



Grizzly bear distribution in relation to habitat areas and recreational use : Cabin Creek-Hilgard Mountains
by Bonnie Marie Blanchard

A thesis submitted 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:

The distribution of grizzly bears in relation to habitat areas and recreational use in the Cabin Creek - Hilgard Mountains region of southwestern Montana was investigated during 1975 and 1976. The distribution of grizzly bears was determined by ground and aerial sightings, radio tracking, and locations of other grizzly bear sign. The bears and their sign were unevenly distributed over the study area with the most observations occurring in Cabin Creek Basin and the least in the Hilgard Mountains. Grizzly bear activity in the study area varied in intensity and distribution between 1975 and 1976. Locations of observations increased in elevation from May through September and were most frequent on south and southwest exposures. Grizzly bears probably selected FEID/AGCA (Importance Value = 25.0) and PIAL-ABLA (I.V. = 20.0) habitat types in the study area out of proportion to their availability. Observations occurred most frequently in the FEID/AGCA type during spring and early summer, and in the PIAL-ABLA type during fall. Timbered and open areas accounted for nearly equal numbers of observations. Grasses and sedges had the greatest overall frequency of occurrence in scats and were the most important foods during spring. Whitebark pine nuts were the predominant fall food. Recreational use was concentrated in the Hilgard Mountains during July and August. Hiking was the predominant method of travel, and average recreational use consisted of three people staying three days. Few recreationists left the trails, and the majority of human-grizzly encounters occurred while the person was on the trail. Most grizzly bears responded to the presence of humans by fleeing. The majority of registered recreationists placed a high "value" on the existence of grizzly bears in the study

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RECREATIONAL USE: CABIN CREEK - HILGARD MOUNTAINS

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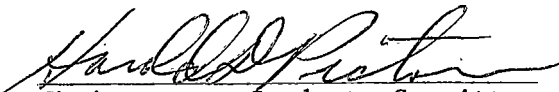
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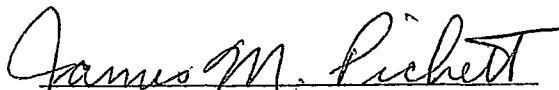
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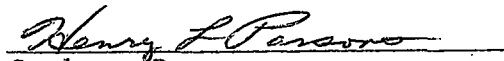
in

Fish and Wildlife Management

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Bozeman, Montana

August, 1978

ACKNOWLEDGMENT

This study was conducted through the support of the Interagency Grizzly Bear Study Team. I wish to thank the IGBS for financial assistance, equipment, and aerial radio-tracking data; and IGBS seasonal field personnel for their attempts to trap bears in the study area and assistance in data collection. I wish to especially thank Mr. Joseph Basile, IGBS Team member, for his advice and encouragement during all phases of the study.

The cooperation and patience of Paul H. Hoskins and personnel of the Hebgen Lake Ranger District, National Forest Service, is appreciated.

I wish to express my appreciation to Dr. Harold Picton, the chairman of my committee, for his advice and assistance in preparation of the manuscript; and to Dr. Robert Moore and Dr. Robert L. Eng for reviewing the manuscript.

Funding was provided by the National Park Service, the U. S. Forest Service, and the Montana Agricultural Experiment Station.

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ABSTRACT

The distribution of grizzly bears in relation to habitat areas and recreational use in the Cabin Creek - Hilgard Mountains region of southwestern Montana was investigated during 1975 and 1976. The distribution of grizzly bears was determined by ground and aerial sightings, radio tracking, and locations of other grizzly bear sign. The bears and their sign were unevenly distributed over the study area with the most observations occurring in Cabin Creek Basin and the least in the Hilgard Mountains. Grizzly bear activity in the study area varied in intensity and distribution between 1975 and 1976. Locations of observations increased in elevation from May through September and were most frequent on south and southwest exposures. Grizzly bears probably selected *FEID/AGCA* (Importance Value = 25.0) and *PIAL-ABLA* (I.V. = 20.0) habitat types in the study area out of proportion to their availability. Observations occurred most frequently in the *FEID/AGCA* type during spring and early summer, and in the *PIAL-ABLA* type during fall. Timbered and open areas accounted for nearly equal numbers of observations. Grasses and sedges had the greatest overall frequency of occurrence in scats and were the most important foods during spring. Whitebark pine nuts were the predominant fall food. Recreational use was concentrated in the Hilgard Mountains during July and August. Hiking was the predominant method of travel, and average recreational use consisted of three people staying three days. Few recreationists left the trails, and the majority of human-grizzly encounters occurred while the person was on the trail. Most grizzly bears responded to the presence of humans by fleeing. The majority of registered recreationists placed a high "value" on the existence of grizzly bears in the study area.

INTRODUCTION

The relationships among grizzly bears (*Ursus arctos horribilis*), habitat areas, and recreational use in the Cabin Creek - Hilgard Mountains area were investigated as a part of the Interagency Grizzly Bear Study Team research in the Yellowstone National Park "ecosystem".

The requirement of federal agencies to delineate "critical habitat" for grizzly bears as stated in the Endangered Species Act of 1973 has increased awareness of the need for more information concerning habitat needs and use by grizzlies. This study provides data on seasonal habitat and food utilization by grizzlies inhabiting federally managed land adjacent to Yellowstone Park.

Very little data exists concerning the effects of recreational activities upon grizzly bear distribution. Chester (1976) studied human-wildlife interactions in the Gallatin Range of Yellowstone Park during 1973 and 1974. He concluded that the intensity of human use did not appear to generally affect wildlife distribution. However, grizzlies were the most likely species to flee from humans and were usually seen away from trails, which tends to indicate an avoidance of human activity. Pearson (1975) suggests that aggressive behavior of grizzlies toward humans is usually a defensive reaction to being surprised at close range, or in protection of young and food supplies. Grizzly bears have been observed in developed areas as well as back-country regions in the Yellowstone "ecosystem" by Knight (1977) and

Craighead and Craighead (1972). These studies report instances of avoidance of human activity by grizzlies as well as cases of apparent tolerance.

Construction of a recreational development which will increase recreational use of the area is under active consideration adjacent to the study area near Mount Hebgen in the Red Canyon Creek drainage. The effects of this increased use upon the existing grizzly population are unknown.

THE STUDY AREA

Physiography

The study area is located in the Gallatin National Forest of Montana, and encompasses 17,427 hectares (67.3 square miles) in the southern end of the Madison Range (Figure 1). It lies approximately seven kilometers (four miles) from the northwest boundary of Yellowstone Park. Elevations range from 2061 meters (6800 feet) at the mouth of Beaver Creek to 3429 m (11,316 ft) on Hilgard Peak.

The southern Madison Range is characterized by recent fault activity, and can be divided into two major geologic units. The deeply dissected, glaciated Hilgard Mountains form the region west of Sentinel Creek (Figure 1) and are largely Precambrian granite with local Paleozoic sedimentary capping (Anon. 1964b). Typical features of glaciated terrain, such as cirques, rock glaciers, and trough valleys, are present. Slopes are steep with frequent outcroppings and talus. Shallow to deep, gravelly to stony soils support vegetation varying from dense lodgepole pine (*Pinus contorta*) forests, to mixed subalpine meadow-Engelmann spruce (*Picea engelmannii*)-subalpine fir (*Abies lasiocarpa*) forests, whitebark pine (*Pinus albicaulis*) forests, krummholz, and alpine vegetation.

The region east of Sentinel Creek (Figure 1) includes the upper Cabin Creek Basin. Witkind (1969) found Paleozoic and Cretaceous shales, sandstone outcroppings, and limestone cliffs overlying

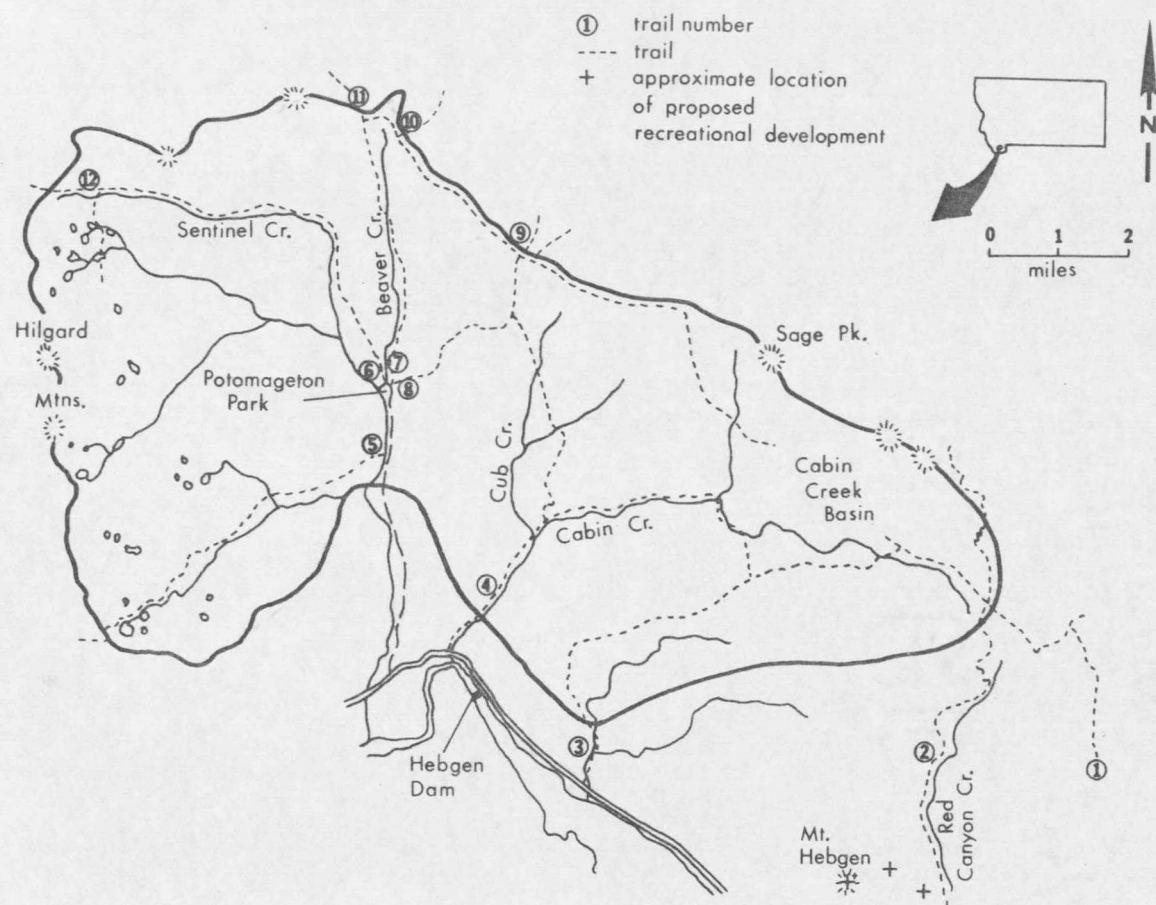


Figure 1. The locations of study area boundaries, trails, and registration boxes.

metamorphic rock. The Kirkwood Ridge and Skyline Ridge anticlines enclose broad, spacious basins. Primary geomorphic processes were glacial scouring, glacial deposition, and mass-wasting (C. Davis 1977; personal communication and unpublished data, Gallatin National Forest soil scientist, Bozeman, MT). This unit is characterized by active slumps and surficial landflows. Soft, unconsolidated bedrock and easily eroded shale and siltstone contribute to this condition.

Many streams draining into upper Cabin Creek have cut 1.5 to 4.5 meters (5 to 15 ft) through soils to bedrock. Range and soil analysis by Forest Service personnel have led to the conclusion that this has resulted in a lowered water table with a subsequent loss of moist meadow types (Anon. 1964a).

Annual precipitation between 1953 and 1967 was 75 to 125 cm (30 to 50 in) in the Cabin Creek Basin and 75 to 150 cm (30 to 60 in) in the Hilgard Mountains (Farnes and Shafer 1970). Annual snowfall is 510 to 760 cm (200 to 300 in) (Farnes and Shafer 1975). Snow survey measurements in 1975 at Sentinel Creek (elevation 2515 m) gave a maximum depth of 292 cm (115 in) during the last week of April, and a maximum of 155 cm (61 in) at Potamageton Park (elevation 2167 m) during late March (Farnes and Shafer 1975).

The Hebgen Dam weather station located between the mouths of Cabin Creek and Kirkwood Creek on the Madison River at an elevation of 1966 m provided climatological data. The area has a typical

montane climate with average annual temperatures around 1.7°C (35°F). Temperature extremes for 1975 and 1976 were 33°C (88°F) in July, 1976, and -37°C (-35°F) in February, 1976 (U.S. Weather Bureau, 1975; 1976).

Land Use Practices

Over the years, the Cabin Creek - Hilgard area has seen a variety of land uses including grazing, logging, and recreation. Hunting and backcountry recreation have been traditional pastimes of the people frequenting the area. Recreational use is mainly in the form of backpacking, fishing, horseback riding, trailbike riding, hunting, and snowmobiling. Maintained Forest Service trails total 103.2 km. The study area can be reached by fifteen different trails, eight of which have trail-head access points within the area boundaries.

Backcountry use and hunting pressure have steadily increased through the years. With recent increasing public awareness of the proposed Taylor-Hilgard Wilderness, the Hilgard Mountains have become more well-known and consequently attract more "wilderness-type" users.

Past grazing of domestic sheep probably resulted in overuse of vegetation, increased soil erosion and compaction, and increased pocket gopher (*Thomomys talpoides*) activity in sections of the Cub

Creek drainage and Cabin Creek Basin (Anon., 1963; Anon., 1964a).

Sheep were not grazed on these allotments after 1963. Forest Service range analysis reported several areas remaining in only "fair" vegetative condition during 1975 and 1976.

Human - Grizzly Bear Encounters

Human - grizzly encounters have been few and most sightings reported to the Forest Service have been from "safe" distances. Problems with grizzlies have been confined largely to hunting seasons when some hunter kills have been wholly or partially consumed. Occasional destruction of property has occurred in hunters' camps.

Forest Service records indicate that bears preyed on sheep when grazing allotments were active. For the periods of record, sheep losses to bears averaged 18 per year (1-32) from 1953 to 1962 in the Cub Creek grazing allotment, and 17.5 per year (0-54) from 1954 to 1963 in the Cabin Creek allotment. The records do not distinguish between losses attributed to grizzly and black bear.

METHODS

Subunit Boundaries

The study area was divided into four subunits to facilitate data analysis (Figure 2). The subunit boundaries were drawn on the basis of major geologic, vegetative, and topographic differences. Subunit One includes Cabin Creek Basin (Figure 1) and associated large subalpine meadow complexes. Subunit Two is largely forested with small interspersed openings. While Subunit Three is vegetationally similar to Two, it is geologically similar to Four which contains the Hilgard Mountains (Figure 1).

Grizzly Bear Distribution

The distribution of grizzly bears was determined by ground and aerial sightings, radio tracking, and locations of grizzly bear sign.

Periodically throughout the field season, Interagency Grizzly Bear Study (IGBS) trapping crews attempted to trap and radio-collar grizzlies in Cabin Creek Basin. On July 19, 1975, a radio-collar transmitter was fitted on a three-year-old female grizzly bear referred to as Bear Four.

