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ROCKY MOUNTAIN FRONT GRIZZLY BEAR MONITORING AND INVESTIGATION

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prepared by:

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Project Leader

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INTRODUCTION

In the conterminous 48 states, only six areas are found to contain self-perpetuating or remnant populations of grizzly bears (*Ursus arctos horribilis*) (US Fish and Wildlife Service 1981). Of these six areas, only the Northern Continental Divide population is contiguous with Canadian and Alaskan grizzly bear populations, and stands the best chance of survival in the future. The northern Continental Divide ecosystem includes Glacier National Park, parts of the Flathead and Blackfoot Indian reservations, parts of five national forests (Flathead, Helena, Kootenai, Lewis and Clark and Lolo), four wilderness areas (Bob Marshall, the Great Bear, Mission Mountains and Lincoln Scapegoat), and a significant amount of state and private land. One of the more unique segments of this ecosystem is the Eastern Rocky Mountain Front where the great plains meet the steep north and south running ridges which form the Sawtooth Range, more commonly known as the Rocky Mountain Front range. Here, along a narrow strip exists the last plains habitat which is inhabited by the grizzly bear.

In 1977, research was initiated on the grizzly bear along the east slope of the Rocky Mountains in northwestern Montana. The study, which was continued until 1979 by the Border Grizzly Project, provided much baseline data concerning grizzly bear populations, home range, movement, and habitat use (Schallenberger and Jonkel 1980). Research efforts were continued in 1980 through a contract agreement between the Bureau of Land Management and the Montana Department of Fish, Wildlife and Parks personnel and Border Grizzly Project personnel (Aune and Stivers 1981). In 1984, monitoring of the East Front grizzly population was continued with support and funding from the Bureau of Land Management, the Montana Department of Fish, Wildlife and Parks, the US Forest Service, US Fish and Wildlife Service. The Nature Conservancy, Williams Exploration Company, Superior Oil Company, American Petrofina and Sunmark Exploration Company previously committed funding to this project (Aune and Stivers 1982 and 1983). Impetus for continuing research on the grizzly bear in this area is the Endangered Species Act of 1973, the grizzly's listing as a threatened species in 1975, and the BLM, USFS and Department of Fish, Wildlife and Parks' need for information on the species in making resource management decisions. This is especially important in relation to increased oil and gas exploration/development and human activities within the study area.

The objectives of the study are: (1) to review and analyze previously accumulated data on grizzly bears, (2) to further delineate and define essential habitat and important use areas within the study area, (3) to determine impacts associated with oil and gas exploration and other human activities, and (4) make recommendations to protect and maintain grizzly populations and habitat. Specific information regarding plant phenology and presence of bear foods, grizzly bear habitat requirements on a

seasonal basis, population numbers on a seasonal and year long basis, food habits on a seasonal basis, interaction with other wildlife species, and bear home ranges, movements and distribution were gathered.

DESCRIPTION OF THE STUDY AREA

The study area lies along the east face of the Continental Divide in northwestern Montana (Fig's 1 and 2). The northern boundary is Highway 2 and the southern boundary is Highway 200. The study area is bounded on the west by the upper portions of the South Fork of the Flathead River, and the Middle Fork of the Flathead River within the Flathead, Lolo, and Helena National Forest's. The eastern boundary extends to approximately Range 6 West. BLM lands, Montana Department of Fish, Wildlife and Parks wildlife management areas, Forest Service non-wilderness and private lands with federal oil, gas and mineral rights were the primary focus of the research.

The study area has been described in Picton (1960), Schallenger (1966), Knight (1970), Mudge (1972), Erickson (1972), Frisina (1974), Holdorf (1981), Schallenger (1974 and 1976), Schallenger and Jonkel (1978, 1979 and 1980), and USDA Forest Service (1977). Picton and Picton (1975), Schallenger (1974 and 1976), Dupuyer Centennial Committee (1977) and USFS (1977) present historical information from the study area. Information on grizzly bears in the region has been reported by Jonkel (1976 and 1977), Schallenger (1974 and 1976), Sumner and Craighead (1973), Hamlin and Frisina (1974), Schallenger and Jonkel (1978, 1979 and 1980) and Aune and Stivers (1981, 1982, and 1983).

Briefly described, elevations on the study area range from about 4200 ft. (1280 m) in river valleys east of the mountains to 9392 ft. (2863 m) on mountain tops. Sedimentary rocks of the limestone and dolomite types generally form the peaks and high ridges, while rocks of the sandstone type often underlie the valley bottoms. Alpine glaciers extensively modified landforms in the past.

Annual precipitation averages about 12 inches (31 cm) at Choteau and up to 65 inches (167 cm) near the Continental Divide. Approximately 80 percent of the precipitation falls as snow. Temperatures range from 90 F (32 C) to about -50 F (-46 C). The climate is characterized by long, cool winters, short, warm summers and strong southwest winds. Climatological data from two reporting stations for 1980-84 along the east front are presented in Appendix A.

The major drainage systems within the study area include the Dearborn River, Sun River, Teton River, Birch Creek and Two Medicine River. Many of the drainages form a characteristic trellis pattern with narrow canyons joining main rivers at abrupt angles (Mudge 1982). Riparian vegetation extends into the high

plains and provides food and cover for black and grizzly bears far from mountainous habitat (Schallenger and Jonkel 1980, Aune and Stivers 1981, 1982 and 1983).

Subalpine fir (Abies lasiocarpa) is dominant and represents climax on most of the timberline forest. Stands of spruce (Picea spp.), white-bark pine (Pinus albicaulis), lodgepole pine (Pinus contorta), Douglas fir (Pseudotsuga menziesii), limber pine (Pinus flexilis), aspen (Populus tremuloides), and cottonwood (Populus trichocarpa) are found on select locations, depending on landform, aspect and elevation. Natural grasslands cover the plains and foothills at lower elevations and intergrade westward into limber pine savanna (Schallenger and Jonkel 1980).

METHODS

Field Methods

Bears were trapped using front foot snares (Aldrich Snare Co., Clallam Bay, Washington). Before trapping began, snares were boiled for several hours in bark, needles and leaves from willow, kinnikinnick and juniper. Then the snares were lightly waxed with melted paraffin. All trapping equipment and bait were handled with gloves. Bait included carcasses of road-killed deer, beaver carcasses from trappers, horses and cattle, plus miscellaneous meat scraps.

Snares were set at the mouth of log cubbies, on trails, and occasionally a dip or barrel set was made. Cubbies were built and prebaited before snares were set. A drag, which consisted of a piece of ripe bait on a rope, was pulled between each snare set and along bear travel routes to attract bears to the set. Warning signs were posted announcing the general location of the set to minimize human/bear encounters. The traps were checked by vehicle or with saddle horse and pack string, daily.

Captured bears were darted with a Palmer Cap-chur gun. Phencyclidine hydrochloride (Sernylan) and promazine hydrochloride (Sparine) mixed in equal portions were used to immobilize grizzly bears. A 2:1 ratio of ketamine hydrochloride (Ketaset) and xylazine (Rompun) was used on small grizzly bears and black bears.

Grizzly and black bears were marked with two colored plastic ear tags, all with the same number. One tag was placed in each ear. A numbered lip tattoo which matched the ear tag number was applied to the inside upper lip.

Grizzly bears were fitted with radio transmitters in the 164 MH range (Telonics, Inc., Mesa, Arizona). Ear tag transmitters (Telonics, Inc., Mesa, Arizona) were fitted on yearling grizzlies. Small grizzlies were not collared to avoid problems associated with increasing neck girth of growing individuals and the possible restriction by the radio-collar. All collars placed

Figure 1. Map of the study area North of the Sun River.

Figure 2. Map of the study area south of the Sun River.

on subadult grizzlies were padded with foam up to two inches thick or had breakout spacers inserted to allow for expected increases in neck girth over time.

Once trapped and drugged, physical measurements of the bear were taken. Weight was determined using a cattle weighing tape or a spring scale for bears under 300lbs. The first premolar was extracted and used to determine age of the bear from cementum annuli counts (Stoneberg and Jonkel 1966).

Radio-instrumented bears were monitored during frequent (twice weekly) aerial flights made in a Piper Supercub. The airplane was equipped with a belly-mounted antenna system. Black and white photos were taken at each location for future reference. Ground tracking efforts were conducted immediately after aerial flights were completed. All locations were plotted on USGS 1:24,000 quad maps by UTM coordinates. Bears were tracked until they denned or until the radio malfunctioned.

Specific radio locations made by ground and aerial tracking efforts were visited to determine the reasons for the bears' presence at each site. Scats, tracks, beds, digging sites, den sites, destruction of rotten logs, dug up squirrel caches, marking trees, hair on fences and other objects, trails, evidence of feeding activity or any other evidence of activity were noted. A 375 m² (0.1 acre) circular plot was delineated within the activity site. Plant species phenology and canopy coverage of each were recorded at the site. Vegetation structure was determined by assigning canopy coverage values to structural tree and shrub heights. Plants were identified according to Hitchcock and Cronquist (1973).

Scats and reports of grizzly bear sightings, tracks, dens, kills and depredations were collected from many sources during the study. Federal and state government agencies, outfitters, guides, hunters, ranchers, and other outdoorsmen cooperated by reporting such information.

Grizzly and black bear scats were collected, tagged and frozen. Scats were differentiated as to species when collected from unknown bears. Scats of greater than 2-inch diameter or 1 quart in volume were labeled grizzly bear scats. Some scats were differentiated as to species by keying guard hairs found in beds and on trees or brush or from tracks found near the scat collection site. Most of the grizzly scats collected were from known radio-collared grizzlies.

Activity patterns were determined by 24-48 hour continuous monitoring of individuals. Real time motion sensing collars were placed on bears to increase reliability of activity data. Nonmotion-sensing collars could yield activity data by interpretation of signal strength by an experienced observer. Motion-sensing collars are designed to transmit in two different modes, depending on the collar position. Constant transmission

in either mode indicates a stationary collar. Intermittency of mode indicates motion of collar, and bear.

Bears were selected for 24-48 hour monitoring according to their availability and proximity to areas of disturbance. Instrumented bears were ground tracked by foot, horseback, or vehicle, for as long as possible. Observers monitored the bears' every one-quarter to one-half hour, from as close as possible (for maximum radio reception) without disturbing the bear. Activity and locations were determined by triangulation, signal integrity, visual contact, or state of transmitted mode. A standard clock-type form was used, where activity could be proportioned into a 12-hour monitoring period. Information recorded on the activity forms included date, bear number, observers, receiver type, observation time, location of observer, location of bear, signal strength, constancy or intermittency of signal, and transmitter mode.

Dens were located by random chance, by helicopter surveys in denning habitat, and by radio tracking bears to their dens from air or ground. Dens were inspected on the ground as time permitted. Pertinent data gathered from each inspection included elevation, aspect, slope, habitat type, land type, den type and condition of the den. Dens located by helicopter were photographed with color slide film from low altitudes while hovering above the den.

Cattle fecal samples were collected during each month of the field season from May to October. Samples were tagged with habitat data and date of collection on each tag. Fresh samples were usually taken. A total of 20 samples a month was taken in various habitats and locations. Samples were frozen, then at a later date, dried and milled to a fine powder for micro-histological examination.

The current dominant class of livestock grazing at each radio location was reported and coded. Also, each vegetation plot conducted in the field was rated from 0-5 where 0 would describe an area not grazed for 2 years or more and 5 described an area which appeared overgrazed. Occular estimates were used to appraise the site condition.

Component mapping was conducted in the field on color and I.R. aerial photos. Mapped units were then transferred onto ortho-photo quads. Different habitat components were color coded on the finished maps. Mapping was 100 percent coverage with ground truthing over the entire area.

