong Creek June 1958	27
31 ^M _C	N.F. Sun River June 1958	N. F. Sun River June 1958	7
32 _C	N.F. Sun River June 1958	Killed N.F. Sun River Nov. 1958	1
33 ^M _C	N.F. Sun River May 1956	Winter range April 1958	14
34-37	Winter range 1957 and 1958	Killed Home Gulch Nov. and Dec. (1) 1957, (3) 1958	2
38-53	Winter range 1957, 1958 and three before 1957	Killed S. Gibson Lake (route 1) (4) 1957, (12) 1958	4-12
54-59	Winter range 1957, 1958 and one before 1957	Killed S. Gibson Lake (route 2) (1) 1957, (5) 1958	4-12
60-71	Winter range 1957, 1958 and three before 1957	Killed N. F. Sun River Oct. and Nov. (6) 1957, (6) 1958	11-12

1/ M - male; F - female

2/ Age when tagged: c - calf; y - yearling; o - older.

An aerial survey during the first week of June 1958 showed a few elk present in several areas along the Continental Divide. Movement across the Divide during May, in previous years, had been reported a number of times by members of the Montana Fish and Game Department (Zajanic, 1948). Considerable sign of movement through the passes of the Divide during the third week of June was noted in both 1957 and 1958. In 1957, during this

time, snow deep enough to limit horse travel was present in many areas along the Divide. In June, 1958, the phenology of the high country was an estimated two weeks ahead of 1957, and there was little snow remaining. Three marked elk (20, 21, 30; Table V) were observed in the higher areas along the Divide during the latter half of June 1958.

Calving was observed on the winter range and in the grassland areas of the lower North and West Forks of the Sun River (Fig. 8). A number of elk calves in the high barrens areas of Wrong Creek and Moose Creek during the last half of June indicated either calving in these higher locations or early movement of calves. That elk calves can move considerable distances is indicated by one calf (31; Table V) which was marked when a week old (Johnson, *Ibid.*) and which had moved seven airline miles and across the North Fork of the Sun River by the next time it was seen, two weeks later. Johnson (*Ibid.*) and Brazda (1953) reported no movements of calves more than two to three miles during the first three weeks of June.

One of the longest movements recorded for the Sun River herd was indicated by a hunter tag return from Big Salmon Lake of the South Fork of the Flathead drainage (Casagrande, 1957), a distance of 40 airline miles (63 trail miles) from the winter range. This indicated a movement similar to that suggested by Gaffney (1941) as the ancestral migration of the Flathead herd from the Great Plains. The maximum movements during this study were shown by two tag returns from the White River in the South Fork of the Flathead drainage, a distance of 28 airline miles from the winter range.