Aerial tracking surveys were made regularly throughout the field seasons by the IGBS Team. When a radioed bear was in the study area, ground tracking was attempted daily with a portable AVM receiver and a break-down, two element Yagi antenna.

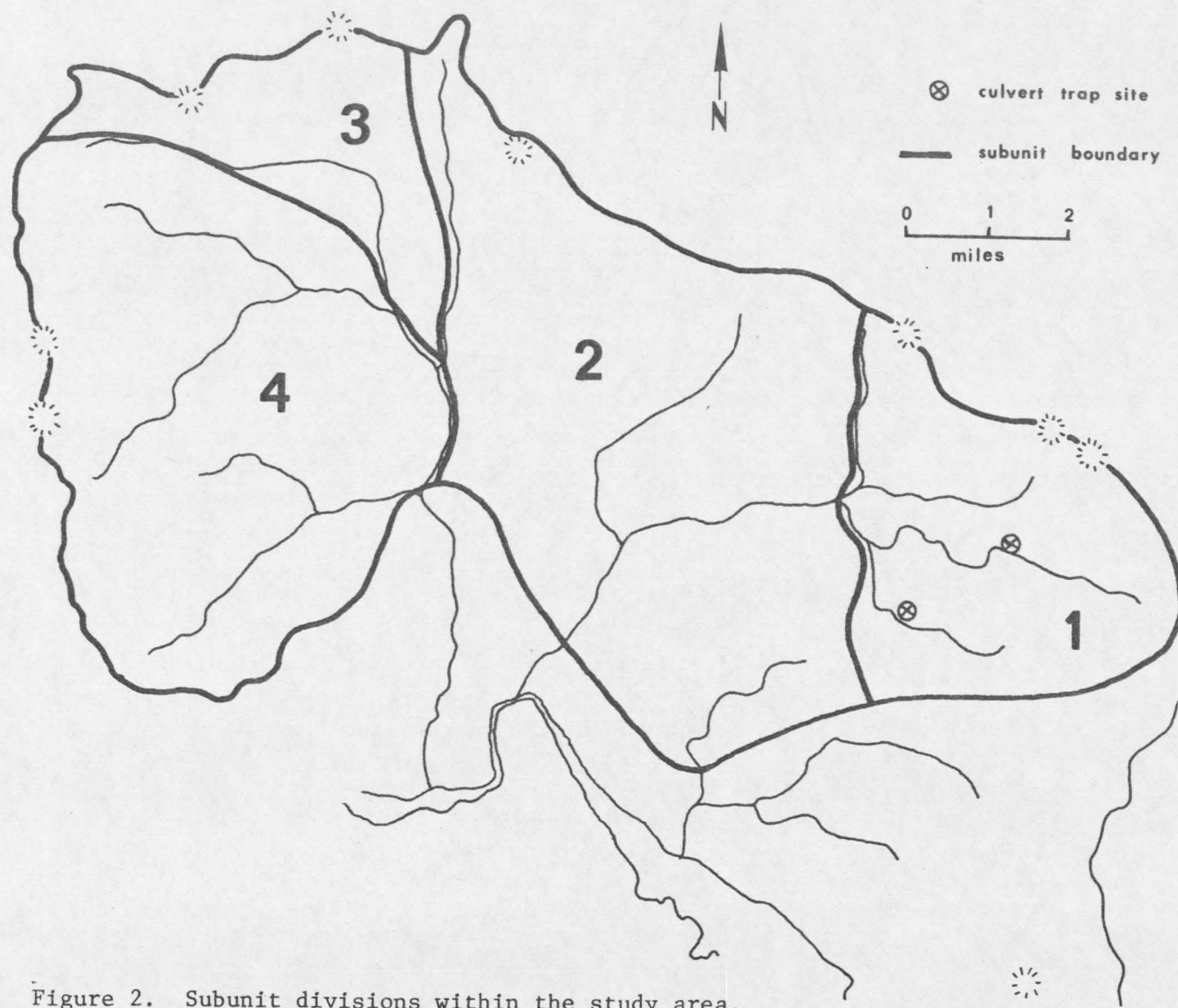


Figure 2. Subunit divisions within the study area.

Ground reconnaissance of major drainages and ridges in the study area for sign of activity was completed at least twice each year. Areas with sign of grizzly activity were more intensively searched.

Tracks identified as grizzly (Greer and Craig 1971) and measured as described by Edwards and Green (1959) aided in determining approximate numbers of grizzlies in an area.

All scats five centimeters or larger in diameter were collected as grizzly scats (Knight 1975). Collected scats were analyzed in the laboratory following methods described by Mealey (1975). Different digestion rates of food items were considered in the analysis of scat content results. Detritus was not included in the analysis, as it was probably ingested incidentally to the consumption of food items. The frequency of occurrence and percent of scat volume for food items in scats were calculated and used to obtain relative Importance Values for the food items. The frequency of occurrence was equal to the total number of times a food item appeared in the scat sample divided by the total number of scats in the sample. The percent of scat volume was equal to the percent each food item contributed to the total scat sample volume. A food item Importance Value was obtained by multiplying the frequency of occurrence and percent of scat volume for that food item and dividing by 100.

Diggings and bed sites were identified as grizzly sign by associations with grizzly sightings, tracks, or scats. Age of all grizzly bear sign was estimated.

Description of Vegetation

Areas of grizzly use were classified by climax habitat type as described by Pfister et al (1977) for forest types and by Mueggler and Handl (1974) for grassland and shrubland types. However, several communities may occur within one habitat type. In order to cover a large area and still obtain detailed information concerning species composition and coverage within communities, a "reconnaissance-type" description of each community encountered was used. Individual communities were identified during ground reconnaissance by differences in canopy coverage of dominant and indicator plant species. All species were listed while walking in a spiral out from a point chosen as characteristic of the community. These reconnaissance plots were therefore circular and variable in size, being at least large enough to contain all species with canopy coverage greater than one percent. Ocular estimates of canopy coverage were made for each species. Plant nomenclature follows Hitchcock and Cronquist (1973). Booth (1972) and Booth and Wright (1959) were also used in species identification.

Communities were mapped on four inches to the mile aerial

photographs and the areas of communities were estimated using grid overlays.

The abundance, distribution, and periods of availability of plant species known to be important foods were noted in community descriptions by cover estimates. Importance Values (I.V.) were calculated for each habitat type as an indicator of its relative importance in providing potential food for grizzlies. An I.V. was obtained by multiplying the number of grizzly bear food plant species in a habitat type by the total canopy coverage of food plant species in that habitat type and dividing by 100. In addition to field observations and scat analysis, Mealey (1975), Mealey et al (1977), and Sumner and Craighead (1973) provided lists of known grizzly bear food plants in the northern Rocky Mountains.

Recreational Use

Registration boxes and mail questionnaires were used to determine distribution and density of recreational use. Twelve registration boxes were installed at trail-heads and trail intersections leading into the area (Figure 1). Boxes at trail-heads (1-3) were operational until July 22, 1975, due to persistent snow drifts. No appreciable recreational use occurred prior to July 1 because of late snow melt in 1975.

Standard methods for using unmanned registration boxes and

mailed questionnaires were used (Lucas and Oltman, 1971; James and Henley, 1968; Robin, 1965; Wenger, 1964; Cushwa and McGinnes, 1963). Registration boxes were placed in conspicuous locations with signs informing users about the study. All trail users seventeen years and older were requested to register. "Group leader bias" was reduced by asking all users in a group to register, which probably also increased the percent of group responses. Registration cards were collected approximately every two weeks from registration boxes at trail-heads, and at least twice from trail intersections until late October. Registered recreationists received questionnaires and a cover letter as soon as possible after collection of the cards (Figures 6 and 7 in Appendix). Stamped, pre-addressed, return envelopes were included to increase the return. A follow-up mailing three to four weeks after the first mailing was used in 1976 to increase the returns.

RESULTS

Grizzly Bear Distribution and Movements

Yearly Variation

Grizzly bears and their sign were unevenly distributed over the study area. A majority (69%) of all observations was recorded in Subunit One during 1975 and 1976 (Table 1). The fewest observations were made in the Hilgard Mountains (Subunit Four). A primary concentration area appeared to be Cabin Creek Basin (Subunit One) during 1975, while observations were more evenly distributed among Subunits One, Two, and Three during 1976. Sightings were more numerous in 1975 than 1976 (Table 2). Also, more grizzly bear scats were collected during 1975 although experience and familiarity with the area had increased by 1976.

TABLE 1. THE DISTRIBUTION OF GRIZZLY BEAR SIGHTINGS, SCATS, AND OTHER SIGN IN THE STUDY AREA SUBUNITS.

Year	<u>Subunit</u>				Total
	One	Two	Three	Four	
1975	75*	6	7	3	92
1976	36	21	11	0	66
Total	109	27	18	3	158

* Number of observations.

Sampling differences between years may have contributed to the variation in the distribution of the bears and their sign during 1975 and 1976, but do not entirely explain it. Persistent snow in 1975 prevented much field work until mid-June, and a majority of the sign observed during the spring of 1976 was found while ground tracking one radio-collared grizzly. Experience also added to the difference between years. However, the marked decrease in grizzly bear use of the subalpine meadows of Cabin Creek Basin during the spring and early summer of 1976 indicate that the differences between the two years are real and at least partly due to a yearly variation in the distribution of grizzly bears.

TABLE 2. A YEARLY COMPARISON OF THE MONTHLY DISTRIBUTION OF GRIZZLY BEAR SIGHTINGS, RADIO LOCATIONS, AND SIGN.

Type of Observation	Apr-May		June		July		Aug		Sept		Oct		Dec	
	'75	'76	'75	'76	'75	'76	'75	'76	'75	'76	'75	'76	'75	'76
Sightings	0	1*	1	0	12	2	5	0	5	3	1	1	2	0
Scats	0	3	1	4	36	1	4	3	0	12	0	8	0	0
Diggings	0	1	2	2	5	1	1	1	2	0	0	1	0	0
Other Sign	0	6	5	9	12	8	1	1	2	1	0	2	0	0
Radio Locations	0	19	0	9	1	2	0	2	5	1	1	0	4	0

* Number of observations.

Seasonal Variation

The number of sightings of grizzly bears varied not only between years, but also among seasons. Observations of grizzlies occurred most frequently from July through September with peaks in these two months for 1975 and 1976 (Table 2). A study in northwest Yellowstone Park, only twelve miles away, found recreationist sightings occurred most often during May/June and September/October (Chester 1976). Chester's observations peaked in July.

Activities of observed grizzlies appeared to change seasonally. Grizzly bears were most frequently observed digging in the spring and early summer (June and July) of 1975. No bears were seen digging in 1976. General field observations and limited data indicate another increase in digging during fall, associated with pine squirrel (*Tamiasciurus hudsonicus*) middens.

Grazing grizzlies were observed most frequently during spring and early summer. Sightings of traveling bears were highest in August and September for both years. Grizzlies seen by recreationists were usually traveling.

During 1975, the majority of grizzlies was seen in July (Table 2) in Cabin Creek Basin. Most scats collected during this year were also located in Cabin Creek Basin and usually associated with diggings in subalpine meadows. These diggings were extensive, and any one observation included several individual digs made during the same

period. Individual digs were usually one to 4.5 m^2 in size, and often 50 to 80 cm deep. One subadult grizzly was observed digging with only its hindquarters visible.

The same areas of extensive digging in 1975 were nearly devoid of scats and diggings during 1976. Only a one week period of very casual digging was recorded during the second year, and digs were shallow (10-20 cm) and only $.3$ to 1 m^2 in size.

In contrast to findings during 1975, the majority of grizzly scats collected in 1976 were found in September and October (Table 2), usually associated with diggings in squirrel middens.

Elevational Variation

As the distribution of grizzlies changed seasonally, the bears and their signs were observed to be at increasing elevations from May through September (Figure 3). Bear Four also exhibited this trend. The mean elevation for sightings in the spring was 2328 m (7683 ft), compared to 2616 m (8635 ft) in the fall. This seasonal shift to higher elevations has been noted for grizzlies in Yellowstone Park (Chester 1976; Mealey 1975) and Glacier National Park (Martinka 1972). These researchers found grizzlies at lower elevations in the late fall, while the IGBS Team observed the grizzly bears in Yellowstone Park to remain at high elevations well into the fall (Knight 1976). Sample sizes in this study are too small to reveal general

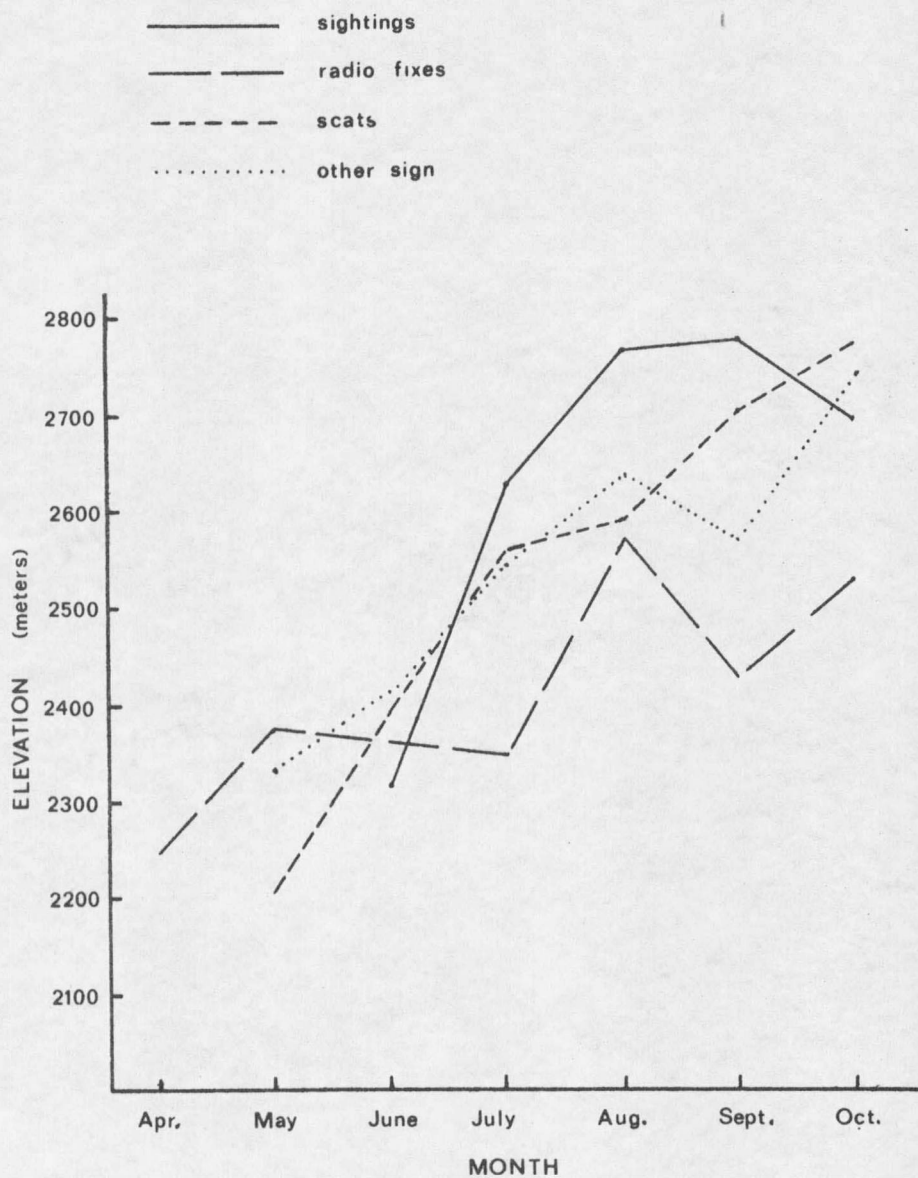


Figure 3. The elevational variation of grizzly bear observations.

shifts in altitude during the fall.