Data Analysis

Distribution, Home Range, Movement and Activity Patterns

Observation data were plotted on USFS ($\frac{1}{4}$ inch=1 mile) maps to record distribution. Distribution maps for each spring, summer

and fall season were prepared. The information collected since 1980 was recorded by UTM's and section, township and range. Each observation represented at least one grizzly bear and ranged to eight. Radio locations were included as an observation and were plotted on both USFS ($\frac{1}{4}$ inch=1 mile) maps and USGS topographic quadrangle maps.

Grizzly bear home ranges were described by the minimum home range method (Mohr 1947, Hayne 1959) and the modified minimum method (Harvey and Barbour 1965). Home range maps were created with the aid of a Honeywell computer and plotter. The Telday home range program was provided by the Montana Department of Fish, Wildlife and Parks. Area calculations for the minimum home range of each bear were completed on the computer. Modified minimum home range area measurements were done using a planimeter.

To quantify daily movements, all consecutive day radio locations were pooled from 8 years of data (1977-1984). Airline distances (in meters) from 1 day's location to the next, were determined using each day's UTM coordinates to calculate the hypotenuse of a right triangle. Where there was more than one location on each consecutive day, the pair of coordinates yielding the greatest distance was used. These daily movements were categorized by season. Seasonal dates are spring - den emergence through June, summer - July through August, and fall - September to den entrance.

All radioed bear movements recorded during 24-48 hour monitoring have been plotted on USGS topographic quadrangle maps. Airline distance between coordinates recorded at the end and beginning of a 24-hour monitoring session were measured. These were then compared to the distance planimetered from a mapping of the bears' actual movements.

The distance between consecutive radio fixes was calculated on a computer. The Telday program provided a calculation option which outputs the mean distance, standard deviation and range of distances between consecutive radio fixes. Comparisons were made between bears and years.

Bear activities were recorded as inactive, stationary active or fully active. Inactive periods were defined as bear being stationary with a constant signal, and signal strength, or mode. Stationary active was defined as bear being stationary with a light to moderate intermittency of signal, signal strength, and/or mode. Fully active was defined as bear not stationary with a moderate to heavy intermittency of signal, signal strength, and/or mode. The stationary active periods prior to fully active periods were termed periods of arousal. The stationary active periods following fully active periods were termed periods of quiescence. The mean length (in hours), range, and standard deviation in length of each of these periods was calculated in a combined sample of 3 years.

Food Habits

Frozen and dried scats were soaked then washed through two wire mesh screens twice. The first wash, using hot water was followed by a second with cold water. Coarser materials gather in the coarse mesh screen (0.156), while finer materials gather in the finer mesh screen (0.0937 inch). The contents of each screen were then placed in a large porcelain pan. Cold water was added and the scat material examined. Dissecting and compound microscopes were used to aid in identification. Items present were identified as to genus and species when possible. The parts of each item were also identified (e.g., leaf, stem, root, berry, etc.). The percent volume of each item was visually estimated. Data from each scat including information about the collection site are coded on computer sheets. Data were sorted and analyzed by computer methods.

The frequency, percent frequency, total volume, percent volume, percent composition, importance value and importance value percent were calculated. Formulas are presented below:

Frequency = Number of scats having the same item

$$\text{Frequency percent} = \frac{\text{Frequency of item}}{\text{Total number of scats}} \times 100$$

Total volume = Total volume of the same item in all scats of the sample

$$\text{Total volume percent} = \frac{\text{Total volume of item}}{\text{Total volume of scat samples}} \times 100$$

$$\text{Percent composition} = \frac{\text{Total volume of item}}{\text{Number of scats with item}} \times 100$$

$$\text{Importance value} = \frac{\text{Percent composition} \times \text{percent frequency}}{100}$$

$$\text{Importance value percent} = \frac{\text{Importance value of item}}{\text{Sum of importance values for all items}}$$

Den Studies

Dens which were located by helicopter or inspected on the ground were plotted on USGS and USFS ($\frac{1}{4}$ inch = 1 mile) maps by UTM's or section, township and range. Physical characteristics data of dens inspected on the ground were derived from actually measuring and observing. Physical characteristics data from dens located by helicopter were derived from both observation (with the aid of color slides) and interpretation of data from USGS quad maps. Physical characteristics data from dens not visited on the ground but accurately plotted on USGS maps by UTM's were extracted from maps and aerial photographs of the area. Physical characteristics data were summarized and put into tables. Data

of entrance and emergence from dens by grizzly bears were determined by radio monitoring individuals.

Impacts of Oil and Gas Exploration and Development Activities

Home ranges were mapped in relation to oil and gas drilling and seismic exploration activities. Radioed bears were monitored for 24-48 hour periods in the area of oil and gas exploration/development activities. Grizzly bear movements and locations were plotted by UTM's on USGS quad maps.

Accurate records of oil and gas drilling activity and the associated phases of activity were kept. Seismic activity information was recorded by the USFS. These were plotted on $\frac{1}{4}$ " - mile maps for annual recording of activities.

Two methods were employed in evaluating seismic activity impacts on bears. Both methods were conducted to test the hypothesis that grizzly bears were displaced by seismic activity and separated their activities both in time and space. The first method involved mapping bear relocations on $\frac{1}{4}$ " to 1 mile scale maps for the period of time that a specific seismic project was conducted. Each radio location was dated. Then seismic lines were mapped on the same scale and each was separated into sections with appropriate dates when major activities (blasting, helicopter crews, etc.) was prevalent. It is recognized that some preparatory activity (i.e. survey crews) occurred on each section of line prior to the major survey activities. Distances were measured from each radio location to the nearest active seismic line section. Summary statistics were calculated for each radioed bear and all bears pooled.

The second method involved monitoring specific behavioral responses of bears to seismic activity. These were recorded in the field by intense monitoring of individual bears and were reported on a case study basis.

Livestock/Bear Relationships

Microhistological analysis of cattle fecal samples followed methods described by Kasworm (1982). Data sets were sorted by month and season for the 2 years of sampling (1982 and 1983). Percent of diet for samples was sorted by species and by general plant categories (grammoids, forb, and browse).

Percent of locations found within pastures being grazed by each dominant livestock class were summarized by computer methods. Allotment maps of the forest and information from private livestock operators were used in assigning a location to a specific grazing regime. Data were summarized by season and put into a table.

Habitat Studies

Habitat data recorded at each radio location included elevation, aspect, slope, habitat components, land type, site information, topography, decade of burn where they occurred, current grazing regime, photointerpretive type, distance to perennial water (meters), and distance to road (meters). Each radio location was plotted on USGS maps and then information was recorded from maps, air photos or when the site was visited on the ground. Data from specific locations were coded and recorded in computer files. Data were analyzed by the SPSS statistical program to determine frequency and relative percent of each input parameter.

Aune and Stivers (1983) discuss the habitat components defined for the East Front. However, in 1984 the component classification used in 1983 was modified. The broader timber component was subdivided into open and closed timber components. These are thoroughly defined in the Results and Discussion section on habitat studies. Each radio location from 1977 to 1984 was reviewed and reclassified as necessary to accommodate this modification. Habitat components use was described using SPSS cross-tabs program to cross-correlate bear activity, elevational occurrence, and season of use for each component.

Seventeen habitat components have been defined for the Rocky Mountain Front study area. These seventeen specific components are often closely associated with each other. For each radio location the exact component utilized by a bear is recorded. However often times a bear is very near a second or associated component. When this occurs a component association is recorded which gives the component the bear is in first, followed by the associated component. Generally if a bear is located and if a 1/10 acre plot conducted at the site would overlap two components an association is formed.

Habitat types were recorded according to Pfister, et al. (1977) and Mueggler and Handl (1974). Nonwilderness land types follow Holdorf (1981) and wilderness land types follow Holdorf, Martinson and On (1980). Land type maps of the study area were obtained from the USFS. Photo interpretive type maps were obtained by the USFS. This system was defined by C. W. Brown (1970) for USFS timber inventory (unpubl. data). Data for burns and grazing come from current maps of burn locations and allotment maps provided by the USFS. No maps exist for these parameters outside USFS boundaries, but data are being collected for their production.

Vegetation data collected from 375 m^2 circular plots were coded for computer analysis. Programming was developed to analyze and sort plots by habitat type or any input parameter.

Habitat availability will be determined using nonmapping methods described by Marcum and Loftsgaarden (1980). Composite home range polygons were developed according to methods described in

Servheen (1981). Analysis of utilization-availability data follows Nue et al. (1974) and Servheen (1981).

Black Bear Investigations

Methods utilized in black bear investigations parallel those described above. Radio collars were placed only on mature animals. Sub-adults and smaller adults were ear-tagged, but not fitted with radio collars. No site inspections of black bear radio locations were made as time limited the development of these studies. Habitat data were extrapolated from maps, air photos and examination of sites from the air. Black bear habitat use data were analyzed with the aid of computer methods described above.

Results and Discussion

Trapping and Radio Tracking

Traplines were operated in five separate regions within the study area in 1984. Traps were set at two cow carcasses on the Pine Butte area from March 26 until April 20. One grizzly (#328) was captured and fitted with a radio collar. A trapline was operated from April 28 until May 23 in the area from Smith Cr. to the Sun River Game Management Area. One grizzly (#328) was recaptured in this area. The area in Elk and Blubber Cr. was trapped from May 1 until June 17. No grizzlies were captured during this trapping effort. Grizzly 282 was observed in the area during trapping efforts. The most successful trapping effort was in the area from Mettler Coulee to Hyde Cr. on the Two Medicine Drainage. Trapping from June 1 to June 30 in this area resulted in the capture of four grizzlies six times. A short trap operation was conducted from June 26 to July 8 in the area along the South Fork of the Sun River from Benchmark to Pretty Prairie. One grizzly (#355) was captured on this trapline. In total, efforts to snare grizzlies during spring were conducted from March 26 to July 8 and resulted in the capture of six different grizzly bears, nine times. One grizzly (#378) was darted from a helicopter during the summer of 1984 on Old Baldy Mtn. Bear 378 was fitted with a radio collar. Spot trapping on select boneyards and depredation sites during the fall resulted in the capture of 4 grizzlies on the Teton River. One of these (#378) was a recapture which had to be relocated to the South Fork of the Flathead River after becoming involved in sheep depredations on the Teton. Two of these bears were also removed from the depredation site or nearby and released at sites on the East Front.

Overall, this year, ten grizzly bears were captured and handled for research or management actions on the Rocky Mountain Front. Physical measurements and data recorded at each capture are presented in Table 1.

Table 1. Physical measurements and marking data from grizzly bears captured on the Rocky Mountain Front, 1984.