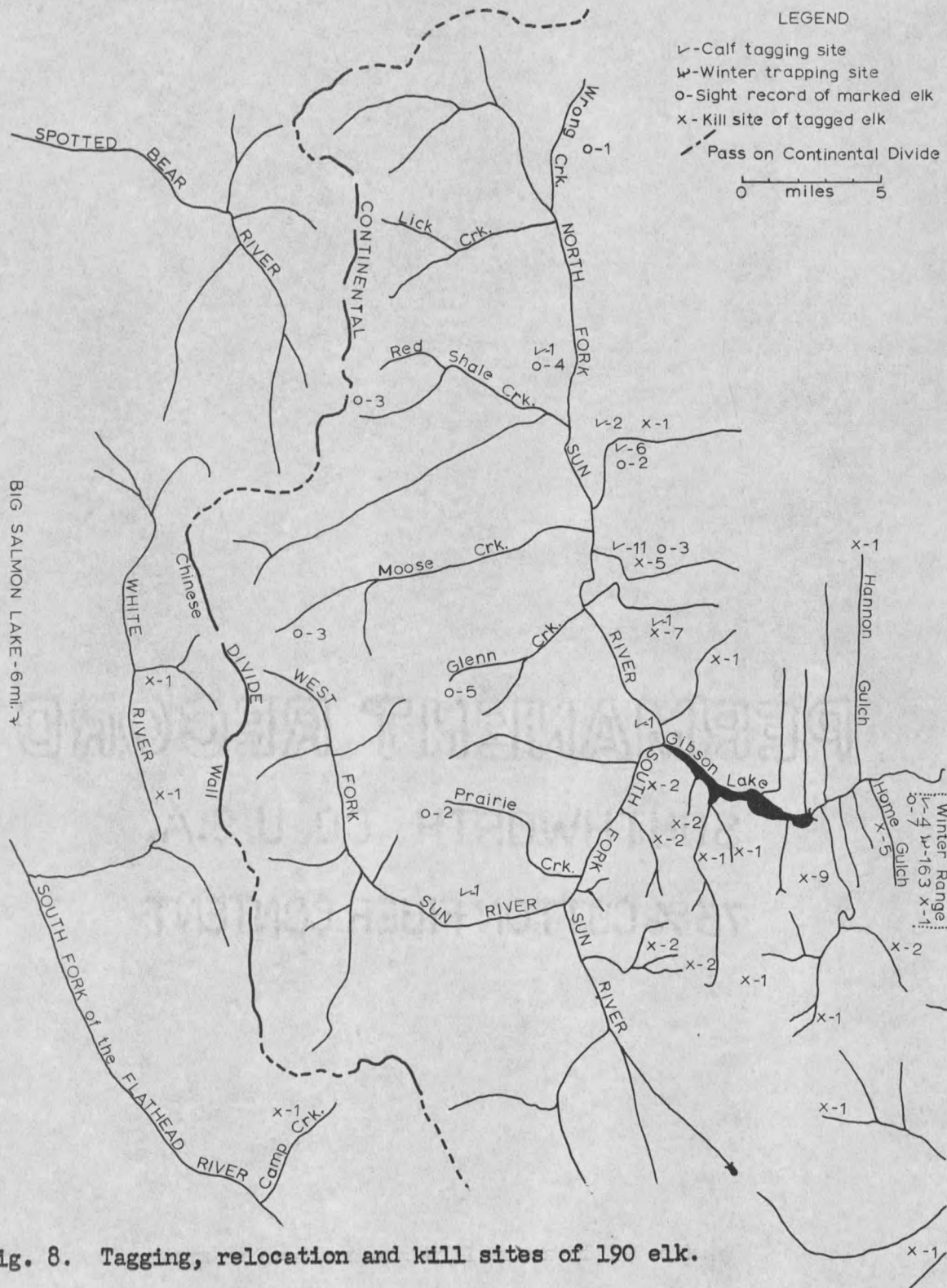


Fig. 8. Tagging, relocation and kill sites of 190 elk.

One animal (9; Table V) was observed in the same township and section during July of both years. This animal and five others (8, 11, 13, 14, 15; Table V) also returned to the same winter range in consecutive years. Each of two marked elk (21, 24; Table V) were observed twice in the same locality during a summer.

An attempt was made to evaluate the hypothesis that an early fall hunting season on the west side of the Divide induced migration into the Sun River Game Preserve on the east side of the Divide. Major pass areas were checked for tracks in both 1957 and 1958. The season opened on September 15, and hunting was allowed on the west slope of the Divide except for the portion of the Spotted Bear drainage immediately west of the Lick Creek passes (Fig. 8) which was closed in 1958.

Throughout both summers, small groups of elk were observed crossing the Divide in both directions. In September, 1957 two passes were checked before hunters entered the open area on the west slope of the Divide. Twelve elk were observed to have crossed into the game preserve. During the first two days after the opening of the season, three elk crossed into the preserve and one into the open area. In September, 1958 eight passes were checked. Four of these passes were open to hunting on their west slopes and closed on the east. In the first two days after the season opened 17 elk (Janson, 1958) were observed to have crossed the Divide with at least five moving into the open areas. Four other passes, closed to hunting on both slopes, were also checked. Five elk moved west and one east during the first three days of the hunting season. This movement was similar to that observed during the summer. Opening day

hunting pressure in one of the more popular areas was 12 hunters in the 18 square mile basin of the upper White River in 1957 and four in 1958 (Casagrande, 1958).