The mean elevation for grizzly bear locations in 1975 was higher than in 1976 due to the large number of spring radio fixes of Bear Four, 72% of which occurred from April through June of 1976 and centered around the den located at 2273 m (7500 ft) (Table 3). Yearly mean elevations of sightings were similar for the two years.

TABLE 3. THE ELEVATIONS OF GRIZZLY BEAR SIGHTINGS AND RADIO LOCATIONS.

Year	Mean	Range	Number of Observations
Sightings			
1975	2658*	2303-3091	26
1976	2722	2515-2909	7
Combined Years	2670	2303-3091	30
Radio Locations			
1975	2449	2182-2666	11
1976	2348	2121-2636	33
Combined Years	2373	2121-2666	44

* Elevations in meters.

Exposures

Grizzlies and their sign were most frequently seen on south and

southwest exposures, with 53% of the bears seen on south-facing slopes alone (Table 4). Aspects of sighting locations at least indicate that the chances of seeing a grizzly are greater on south and southwest exposures in this area.

Scats and other grizzly bear sign were found most frequently on southwest aspects. During July the scats collected on south and southwest exposures were usually associated with diggings in sub-alpine meadows.

In Cabin Creek Basin, south-facing slopes are predominantly sub-alpine meadows interspersed with either open canopy forests or small patches of timber. Visibility is good and may partly explain the majority (79%) of the sightings and sign being on south and southwest exposures.

Radio locations of Bear Four were more evenly distributed on all exposures. West (23%), southwest (23%), and northwest (21%) exposures were most frequently used. Bear Four's den in the winter of 1975-76 was on a west-facing slope. The majority of west exposure locations can be accounted for by her frequent returns to the den site during the spring.

Craighead and Craighead (1972) found the majority of grizzly bear dens on north exposures in Yellowstone Park. The IGBS Team, during 1975 and 1976, has located dens on every exposure in the Park, with the most (29%) on northwest-facing slopes (Knight 1977).

TABLE 4. THE ASPECTS (EXPOSURES) OF GRIZZLY BEAR SIGHTINGS, RADIO LOCATIONS, AND SIGN.

Aspect	1975			1976		
	Number of Sightings	Number Sign Locations	Number Radio Locations	Number of Sightings	Number Sign Locations	Number Radio Locations
East	1	3	1	0	0	2
North	0	0	0	0	1	1
Northwest	0	4	3	0	1	6
Northeast	1	0	0	1	0	2
South	16	17	1	1	9	3
Southeast	0	5	0	1	7	4
Southwest	8	38	3	2	41	7
West	0	4	3	1	5	7

Habitat Use and Food Habits

Habitat Use

Grizzly bears appeared in different habitat types as their distribution varied seasonally within the study area. This change can be at least partially explained by shifting food habits.

This study area potentially provides good grizzly bear foraging habitat as indicated by the higher Importance Values (I.V.) of the most available habitat types (Table 5). *Festuca idahoensis*/Agropyron caninum (FELD/AGCA) meadows were the third most abundant habitat type and had the second highest I.V. of all areas typed. Grass-forb meadows consistently ranked higher than forested habitats by supporting a diversity of abundant food plant species. The availability of grasses and sedges was generally very substantial due to high percent coverages.

Abies lasiocarpa/Vaccinium scoparium (ABLA/VASC), *Pinus albicaulis*-ABLA, and ABLA-PIAL/VASC habitat types were the most available timber types and had the highest I.V.'s for forested habitat types. The importance of the ABLA/VASC type is largely due to the potential food available as berries of grouse whortleberry (*Vaccinium scoparium*). Forests containing whitebark pine populations provide a potential food source of pine nuts.

Observations of grizzly bears and their sign occurred in higher frequencies in relation to the "availability" (percent of total area)

of habitat for the *FEID/AGCA* and *PIAL-ABLA* types (Table 5). This suggests a possible selection for these two habitat types by grizzlies. The most available habitat type, *ABLA/VASC*, accounted for only one-tenth of the observations, indicating grizzlies did not generally select this habitat type in this area. In other habitat types, frequencies of observations occurred in relative proportion to the availability of habitat.

Vegetative analysis of communities within the *FEID/AGCA* and *PIAL-ABLA* habitat types reveal potential food sources for grizzlies selecting these habitats, and help explain the large number of observations in Cabin Creek Basin during 1975. One community of the *FEID/AGCA* habitat type in the basin accounted for 41% (44 of 108) of the observations of grizzly bears and their sign in Subunit One. This community was a forb-dominated subalpine meadow with abundant pocket gopher activity. The soil was typically hard-packed with a vegetative cover of 80-85%. *Lomatium* (*Lomatium triternatum*) was the dominant forb, and onion grass (*Melica spectabilis*) was the dominant grass. Yampa (*Perideridia gairdneri*), bluebells (*Mertensia ciliata*), and mountain brome (*Bromus carinatus*) were common. Intensive digging by grizzlies occurred in this community during July of 1975 for fleshy roots of *lomatium*, onion grass, yampa, springbeauty (*Claytonia lanceolata*), and for pocket gophers and their caches of these roots. This community usually occurred on rolling south and

TABLE 5. A COMPARISON OF HABITAT TYPE IMPORTANCE VALUES WITH AREA AVAILABILITY.

Habitat Type	I.V.*	Area Availability	Number of Observations	Number of Radio Locations
Stream Bottom	26.7	0.4	1	0
<i>Festuca idahoensis</i> /Agropyron caninum (Feid/AGCA)	25.0	13.9	68	2
<i>Pinus albicaulis</i> - <i>Abies lasiocarpa</i> (PIAL-ABLA)	19.0	15.5	33	2
<i>Deschampsia caespitosa</i> /Carex spp. (DECA/CAREX)	17.9	0.6	1	0
<i>Festuca idahoensis</i> /Deschampsia caespitosa (FEID/DECA)	16.2	1.5	1	0
<i>Abies lasiocarpa</i> /Vaccinium scoparium (ABLA/VASC)	14.1	28.1	15	7
<i>Abies lasiocarpa</i> - <i>Pinus albicaulis</i> / Vaccinium scoparium (ABLA-PIAL/ VASC)	13.4	11.9	8	5
<i>Abies lasiocarpa</i> /Calamagrostis rubescens (ABLA/CARU)	11.1	3.4	0	0
<i>Abies lasiocarpa</i> /Calamagrostis canadensis (ABLA/CACA)	10.9	0.5	0	0
<i>Abies lasiocarpa</i> /Vaccinium globulare (ABLA/VAGL)	9.1	10.5	9	5

TABLE 5 (CONTINUED)

Habitat Type	I.V.*	Area Availability	Number of Observations	Number of Radio Locations
<i>Artemesia tridentata</i> / <i>Festuca idahoensis</i> (ARTR/FEID)	7.4	1.0	0	4
<i>Picea engelmannii</i> / <i>Galium triflorum</i> (PIEN/GATR)	6.2	0.3	1	0
<i>Abies lasiocarpa</i> / <i>Arnica cordifolia</i> (ABLA/ARCO)	4.5	3.5	5	2
Clearcut (ABLA/CARU)	4.5	0.4	4	2
<i>Abies lasiocarpa</i> / <i>Menziesia ferruginea</i> (ABLA/MEFE)	2.1	1.1	3	11
<i>Picea engelmannii</i> / <i>Smilacina stellata</i> (PIEN/SMST)	1.4	0.1	0	0
<i>Pseudotsuga menzeisia</i> / <i>Carex geyeri</i> (PSME/CAGE)	1.4	0.1	0	0
<i>Picea engelmannii</i> / <i>Linnaea borealis</i> (PIEN/LIBO)	0.1	<0.1	0	0

* Importance Value = (Number of grizzly food plant species in a habitat type) X (Total canopy coverage of food plant species in that habitat type) / 100.

** Area Availability = (Area of habitat type / Total typed area) X 100.

southwest aspect slopes near elevations of 2604 m (8400 ft).

One community within the *PIAL-ABLA* habitat type accounted for nearly one quarter (26 of 108) of the observations in Subunit One. This community occurred on fairly steep south and west aspect slopes at elevations of 2670-2790 m (8600-9000 ft). Open timber stands were dominated by whitebark pine with 15-20% canopy coverage. Shrubs were sparse, and frequent openings and understory vegetation consisted of a large variety of forbs and grasses with low individual coverages. Grizzlies and their sign were observed most frequently in this community during autumn, usually associated with diggings in squirrel nut caches.

In addition to a high availability of *FEID/AGCA* and *PIAL-ABLA* habitat types, Subunit One contained other areas of potential grizzly foraging habitat. Springs creating the headwaters of Cabin Creek occurred in nearly every habitat type, resulting in numerous moist microsites of lush growths of sedges, grasses, and mesophytic forbs. These microsites potentially provided succulent vegetation for grizzly bears throughout most of the growing season.

In contrast to the distribution of grizzly bear observations, radio locations of Bear Four occurred in nearly equal proportions to the availability of habitat types (Table 5). The exception was the *ABLA/Menziesia ferruginea* (*ABLA/MEFE*) habitat type which comprised only one percent (127 ha; 314 acres) of the total area typed, yet

accounted for 28% of the radio locations. Bear Four's den was located in this habitat type (in Subunit Two), and her use of this habitat type may be a reflection of the area's den site and cover qualities rather than its potential for providing grizzly food plants (I.V. equals only 2.1). This type usually occurs in western Montana, however Pfister et al (1977) recorded "an isolated population west of Yellowstone National Park in the Madison Range" where it is restricted to cool sheltered slopes.

Use of Forested and Nonforested Habitats

Grizzly bears and their sign were observed in nearly equal frequencies in the timber and in the open (Figure 4). However, these locations depended on the amount of time spent by an observer in an area and the visibility of bears and sign at that location, possibly creating artificially high frequencies in non-forested areas. In contrast, 85% of the radio locations of Bear Four occurred in the timber. The high percent of radio locations in forested areas suggests a much higher use of forested types, at least during the day, than indicated by ground and aerial observations alone. Radio-collared grizzlies in Yellowstone Park were found in open areas in only four percent of the aerial locations in 1975 and seven percent in 1976 (Knight, 1977; Knight, 1976).

While locations of radio fixes indicate the importance of

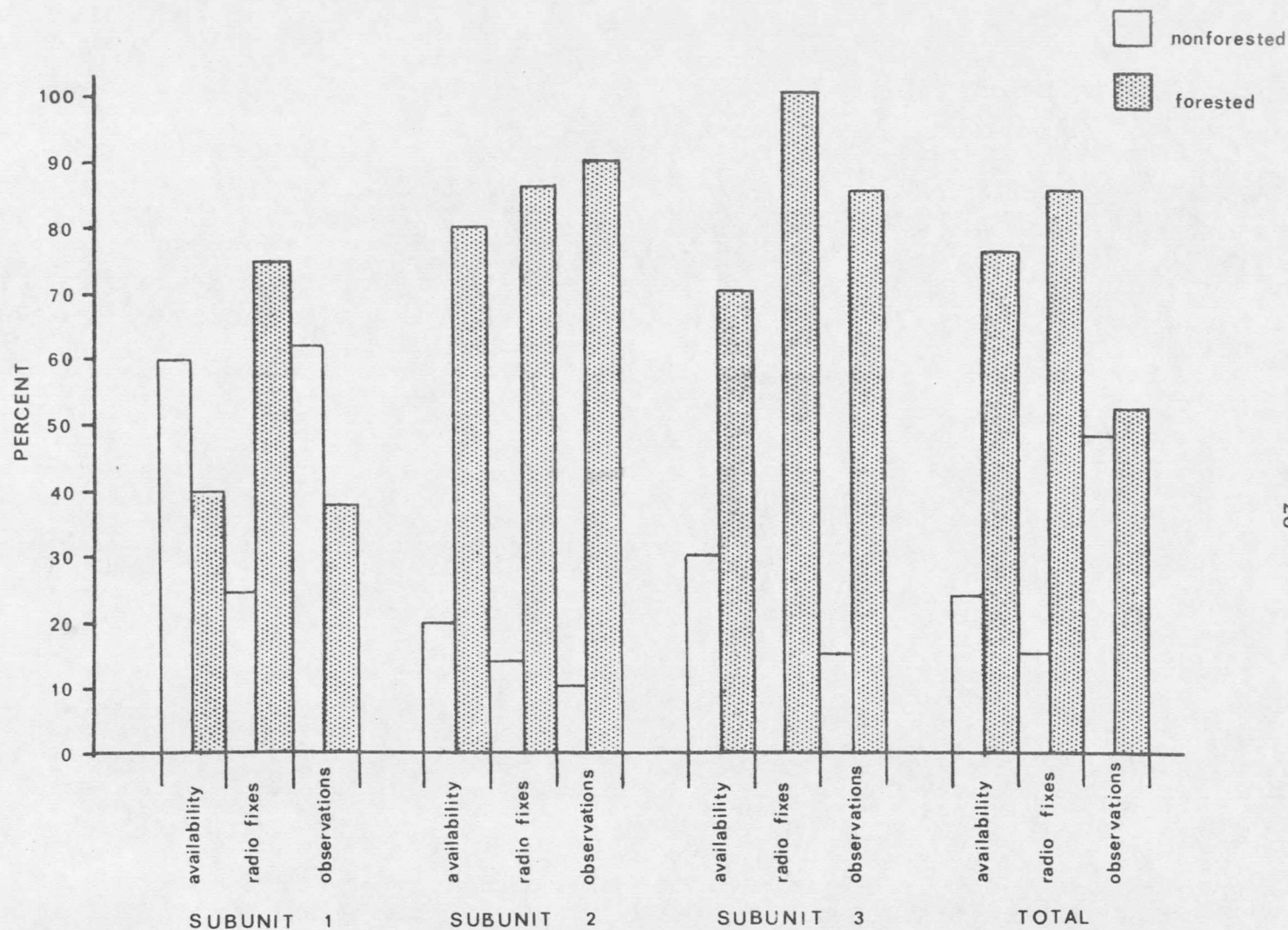


Figure 4. Percent of grizzly bear locations in relation to the availability of nonforested and forested areas in Subunits One, Two, and Three.

forested types to grizzlies, when grizzlies or their sign were located in the timber, a meadow opening or mesic inclusion was usually within one quarter mile of the observation point.