Bear Number		328	544	313	485	366	355	378	317	392	326
Date		4/6	6/13	6/20	6/26	6/26	7/6	8/23	9/10	9/25	10/2
Age and sex ^{1/}		2.5M	4.5M	3.5F	8.5M	5.5F	8.5M	2.5M	2.5F	3.5M	1.5
Weight ^{2/} Behind hump	lb.	241	298	157	280	189	364	205	244	205	213
	kg.	109	135	71	127	86	165	93	111	93	97
Over hump	lb.	271	-0-	197	334	201	456	221	280	235	244
	kg.	123	-0-	89	152	91	207	100	127	107	111
Scale weight	lb.	270	-0-	225	-0-	210	-0-	260	260	230	270
	kg.	123	-0-	102	-0-	95	-0-	118	118	104	123
Total body length ^{3/}	in.	62.5	71.75	64.5	71.0	66.0	75.0	66.5	67.5	64.5	64.0
	cm.	158.8	182.2	163.8	180.3	167.6	190.5	168.9	171.5	163.8	162.6
Neck girth ^{4/}	in.	23.25	24.0	23.5	25.5	23.5	31.0	23.0	25.5	22.5	25.5
	cm.	59.1	61.0	59.7	64.8	56.7	78.7	58.4	64.8	57.2	64.8
Chest girth ^{5/}	in.	42.0	45.0	36.25	44.0	38.5	48.5	39.5	42.0	39.5	40.0
	cm.	106.7	114.3	92.1	111.8	97.8	123.2	100.3	106.7	100.3	101.6
Shoulder height ^{6/}	in.	30.5	36.5	27.0	-0-	31.0	40.5	29.0	37.0	38.5	28.0
	cm.	77.5	92.7	68.6	-0-	78.8	102.9	73.7	94.0	97.8	71.1
Shank length ^{7/}	in.	16.5	17.75	14.75	17.25	15.0	18.5	17.0	18.0	16.0	16.0
	cm.	41.9	45.1	37.5	43.8	38.1	47.0	43.2	45.7	40.6	40.6
Foot measurements ^{8/}											
Front pad width	in.	5.50	5.63	5.00	5.50	4.75	6.25	5.87	5.75	5.87	5.25
	cm.	13.97	14.30	12.70	13.97	12.07	15.88	14.91	14.61	14.91	13.34
Front pad length	in.	2.75	3.13	2.50	3.00	2.50	3.25	3.25	3.00	2.87	2.50
	cm.	6.99	7.95	6.35	7.62	6.35	8.26	8.26	7.62	7.29	6.35
Front foot length	in.	5.50	5.25	4.75	5.25	4.75	5.25	5.00	4.50	5.00	4.25
	cm.	13.97	13.34	12.07	13.34	12.07	13.34	12.70	11.43	12.70	10.80
Front claw length	in.	2.00	2.13	1.75	1.50	2.63	2.50	2.00	2.00	2.25	2.00
	cm.	5.08	5.41	4.45	3.81	6.68	6.35	5.08	5.08	5.72	5.08

Foot measurements (gont.)											
Front claw arc	in.	2.50	3.00	2.75	3.00	3.13	4.00	3.25	2.75	3.13	2.50
	cm.	6.35	7.62	6.99	7.62	7.95	10.16	8.26	6.99	7.95	6.35
Hind pad width	in.	-0-	5.50	4.50	4.75	4.25	6.00	5.50	5.50	5.50	5.00
	cm.	-0-	13.97	11.43	12.07	10.80	15.24	13.97	13.97	13.97	12.70
Hind pad length	in.	6.00	5.50	6.38	7.00	6.25	8.25	7.75	7.25	7.00	5.75
	cm.	15.24	13.97	16.21	17.78	15.88	20.96	19.69	18.42	17.78	14.61
Hind foot length	in.	9.50	9.63	8.13	8.75	8.00	10.50	9.63	9.50	9.00	7.25
	cm.	24.13	24.46	20.65	22.23	20.32	26.67	24.46	24.13	22.86	18.42
Testes length	in.	2.00	3.00	-0-	-0-	-0-	3.00	2.25	-0-	1.50	2.00
	mm.	50.8	76.2	-0-	-0-	-0-	76.2	57.2	-0-	38.1	50.8
Testes width	in.	1.00	1.75	-0-	-0-	-0-	1.75	1.13	-0-	1.00	1.00
	mm.	25.4	44.5	-0-	-0-	-0-	44.5	28.7	-0-	25.4	25.4
Baculum length	in.	5.50	7.00	-0-	-0-	-0-	6.25	5.00	-0-	5.25	4.25
	cm.	13.97	17.78	-0-	-0-	-0-	15.88	12.70	-0-	13.34	10.80
Mammæ Condition											
Length	in.	-0-	-0-	0.25	-0-	0.38	-0-	-0-	0.25	-0-	-0-
	mm.	-0-	-0-	6.35	-0-	9.65	-0-	-0-	6.35	-0-	-0-
Diameter	in.	-0-	-0-	0.25	-0-	0.38	-0-	-0-	0.25	-0-	-0-
	mm.	-0-	-0-	6.35	-0-	9.65	-0-	-0-	6.35	-0-	-0-
Reproductive Status		-0-	-0-	None	-0-	None	-0-	-0-	None	-0-	-0-
Color		Brn w/ blonde tips	Drk Brn w/some silver tips	Drk Brn Tan saddle and side	Drk Brn Blonde sides	Blonde w/drk legging	Drk Brn Blond head	Silver tip	Brn w/ blonde sides	Brn w/ blonde sides	Blonde
Fat Index		4	3.5	4	3	3.5	4	3	4	4	4.5
Ear tags	Left	328	544	313	484	366	355	378	317	392	326
		Green	Blue	Green	Green	Green	Green	Green	Green	Green	Green

Ear tags (cont.)

	Right	328 Green	544 Blue	313 Green	485 Green	366 Green	355 Green	378 Green	317 Green	392 Green	326 Green
Tattoo		328 black	544 black	313 black	485 black	366 black	355 black	378 black	317 black	392 black	326 black
Collar color		Black	Black	Black	Black	Black	Black	Black	Black	Black	Black
806/3/1&2											
802/1											

Table 2. Radio Monitored Bears, 1984

<u>No.</u>	<u>Sex</u>	<u>Age</u>	<u>March-April</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>August</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Total</u>
220	F	23.5	1*	3	6	9	9	4	3	1*	36
500	F	5.5	1*	4	7	8	9	6	6	1*	42
273 <u>1/</u>	F	10.5	8*	4	6	9	9	4	-	-	40
335 <u>2/</u>	F	6.5	4*	2	-	-	-	-	-	-	6
485	M	8.5	3*	4	5	8	8	4	3	1*	36
498	M	5.5	4*	-	-	4	7	4	3	3	25
518 <u>3/</u>	F	3.5	2*	-	-	-	-	-	1	-	3
328	M	2.5	-	3	5	7	10	3	6	4*	38
544 <u>4/</u>	M	4.5	-	-	5	8	10	4	-	-	27
313	F	3.5	-	-	2	8	8	4	3	1*	26
366	F	5.5	-	-	1	8	10	6	3	1*	29
355	M	8.5	-	-	-	7	8	5	3	3*	26
378 <u>5/</u>	M	2.5	-	-	-	-	3	5	-	-	8
317	F	2.5	-	-	-	-	-	5	4	1*	10
392	M	2.5	-	-	-	-	-	3	3	3*	9
326 <u>6/</u>	M	1.5	-	-	-	-	-	-	6	1	7
			<u>23</u>	<u>20</u>	<u>37</u>	<u>76</u>	<u>91</u>	<u>57</u>	<u>44</u>	<u>20</u>	<u>348</u>

1/ Bear 273 was illegally shot and killed on September 23, 1984.

2/ Bear 335's radio collar malfunctioned in May.

3/ Bear 518's radio collar was cast in April.

4/ Bear 544 was illegally killed in September.

5/ Bear 378 was relocated to the S. Fk. of the Flathead on September 27.

6/ Bear 326's radio collar was cast in November.

* Includes Den location as one radio fix.

800/17/2

Seventeen different grizzly bears were monitored during the 1984 report period. One of these (#372) was a relocated bear from the Helena National Forest which traveled through the East Front back toward her capture site. Sixteen grizzlies monitored for research included eight females and eight males (Table 2). Two of these grizzlies are ranging south of the Sun River while 14 were from north of the Sun River.

Eleven grizzlies wore fully operable collars at the end of the report period. One radio collar has malfunctioned (335) during the year and two collars (518 and 326) were cast.

A total of 348 radio contacts were made with 16 different grizzly bears from the period beginning March 16 and ending November 30 for an average of 43 locations a month. Table 2 presents the distribution of tracking effort for each bear by month.

Distribution

Distribution of grizzly bears was determined by plotting 2,681 observations gathered between the years 1976 and 1984 for the Sun River North study area (Fig. 3). A total of 698 observations is reported in Schallenberger and Jonkel (1980). One thousand nine hundred and eighty-three were collected during the 1980-84 field seasons. Table 3 presents the distribution of observation data for each year by season. About 30.7, 40.8, and 28.5 percent were collected during the spring, summer, and fall respectively.

Table 3. The number of observations plotted on the Sun River North^{1/} overall and seasonal distribution maps, 1976 - 1984.

Period ^{2/}	Spring	Summer	Fall	Total
1976-79 ^{2/}	148	345	205	698
1980	50	83	62	195
1981	186	128	89	403
1982	173	200	148	521
1983	183	189	165	537
1984	84	149	94	327
TOTAL	824	1,094	763	2,681

1 - North of Township 21-22 line.

2 - Reported in Schallenberger and Jonkel, 1980.

801/20

Figures 4, 5, and 6 show the seasonal distribution of observation data. Seasons are defined as spring (March - June 30), summer (July 1 - August 30), and fall (September 1 - November).

Distribution of grizzly bears south of the Sun River was determined by plotting 471 observations gathered between 1976 and 1984. (Fig. 7). A total of 289 observations is reported in Schallenberger and Jonkel (1980). One hundred and eighty-two observations were collected during 1980-84 field seasons. Table 4 presents the distribution of observation data for each year by season. Approximately 35, 34, and 31 percent of the observations were collected during spring, summer and fall, respectively.

Figure 3. Distribution of 2,681 grizzly bear observations, 1976-84, north of the Sun River.

Figure 4. Distribution of 824 grizzly bear observations collected during spring, 1976-84, north of the Sun River.

Figure 5. Distribution of 1,094 grizzly bear observations collected during summer, 1976-84, north of the Sun River.

Figure 6. Distribution of 763 grizzly bear observations collected during fall, 1976-84, north of the Sun River.

Table 4. The number of observations plotted on the Sun River South ^{1/} overall and seasonal distribution maps, 1976 - 1984.

Period	Spring	Summer	Fall	Total
1976-79 ^{2/}	87	93	109	289
1980-83	57	37	6	100
1984	23	29	30	82
TOTAL	167	159	145	471

1 - South of township 21-22 line.

2 - Reported in Schallenberger and Jonkel, 1980.
801/20

Figures 8, 9, and 10 show the seasonal distribution of observation data south of the Sun River. Seasons are defined as above.

Table 5 presents the 1984 observation data by type for each season, north of the Sun River. Table 6 presents observation data by type for each season, 1976-84, for the area south of the Sun River. Observation data north of the Sun River is composed of 61 percent radio locations whereas south of the sun only 31 percent of the distribution data is from radio locations. Distribution data south of the Sun River is probably less reliable than data from north of the Sun River.

Table 5. Number of observations for each season by observation type, for Sun River North study area, 1984.

Observation Type	Spring	Summer	Fall	Year
Radio Location	63	125	74	262
Sighting	4	10	8	22
Scat	7	6	7	20
Track	9	4	3	16
Other	1	4	2	7
TOTAL	84	149	94	327

Figure 8. Distribution of 167 grizzly bear observations collected during spring, 1976-84, south of the Sun River.

Figure 9. Distribution of 159 grizzly bear observations collected during summer, 1976-84, south of the Sun River.

Table 6. Number of observations for each season by observation type, for Sun River South study area, 1984.

	Spring	Summer	Fall	Year
Radio Location	8	21	19	48
Sighting	11	4	2	17
Scat	0	3	6	9
Track	4	1	3	8
Other	0	0	0	0
TOTAL	23	29	30	82

801/20

Seasonal distribution maps reveal the importance of river valley, creek bottom and foothills habitat to grizzly bears during the spring. Schallenberger and Jonkel (1980), Servheen (1981) and Jonkel (1980) report the importance of low elevation wet sites and creek bottoms to grizzly bears in the spring. The concentration of grizzly bears along these foothills, creek and river bottoms appears to be related to the early snow melt from these sites and the phenology of important bear foods. Grizzly bears distribute themselves more evenly throughout the area during summer and fall.