An aerial survey made on October 9, 1957, after a heavy snowfall, showed 18 fresh game trails crossing the Divide in the study area. To avoid considering mountain goat trails, only trails which descended on both sides of the Divide were counted. Three of the trails were heavily used through the passes of the upper White River basin. The last hunters were reported to leave the basin on October 17. Another flight made on November 5 showed nine trails crossing the Divide. Of six well used trails, one was in the area of the White River basin.

It is considered unlikely that the level of hunting in the early season had any appreciable effect on elk migration. Because of the observed ability of elk to negotiate snow of considerable depth and the presence of game trails through the passes in November, the hypothesis that elk frequently are imprisoned by snow, against their will, on the west side of the Divide also seems unlikely.

To evaluate some of the factors influencing the fall migration, the weekly hunter kill figures for seven weeks in November and December of 1957 and five weeks in 1958 were classified by temperature and snow cover (Table VI). Weekly ground trend counts for six weeks in 1957 were also classified. A week in which over 50 elk were killed was regarded as a period of high kill. If the minimum temperature dropped below 10° Fahrenheit for two consecutive days it was regarded as a period of low tempera-

Table VI. Weekly trend counts and hunter harvest classified by weather conditions.

Weather Conditions ^{1/}	Number of Weeks			
	High		Low	
	Kill ^{2/}	Count	Kill	Count
Snow with high temperatures	4	4	2	-
Snow with low temperatures	1	-	-	-
No snow and high temperatures	1	-	4	2

^{1/} Source; Gibson Dam; Climatological Data, Montana. U. S. Weather Bureau. IX(11, 12); IXI(11).

^{2/} Total weekly kill checked through checking stations.

ture. The lowest temperature recorded during the hunting seasons was a -12° F. Snow cover was regarded as an influencing factor whenever it reached a depth of two inches. Maximum depth recorded during the hunting seasons was 11 inches. A high trend count was regarded as one in which the number of elk observed on the winter range, which was closed to hunting, was 50 per cent above the count for the preceding week.

Table VI indicates that there is some correlation between the presence of snow and the indices of a high migration rate. It is hypothesized that snow increased the rate of migration as well as provided a tracking medium for hunters. Anderson (1954) and Murie (Ibid.) regarded snow as the chief causal factor of fall migration.

HARVEST BY HUNTERS

Analysis of 51 tag returns from hunter killed elk indicated that the Sun River herd was harvested during three different hunting seasons in each year.

The earliest season began on September 15 on the west side of the Divide. Three tag returns (six per cent) were received from this season, two from the White River and one from Camp Creek. The second season opened on the third weekend in October and covered the area east of the forks of the Sun River. The third season was a modification of the second in which the area north of Gibson Lake and the Sun River was closed on November 15.

About 29 per cent of the tag returns came from the area north of Gibson Lake and most (13 of 15) of these were from the North Fork of the Sun River. Fifty-five per cent of the tag returns were from two migration routes south of Gibson Lake (Fig. 8). Route one, which supplied 34 per cent of the tag returns, was through a series of passes one to two miles south of the Lake. Route two, which furnished 12 per cent of the tag returns, was through another series of passes five to six miles south of the Lake. Fifteen per cent of the tag returns were from the vicinity of the passes immediately adjoining the winter range. The remaining four per cent were from scattered kills in the southern Sun River drainage.

Since the hunting season in the Sun River closed when the desired kill was reached, the length of the season varied considerably for the two years as did the type of hunter that did the killing. The area lying east of a north-south line drawn through Gibson Dam is relatively access-

ible and can reasonably be hunted on foot with the aid of a four-wheel drive vehicle. These features enable weekend hunters to use the area to a greater extent than the region west of this line. The area west of the line is relatively inaccessible because of a combination of rugged terrain and the Bob Marshall Wilderness area. Hunters who utilize this area usually use horses, at least to carry out the kill and are frequently on extended packtrips. In 1958, which had a kill of 650 animals, the season closed during the last week of November. In 1957, with a milder fall and a kill of 850 elk, the season ran well into January. One-third of the tag returns came from areas accessible to hunters without horses in 1958 as compared with 46 per cent in 1957. Thus a longer season appears advantageous to the hunters without horses.