Forested areas accounted for more observations during 1976 compared to 1975 (Table 6). This coincided with the increased use of whitebark pine forests (*PIAL-ABLA* habitat type) during the spring and fall of 1976.

TABLE 6. A YEARLY COMPARISON OF THE PERCENT OF GRIZZLY BEAR OBSERVATIONS IN FORESTED HABITATS.

Subunit	Availability*	1975	1976
One	51.3%	23.3%	86.7%
Two	62.6	71.4	95.5
Three	66.7	66.7	100.0

* Availability = the percent of area with forested overstory.

Food Habits and Scat Analysis

Analysis of grizzly bear contents, in conjunction with apparent habitat use revealed yearly and seasonal food habits. Food items in scats were ranked by Importance Values. Comparison of I.V.'s, which were obtained using the frequency of occurrence and percent of scat volume of each food item, revealed that food items were not of equal importance each year in collected grizzly scats. Forbs were most

important in 1975, followed closely by grasses and sedges (Table 7). Whitebark pine nuts were most important in 1976 with grasses and sedges a distant second (Table 8). When years were combined, grasses and sedges had the greatest frequency of occurrence and overall importance.

A major difference between years was the absence of corms and roots in the 1976 samples. This corresponded with the relative lack of digging noted that year. Site examination of diggings during 1975 revealed unearthed pocket gopher caches of springbeauty corms, lomatium tubers, onion grass corms, and yampa tubers. Diggings for these caches were the deepest. Shallower diggings revealed sheared tops of yampa and onion grass which indicated that grizzlies were consuming the growing tubers and corms of at least these two plant species. Scats collected during the digging period (late June and early July, 1975) contained roots of all four species. These scats were concentrated in the *FEID/AGCA* habitat type in the Cabin Creek Basin.

Scat analysis revealed seasonal use of some food items. Grasses and sedges were the most important foods during spring. The high percentage of whitebark pine nuts in scats collected during early spring indicated they were selected for at that time. These scats containing pine nuts nearly always contained some amount of grass. Pocket gopher and moose (*Alces alces*) remains were noted in some

TABLE 7. THE CONTENTS OF GRIZZLY BEAR SCATS¹ COLLECTED DURING 1975.

Food Item	Plant Part	Frequency of Occurrence Percent ²	Percent Composition ³	Percent of Total Scat Volume	I.V. ⁴	I.V.% ⁵
Unidentified Forbs	leaves, stems	86.5	43.5	37.7	32.6	48.3
Graminae/ Cyperaceae	head, stems, leaves	86.5	37.2	32.2	27.9	41.3
<i>Claytonia lanceolata</i>	entire	51.4	15.4	7.9	4.1	6.1
<i>Melica spectabilis</i>	corms	29.7	20.1	6.0	1.8	2.7
<i>Lomatium triternatum</i>	tubers, leaves	13.5	21.8	3.0	0.5	0.7
<i>Pinus albicaulis</i>	nuts	5.4	99.0	5.4	0.3	0.4
Rodentia	<i>Thomomys talpoides</i>	5.4	47.5	2.6	0.1	0.2
Formicidae	mature	5.4	35.0	1.9	0.1	0.2
<i>Perideridia gairdneri</i>	tubers	5.4	22.5	1.2	0.1	0.2
Total				97.9	67.5	100.1

1 Sample size = 37.

2 Frequency of Occurrence Percent = (total number times item appeared in scats/total number scats) X 100.

3 Percent Composition per Item = average percent composition in scats containing that item.

4 Importance Value = (Frequency of Occurrence X Percent of Scat Volume)/ 100.

5 Importance Value Percent = Importance Value/total Importance Values.

TABLE 8. THE CONTENTS OF GRIZZLY BEAR SCATS¹ COLLECTED DURING 1976.

Food Item	Plant Part	Frequency of Occurrence Percent ²	Percent Composition ³	Percent of Total Scat Volume	I.V. ⁴	I.V.% ⁵
<i>Pinus</i>						
<i>albicaulis</i>	nuts	86.2	84.4	72.7	62.7	85.5
Gramineae/ Cyperaceae	leaves, stems, heads	58.6	18.3	10.7	6.3	8.6
<i>Equisetum</i> spp.	stems	41.4	18.6	7.1	2.9	4.0
Rodentia/ Cervidae	<i>Thomomys talpoides</i> <i>Alces alces</i>	20.7	19.3	4.0	0.8	1.1
Unidentified Forb	leaves, stem	34.5	2.8	1.0	0.4	0.6
<i>Juniperus</i> <i>communis</i>	berries	3.5	70.0	2.4	0.1	0.1
Formicidae	mature, larvae	6.9	12.5	0.9	0.1	0.1
<i>Cirsium</i> spp.	leaves, stems, flowers	10.4	1.7	0.2	< 0.1	< 0.1
Bones	unidentified	3.5	1.0	<u>0.1</u>	<u>< 0.1</u>	<u>< 0.1</u>
Total				99.1	73.3	100.0

1 Sample size = 29.

2 Frequency of Occurrence Percent = (total number times item appeared in scats/total number scats) X 100.

3 Percent Composition per Item = average percent composition in scats containing that item.

4 Importance Value = (Frequency of Occurrence X Percent of Scat Volume)/ 100.

5 Importance Value Percent = Importance Value/ total Importance Values.

spring scats.

Grizzlies ate fleshy roots during the late spring and early summer, and grasses, sedges, and forbs throughout the summer. Pocket gopher remains were found in scats containing corms and tubers, and were probably selected for as indicated by the high percent composition of hair (Table 7).

Whitebark pine nuts were by far the most important fall food item. Scats containing pine nuts usually contained nothing else during this season. Horsetail (*Equisetum* spp.) was second in importance.

The majority of scats in the 1976 sample were collected during the spring and fall which largely accounts for the high frequency of occurrence and importance of whitebark pine nuts during 1976. This finding corresponds with the high frequency of grizzly bear observations in whitebark pine habitat areas (*PIAL-ABLA* habitat type). Other studies have discussed the importance of whitebark pine nuts to grizzlies in Yellowstone Park (Knight, 1977; Mealey, 1975; Craighead and Craighead, 1972) and the Scapegoat Wilderness (Sumner and Craighead 1973).

Scats containing pine nuts were found at an average elevation of 2643 m (8722 ft), compared to 2482 m (8190 ft) for scats containing grasses and sedges. This change in scat composition generally corresponds to the seasonal shift in grizzly distribution with

elevation and the use of ridges rather than basin meadows.

Grizzly bears in the study area appeared to depend basically on grasses, sedges, and forbs during the growing season. Seasonal items such as pine nuts and fleshy roots were probably eaten in proportion to their availability during a year.

Other studies have shown the importance of grasses and sedges in the diet of grizzly bears. Mealey (1975) stated that grizzlies of the "mountain economy" in Yellowstone Park concentrated in areas of succulent vegetation, using seasonal foods incidentally. He found grasses and sedges were important throughout the growing season, and springbeauty was most important in July and August. Pine nuts were highly selected for in the fall as indicated by a high percent composition in scats from that season. Grasses and forbs made up the greatest volume in scats analyzed by the IGBS Team during 1975 and 1976 (Knight 1977). Analysis of grizzly scats from the Scapegoat Wilderness revealed insects and forbs had higher percent compositions and Importance Values than grasses and sedges (I.V. = 8.2) (Sumner and Craighead 1973).

Distribution of Recreational Use

Attempts were made to assess the general distribution and density of present recreational use and to relate it to the distribution of grizzly bears.

Comparison of registration cards with returned questionnaires revealed that not all individuals registered. However, the total return of questionnaires (62%) compared favorably with other backcountry studies in Montana (85%; Lucas, in press) and in Yellowstone Park (43%; Chester, 1976) when both used second "reminder" mailings. In this study the 1975 return of 58% was increased to 67% in 1976 with a second mailing.

Season of Use

Peak recreational use occurred in July and August in all subunits, however Subunit Four received a substantial majority of the total use (Figure 5). Chester (1976) found backcountry use in the Gallatin Range of Yellowstone Park during 1973 and 1974 was also highest in July and August.

Trail Use

Trails leading into the Hilgard Mountains (Trails 5-10; Figure 1) were the most frequently used by registering users (Table 9). Trails five and six accounted for 59% of the users. These two trails are the only direct access routes to the alpine lake areas. Fishing

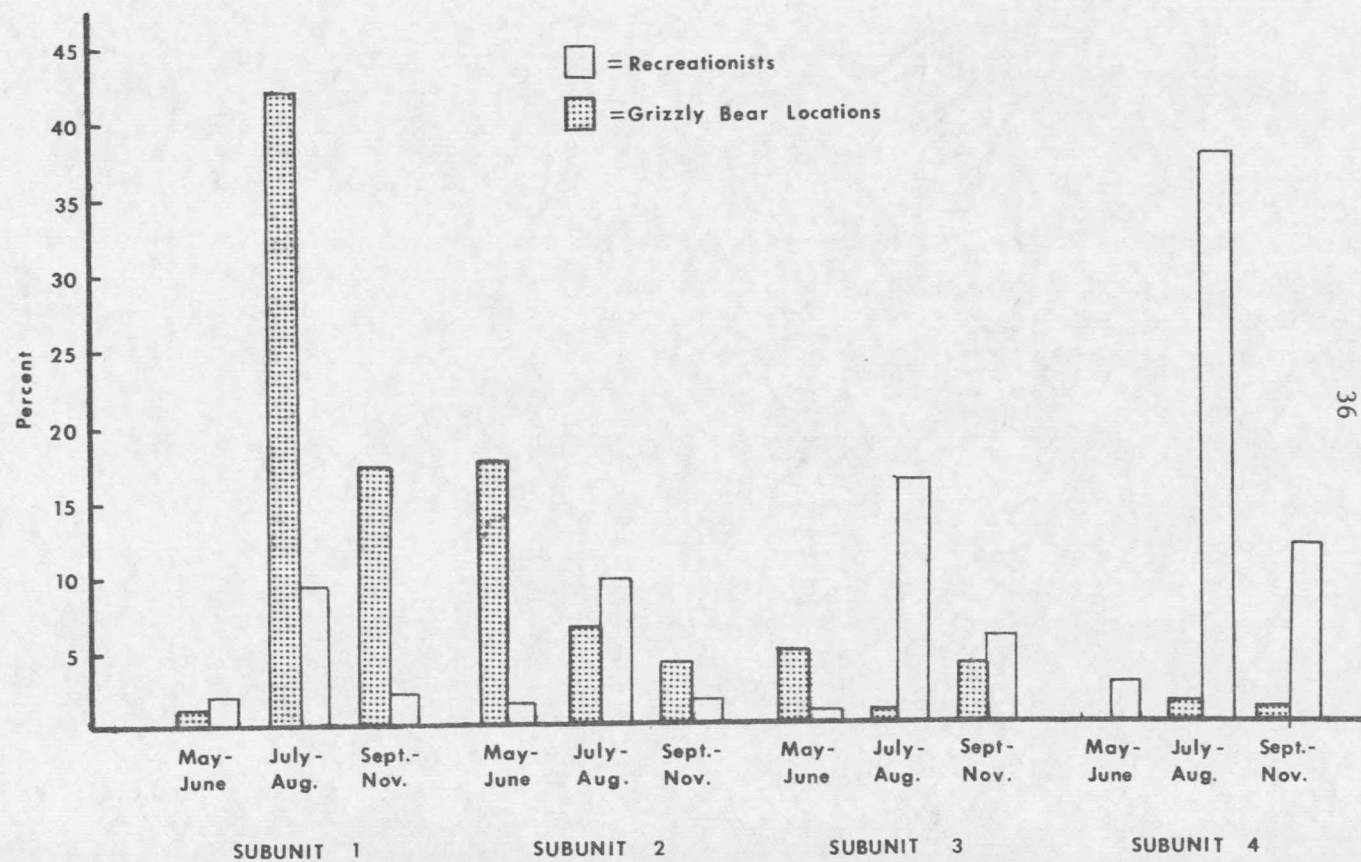


Figure 5. A seasonal comparison of the distribution of grizzly bear observations and recorded recreationist use in the study area subunits.

appeared to be an important reason for the use of the Hilgard Mountains. Trails leading into the Cabin Creek Basin (trails 1-4) carried only 29% of the user traffic.

TABLE 9. THE DISTRIBUTION OF RECREATIONISTS BY TRAIL.*

Year	<u>Trails</u>		
	1 - 4	5 - 10	5 & 6
1975	223**	496	417
1976	179	513	410

* See Figure 2.

** Number of recreationists.

Method of Travel

Hiking was the predominant method of travel (Table 10). Trail-bike users were a minor component of the registrants. Observations suggested that horseback riders were generally few throughout the summer, but increased markedly in the fall, associated with hunting season.

TABLE 10. THE METHOD OF TRAVEL BY RECREATIONISTS.

Year	Hiking	Horseback	Trailbike	No. Groups
1975	81.3%*	15.4	5.2	155
1976	90.0	8.9	3.7	191

* Percent of groups.

Length-of-stay

An average recreationist stayed in the backcountry nearly three days and traveled with two companions (Table 11). Over 40% of the users did not stay overnight on their trip into the study area. Trips lasting two days or less accounted for 59% of the users. Lucas's (in press) study of Montana backcountry areas found most recreationists were day users. Trips of two nights or less accounted for 58% of all users in those areas.

TABLE 11. A SUMMARY OF RECORDED RECREATIONAL USE.

	1975	1976
Number of groups registered	256	270
Number of users registered	719	688
Average group size	2.8	2.6
Average number of days/user	2.9	2.8

"Value" of Grizzlies to Recreationists

Registrants were asked what "value" they placed on the existence of grizzly bears in the study area. A large majority preferred having ~~grizzlies inhabit the area~~ (Table 12).

TABLE 12. THE "VALUE" OF GRIZZLY BEARS TO RECREATIONISTS BY PERCENT OF GROUPS.

Year	Prefer Grizzlies	Prefer No Grizzlies	No Opinion	Number of Groups Responding
1975	86.6%	7.9%	5.5%	127
1976	86.3	6.9	6.9	131
Total	86.4	7.4	6.2	258

Human - Grizzly Bear Encounters

With grizzly bears inhabiting areas used by recreationists, the possibility of confrontations between the bears and people exists. Human - grizzly bear encounters did occur on the study area during 1975 and 1976.

Most grizzly bears were initially encountered while the person was on a trail (in 19 of 29 encounters). Returned questionnaires revealed that very few people traveled off the trail, and those who did tended to see more wildlife.

Off-trail use has been shown to be uncommon in Montana back-country areas (Lucas, in press). Chester (1977) found that most wildlife was seen when observers were off the trail in the Gallatin Range of Yellowstone Park. He reported that the chance of seeing a grizzly was three to four times greater while off the trail in that area. These results, combined with the relatively high frequency of on-trail encounters with grizzly bears in this study area, suggest a potential for increased human - grizzly encounters if both off and on-trail use increases.

Grizzly bears were most commonly observed at distances between 100 and 300 meters (in 16 of 30 encounters). Seven of 30 grizzly-human encounters occurred within a distance of 50 meters. In each case the grizzly fled immediately upon discovering the observer. No females with cubs and one female with two yearlings were involved in

in these "close" encounters.