Several biases exist in present distribution maps. The study area is large and the extreme southern, extreme northern and back country areas received less field effort. Much of the information in these regions reflects low intensity of field work, rather than the true distribution of grizzly bears. Restricted access to some private land also prohibited field work in areas which deserve attention. The Deep Creek area appears to receive high grizzly bear use; however, observation data are limited in this area.

Figures 11 and 12 present trap sites for study areas north and south of the Sun River 1980-84. Examination of these figures shows the relative proportion of the study area sampled as yet by trapping efforts. Distribution data is poor in areas where trapping and radio relocation efforts have not occurred. Areas needing significant field efforts are the Dearborn, the Heart Butte area, the Deep Creek area and the North Fork of the Sun River in order of priority.

Home Ranges

Annual home ranges were mapped for 10 different grizzly bears monitored during 1984 (Figures 13-22). Home ranges for bears 544, 313, 366, and 355 are not complete annual ranges since these bears were captured in late June and July. Therefore few spring locations are present in their home range maps for 1984. Comparisons of home range sizes are presented in Table 7.

Figure 11. Trap sites north of the Sun River, 1980-84.

Figure 12. Trap sites south of the Sun River, 1982-84.

Figure 13. Minimum and modified minimum home range of grizzly 220, 1984.

Figure 14. Minimum and modified minimum home range of grizzly 273, 1984.

Figure 15. Minimum and modified minimum home range of grizzly 500, 1984.

Figure 16. Minimum and modified minimum home range of grizzly 544, June 14 to September 11, 1984

Figure 17. Minimum and modified minimum home range of grizzly 498, 1984.

Figure 18. Minimum and modified minimum home range of grizzly 485, 1984.

Figure 19. Minimum and modified minimum home range of grizzly 313, 1984.

Figure 20. Minimum and modified minimum home range of grizzly 366, 1984

Figure 21. Minimum and modified minimum home range of grizzly 328, 1984.

Figure 22. Minimum and modified minimum home range of grizzly 355, July 9 to November 27, 1984.

Home range size in the Badger-Two Medicine-Middle Fork Flathead area appears to be smaller than those of bears from south of Birch Creek. Home range size in the Badger-Two Medicine area are comparable to those reported by Jonkel (1982) for the North and South Forks of the Flathead. Jonkel (1982) states that food and cover are major determinants of home range size and shape. Home ranges can be smaller in areas where food and cover (habitat quality) is better. Based on preliminary data it appears from ground reconnaissance and grizzly home ranges that the Badger-Two Medicine area is a higher quality habitat than the areas south of Birch Creek. The moist maritime climate of the Badger-Two Medicine no doubt produces habitat of similar quality as that in areas of the Flathead drainages.

Bear 220 who produced cubs this spring reduced her home range considerably over last year, as has been noted for her previously (1980 and 1982) when she selected small and remote home ranges during years with cubs as compared to years with yearlings during which she roamed more widely. Bear 220 did not move out into the foothills this spring.

Table 7. Modified minimum and minimum home range sizes of grizzly bears, 1983 and 1984.

Bear No.	Sex	Age	1983 (KM ²)		1984 (KM ²)	
			Mod. Min	Min.	Mod. Min	Min
220	F	23.5	375.1	734.6	30.9	174.5
257	F	14.5	255.5	466.3	-----	-----
548 ^{1/}	F	12.5	166.1	385.5	-----	-----
273	F	10.5	124.3	360.8	102.1	422.9 ^{3/}
335	F	6.5	272.9	404.0	-----	-----
500	F	5.5	60.4	311.9	91.3	559.3
518	F	3.5	145.2	349.3	-----	-----
524	F	2.5	45.3	309.8	-----	-----
544	M	4.5	164.9 ^{2/}	870.8 ^{2/}	52.2	234.9 ^{3/}
498	M	5.5	606.4	1803.6	71.6	608.4
485	M	8.5	76.4	388.1	68.0	632.8
313	F	3.5	-----	-----	45.6	195.5
366	F	5.5	-----	-----	10.9	95.4
328	M	2.5	-----	-----	244.2	2055.8
355	M	8.5	-----	-----	84.7	512.61

1 - Represents home range between August 1982 and September 1983.

2 - Represents home range between June 1982 and June 1983.

3 - Bear died before den locations were made.

In contrast grizzly 500 who produced her first litter of cubs increased her home range over 1983. Bear 500 is a foothills and prairie bear who was probably significantly affected by drought conditions in 1984. She also is an inexperienced mother who may

not have perfected her strategy for insuring her offsprings survival.

Male and female home ranges on the east front were generally larger than those reported in other areas of northwestern Montana (Jonkel 1978, 1980 and Servheen 1981). Home range sizes were similar to those reported in Schallenberger and Jonkel (1980) for the East Front area. In general, males had larger home ranges than females within the area. This has been reported in other studies of grizzly bears (Jonkel 1977, 1978, 1980; Servheen 1981; Knight 1979, 1980; Pearson 1975 and Schallenberger and Jonkel 1980). A summary of home range data from the East Front has not been completed. Work is continuing on this aspect of our investigations.

Breeding Areas

Breeding pairs were observed in the Smith Creek, Ford Creek, and Willow Creek areas in 1984. These could involve observations of one or most probably two separate breeding pairs observed from May 3 to June 10 in the area. Also bear 485 bred at least two females (one was most likely 366 who was later captured) between May 8 and June 4. Courting of these females was observed on Autumn Creek in Glacier National Park and on the South Fork of the Two Medicine River along Rowe Creek and in Mettler Coulee.

Data from 1980-84 has shown that all spring range is used during the breeding season and should be considered breeding areas. In addition some female bears appear to select some remote areas which are not considered spring range, to breed. Bears such as 257 and 335 selected high elevation subalpine or alpine areas to mate. Special protection could be afforded in these areas to protect breeding pairs during courtship.

Activity Patterns and Daily Movements

Little additional data was gathered during 1984 in the area of Activity Patterns and daily movements. Significant changes in the data from 1983 are not expected. The reader is referred to our 1984 Annual Report to examine activity patterns and daily movements of East Front Grizzly bears.

Food Habits

A total of 60 grizzly bear scats were collected and analyzed from the 1984 field season. Data from these scats was coded and is being entered into data files to be analyzed by B SCAT Program.

Significant differences were not noted in the food habits of grizzlies this year except for the slightly reduced presence of berries in the scats. Dry conditions this summer resulted in very poor berry crops in some areas of the Rocky Mountain Front. Data from 1984 scat analysis is not yet in completed form for presentation. The reader is referred to our 1983 report for

further information. Most of the scats collected in 1984 came from our study area south of the Sun River and the Badger-Two Medicine area.

Den Studies

Fifty-two grizzly bear dens have been located since 1977 in and near the study area. Forty-six of these dens were located North of the Sun River while six were located South of the Sun River. Figure 23 and 24 shows the distribution of these dens throughout each region. Forty-six of these dens were east of the Continental Divide while six were located west of the Continental Divide. Table 8 presents the data acquired from each den or each den location. Data from those dens not visited or found on the ground are considered accurate, but may be subject to change if a ground inspection is made.

East of the divide 22 of 46 dens had northeast aspects, while one had a north aspect, nine had southeast aspects, seven had southwest aspects, one had a west aspect, one had an east aspect, and five had northwest aspects. Dens were found in eleven different land types and nine different habitat types. East of the divide, dens ranged in elevation from 1859-2377 m (6097-7796 ft) and averaged 2154 m (7065 ft). Slopes ranged between 35-80% and averaged 56%.

Gillespie and Jonkel (1980) reported den sites in the south fork of the Flathead River were on south western to southeastern exposures on steep slopes from 29-41°. East Front dens were mostly (67%) on northeast to southeast slopes. They also report dens in the elevational range of 1768-2033 m (5800-6670 ft). East Front dens appear to be generally higher in elevation. Our six westside dens showed a lower elevational range and mean as compared to the dens found east of the divide. Servheen (1981) found grizzly dens in the Mission Mountains were on aspects between 45 and 277° with slopes between 28 and 35°. He found dens within the elevational range of 2050 and 2500 m (6724-8200 ft). As compared to the east front these dens were on slightly more southerly slopes, however, higher in elevation.

All dens were dug except three which were natural cavities. Three natural cave dens were found in one area, but only one was recorded as used by a grizzly bear. It was used by a female with three yearling cubs and all denned together. The other cave dens had been used by bears in the past. Three dens in our sample were recorded as being used more than one year by the same grizzly bear. Six dens were in such a condition that they were not reusable at the time of recording den data.

Tables 9 and 10 present den entrance and emergence dates recorded during this study. Grizzly bears entered their dens from November 2 until December 5. Movement to den sites occurred from October 6 to approximately November 25. Grizzly bears emerged from dens from March 10 to May 13. Movement from den sites

Figure 24. Den sites south of the Sun River, 1977-84.

Table 8. Data from 52 grizzly bear dens within the study area, 1977-84.

Den No.	Name Location	Type Den	Elevation	Aspect (°)	% Slope	Habitat Type	Land Type	No. yrs. Used	Condition	Bear No.
1 ⁴ / ₂	Hurricane Mtn	Dug	2073	N40E	60	ABLA/PIAL/VASC	VI	1	Good	335
2 ² / ₃	Hoy Gulch	Dug	2012	N40E	50	ABLA/PIAL/VASC	VI	2	Good	257
3 ³ / ₃	Kid Creek	Natural Cavity	2060	N35W	40	PIAL/ABLA	VI	1	Good	220
4 ³ / ₃	Rival Creek	Dug	2196	N290W	70	Scree	VI	1	Good	220
*5 ² / ₃	Rival Creek	Dug	2012	N47E	52	PIAL/ABLA	VI	3	Good	257
6 ³ / ₃	Bruce Creek	Dug	2012	N335W	35	ABLA/PIAL/XETE	VI	1	Caved in	Unkn.
*7 ¹ / ₃	Mt Lockhart	Dug	2256	N20E	50	ABLA/PIAL/VASC	202	1	Unkn.	220
*8 ³ / ₃	Ear Mtn	Dug	2073	N20E	40	ABLA/PIAL/VASC	202	2	Good	273
*9 ¹ / ₃	Headquarters Cr	Dug	2073	N70E	60	ABLA/PIAL/VASC	VIII	1	Unkn.	218
10 ¹ / ₃	Lick Creek	Dug	2073	N20E	50	ABLA/XETE/VASC	VIII	1	Unkn.	223
*11 ¹ / ₃	Rock Creek	Dug	2134	N50E	40	ABLA/XETE/VASC	VII	1	Unkn.	271
12 ⁴ / ₃	Slategoat Mtn	Dug	2072	N40E	40	ABLA/XETE/MEFE	Vc	1	Good	510
13 ⁴ / ₃	Miners Creek	Dug	2250	S120E	60	ABLA/PIAL/VASC	Va	1	Good	Unkn.
14 ⁴ / ₃	Miners Creek	Dug	2262	S190W	40	PIAL/ABLA	VI	1	Good	Unkn.
15 ⁴ / ₃	Wapiti Creek	Dug	2371	S140E	65	ABLA/XETE	VI	1	Good	Unkn.
16 ⁴ / ₃	Wapiti Creek	Dug	2371	S140E	65	ABLA/XETE	VI	1	Good	Unkn.
17 ⁴ / ₃	Wapiti Creek	Dug	2371	S140E	65	ABLA/XETE	VI	1	Good	Unkn.
18 ¹ / ₃	Slategoat Mtn	Dug	2340	S110E	65	ABLA/PIAL/VASC	VI	1	Caved in	Unkn.
19 ³ / ₄	Ear Mtn	Dug	2140	N60E	55	Scree	-	1	Good	Unkn.
20 ⁴ / ₄	Wright Creek	Dug	2189	N70E	70	PIAL/ABLA	202	1	Caved in	Unkn.
21 ³ / ₃	Rocky Mtn	Dug	2250	N40E	80	ABLA/PIAL/VASC	202	1	Caved in	Unkn.
22 ³ / ₃	Rival Creek	Dug	2134	S220W	60	Scree	202	1	Caved in	Unkn.
23 ⁴ / ₄	Open Creek	Dug	2134	S200W	65	ABLA/PIAL/VASC	Vb	1	Good	220
24 ⁴ / ₄	Bennie Hill	Dug	2085	N260W	60	Scree	VI	1	Good	335
25 ⁴ / ₄	Miners Fork	Dug	2256	N40E	65	ABLA/PIAL/VASC	Va	1	Good	548
26 ⁴ / ₄	Chute Mtn	Dug	2255	N40E	40	ABLA/	18	1	Caved in	273
27 ⁴ / ₄	Wright Creek	Dug	2170	N60E	50	Scree	202	1	Good	544
28 ¹ / ₄	Emerald Lake	Natural Cavity	2134	S200W	60	ABLA/PIAL/VASC	202	1	Good	333

Table 8. Data from 52 grizzly bear dens within the study area, 1977-84, (continued).