Since elk were "aged" when tagged it was possible to predict what the age composition of the tag return kill should be if all age classes were equally vulnerable. Comparison of this predicted kill with the actual kill (Table VII) revealed a considerable difference. Application of a chi square goodness of fit test gave a confidence level of 90 per cent that there was a "real" difference between the predicted kill and the actual kill. It was noted that the two year age group contributed the major portion of the computed chi square value under the mentioned test while the yearling and calf age groups contributed much smaller amounts. While the kill for both sexes in the two year age group was higher than predicted, most of the differential was due to the males. The differences were not statistically significant when classified by sex. Only one of the two year old elk was killed before November in the

Table VII. A comparison of predicted kill with actual kill of tagged elk.

	Adults	Two year olds	Yearlings	Calves	Total
Predicted	28	5	6	4	43
Actual	30	9	3	1	43

more active portion of the breeding season. An explanation for the differences in kill, if "real", of the three age groups is not readily apparent.

EVALUATION OF MARKERS

Compilation of information gathered from hunter killed elk in 1958, relocations of marked animals and retrapping records permitted an evaluation of the comparative durability of the two types of plastic markers.

In general the sheet plastic markers appeared to be the most durable (Table VIII) with one marker being retained for 41 months. Two intact sheet plastic markers in the over 30 month category were damaged but not severely enough to prevent field recognition. Of the five elk which lost their markers, four had also lost the metal stock tag holding the marker on the ear. The markers used were comparable to the heavier ones described by Brazda (Ibid.) and the durability was similar to that reported by him.

The ribbon type markers could be read more quickly and at greater distances than the sheet plastic ones, however they were less durable.

Table VIII. The comparative durabilities of two types of plastic markers.

Time in months	Condition of markers			Total
	Intact	Damaged ^{1/}	Lost	
Ribbon markers				
4-6	7	-	2	9
7-13	12	6	4	22
16-21	1	1	5	7
Sheet markers				
4-6	3	-	-	3
7-13	16	-	5	21
16-21	1	-	-	1
30+	2	-	-	2

^{1/} Damaged beyond recognition.

When last seen only 20 of 38 elk could have been recognized by means of the ribbon marker. The longest retention period of a recognizable ribbon marker was 16 months. Most of the ribbon markers were made by using a Jesse knot (Craighead, 1956) but cracks were observed at these knots in a number of the returned markers. The use of an industrial stapler (Casagrande, 1958) to eliminate these knots shows promise.

SUMMARY

A study of summer use of vegetative types, migration and harvest of

the Sun River elk herd in Montana was conducted during 1957 and 1958. A total of 190 elk was individually tagged and marked to facilitate movement and harvest studies. Discussion of the usage of vegetative types was based upon observations of 2,544 elk seen during the summers of 1957 and 1958.

Five vegetative types and three subtypes were recognized in the study area. During June the grassland areas were the most heavily used type. Movement through the forest types to the subalpine barrens was noted in June and July. The most heavily used subtype in the subalpine barrens was the forb subtype, followed by the mixed subtype. The beargrass subtype, which covered half of a special study area in the barrens, was little used. In late summer a downward movement into the forest types was noted. All harems and sexually active males observed were in forest types.

Group size appeared to be related to the cover type with the largest groups being found in open areas.

Migration of part of the elk herd from the winter range to the North Fork of the Sun River was observed. The grassland areas of the lower North Fork drainage were used as a calving ground.

Checks for movement through the passes of the Continental Divide indicated that a September hunting season on the west side of the Divide did not induce any appreciable movement of elk into the Sun River Game Preserve on the east side.

Weekly hunter kill and weekly ground trend counts on the winter range indicated that the fall migration is at least partially correlated

with snowfall.

Six per cent of 51 tagged elk were killed in the September hunting season on the west side of the Continental Divide. The majority of the elk harvested from the Sun River herd were killed on the North Fork of the Sun River and in the area south of Gibson Lake during November and December. Sixty-seven per cent of the hunter tag returns were from elk killed in the vicinity of passes. Because of the relationships of rugged terrain and the Bob Marshall Wilderness area, a prolonged hunting season appeared to be advantageous to hunters who did not have access to horses.

In a sample of 43 marked elk, an unexpectedly high kill of two year old elk and low kills of yearling and calf elk was noted.

Ear markers of colored sheet plastic were found to be more durable than those made of plastic ribbon material.

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