Most grizzly bears responded to the presence of humans by fleeing immediately (in 16 of 22 encounters). During the two years of the study no grizzlies responded aggressively to humans. An outfitter reported the destruction of a hunting camp by two subadult grizzly bears in Sentinel Creek drainage during September, 1975. They fled immediately upon discovery. A hunter killed elk was partially consumed in Cabin Creek Basin during October of the same year by a lone adult grizzly. Most bears in the Gallatin Range of Yellowstone Park also fled upon becoming aware of the presence of humans (Chester 1977).

DISCUSSION

Habitat Use and Seasonal Movements of Grizzly Bears

Grizzly bears are known to inhabit adjacent drainages to the north and east of the study area and the nearby northwest corner of Yellowstone National Park (Knight, 1977; Chester, 1977). The Hilgard - Cabin Creek area is continuous with these drainages, and few grizzlies appear to remain year-round within the study area boundaries. Bears may occasionally den within the study area, however general observations revealed that the majority of grizzlies moved into the area during spring and early summer. These movements seem to be largely affected by the rate of snow melt. Grizzlies were noted at lower elevations adjacent to the study area during the springs of 1975 and 1976, and appeared to follow receding snow into Cabin Creek Basin. Local residents and Forest Service personnel have stated that grizzlies have historically used Cabin Creek Basin during the spring and summer months.

Grizzlies and their sign were seen both years in the lower Red Canyon Creek drainage during May when vegetation first became available in meadows. Two grizzlies were observed digging and grazing in this area during late May of 1975. Tracks were observed on the Red Canyon Creek trail indicating some grizzlies were using the trail to travel north. This drainage may provide an access route into the Cabin Creek Basin during the spring.

Sign was also observed during the spring in the Tepee Creek drainage along the east boundary of the study area. Bear Four and at least one other grizzly used the lower Cabin Creek drainage and an area around Potamageton Park in the spring of 1976.

During 1975, grizzlies began digging in open subalpine meadows in Cabin Creek Basin during late June and continued until mid-July. At the peak of use during the first week of July, track measurements and sightings indicated that a minimum of eight and possibly twelve individual grizzlies were using a two square mile area. The grizzlies were primarily digging for fleshy roots as revealed by feeding site and scat analysis. Preferred digging sites were evident, and grizzlies appeared to concentrate near these sites. Concentrations of grizzlies at abundant food sources have been observed in other studies (Mundy and Flook, 1973; Martinka, 1971; Hornocker, 1962; Storer and Trevis, 1955).

Grizzly bears did not concentrate in Cabin Creek Basin during 1976. One possible reason may have been the increase in trapping activities in the Basin. Trapping crews spent a similar number of trap-days in Cabin Creek Basin during 1975 and 1976, however an additional culvert trap and several snares were used in 1976. Trailbikes were used by the crews to check traps at least once a day. It is possible that this increase in human activity may have deterred some bears from staying in the area. Craighead and Craighead (1972) recorded cases of

abandonment of den sites by grizzlies when disturbed by observers while the bears were digging. Bear Four left a possible den site north of the study area during the winter of 1975-76 at the same time snowmobile activity was observed in the vicinity (Knight 1976). That winter she finally denned nine airline miles to the south.

Another possible factor may have been the mild spring of 1976. Snow persisted well into June of 1975 with a maximum of 96.5 cm (38 in) of snow on the ground in late May at the Hebgen Dam weather station, compared to 20.3 cm (8 in) during 1976 (Farnes and Shafer 1975). Although total precipitation was similar for both years, May and June of 1975 had 31 days with one inch or more snow on the ground, while there were only six such days during these two months in 1976. Thus large areas of snow free range were available early to grizzlies in 1976, and possibly resulted in a dispersal of bears rather than concentrations at a few food sites.

Grizzlies appeared to disperse during the summer as vegetation dessicated in the open meadows. Distribution of grizzly sign suggested movements into neighboring drainages to the north and east, and into the more densely timbered areas toward the Hilgard Mountains. Bear Four exhibited this trend by using adjacent drainages to the north and east.

During 1975 a minimum of three grizzlies remained in the immediate vicinity of Cabin Creek Basin. No grizzlies appeared to remain

in the basin during the summer of 1976.

The importance of grass-forb meadows to grizzly bears in the study area is apparent from the results of scat analysis, feeding site examinations, and locations of observations. When grizzlies or their sign were located in the timber, a meadow opening or mesic inclusion was usually nearby. Complexes of moist grass-forb meadows and timber appear to provide desirable grizzly habitat by providing abundant food plants interspersed with areas of cover and shelter. Other studies have pointed out the importance of habitat interspersion to grizzlies (Schallenberger, 1976; Mealey, 1976; Knight, 1975; Mealey and Jonkel, 1975; Craighead and Craighead, 1972).

In addition to succulent vegetation, whitebark pine nuts, and thus the habitats supporting whitebark pine populations, are important to grizzly bears in this study area. Grizzlies in Yellowstone Park and the Scapegoat Wilderness have been found to move into whitebark pine forests when nut crops are good (Knight, 1977; Sumner and Craighead, 1973). Whitebark pine nuts provide a good source of fat and protein for grizzlies (Mealey 1975).

Scat analysis and feeding sites revealed whitebark pine nuts may be very important during the spring of some years following emergence from dens. Bear Four used pine squirrel caches along snow-free ridges in the spring of 1976 when little vegetation was available. Grizzly scats from the spring were found in whitebark pine stands and along

ridges throughout the study area. The use of whitebark pine nuts was found to be widespread in Yellowstone Park by the IGBS, especially in 1976 (Knight 1977). Few ungulates winter within the study area and provide little if any carrion in the spring for emerging grizzlies. The extent of whitebark pine nut utilization in the spring is probably related to the rate of snow melt and vegetation growth.

Grizzlies and their sign appeared in habitats supporting whitebark pine stands as pine squirrels began harvesting the nuts during the fall. Observations and scat analysis revealed that the grizzlies raided squirrel middens throughout the fall and appeared to utilize whitebark pine nuts almost exclusively by the latter part of the season.

In general, the number of grizzlies using any portion of the Cabin Creek - Hilgard Mountain area during a year appears to be at least partially dependent upon the availability of seasonal food crops such as fleshy roots, pocket gophers, succulent vegetation, and whitebark pine nuts.

Recreational Use

At present the distribution of recreational use in relation to grizzly use appears to create few human-grizzly conflicts in the study area. Recreationists concentrate in the Hilgard Mountains (Subunit Four) during the summer months. Most of the few grizzly sightings in

this subunit have been limited to the lower elevations of the drainages.

However, areas of potential human-grizzly conflict do exist. A high percent of the locations of grizzlies and their sign occurred in Cabin Creek Basin (Subunit One) during July and August. Although maximum recreational use occurs during this season, few people presently travel into this subunit. If recreational use and development continue to increase, the potential for human-grizzly conflicts will also increase in the Cabin Creek Basin area. The relatively high percentage of on-trail sightings of grizzlies in the basin also tend to confirm the potential for increasing confrontations. Sumner and Craighead (1973) have stated that grizzly habitat "should receive only light recreational and livestock use. Roving tends to degrade the habitat as does excessive trail use."

Moderate grizzly use of Subunits Two and Three, particularly in the spring, present potential areas for conflict if recreational use is increased. Mundy and Flook (1973) report two causes for increased human-grizzly encounters in the Canadian national parks: "one is the attraction of bears to garbage, the other is the increase in numbers of hikers in the backcountry". There has been a significant increase in backcountry grizzly incidents in Glacier National Park since 1960, probably related to increased recreational use of the backcountry (Martinka 1971). Cole (1973) has suggested a relationship between

increasing human-grizzly encounters in Yellowstone Park and increased use of the backcountry.

Returned questionnaires indicated that a majority of recreationists placed a high "value" on the existence of grizzly bears in the study area. Apparently grizzlies symbolize wilderness and backcountry qualities to many of the current users, although grizzlies are known to frequent developed areas as well as backcountry regions.

Registration Rates

The data taken from questionnaires depend upon registration rates, which in turn are dependent upon the type of user. Hiking wilderness users usually register at a high rate (Wenger and Gregersen 1964). The Forest Service placed a trail counter on trail six from July 28 to October 20, 1975. One-way traffic was estimated to be about 350. Registration cards and questionnaires from August, September, and October indicated one-way traffic to be 190. Therefore over 50% of the people using trail six during this period did not register.

Total days of registered use (user-days) were 1516 for 1975 and 1247 for 1976. Using a 50% registration rate, the corrected number of user-days would be around 3000 each year. However this does not correct for hunting season rates.

Horse-riders have frequently been shown to register at very low

rates (Wenger and Gregersen, 1964; Lucas, in press). The trail counter results from October 20 through November 6, 1975, placed one-way traffic at 87, discounting horse traffic. During October and November, 14 and three users registered at this trail head in 1975 and 1976, respectively. This indicates that probably at least 10 times as many people actually used the area during hunting season as was indicated by registration cards.

Hunters were rarely observed to register. Most were reluctant to take the time once the horses were packed. The study area has a major influx of hunters when the season opens. Outfitters are distributed throughout the backcountry regions, and hunters camped to the north and east spill into the area. General observations revealed that the majority of hunting was concentrated during the first 10 days of the season. Because of the lack of cooperation by hunters, the data concerning recreational use of the study area do not adequately represent hunting season use.

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APPENDIX

History of Land Use Practices

Timber was harvested in the Timber Creek drainage of Beaver Creek in 1970 and 1974. A total of 90.7 hectares (224 acres) have been clearcut at an average elevation of 2273 m (7500 ft).

In the past, the Forest Service had granted four grazing allotments in the study area; the Kirkwood Allotment (cattle and horse), the Red Canyon Allotment (cattle and horse), the Cub Creek Allotment (sheep and goat), and the Cabin Creek Allotment (sheep and goat).

The Cub Creek Allotment was essentially the same as that portion of the study area designated Subunit Two in Figure 2. Records for this allotment date back to 1939, although it is known that this allotment and the Cabin Creek Allotment were grazed as early as 1910. An average of 1000 sheep grazed annually. As early as 1939, overuse of the vegetation and soil erosion were noted (Anon., 1963). In 1962 range analysis maps showed a marked trend toward replacement of grasses by forbs, increased soil compaction, and a high percentage of increaser and invader species throughout the allotment. In the fall of 1962, the permit and allotment were discontinued.

The Cabin Creek Allotment, in the head of the Cabin Creek drainage basin (Subunit One in Figure 1), extended into the North Fork of Kirkwood Creek. Grazing records beginning in 1939 show an average of 1000 sheep permitted annually. As early as 1939 signs of overuse were noted by Forest Service personnel. Soil compaction, trailing,

increased pocket gopher activity, and increased soil erosion became more pronounced through the years. Range transects of 1963 rated 68% of the allotment in fair or poor vegetative condition, 78% with fair to poor soil conditions, and 48% of the allotment in "weed" type vegetation. These weed types were believed to have been mountain grassland in the past. In July, 1962, the Forest Service district sprayed a 30.3 ha (75 acre) plot with 2,4-D in an attempt to improve watershed conditions, and 16.2 ha of this plot were seeded with perennial grasses. 1963 was the last year sheep grazed on the allotment. A Forest Service range transect in 1968 showed the range of Cabin Creek Basin in a "fair" condition, but "downward" trend.

The Kirkwood Allotment was last grazed in 1961, and the Red Canyon Allotment in 1959.



DEPARTMENT OF BIOLOGY

COLLEGE OF LETTERS & SCIENCE MONTANA STATE UNIVERSITY, BOZEMAN 59715

Dear

This summer a research project is being conducted in the Cabin Creek-Hilgard Mountains area. The project involves the impact of recreational use on grizzly bears.

I hope to determine the number of grizzlies in the area, habitats and food sources being used, and possible correlations between the use of areas by grizzlies and humans. To do this I need to determine the amount and distribution of recreational use in the area. This is where you can help me. I would appreciate it if you would fill out the enclosed questionnaire as soon as possible and return it to me.

The results of my study will hopefully produce recommendations for future management of this area. Your comments would be appreciated, and space is provided on the questionnaire.

Please fill out the questionnaire as soon as possible and return it in the stamped envelope provided for your convenience. Thank you for your interest and cooperation.

Sincerely,

Figure 6. Cover letter mailed with questionnaire.

DO NOT FILL IN
THIS COLUMN

name: _____

1. date trip started _____ (1)

2. date trip ended _____ (2)

3. method of travel:

backpack; hiking _____	_____ (3)
horseback _____	no. horses _____ (4)
trailbikes _____	no. bikes _____ (5)

4. were you hunting? yes _____ no _____ (6)

fishing? yes _____ no _____

5. number in your group _____ (7)

6. Please indicate your route of travel by tracing the route with a pen on the map enclosed. Mark your campsites with a circle and indicate how many nights you camped at each one by placing the number of nights within the circle.

7. Indicate the number of each species of wildlife seen in groups (for example: elk 8, 2, 20 would mean you saw 3 groups of elk with 8 in one group, 2 in another, and 20 in the last). Put the location of each group on the map and indicate which species it is by placing the first letter of the species plus the number in the group at the location (for example: e8, e2, e20 would be written on the map at the sighting location).

e elk _____	_____ (8)
m moose _____	_____ (9)
d deer _____	_____ (10)
c coyote _____	_____ (11)
b black bear _____	_____ (12)
g grizzly bear _____	_____ (13)
s sheep _____	_____ (14)
o goat _____	_____ (15)
- other _____	_____ (16)

8. If you saw one or more grizzlies, how did you know they were grizzlies?

9. Do you feel you saw enough wildlife on your trip? yes _____ no _____ (17)

10. In your opinion, what "value" would you place on the existence of grizzly bears in this area? Would you prefer grizzlies living in the area, no grizzlies, or is this issue of no importance to you? _____ (18)

Figure 7. Questionnaire mailed to registrants.

11. Please fill out an encounter form for each group of wildlife you saw.
Use the key at the bottom of the page to fill in the blanks.

ENCOUNTER FORM species _____ topography _____ date _____ obs. location _____ time _____ distance _____ sex _____ activity _____ age _____ vegetation _____ response _____ wind _____	ENCOUNTER FORM species _____ topography _____ date _____ obs. location _____ time _____ distance _____ sex _____ activity _____ age _____ vegetation _____ response _____ wind _____
ENCOUNTER FORM species _____ topography _____ date _____ obs. location _____ time _____ distance _____ sex _____ activity _____ age _____ vegetation _____ response _____ wind _____	ENCOUNTER FORM species _____ topography _____ date _____ obs. location _____ time _____ distance _____ sex _____ activity _____ age _____ vegetation _____ response _____ wind _____
ENCOUNTER FORM species _____ topography _____ date _____ obs. location _____ time _____ distance _____ sex _____ activity _____ age _____ vegetation _____ response _____ wind _____	ENCOUNTER FORM species _____ topography _____ date _____ obs. location _____ time _____ distance _____ sex _____ activity _____ age _____ vegetation _____ response _____ wind _____

species: (1) grizzly; (2) black bear; (3) elk; (4) moose; (5) deer; (6) coyote; (7) sheep; (8) goat; (9) other, specify

date: time of sighting

time: time of day of sighting

sex: (1) male; (2) female; (3) unknown

age: (1) young of year; (2) immature; (3) adult; (4) unknown

response of animal: (1) none; (2) alert-stood ground; (3) fled immediately; (4) slowly walked away; (5) slowly approached; (6) fled-stopped-fled; (7) charged; (8) alert-moved away

topography: (1) ridge; (2) hillside; (3) swale; (4) stream bottom; (5) rock covered hillside; (6) level area; (7) rocky cliff

observer location: (1) on trail; (2) off trail; (3) in or near camp

distance: distance from observer when first seen

activity: (1) resting; (2) feeding; (3) moving slowly; (4) running; (5) alert

vegetation: (1) grass-weed meadow; (2) dense timber; (3) scattered timber; (4) swamp, marsh; (5) willow bottoms; (6) alpine tundra

wind: (1) none; (2) slight breeze; (3) gusty; (4) strong wind; (5) unknown

Please feel free to make any comments:

Figure 7 (cont.). Questionnaire mailed to registrants.