Den No.	Name Location	Type Den	Elevation	Aspect (°)	% Slope	Habitat Type	Land Type	No. yrs. Used	Condition	Bear No.
29 ⁴ / ₂	Washout Creek	Dug	2048	E90E	80	ABLA/PIAL/VASC	VI	1	Good	257
30 ⁴ / ₂	Route Creek	Natural Cavity	2170	N20E	15	ABLA/PIAL/VASC	II	1	Good	518
31 ¹ / ₅	Clack Creek	Natural Cavity	2390	S120E	50	Scree	VI	1	Good	230
32 ⁴ / ₂	Waldron Creek	Dug	2183	W270W	65	ABLA/	18	1	Unkn.	220
33 ⁴ / ₂	Bear Gulch	Dug	2256	S265W	60	PIAL/ABLA	18	1	Good	273
34 ⁴ / ₂	Chute Mtn.	Dug	2146	S100E	60	ABLA/PIAL/VASC	-	1	Good	273
35 ⁴ / ₂	Rierdon Gulch	Dug	2256	N20E	60	ABLA/PIAL/VASC	202	2	Occupied	500
36 ¹ / ₅	Bloody Hill	Dug	2317	S120E	55	ABLA/PIAL/VASC	VI	1	Good	335
37 ¹ / ₅	Clack Creek	Unknown	1902	N15E	50	Unknown	VI	1	Unkn.	498
38 ¹ / ₅	Patrol Ridge	Unknown	1860	N315W	80	Unknown	VI	1	Unkn.	485
39 ¹ / ₅	Waldron Cr	Dug	2222	S230W	40	ABLA/PIAL/VASC	181	1	Occupied	220
40 ¹ / ₅	Twenty-five Mile Cr.	Dug	1555	N30E	50	Unknown	-	1	Occupied	485
41 ¹ / ₅	Twenty-five Mile Cr.	Dug	1768	S100E	50	ABLA/MEFE	-	1	Occupied	313
42 ¹ / ₂	Benson Cr.	Dug	1859	N335W	50	ABLA/MEFE	181	1	Occupied	366
43 ¹ / ₂	Benson Cr.	Dug	2195	S110E	50	ABLA/PIAL/VASC	181	1	Fresh	Unkn.
44 ¹ / ₂	Mt. Frazier	Unknown	2012	N320W	60	Scree	VI	1	Occupied	317
45 ¹ / ₂	Waldron Cr.	Dug	2073	N15E	60	ABLA/PIAL/VASC	202	1	Occupied	392
46 ¹ / ₂	Route Creek	Dug	2377	S110E	75	PIAL/ABLA	VI	0	Fresh	220
South of the Sun River										
*47 ¹ / ₂	Crow Pk.	Dug	2438	S40W	40	PIAL/ABLA	-	1	Good	229
48 ¹ / ₂	Burned Pt.	Dug	2317	N30E	60	ABLA/PIAL/VASC	182	1	Unkn.	347
*49 ¹ / ₂	Camp Cr.	Dug	2189	N6E	65	ABLA/LUHI/MEFE	183	1	Good	Unkn.
*50 ¹ / ₂	Evans Pk.	Dug	2164	N24E	65	ABLA/PIAL/VASC	-	1	Good	282
51 ¹ / ₂	Goat Cr.	Dug	2024	N45E	40	ABLA	VIII	1	Occupied	355
52 ¹ / ₂	Straight Cr.	Dug	2170	S140E	70	PIAL/ABLA	VI	1	Occupied	328

* Reported in Schallenger and Jonkel 1980.

1 - Located by airplane radio location.

2 - Den area visited but den not located.

3 - Ground inspection of den made.

4 - Photographed and observed by helicopter.

5 - Den location west of divide.

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Table 9. Dates of movements to dens and final entry of dens for grizzlies, 1980-84.

Bear No.	Sex	Age	Year	Movement to Den Site	Approximate Den Entry	Reproductive Status
257	F	10.5	1980	October 18	November 5	Cubs present
220	F	19.5	1980	October 20	November 5	Cubs present
223	M	6.5	1980	After October 6	November 23	--
257	F	11.5	1981	October 13	November 2	Pregnant
220	F	20.5	1981	October 22	November 2	Pregnant
335	F	3.5	1981	After October 28	November 2	No cubs
273	F	7.5	1981	October 28	November 2	No cubs
333	M	3.5	1981	November 8	Unknown	--
220	F	21.5	1982	November 4	November 9-18	Cubs present
257	F	12.5	1982	November 4	November 9-18	Cubs present
273	F	8.5	1982	October 25	November 22	Pregnant
335	F	4.5	1982	November 2	November 4	Pregnant
544	M	2.5	1982	November 4-7	November 8	--
548	F	10.5	1982	November 18-21	November 22-25	Cubs present
257	F	13.5	1983	October 6	October 21-November 5	Bred and possibly pregnant
335	F	5.5	1983	October 12	November 5-9	Bred and possibly pregnant
518	F	2.5	1983	October 12	November 27-30	--
220	F	22.5	1983	October 28-November 1	November 5-9	Unknown
500/499	F	4.5	1983	October 28-November 1	November 5-9	Bred and possibly pregnant
273	F	9.5	1983	November 1-5	November 5-9	Cubs present
485	M	7.5	1983	October 28	November 5-9	--
498	M	4.5	1983	November 15-30	December 5	--
220	F	23.5	1984	October 22	November 5	Cubs present
500/499	F	4.5	1984	October 29-November 5	November 5	Cubs present
485	M	8.5	1984	November 8	November 15-26	--
328	M	2.5	1984	November 8-15	November 15-26	--
313	F	3.5	1984	October 8	October 22-November 8	No cubs
366	F	5.5	1984	October 22-November 15	November 8-15	Pregnant
355	M	8.5	1984	November 15	November 15-26	--
317	F	2.5	1984	October 22-November 5	November 5	No cubs
392	M	2.5	1984	November 8-15	November 15-26	--
498	M	5.5	1984	November 15	November 27-December 1	--

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Table 10. Dates of den emergence and movement from den sites, 1980-84.

Bear No.	Sex	Age	Year	Approximate Den Emergence	Movement from Den Site	Reproductive Status
220	F	19.5	1980	April 29-May 13	May 13	Cubs present
257	F	11.5	1981	March 10-March 28	March 28	Yrling cubs present
220	F	20.5	1981	April 18	April 24	Yrling cubs present
223	M	7.5	1981	March 28	March 28-April 15	--
220	F	21.5	1982	May 1	May 15	Cubs present
257	F	12.5	1982	April 27-30	May 1	Cubs present
333	M	4.5	1982	April 23-26	April 27	--
273	F	8.5	1982	March 20-30	April 1-4	No cubs
335	F	4.5	1982	April 5-18	April 19	No cubs
220	F	21.5	1983	April 6	April 13	Yrling cubs present
257	F	13.5	1983	March 11	March 26	Yrling cubs present
548	F	11.5	1983	April 6	April 13	Yrling cubs present
273	F	9.5	1983	April 5	April 18	Cubs present
335	F	5.5	1983	April 13	April 21	No cubs
544	M	3.5	1983	April 13	April 18	--
220	F	23.5	1984	May 1-8	May 15-25	Cubs present
500	F	5.5	1984	April 30-May 7	May 8	Cubs present
273	F	10.5	1984	March 31	April 1-4	Yrling cubs present
335	F	6.5	1984	April 4	April 9-14	Cubs present
485	M	8.5	1984	April 4-10	April 10-14	--
498	M	5.5	1984	March 23	April 1-4	--
518	F	3.5	1984	March 31	April 1-9	No cubs

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occurred from March 26 to May 15. Servheen (1981) reported that bears in the Mission Mountains moved to dens between October 10 and November 20 and denned between November 2 and November 22. Gillespie and Jonkel (1980) reported den emergence between April 12 and May 9 and den entrance between November 2 and November 26 for grizzly bears in the South Fork of the Flathead River.

Pregnant females arrived at dens earliest and denned earlier than females with cubs or females without cubs. Females with cubs arrived at dens earlier than females without cubs, but both denned at about the same time.

Females with cubs emerged from dens and moved from den sites later than all other bears. Little differences were noted in dates of emergence or movement from dens for males, females with yearlings, or females with cubs.

Impacts of Oil and Gas Activity

During the 1984 field season, six oil and gas exploratory drilling operations were conducted within the study area. Two of these wells were drilled just outside the occupied grizzly bear habitat. None of the remaining four wells were drilled in preferred bear habitat components and three of the four were mitigated by seasonal drilling restrictions thus were drilled during the summer - winter period. The only unmitigated drilling activity took place on private land in an area outside the range of radioed bears monitored during 1984. As a result, the 1984 exploratory drilling operations offered little opportunity to examine the impacts of this activity on grizzly bears. The reader is referred to the 1984 report for further discussion on this subject area.

Ten seismic prospecting permits were issued in 1984 by the U.S. Forest Service and Bureau of Land Management along the East Front. (Table 11) Two permits were issued in wilderness study areas. A total of four seismic projects were conducted mostly in areas south of the Sun River while six projects were conducted north of the Sun River almost exclusively in the Badger - Two Medicine area.

All of the monitoring efforts to study the relationship of grizzly bears to seismic exploration was conducted in the Badger-Two Medicine area in 1984. A total of 234 miles of seismic line was completed in the Badger - Two Medicine area from May through October of 1984. A total of 39 miles was conducted during the spring season with 195 miles completed during the summer/fall period. During this period four different radio collared bears were monitored by air and ground. All of the lines conducted during this period were surface charge.

Table 11. Seismic work completed on the Rocky Mountain Ranger District in 1984.

Company	Surface Charge	Method (km)			Total
		Porta-drill	Vibroseis	Magneto-Telluric	
Conoco	106.1				106.1
Sohio	41.9				41.9
Amoco		57.9	20.9		78.8
Chevron	161.0				161.0
Arco	140.1				140.1
Phoenix Geophysic				26 stations	---
Amareda Hess	38.6				38.6
	<u>487.7</u>	<u>57.9</u>	<u>20.9</u>	<u>26 stations</u>	<u>566.5</u>

Bears did appear to distribute themselves in time and space to avoid seismic activity. Figure 25 shows the spatial distribution of bears to seismic lines in this area. When time is incorporated in analysis, results indicate bears were on the average located 8.1 km from seismic activities in this area. Similar analysis from 1983 is comparable with bears on the average 12.4 km from seismic activities (Aune and Stivers 1984).

Table 12. Mean distance (km) of radio locations to nearest section of active seismic line in Badger - Two Medicine area, 1984.

	Spring	Summer	Fall	Total
N	11	45	7	63
Mean	11.2	7.7	5.2	8.1
S.D.	4.3	3.2	3.3	3.7
Range	6.4 - 20.1	1.6 - 15.3	0.8 - 9.3	0.8 - 20.1

In the 1984 seismic program a seasonal restriction of seismic activity on spring range was imposed. Table 12 presents seasonal data on distance of radio locations to the nearest seismic activity. It is clear that the seismic program resulted in a much closer spacing of bears and this activity during summer and fall. The seasonal restriction on spring range did appear to reduce proximity of radio monitored bears to the seismic projects.

In 1983, Aune and Stivers (1984) suggested some individual variation in tolerance of bears to seismic activity. Analysis of

Figure 25. Distribution of grizzly bears in relation to the 1984 seismic project in the Badger-Two Medicine area.

data from 1984 seems to concur. Table 13 presents the distance to the nearest seismic activities by each individual bear. Sample size for some of these bears is wanting. Two of the monitored bears left the Badger - Two Medicine in late summer to spend the remaining field season inside the wilderness. All bears spent a great proportion of time more than 3.22 km (2 mi.) from seismic activities during the year.

Eight case studies are singled out this year to demonstrate bear responses to seismic activity. One case involves a subadult male which was possibly involved in sheep predation as a seismic project prevailed in the Palookaville area. The other seven cases involve the same bear exposed to multiple seismic lines through the summer and fall. Cases presented in Aune and Stivers (1984) suggest varying responses by individual bears. These studies provide additional support to this conclusion. Numbering of these case studies is continuing from 1983.

Table 13. The distance to the nearest seismic activities for 4 grizzly bears in the Badger - Two Medicine area, 1984.

Bear No	Sex	Age	N	Mean	Range	S.D.	Percent Greater than 3.22 km
366	F	5.5	27	6.6	0.8 - 10.1	2.5	74
544	M	4.5	23	8.1	1.6 - 13.4	3.3	74
313	F	3.5	4	13.8	3.6 - 20.1	7.1	75
485	M	8.5	9	9.8	4.0 - 15.3	3.6	89
Total	-	-	63	8.1	0.8 - 20.1	3.7	76

Case 4

Bear 544 a 4.5 year old subadult male was previously captured and monitored in the Teton River area. As a three-year old bear, he dispersed to the Badger - Two Medicine area where he had been establishing a new home range. On 7/2 he moved into the Deep Creek area only 3/4 mile from seismic Line 3 which was being shot on its north end. Bear 544 remained in the area until 7/16. During that period the sheep herd at Palookaville had suffered depredation losses. Also during that period seismic crews blasted the north half of Line 3 and the remainder of Line 4 (Figure 14). A helicopter LZ was located at Palookaville. Bear 544 was located five times by air and ground. On two occasions the helicopters were nearly over him in their flight path. He was located in secure timber and dense aspen cover at all locations. After the crews left the area, he was located once bedded within 100 ft. of a completed seismic line. Analysis indicates that bear 544 remained in the area but on the average was two miles from the blasting on the seismic operation (range four mi to seven mi) of Lines 3 and 4. During that period and

beyond it appeared that bear 544 was attracted to the area of the sheep allotment and was trailing the band of sheep. The attraction of these sheep surely influenced the behavior of bear 544. After the sheep were removed from the allotment bear 544 left the area. Later that year he was illegally killed and the carcass discovered.

In summary bear 544 was not displaced from an area with a powerful attractant by seismic activity. Bear 544 was able to remain in the area but select secure bedding sites far enough away from the blasting but within striking distance of a band of sheep. The powerful influence of the attractant probably dampened the response of the bear to the seismic operations.

Case 5

Bear 366 a 5.5 year old female was located on 7/23 on the East side of the Continental Divide in Benson Creek. On 7/23 - 8/1 seismic operations were conducted on Line 5 from east to west moving toward the location of bear 366. On 7/25 ground crews picked up bear 366. As seismic blasting came nearer to bear 366, she began moving west up the Sydney Creek drainage. Seismic blasting could be heard on the N. Fk of Badger and North on Line 11 coming down Benson Creek. Helicopters passed over the Divide repeatedly to the North and around Badger Cabin. At 2:30 p.m. bear 366 was moving west toward the Continental Divide. By 8:00 p.m. she had dropped over the Divide and settled in the head of Morrison Creek. She remained here until 8/1 when the blasting on Line 11 crossed into Puzzle Creek to her north and west of the Continental Divide. Meanwhile blasting on Line 5 was completed and by 8/2 bear 366 had moved back into Sydney Creek. Bear 366 traveled 1.7 miles from 7/25 to 7/26 and 2.1 miles from 7/27 to 8/2 when she returned to Sydney Creek. During these monitoring periods she was very active during the daylight period.

In summary bear 366 was exposed to slightly staggered seismic lines on each side (North and South) of her. She was able to use the Continental Divide as a topographic screen from the seismic activities of two lines that were 6.5 miles apart which had staggered shooting schedules. The bear moved 1.7 and 2.1 miles back and forth across the Divide to avoid these activities.

Case 6

Bear 366 had been located up and down a two mile stretch of Lee Creek six times between 8/6 and 8/20. She was active very much during daylight hours feeding on *Shepherdia canadensis* common along this drainage. Movement between locations was generally one mile or less. From 8/13 to 8/17 seismic activities occurred on Line 12 about three miles north on Lost Shirt Creek, on the west portion of Line 15 about three miles south of bear 366, and on the west end of Line 19 about 3.5 miles to the south-east. No seismic activity was conducted in Lee Creek Drainage during that period. Seismic crews were within six-eight miles of each other

during much of that period from 8/13 to 8/17. Bear 366 appeared to remain in Lee Creek during this period with little behavioral response noted to activities going on in drainages three miles north and south of her berry fields.

In summary bear 366 was not displaced a second time (refer to case 5) when exposed to seismic operations greater than three miles from her location. Factors influencing behavior during this period may be previous experience to the seismic activities, presence of ripening berries in a choice berry field, and adequate topographic screening of the activities from the bear.

Case 7

Bear 366 was located four times from ground and air from 8/23 to 8/30 in Lee Creek. She worked as had been observed previously up and down the creek feeding on *Shepherdia canadensis*. During that period the north half of Line 25 was shot, high across the upper end of Lee Creek. Bear 366 was monitored from 7:45 a.m. to 1:00 p.m. on 8/30. Early that morning before seismic activity occurred bear 366 had been high on the upper end of Lee Creek. By 11:00 p.m. she had moved 1.5 miles down stream as blasting was conducted across the upper end of Lee Creek. Blasting was also occurring on Line 19 about 7.5 miles from the crew on Line 25. Bear 366 remained 2.5 miles from blasting activity on Seismic Line 25.

In summary, a seismic line across the upper edge or ridge line of a drainage did not cause bear 366 to leave a choice berry field. However, the bear did move to the lower edge of the drainage about 2.5 miles from the line. This is the third case report of bear 366's encounter with seismic activity and habituation to such activities may be a factor in this observed interaction.

Case 8

Bear 366 was located in Sydney Creek on 9/4 as a seismic crew shot through moving north on Line 21. This conflicts with U.S. Forest Service data that this line was shot from 9/29-10/10. Helicopters slinging gear, ground crews, and seismic blast were moving through lower Sydney Creek on 9/4 to within 1/2 mile of bear 366. By 9/5 with ground crews to monitor bear 366 she had moved 1.5 miles to the Lee Creek drainage. She was monitored in Lee Creek until 5:00 p.m. on 9/6. Bear 366 behaved as expected during that period as seismic crews had moved north over four miles away.

In summary, bear 366 endured blasting at a distance of 1/2 mile away but soon afterwards left to the security of another favored drainage as seismic activity in Sydney Creek peaked.

Cases 5 through 8 did not entail as much ground monitoring as desired. However, this author feels they are valid case reports.

These reports discuss the antics of one female bear and are reported in separate cases to illustrate some essential points.

First, I hypothesize that bear 366 showed a decrease in displacement response to seismic operations as the season progressed. Bear 366 appears to have habituated to a certain degree, accepting seismic activity in adjacent drainage surrounding her favored Lee Creek. Secondly, bear 366 refined her response to the seismic activity by making minimal movements away from the activity using topographic screening. During this season bear 366 had one of the smallest home ranges of all East Front female grizzly bears and was exposed to the highest levels of seismograph activity. No baseline data is present for this bear to compare to previous years. Thirdly, habituation may not be a preferred management treatment since it may increase risk of mortality. Bear 544 (case 4) may be an illustration of this concept.

Much further study on a case by case basis is needed to refine our understanding of grizzly bear response to seismic activity. Individual variation, habituation, presence of attractants, intensity of activity, and habitat preference/security can interplay to create complicated scenarios which may be difficult to interpret. General rules providing seasonal restrictions, proper spacing and scheduling of seismograph programs seem most appropriate at this time. Recent results seem to indicate that guidelines in place for seismograph activity are adequate and are successfully working when adhered to.

Livestock/Bear Relationships

A summary of data gathered from 1982 and 1983 was completed in 1984 to present at a professional symposium. A draft form of the paper is presented as Appendix B of this document. Work on this area will be continued by a graduate project to begin in spring of 1985.

Habitat Studies

Availability/Utilization of Habitat

Grizzly bear use of habitat types, habitat components, PI types, burns and land types should be compared with relative availability of types and components to present a clearer view of habitat preference. Servheen (1981), Zager (1980) and Aune and Stivers (1981) used a random sampling technique (Marcum and Loftsgaarden 1980) to determine the relative availability of habitat components in studies of grizzly bear habitat preference. A project to compare availability and utilization is in progress on the East Front.

The sampling of random points of habitat over the area from Sun River to Birch Creek is completed (Fig. 26). Data is coded and has recently been output for analysis. An error in the file was

Figure 26. Area sampled for Availability/Utilization habitat studies.

Figure 27. Composite home range of grizzlies 273, 257 and 500, 1977-84.

Figure 28. Composite home range of grizzlies 220, 548 and 335, 1977-84.

detected and needs correction before results can be presented. File proofing and editing will need to be conducted and tests of statistical soundness completed. To date we have on record 5673 random points with 3683 of these within spring range. This project will continue in 1986.

Two data files from the random file were created to separate two bear groups. Group 1 included bears whose home range was primarily a foothills plains type while group 2 included bears with home ranges of the more mountainous high elevation type. Composite home ranges of each group are presented in Figures 27 and 28. Habitat preference for each group is being compared.

Vegetation Studies

A total of 259 activity site plots has been recorded at radio locations between 1978 and 1984. These include 200 feed sites and 94 bed sites. Data from these plots and plots conducted during 1980-84 have been computer coded and entered awaiting analysis. Results of 40 activity plots from the Pine Butte area are presented in Aune and Stivers, 1985. Specific information regarding species composition, tree stand density, shrub and tree vertical structure, and canopy coverage of species from each plot is available. Plots are separated into feeding site and bed site plots or both. Analysis by computer will allow flexibility in analysis so any combination of parameters can be correlated quickly. The relationship of plant communities to grizzly bears between and within habitat components or habitat types can be examined. Each plot was evaluated as to the current grazing regime which existed at the time the plot was completed. With such data, the influences of grazing on cover and grizzly bear foods may be evaluated. Seasonal importance of specific plants and plant communities will be more thoroughly analyzed. Data analysis of vegetation plots is not complete, but is expected to be completed by 1986.

To facilitate computer analysis of data from activity plots, a complete plant species list for the East Front is being developed. (See Aune and Stivers 1984 Appendix C). Expansion and development of the list will continue as time permits.