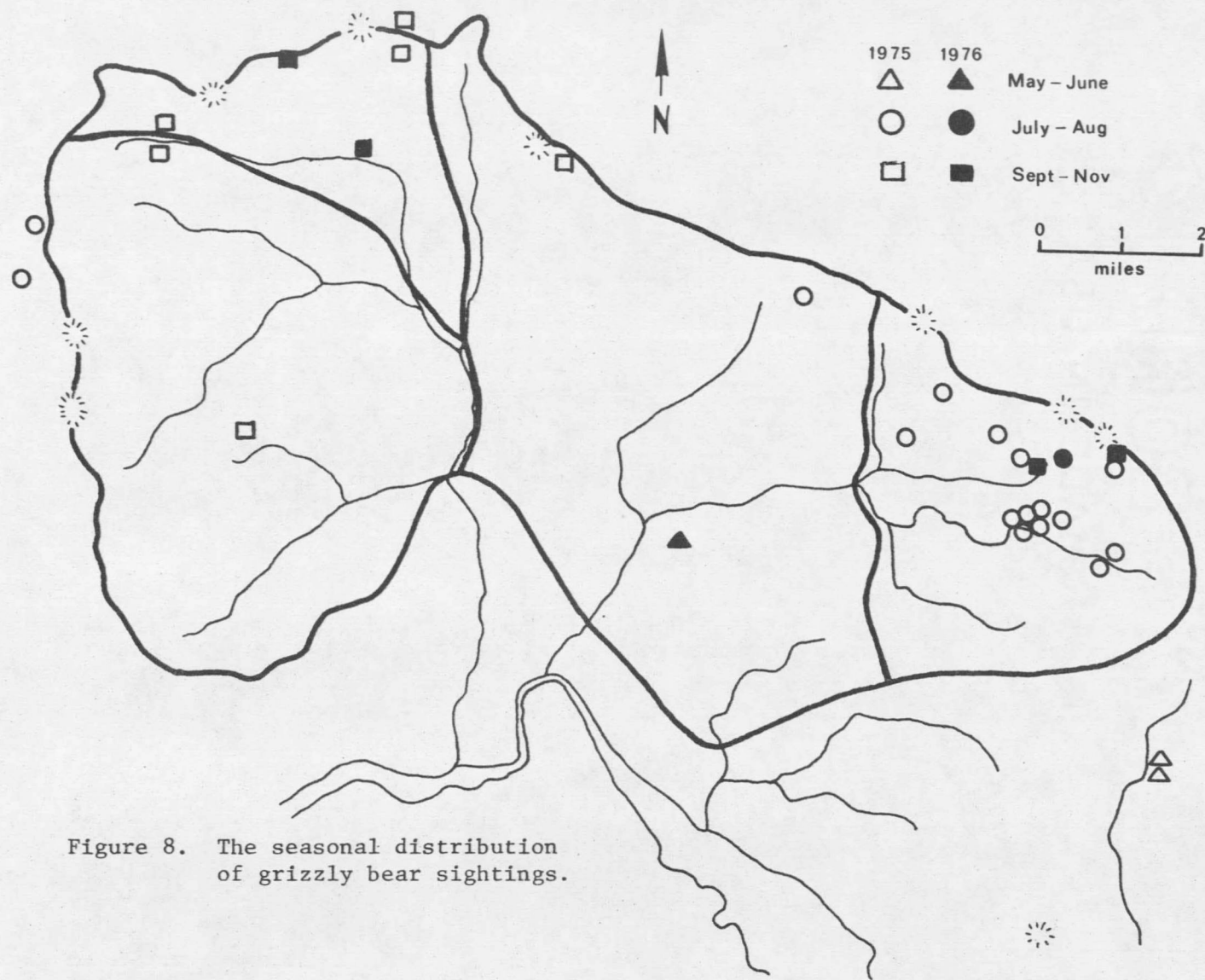
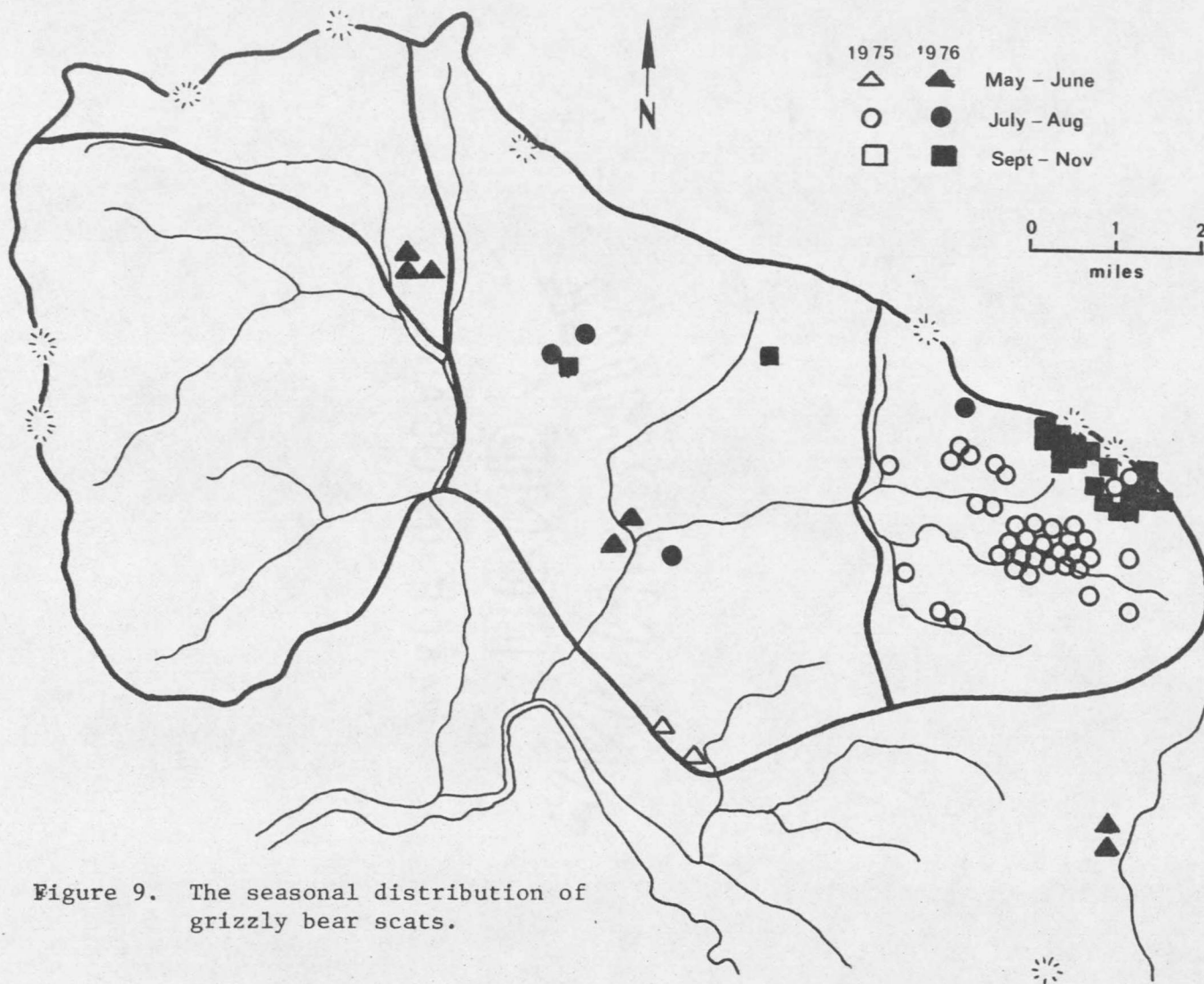
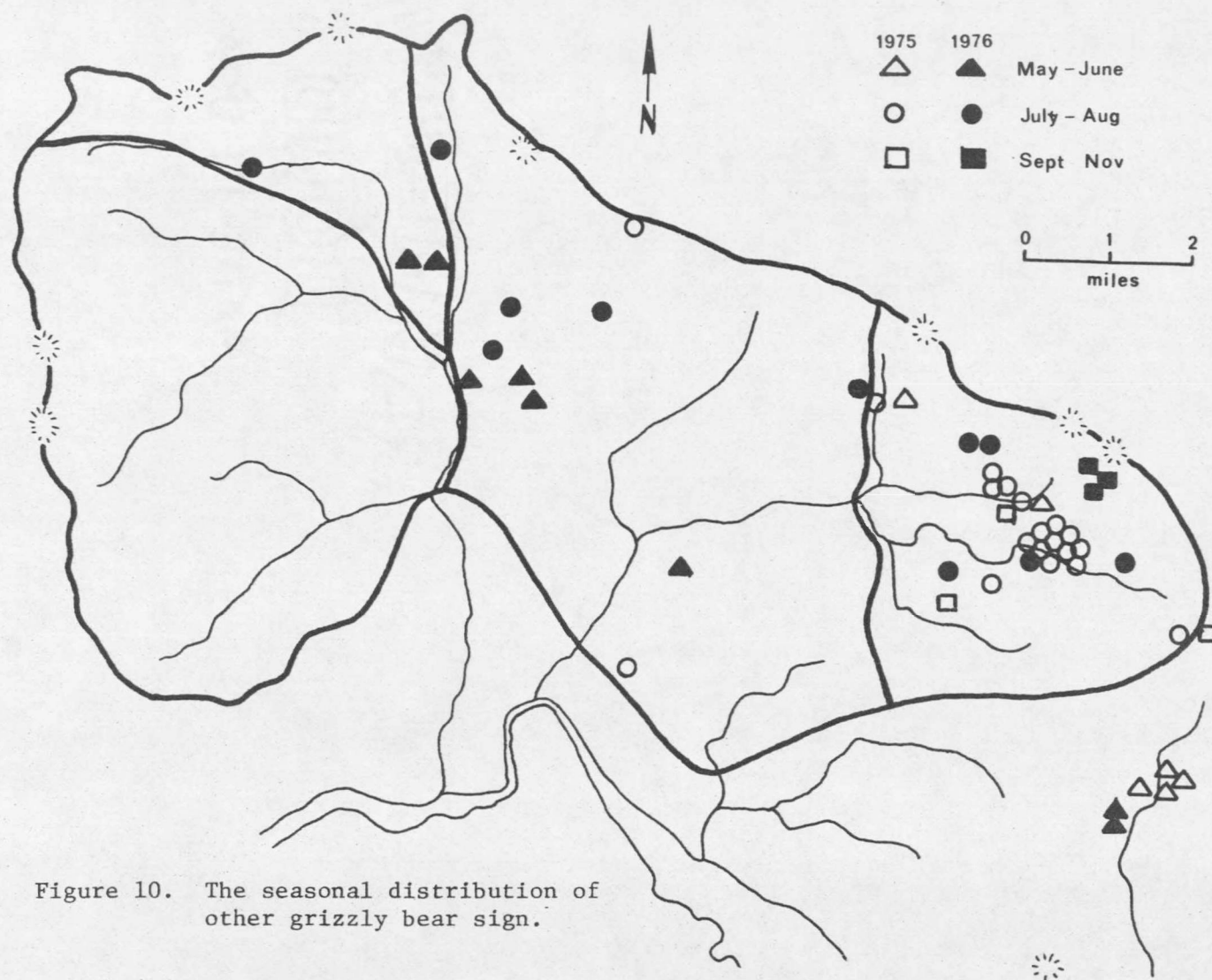


Figure 8. The seasonal distribution of grizzly bear sightings.





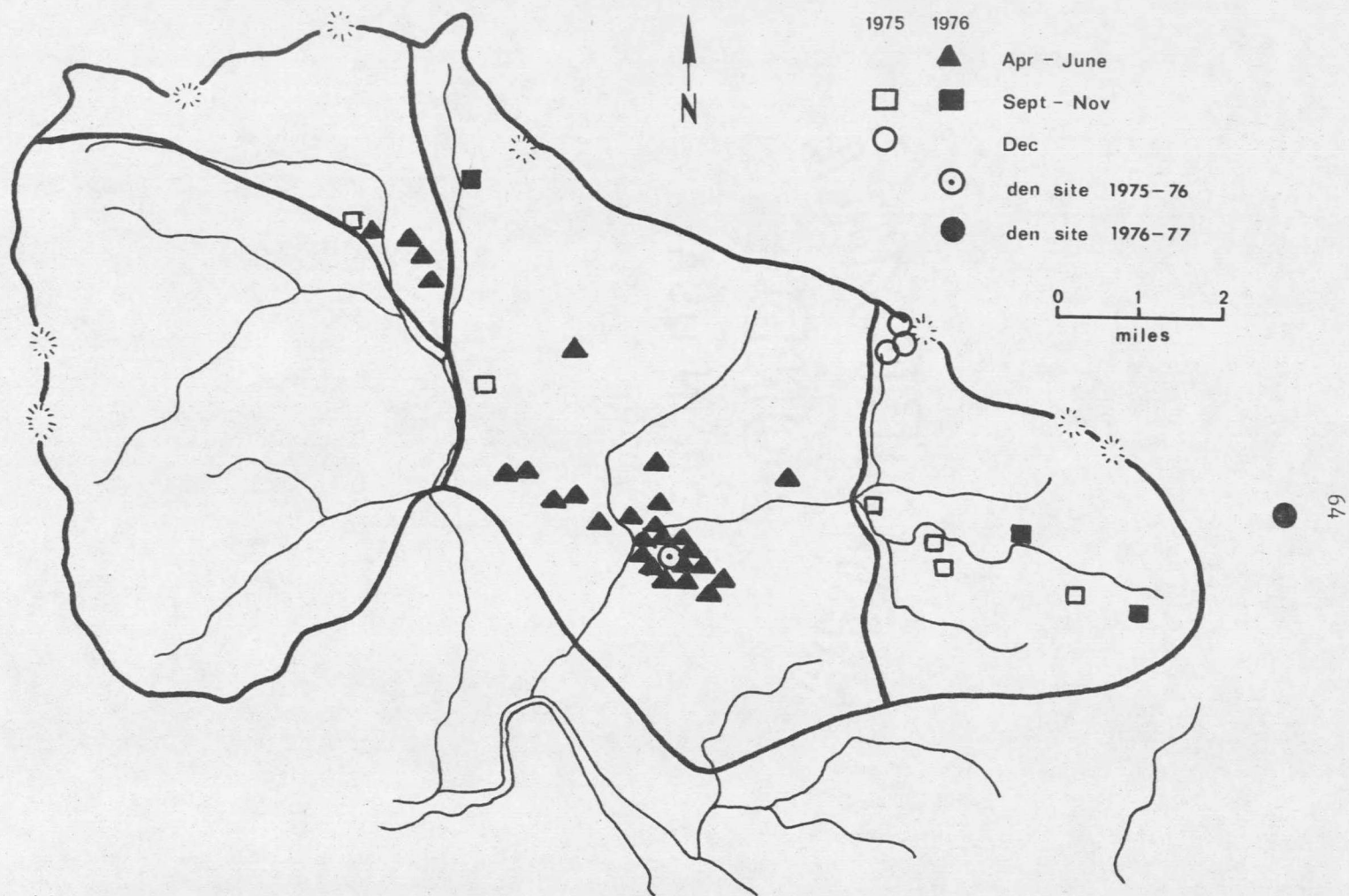


Figure 11. Radio locations and dens of Bear Four within the study area.