At the present time, 10 species representing 6 genera of trees, 74 species from 35 genera of shrubs, 10 species within 7 genera of ferns or fern allies, 134 species representing 41 genera of graminoids, and 465 species from 213 genera of forbs have been reported and listed. A total of 693 species of plants representing 302 genera is listed.

Habitat Component Mapping

Habitat components were mapped in the area from Steamboat Mountain to the Middle Fork of the Dearborn from July 15 until October 15 during 1984 (Figure 29). One team of two field mappers covered 72,000 acres of grizzly bear habitat, mapping 100

Figure 29. Area habitat component mapped in 1984.

percent of the area. A total of 32,000 acres were within the Lewis and Clark Forest. Approximately 38% of the Dearborn-Elk-Falls Creek Bear Management Unit was component mapped.

Field mappers described 21 different components in this area (Appendix C). Several additions to the components used by Aune and Stivers 1984 were made. Mappers actually further dissected prairie grasslands into hay meadows, agricultural lands, and prairie grasslands. Mountain grasslands were classified into three subclasses based upon development of the vegetation. Snow chutes were divided into two subclasses based on vegetation cover. Shrub fields and clearcuts were also further divided than previously defined.

Population Biology

A decline in field emphasis from the Deep Creek to Birch Creek core study area occurred in 1984. However, marked plus observed data from grizzly bears was collected and produced a fifth year of population data from the core area. Lower intensity of field effort probably reduced the reliability of data in 1984 as compared to previous years. Some assumptions were made regarding previously marked bears on the area.

Sex and Age Data

Table 14 presents age and sex data from the marked population within the core study area (Deep Creek to Birch Creek) during 1984. Since 1977, 28 individual grizzly bears have been ear tagged in this area (Appendix D). Twenty-four of these have been radio monitored at some time during this period. Two of the 28 marked bears was moved to the South Fork of the Flathead River and nine of these are known to be dead. During the 1984 season, the marked and monitored population consisted of 10 individual bears, three unmarked yearlings of a marked female (one of which was later collared) and 10 or more unmarked cubs accompanying marked females for a total of 23. Three other marked bears whose collars are non-functional are present on the study area. Table 15 presents age and sex data from the marked plus observed grizzly population from Deep Creek to Birch Creek, 1984. It is likely that more bears exist than were observed on the study area in 1984. This year several more subadults were probably present but could not be clearly separated by color marking or other

Table 14. Age and sex data from the marked grizzly bear population, Deep Creek to Birch Creek, 1984.

	Adult	Subadult	Yearling	Cubs	Total
Male	2 ^{1/}	3	1	0	6
Female	6	2	0	0	8
Unknown	0	0	2	10 ^{2/}	12
Total	8	5	3	10	26

^{1/} Assumes marked males 218 and 203 are alive and present on study area. Observations indicate they are.

^{2/} Assumes 1 cub produced by bear 335 whose radio malfunctioned before we could confirm litter size. Tracks in snow indicate at least 1 cub.

Table 15. Age and sex data from marked plus observed grizzly bear population, 1984, Deep Creek to Birch Creek.

	Adult	Subadult	Yearlings	Cubs	Total
Male	2 ^{1/}	3	1	0	6
Female	8	2	0	0	8
Unknown	1	2 ^{2/}	2	10 ^{2/}	17
Total	11	7	3	10	31

^{1/} Lower field effort reduced efficiency of observing males. In 1983 we observed four different males. It is likely that 1984 figures are lower than expected because we spent less time on this area to distinguish separate males.

^{2/} More subadults probably existed than could be easily distinguished in 1984. We count only those clearly identifiable to avoid duplication.

^{3/} Assumes only one cub produced by bear 335 whose radio malfunctioned before we could confirm litter size. Tracks in snow indicate at least one cub. No cubs are assumed for marked female 548 who possibly produced a litter in 1984.

Table 16. Age structure reported for Deep Creek to Birch Creek core area 1980-84.

	Adult	Subadult	Yearlings	Cubs	Total
1980	8	6	6	7	27
1981	9	8	7	2	26
1982*	9	11	2	11	33
1983*	11	4	8	3	26
1984	11	7	3	10	31

* Decreased field emphasis in the core area reduced reliability at upper end of population range. It is likely more bears exist than indicated in this table. These numbers represent a minimum count of distinguishable bears based on marked and observed animals.

physical features. Between Deep Creek and Birch Creek at least 31 different grizzlies were identified. The number of cubs presented in these tables is probably higher since bear 335's radio malfunctioned as expected before we could get a complete count of her litter. Also radioed bear 548 from 1982 probably produced a litter as well but was not observed in 1984.

Table 16 compares age structure of the population between years 1980-84. The total population appears to be stable or increasing with birth pulses every two years. Average number of bears observed in five years is 28.6. The adult population has increased by three since 1980. These were all females recruited into the population. Bear 273 was recruited in 1980, bear 335 and 500 in 1984.

Density Estimation

No density estimates were calculated for 1984 in the core area. No change was expected from the estimates presented in the 1984 report (Aune, Stivers, and Madel 1984).

Minimum counts were conducted in two other areas of the East Front. These data represent minimum number of observed bears and are not to be considered population estimates for these areas. All counts include only verified observations by field personnel, ranchers, and other biologists in the areas.

In the north half of the Badger-Two Medicine area in 1984, seven different grizzlies were observed and verified. These include four marked bears (nos. 544, 313, 366, and 485). Unmarked bears

observed include a female with two yearling cubs on Mt. Pablo. It is also likely that marked bear 333 still exists within this area. However, we have no verification of this so did not include him in the total. We observed male bear 485 with an unmarked female within the boundaries of Glacier Park but did not include her in the minimum count. Tracks indicate that few other bears were present within the area trapped in Hyde-Hall-Box Creek. No trapping and no field work was conducted south of the North Fork of Badger Creek. Summer track data indicates there are probably several subadults present in the area examined at least occasionally.

South of the Sun River we observed 14 different individual bears. These included marked bears 355 and 282. Unmarked bears included a minimum of two adult females (observations of breeding pairs between Elk Creek and Sun River indicate two or possibly three different females), one female with two cubs, one female with one cub, three unmarked subadults, and two unmarked adults of unknown sex. At least four adult females could be accounted for based on breeding pair observations and family group observations south of the Sun River.

A definite decrease in the number of grizzlies in the Elk Creek area has occurred from 1979 when Schallenberger and Jonkel reported high densities for this area. Trapping in the Elk Creek area from 1982 to 1984 intensively produced only one grizzly capture (#282). Observations indicate other grizzlies have traveled through but did not remain. The area is good quality habitat.

Overall a total of fifty-two different grizzlies were observed or counted in the East Front of the Rocky Mountains near or outside of the wilderness boundary. Observations of grizzlies were made deep inside the wilderness this year but were not counted in this exercise.

A minimum of 12 distinguishable adult female grizzly bears along the East Front were observed in 1984 mostly outside the wilderness boundary or near it. Five of these females had cubs of the year, three had yearlings, three were not accompanied by cubs and one may or may not have cubs of the year (#548). Since 1982 within the entire area of the East Front we can account for records of a minimum of 15 distinguishable adult females. There are probably several more females present since little field work was conducted in the Heart Butte area, Falls Creek area, or in the wilderness along the Continental Divide. Also to eliminate duplication possibilities we chose to carefully select only observations clearly separable from year to year. Seven of the 15 females were marked grizzly bears.

Production Data

Production data produced in table 17 shows that since 1980 thirty-eight cubs have been produced on the study area north.

All but two of these cubs were produced in the area from Deep Creek to Birch Creek. Few records and limited field effort north of Birch Creek are available. Birth pulses seem to occur every other year. Bears 335, 257, 220, and 500 all produced a litter of cubs in 1984. We could not verify if bear 548 produced a litter of cubs or not since her collar malfunctioned in 1983. In 1985 it is possible for bear 366 to produce cubs since she was bred in the spring by male 485.

Again bears 220 and 257 continue the pattern of alternate year reproduction. Bear 220 has produced 12 cubs in 8 years, while bear 257 has produced 9 cubs in 8 years.

Table 17. The number of cubs with each female observed in the study area north of the Sun River, 1980-84.

Year	No. Females	No. Cubs	Average Litter
1980	3	7	2.33
1981	1	2	2.00
1982	4	11	2.75
1983	2	5	2.50
1984	6	13	2.16
TOTAL	16	38	2.38

Table 18 presents production data for the area south of the Sun River. Since no females are marked in this area data is confined to observations which can be independently verified. One female grizzly which was bred by male 282 in the Dearborn area produced a litter of two cubs. Overall limited records indicate smaller

Table 18. The number of cubs with each female observed in the study area south of the Sun River, 1983-84.

Year	No. Females	No. Cubs	Average Litter
1983	1	1	1.00
1984	2	3	1.50
Total	3	4	1.25

litter size in the less productive habitat south of the Sun River. Further study is needed to verify this.

Table 19 shows average litter size for the entire East Front from 1976 to 1984 based on observation records for that period. Average litter size has declined some in 1983 and 1984 a possible indication of the stress due to drought conditions during those year.

Table 19. The number of females with cubs observed in the entire East Front area, 1976-84.

Year	No. Females	No. Cubs	Average Litter
1976	3	5	1.66
1977	2	5	2.50
1978	4	9	2.25
1979	1	2	2.00
1980	4	9	2.25
1981	1	2	2.00
1982	4	11	2.75
1983	3	6	2.00
1984	8	16	2.00
Total	30	65	2.16

Age of First Reproduction

Both grizzly No. 335 and 500 produced their first litters in 1984. Bear 335 was bred in 1982 at age 4.5, failed to produce cubs in 1983. She was bred again in the spring of 1983 and produced a litter of at least one cub in 1984 at the age of 6.5 (aged in 1982). Bear 335's collar malfunctioned as expected in May of 1984. Tracks in snow indicated the presence of cubs but no observation of the litter was made prior to radio malfunction. A female with one cub and a female with three cubs were observed in the area of her former home range. Bear 500 was bred at age 4.5 in 1983 and produced a litter of three cubs in 1984 at the age of 5.5. Grizzly 366 was bred in 1984 at the age of 5.5 and may produce cubs in the spring of 1985.

The observed age of first reproduction in two East Front grizzly bears during 1984 was 5.5 and 6.5. McLelland (1982) reported females producing their first litters at age 5.5 in B.C. Canada. Craighead et. al. (1974) found 4.5 to be the youngest age of first successful conception. In the Yukon, 6.5 years was the youngest age of first reproduction (Pearson, 1985).

Mortality

Known bear mortality since 1977 in the East Front consists of 20 bears (Table 20). Seven of these mortalities occurred in the area south of the Sun River while 13 occurred in the study area north of the Sun River. Non hunting mortalities have accounted for 50 percent of total losses to the population. Table 21 presents the age, sex, and circumstances of bears lost to the population. Males accounted for 70.0 percent of the mortalities and females 30.0 percent. Less than one female per year has been reported as killed since 1977. Subadults account for 63.2 percent of the mortality, while adults comprise 36.8 percent of the total.

Along the entire East Front 39 grizzlies (Appendix D) have been captured and handled by various agencies and researchers since 1977. Fifteen of these bears were lost to the population by relocation to British Columbia or direct mortality. In addition, four are strongly suspected of being killed but unreported. From a marked population of 39 bears at least 15 (38.5) and possibly 19 (48.7) were removed from the population since 1977.

Little information is available pertaining to natural mortality within the study area. In 1983 grizzly 220 came out of the den with three yearling cubs. However by May she was observed with only two cubs. The cause of the loss of one of these yearling cubs is not known.

Black Bear Studies

Black bears and grizzly bears are sympatric on the Rocky Mountain Front. Since they are closely related species, some black bear information was accumulated incidental to the ongoing grizzly bear monitoring program.