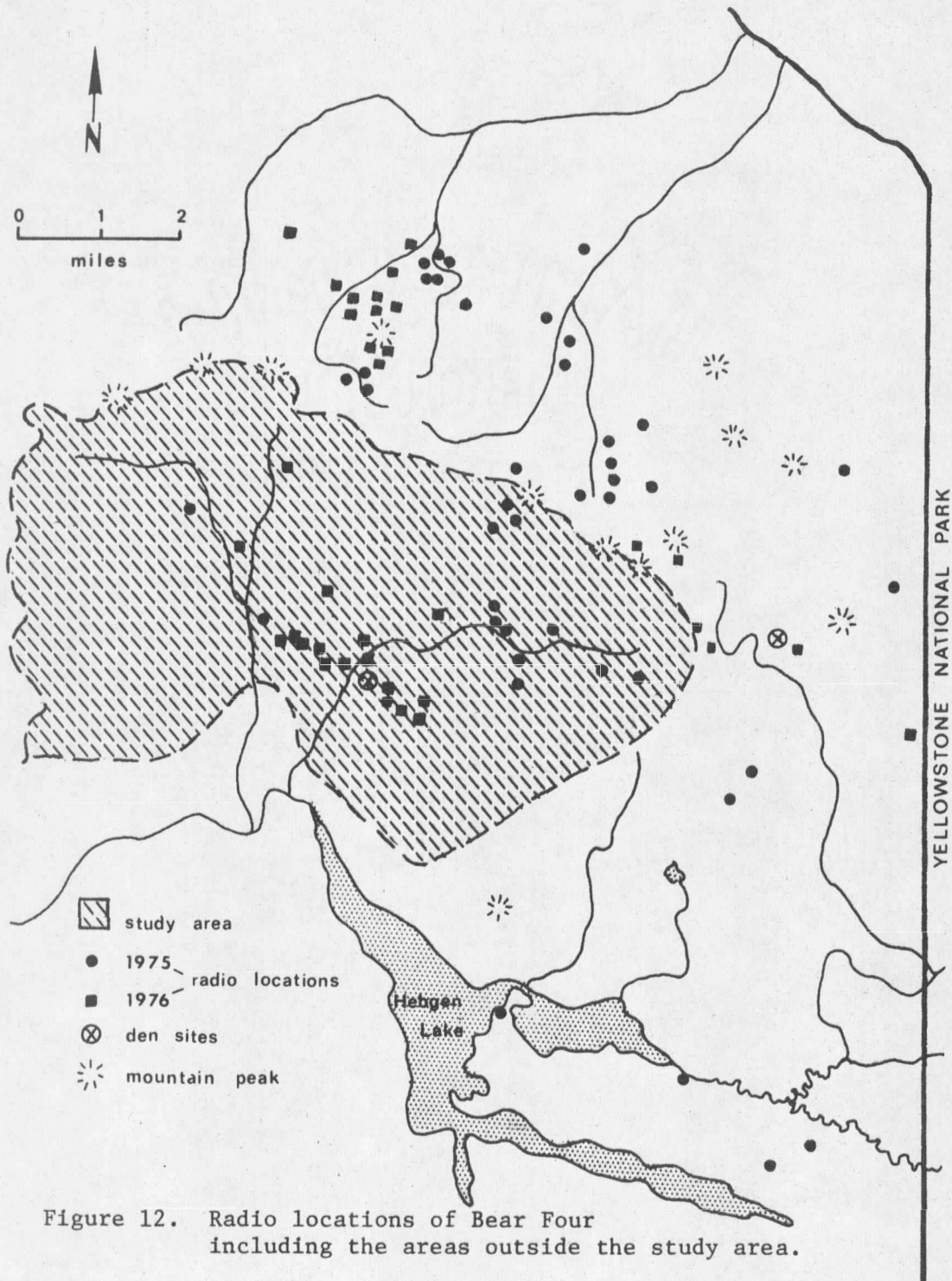


Figure 12. Radio locations of Bear Four including the areas outside the study area.

Occurrence of Black Bears

Black bears (*Ursus americanus*) are sympatric with grizzlies in the study area and were observed in all four subunits (Figure 13). The majority were observed in Subunit One as were the majority of grizzlies.

Uncollected scats, which were either black bear or unidentified grizzly bear scats, were distributed throughout Subunits One, Two, and Three during 1975 and 1976 (Figure 14).

While black bears and their sign were seen more frequently at lower elevations than grizzlies, they were observed using some areas concurrently with grizzlies. A black bear was observed several times grazing as close as 300 meters, but never in sight of a grizzly bear.

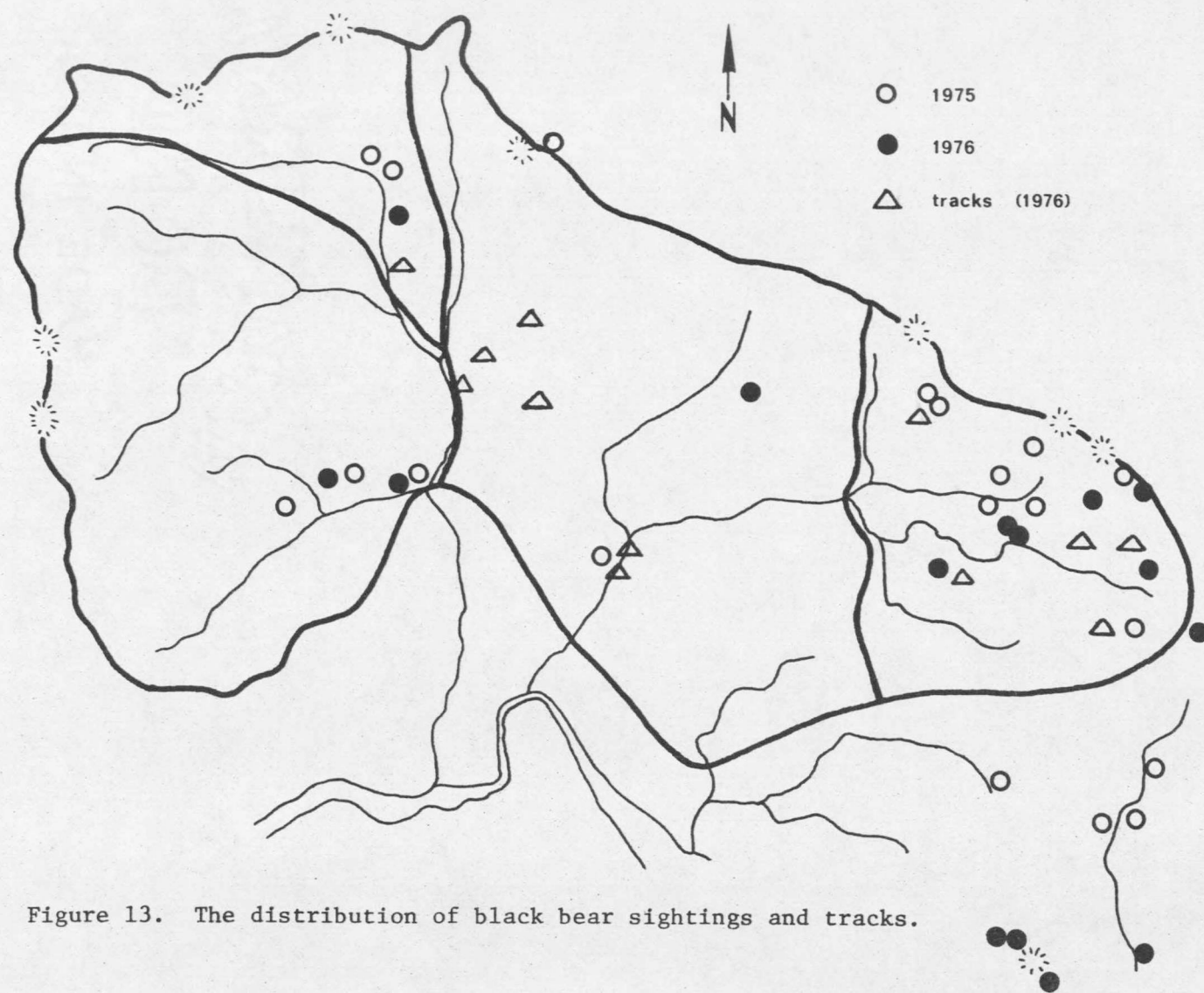


Figure 13. The distribution of black bear sightings and tracks.

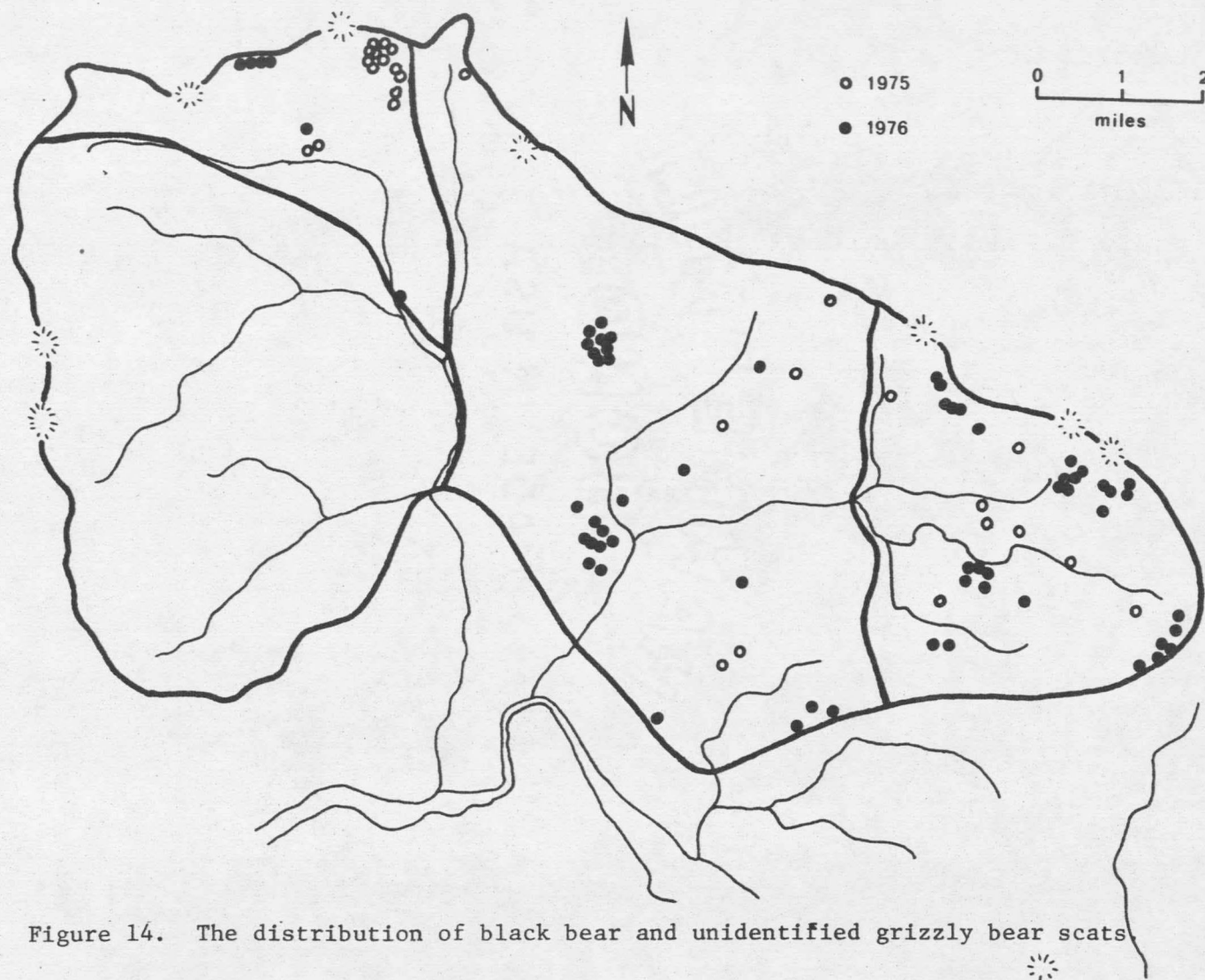


Figure 14. The distribution of black bear and unidentified grizzly bear scats

TABLE 13. A SUMMARY OF HABITAT TYPES IN SUBUNITS ONE, TWO, AND THREE.

Habitat Area	Subunit 1 Hectares	Subunit 2 Hectares	Subunit 3 Hectares	Total Hectares (%)
Forested:				
<i>Abies lasiocarpa/Vaccinium scoparium</i> (ABLA/VASC)	631.8	2609.3	166.9	3408.0 (28.1)
<i>Abies lasiocarpa/Vaccinium globulare</i> (ABLA/VAGL)	364.6	591.7	318.0	1274.3 (10.5)
<i>Abies lasiocarpa/Menziesia ferruginea</i> (ABLA/MEFE)	0	127.0	0	127.0 (1.1)
<i>Abies lasiocarpa/Arnica cordifolia</i> (ABLA/ARCO)	110.7	309.5	0	420.2 (3.5)
<i>Abies lasiocarpa/Calamagrostis rubescens</i> (ABLA/CARU)	94.9	313.6	0	408.4 (3.4)
<i>Abies lasiocarpa/Calamagrostis canadensis</i> (ABLA/CACA)	0	0	63.1	63.1 (.5)
<i>Abies lasiocarpa-Pinus albicaulis/Vaccinium scoparium</i> (ABLA-PIAL/VASC)	566.4	648.6	221.3	1436.3 (11.9)
<i>Pinus albicaulis-Abies lasiocarpa</i> (PIAL-ABLA)	581.0	1024.0	271.1	1876.1 (15.5)
<i>Pseudotsuga menziesia/Carex geyeri</i> (PSME/CAGE)	0	7.7	0	7.7 (.1)
<i>Picea engelmannii/Galium triflorum</i> (PIEN/CATR)	0	33.2	0	33.2 (.3)
<i>Picea engelmannii/Smilacina stellata</i> (PIEN/SMST)	3.0	7.7	0	8.9 (.1)

TABLE 13 (CONTINUED)

Habitat Area	Subunit 1 Hectares	Subunit 2 Hectares	Subunit 3 Hectares	Total Hectares (%)
Forested (continued)				
<i>Picea engelmannii</i> / <i>Linnaea borealis</i> (PIEN/LIBO)	0	3.2	0	3.2 (.1)
<i>Abies lasiocarpa</i> ? (ABLA/?)	0	33.2	0	33.2 (.3)
Total Forested	2352.4	5708.7	1040.4	9099.6 (75.1)
Non-forested:				
Clearcut (ABLA/CARU)	0	42.3	0	42.3 (.4)
<i>Festuca idahoensis</i> / <i>Agropyron caninum</i> (FEID/AGCA)	788.0	613.2	283.6	1684.8 (13.9)
<i>Festuca idahoensis</i> / <i>Deschampsia caespitosa</i> (FEID/DECA)	50.2	95.4	35.2	180.9 (1.5)
<i>Deschampsia caespitosa</i> / <i>Carex</i> spp. (DECA/CAREX)	37.8	31.6	0	69.4 (.6)
<i>Artemesia tridentata</i> / <i>Festuca idahoensis</i> (ARTR/FEID)	1.6	123.8	0	125.4 (1.0)
<i>Salix</i> spp. (SALIX)	58.7	7.3	0	66.0 (.5)
<i>Carex</i> spp. (CAREX)	2.0	2.4	0	4.5 (< .1)
Stream Bottom	17.4	33.2	0	50.6 (.4)
Exposed Soil	0	17.0	0	17.0 (.1)
Scree	170.9	5.1	101.2	277.2 (2.3)

TABLE 13 (CONTINUED)

Habitat Area	<u>Subunit 1</u> Hectares	<u>Subunit 2</u> Hectares	<u>Subunit 3</u> Hectares	<u>Total</u> Hectares (%)
Non-forested (continued)				
Talus	265.0	184.1	40.3	489.4 (4.0)
Water	0	17.5	0	17.5 (.1)
Total Non-forested	1391.5	1172.9	460.3	3024.6 (24.9)
TOTAL	3743.9	6881.6	1500.7	12124.2(100.0)

TABLE 14. THE OCCURRENCE OF KNOWN GRIZZLY BEAR FOOD PLANTS WITHIN HABITAT TYPES OF SUBUNITS ONE, TWO, AND THREE.

Food Plants ¹	Non-forested Habitat Types						Forested Habitat Types											
	Stream Bottom (6) ²	FEED/ACA (Festuca lilacensis/agropyron canine)	DECA/CAREX (Deschampsia cespitosa/Carex spp.)	FEED/DECA (Festuca lilacensis/Deschampsia cespitosa)	ANTH/FEED (Artemisia tridentata/Festuca lilacensis)	Clearcut (ABLA/CARU)	FIAL-ABLA (Pinus albionensis-Abies lasiocarpa)	ABLA/VASC (Abies lasiocarpa/Vaccinium scoparium)	ABLA/FIAL/VASC (Abies lasiocarpa/Pinus albionensis/Vaccinium scoparium)	ABLA/CARU (Abies lasiocarpa/Columbiana rubsomus)	ABLA/CACA (Abies lasiocarpa/Columbica- tis canadensis)	ABLA/VAGL (Abies lasiocarpa/Vaccinium globulare)	PIEN/GATR (Picea engelmannii/Gallium tri-florum)	ABLA/ARCO (Abies lasiocarpa/Arctostaphylos uva-ursi)	ABLA/MEFE (Abies lasiocarpa/Menyanthes ferruginea)	PIEN/SNET (Picea engelmannii/Smilacina etiolata)	PIEN/CACE (Pseudotsuga menziesii/Carex geyeri)	PIEN/LIBO (Picea engelmannii/Lilium borwale)
Trees																		
Pinus albicaulis				14.3/.1	14.3/.1		100/35.5	19.2/2.1	87.5/28.1	42.8/2.3	100/.5	18.2/1.5		57.1/1.4				
Pinus flexilis	5.1/.5						8.3/.1	26.9/3.1		28.6/.1		27.3/.1	100/.5	14.3/.1	100/.5			
Shrubs																		
Amelanchier alnifolia	2.6/.1						8.3/.1		12.5/.1			63.6/.6	100/.5	57.1/.6				100/.5
Juniperus communis							16.7/.1	61.5/1.1	50/2.4			9.1/.1		28.6/.5				
Lonicera utahensis	20.1/.1	2.6/.1					8.3/.1	19.2/.3	25/.1	57.1/.6							100/.5	
Ribes spp.	40/2	2.6/.1						3.9/.1		28.6/.1							100/.5	
Rubus parviflorus	20/1	2.6/.1						3.9/.1	12.5/.1	42.9/4.4								
Sambucus racemosa	40/2	10.3/.1					8.3/.1	23.1/1.1				18.2/1.4						
Shepherdia canadensis	23.1/1.1	2.6/.1					8.3/.1	19.2/.3	12.5/1.9			100/.3						
Vaccinium globulare							33.3/3.5	100/26	37.5/12.6	14.3/.1		45.5/3.1		28.6/.1	100/.5			100/.5
Vaccinium scoparium															100/37.5			
Herbs																		
Grasses	80/35	100/32.8	100/43.8	100/61.8	100/15.4	100/37.5	75/19.3	80.8/6.3	75/4.6	100/21.6	100/15	81.8/8.2	100/37.5	71.4/3.1	100/3	100/15	100/.5	100/.5
Carex spp.	100/43	48.7/5.7	75/52.5	57.1/10.9	28.6/7.5	100/3	41.7/3.7	69.2/5.5	62.5/10.7	57.1/6.5		63.6/9.1	100/15	57.1/1				
Melilotus spectabilis	40/3.5	89.7/11.1	50/.3	28.5/2.2	71.4/3.5		8.3/.1	7.7/.1		14.3/.1				14.3/.1				100/15
Apoecis spp.	40/7	79.5/2	25/.8	100/6.1	42.8/2	100/.5	41.7/1.8	12.5/.1		14.3/.1				85.7/5.6				
Aster spp.	20/1	41/7		42.9/4.4	28.6/2.2	100/.5	83.3/6.3	38.5/1.5	50/8.5	100/5.7	100/3	90.9/6.3		14.3/.1		100/3	100/3	
Astragalus spp.		20.5/.5			28.6/.1		25/1.3	11.5/.3	25/.4	14.3/.1		18.2/.3		14.3/.1				
Castilleja spp.		18/6	25/.1	14.3/.4		100/.5	8.3/.1	23.1/1.1	50/.6	14.3/.1		18.2/.1		14.3/.1				
Equisetum spp.	60/8	7.7/.1						7.7/.1		14.3/.4						100/15		
Eriogonum spp.		28.2/3.7	50/10.1	85.7/12.2		100/.5	8.3/.1	7.7/.1		28.6/.5	100/.5		100/.5					
Hieracium lasatum	60/8.2	10.3/.1					16.7/.3	11.5/.3	37.5/2					14.3/.1				
Hieracium spp.		2.6/.1					8.3/.1			28.6/.1	100/62.5			14.3/.1				
Mertensia ciliata	40/13.1	43.6/2.4	75/19.5	14.3/.4	14.3/.1		16.7/.1	50/.6	25/.1	42.9/2	100/3	63.6/16	100/.5	42.9/6		100/3	100/.5	
Oenothera chilensis		10.3/9.1	50/.3	42.9/9.1				15.4/3		14.3/.4		9.1/.1		14.3/.1				
Oenothera occidentalis		28.2/1								14.3/.4	100/15	9.1/1.4		14.3/.1				
Samolus triangularis	40/15.5		75/5.3			100/.5		11.5/.3										
Taraxacum officinale	40/2	18/2	50/.3			100/.5				14.3/2	100/5	63.6/2.6	100/3	71.4/3.1	100/.5			100/.5
Erythronium grandiflorum	20/6	69.2/1.4		57.1/.6	14.3/.1	100/.5	91.7/5.8	80.8/2.6	100/3.6	57.1/.6				14.3/.1				
Claytonia lanceolata	20/1	33.3/6		14.3/.1			33.3/6		37.5/5									
Lomatium spp.		2.6/.1																
Lomatium triternatum		18/3.7			51.4/2.4													
Perideridia gairdneri	40/3.1	28.2/1.5			42.9/2.2													
Polygonum bistortoides		7.7/.1	100/1.1	51.4/6.6			8.3/.1	3.9/.1										
Allium spp.																		
Cirsium spp.	40/7		25/3.8			100/.5												
Prunella spp.	40/8.1	12.8/6					8.3/.3	26.9/.1		85.7/1.5		18.2/.3	100/3	14.3/.1				
Ligustrum filicinum		46.2/4.3		57.1/9.5	14.3/.1		50/.3	15.4/2		12.5/.1		19.1/1	100/.5					
Smilacina stellata						100/.5						19.1/1	100/.5					
Trifolium spp.		12.8/2											100/.5	14.3/.1				
Ranunculus spp.	40/1			28.6/.5							100/.5							
Total Occurrence ³	20	31	13	14	17	10	24	27	18	23	9	20	4	23	5	4	7	4
Total Coverage ⁴	133.4	80.5	137.6	115.7	43.6	44.5	79.1	52.1	74.5	48.1	120.5	45.6	2.0	19.6	42.0	36.0	20.5	2.0
Importance Value ⁵	26.7	25.0	17.9	16.2	7.4	4.5	19.0	14.1	13.4	11.1	10.9	9.1	6.2	4.5	2.1	1.4	1.4	0.1

¹ Data are listed by Percent Constancy/Percent Coverage, where Constancy = percent of community plots containing a plant; and Coverage = average canopy coverage by a plant for all plots in the area.

² Number of plots per habitat type.

³ Total Occurrence = Number of grizzly bear food plants in a habitat type.

⁴ Total Coverage = the sum of grizzly bear food plant coverages for each habitat type.

⁵ Importance Value = (Number of grizzly bear food plant species in a habitat type) X (Total canopy coverage of food plant species in that habitat type) / 100.

TABLE 15. A SUMMARY OF GRIZZLY BEAR SCAT¹ CONTENTS FOR 1975 AND 1976 COMBINED.

Food Item	Frequency of Occurrence Percent ²	Percent Composition ³	Percent of Total Scat Volume	I.V. ⁴	I.V.% ⁵
Graminae/Cyperaceae	74.2	30.7	22.8	16.9	35.3
<i>Pinus albicaulis</i>	40.9	85.4	35.0	14.3	29.9
Unidentified Forbs	63.6	33.8	21.5	13.7	28.6
<i>Claytonia lanceolata</i>	28.8	15.4	4.4	1.3	2.7
<i>Melica spectabilis</i>	16.7	20.1	3.4	0.6	1.3
<i>Equisetum</i> spp.	16.7	18.6	3.1	0.5	1.0
Rodentia/Cervidae	12.1	25.1	3.1	0.4	0.8
<i>Lomatium triternatum</i>	7.6	21.8	1.7	0.1	0.2
Formicidae	6.1	23.8	1.4	0.1	0.2
<i>Perideridia gairdneri</i>	3.0	22.5	0.7	<0.1	<0.1
<i>Juniperus communis</i>	1.5	70.0	1.1	<0.1	<0.1
<i>Cirsium</i> spp.	4.6	5.0	0.2	<0.1	<0.1
Bone	1.5	1.0	0.1	<0.1	<0.1
Total			98.5	47.9	100.0

¹ Sample size = 66.

² Frequency of Occurrence Percent = (total number times item appeared in scats/total number scats) X 100.

³ Percent Composition per Item = average percent composition in scats containing that item.

⁴ Importance Value = (Frequency of Occurrence X Percent of Scat Volume)/ 100.

⁵ Importance Value Percent = Importance Value/ Total Importance Values.

TABLE 16. A SEASONAL CLASSIFICATION OF GRIZZLY BEAR SCAT CONTENTS FOR 1975 AND 1976 COMBINED.

Season	n	Food Item	Frequency of Occurrence Percent ¹	Percent Composition ²	Percent of Total Scat Volume	I.V. ³	I.V.% ⁴
Spring	10	Graminae/Cyperaceae	80.0	40.0	32.3	25.8	51.5
(May-June)		<i>Pinus albicaulis</i>	40.0	91.3	36.5	14.6	29.1
		Rodentia/Cervidae	50.0	22.2	11.1	5.6	11.2
		Formicidae	30.0	25.0	7.5	2.3	4.6
		Forbs	30.0	11.7	3.5	1.1	2.2
		<i>Juniperus communis</i>	10.0	70.0	7.0	0.7	1.4
		Bones	10.0	1.0	0.1	<0.1	<0.1
					98.0	50.1	100.0
Summer	34	Forbs	88.2	45.6	40.2	35.5	50.0
(July-Aug.)		Graminae/Cyperaceae	88.2	35.5	31.4	22.7	39.0
		<i>Claytonia lanceolata</i>	55.9	15.4	8.6	4.8	6.8
		<i>Melica spectabilis</i>	32.4	20.1	6.5	2.1	3.0
		<i>Lomatium triternatum</i>	14.7	21.8	3.2	0.5	0.7
		Rodentia	8.8	30.0	2.7	0.2	0.3
		<i>Perideridia gairdneri</i>	5.9	22.5	1.3	0.1	0.1
		<i>Pinus albicaulis</i>	2.9	70.0	2.1	0.1	0.1
		<i>Equisetum</i> spp.	2.9	23.0	0.7	<0.1	<0.1

TABLE 16 (CONTINUED)

Season	n	Food Item	Frequency of Occurrence Percent ¹	Percent Composition ²	Percent of Total Scat Volume	I.V. ³	I.V.% ⁴
Summer (continued)							
		Formicidae	2.9	20.0	0.6	<0.1	<0.1
					97.3	71.0	100.0
Fall	22	<i>Pinus albicaulis</i>	100.0	85.1	85.1	85.1	93.2
Sept.-		<i>Equisetum</i> spp.	45.5	18.2	8.3	3.8	4.2
Oct.)		Graminae/Cyperaceae	50.0	10.3	5.1	2.6	2.9
		<i>Cirsium</i> spp.	13.6	5.0	0.7	0.1	0.1
		Forbs	40.9	2.0	0.8	0.3	0.3
					100.0	91.3	100.7

- ¹ Frequency of Occurrence Percent = (total number times item appeared in scats/total number scats) X 100.
- ² Percent Composition per Item = average percent composition in scats containing that item.
- ³ Importance Value = (Frequency of Occurrence X Percent of Scat Volume)/ 100.
- ⁴ Importance Value Percent = Importance Value/ total Importance Values.

TABLE 17. A SUMMARY OF THE NUMBER OF QUESTIONNAIRES MAILED AND RETURNED.

	1975	1976	Total
First mailing:			
Number delivered	315	319	634
Number returned	183	181	364
Percent returned	58.1	56.7	57.4
Second mailing:			
Number delivered		88	88
Number returned		31	31
Percent returned		35.2	35.2
Total Percent Returned	58.1	66.5	62.3

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