Figure 30 presents the study area for black bear investigations conducted in 1981-83 (1984 data was not plotted at the time of this report). The core study area extends from the Sun River north toward Birch Creek. The western boundary is the Bob Marshall Wilderness boundary. The area is described elsewhere in this report. Observation data were collected for the entire East Front area whereas radio telemetry studies were focused on the core area.

During the 1984 trapping season, 41 different black bears were captured 57 times. All bears were ear tagged. Thirty-two were captured in the area south of the Sun River while 9 were captured north of the Sun River in the Badger-Two Medicine area. Physical measurements data from these bears is presented in Table 22. Thirty-two males and nine females were captured.

Radio monitoring of three black bears continued during the spring of 1984. Both black bear's 506 and 515 collars malfunctioned in

Table 20. Mortality summary for Rocky Mountain East Front grizzlies, 1977-84.

Year	Sun River North		Sun River South		Rocky Mtn. East Front		Total
	Non hunting	Hunting	Non hunting	Hunting	Non hunting	Hunting	
1977	1	0	0	1	1	1	2
1978	1	1	0	0	1	1	2
1979	1	0	1	1	2	1	3
1980	1	0	2	0	3	0	3
1981	0	2	1	0	1	2	3
1982	0	2	0	0	0	2	2
1983	0	1	0	0	0	1	1
1984	2	1	0	1	2	2	4
TOTALS	6	7	4	3	10	10	20

Table 21. Age and sex data from 16 grizzlies lost to the population, 1977-83.

Bear No./Record No.	Age	Sex	Date	Location	Cause
<u>Marked</u>					
110 ¹ / ₁	2.5	F	6/77	Blackleaf	Livestock Depredation
531 ¹ / ₂	3.5	M	5/78	Muddy Creek	Livestock Depredation
229 ² / ₂	10.5	M	10/21/79	Elk Creek	Hunting
271 ¹ / ₂	7.5	M	10/79	North Fork Sun River	Illegal
332 ² / ₂	16.0	M	1/17/79	Elk Creek	Livestock Depredation
347 ² / ₂	4.5	M	8/80	Alice Creek	Livestock Depredation
348 ² / ₂	4.5	M	7/29/80	Caddotte Creek	Livestock Depredation
430-431 ¹ / ₁	3.5	F	10/80	Badger Creek	Livestock Depredation
540-510 ¹ / ₁	15+	F	10/81	North Fork Sun River	Hunting
519 ¹ / ₁	1.5	M	10/30/82	Teton	Hunting
529 ¹ / ₁	2.5	M	11/12/82	North Fork Sun River	Hunting
550 ¹ / ₁	3.5	M	10/1/83	S. Fk. Flathead River	Hunting/Livestock Depredation
273 ¹ / ₁	10.5	F	9/23	Teton	Illegal
544 ¹ / ₁	4.5	M	9/?	Badger Creek	Illegal
518 ² / ₂	3.5	F	10/21	Teton	Hunting
282 ² / ₂	8.5	M	10/24	Dearborn	Hunting
<u>Unmarked</u>					
1 ² / ₁	15+	F	11/8/77	Elk Creek	Hunting
2 ¹ / ₁	3.0	M	10/78	Badger Creek	Hunting
3 ² / ₂	1.5	M	10/25/81	Dupuyer Creek	Hunting
4 ² / ₂	Unknown	Unknown	11/81	Elk Creek	Illegal

1 - Sun River north study area.

2 - Sun River south study area.

* - Relocated into Sun River fall 1980.

3 - Relocated to S. Fk. Flathead after livestock depredations then shot by hunter.

Figure 30. Black bear core study area and distribution map for the Rocky Mountain Front, 1981-83.

early May. Bear 515 was legally harvested and his collar returned in September of 1984. Black bear 523 cast her collar in May. No functional black bear collars were present on the study area by June 1.

In the spring of 1984, 23 radio locations of three black bears were recorded. No further efforts were made to collar additional black bears in the study area. A summary of all black bear data from 1981-84 and a comparison with grizzly information from the same area is being completed.

Distribution and Home Range

Distribution maps for black bear data were not updated in 1984. Readers are referred to the 1984 report for further information. Most of the observation data from 1984 comes from north of Birch Creek and south of Sun River where grizzly monitoring was most intense.

A total of 76 observations was collected in 1984 north of the Sun River. Table 23 shows the number of observations for each observation type. A total of 45 observations were collected south of the Sun River.

No home range data was gathered in 1984 since all collars were non-functional by June 1. A summary of all black bear distribution and home range data will be completed by 1986.

Table 23. East Front black bear observations by each observation type, north of the Sun River, 1978-84.

	1978-79	1980	1981	1982	1983	1984	Total
Radio location	0	0	48	124	163	23	358
Observation	6	20	50	42	50	53	221
Scat	3	2	51	73	36	18	183
Track	1	1	10	34	15	5	66
Other	1	0	4	0	0	0	5
Trap	30	10	7	12	2	9	70
TOTAL	41	33	170	285	266	108	903

Den Studies

No new black bear dens were located in 1984. The reader is referred to the 1984 annual report for further information.

Table 22. Black bears captured on the East Front, 1984

Bear Number		327	202 [*]	354 ^{1/*}	352	455	353	475	364	339	344
Date		5/2	5/2	5/4	5/5	5/7	5/8	5/8	5/10	5/10	5/10
Age and sex		10.5M	13.5M	7.5M	7.5M	2.5M	2.5M	7.5M	2.5F	9.5M	1.5M
Weight											
Tape	lb.	298	189	142	182	68	41	142	74	244	50
	kg.										
Scale	lb.	300	240	190	230	105	80	200	100	245	50
	kg.										
Ear tags											
Left		327 Green	202 Blue	354 Green	352 Green	455 Green	353 Green	-0-	364 Green	339 Green	344 Green
Right		327 Green	202 Orange	354 Green	352 Green	-0-	353 Green	475 Green	364 Green	339 Green	344 Green
Lip tatoo		327 Black	202 Green	465/530 Black	352 Black	455 Black	353 Black	475 Black	364 Black	339 Black	344 Black
Location		Beaver Cr.	Elk Cr.	Blubber Cr.	Beaver Cr.	Blubber Cr.	Beaver Cr.	Elk Cr.	Sun Riv G.M.A.	Ford Cr.	Beaver Cr.

* Denotes a recapture from previous years

^{1/} Previously bear 530 changed tags to 465 then again to 354

^{2/} Previously bear 535 changed tags to 365

Table 22. Black bears captured on the East Front, 1984 (cont.)

Bear Number		534 [*]	365 ^{2/*}	536 [*]	332	375	331	513 [*]	507 [*]	495	388
Date		5/11	5/12	5/12	5/12	5/13	5/14	5/17	5/17	5/18	5/19
Age and sex		4.5M	5.5M	11.5M	2.5M	14.5M	5.5F	4.5M	2.5M	2.5M	2.5M
Weight											
Tape	lb.	118	253	280	68	210	74	175	65	77	49
	kg.										
Scale	lb.	150	-0-	-0-	90	285	125	225	90	-0-	80
	kg.										
Ear tags											
Left		534 Blue	365 Green	-0-	332 Green	375 Green	331 Green	-0-	507 Red	495 Green	388 Green
Right		-0-	365 Green	536 Blue	332 Green	375 Green	331 Green	513 Red	507 Red	-0-	388 Green
Lip tatoo		534 Black	535/365 Black	536 Black	332 Black	375 Black	331 Black	513 Black	507 Blue	495 Black	388 Black
Location		Sun Riv G.M.A.	Elk Cr.	Goss Cr.	Blubber Cr.	Sun Riv G.M.A.	Willow Cr.	Sun Riv G.M.A.	Elk Cr.	Elk Cr.	Smith Cr.

* Denotes a recapture from previous years

^{1/} Previously bear 530 changed tags to 465 then again to 354

^{2/} Previously bear 535 changed tags to 365

Table 22. Black bears captured on the East Front, 1984 (cont.)

Bear Number	380	387	389	393	383	399	318	547 [*]	360	356	345	
Date	5/22	5/22	5/23	5/26	6/2	6/3	6/4	6/4	6/5	6/7	6/9	
Age and sex	20.5F	1.5M	2.5F	9.5M	3.5M	4.5M	2.5M	6.5M	2.5M	4.5F	4.5F	
Weight												
Tape	lb. kg.	95	35	62	253	65	81	53	213	62	75	68
Scale	lb. kg.	145	60	85	305	115	145	75	235	80	95	100
Ear tags												
Left		380 Green	387 Green	389 Green	393 Green	383 Green	399 Green	318 Green	-0-	360 Green	356 Green	345 Green
Right		380 Green	387 Green	389 Green	393 Green	383 Green	399 Green	318 Green	547 Blue	360 Green	356 Green	345 Green
Lip tatoo		380 Black	387 Black	389 Black	393 Black	383 Black	399 Black	318 Black	547 Black	360 Black	356 Black	345 Black
Location		Shed Cr.	Shed Cr.	Beaver Cr.	Elk Cr.	Blubber Cr.	Elk Cr.	Goss Cr.	Mettler Coulee	Hyde Cr.	Mettler Coulee	Elk Cr.

* Denotes a recapture from previous years

1/ Previously bear 530 changed tags to 465 then again to 354

2/ Previously bear 535 changed tags to 365

Table 22. Black bears captured on the East Front, 1984 (cont.)

Bear Number		336	322	386	349	348	397	330	400	390	340
Date		6/11	6/19	6/19	6/24	6/25	6/28	6/28	7/1	7/3	10/7
Age and sex		8.5F	5.5M	2.5F	13.5M	2.5M	9.5M	2.5M	2.5F	12.5M	2.5M
Weight											
Tape	lb. kg.	95	105	50	168	71	161	56	42	262	118
Scale	lb. kg.	130	160	73	225	105	240	85	-0-	290	165
Ear tags											
Left		336 Green	322 Green	386 Green	349 Green	348 Green	397 Green	330 Green	400 Green	390 Green	340 Green
Right		336 Green	322 Green	386 Green	349 Green	348 Green	397 Green	330 Green	400 Green	390 Green	340 Green
Lip tatoo		336 Black	322 Black	386 Black	349 Black	348 Black	397 Black	330 Black	400 Black	390 Black	340 Black
Location		Mettler Coulee	Mettler Coulee	Hyde Cr.	Hyde Cr.	Box Cr.	Mettler Coulee	W. Fk. Sun R.	S. Fk. Sun R.	W. Fk. Sun R.	Smith Cr.

* Denotes a recapture from previous years

1/ Previously bear 530 changed tags to 465 then again to 354

2/ Previously bear 535 changed tags to 365

Three black bears were monitored during den emergence in 1984. Table 24 presents dates of den emergence for black bears from 1982-84. In 1984 the two black bears denned at low elevations emerged two weeks earlier than the black bear denning at high elevations.

Food habits

Sixty-two black bear scats were collected in 1981, 83 scats were collected in 1982, 52 scats in 1983 and 65 scats were collected in 1984. A total of 269 black bear scats have been collected and analyzed from 1981-84. Data is coded and available for computer analysis. No results are available yet. A summary of scat data is being completed and will be included in the black bear summary report in 1985.

Table 24. Dates of den emergence and movement from den sites, 1982-84.

Bear No.	Sex	Age	Year	Approx. Den Emergence	Movement from Den Site	Reproductive Status	
509	F	11.5	1982	Apr. 23	May 1	Cubs	present
212	M	7.5	1982	Apr. 02-09	Apr. 10	-	
509	F	12.5	1983	Apr. 01-06	Apr. 7	Yearlings	present
523	F	7.5	1983	Mar. 10-26	Mar. 26	No	cubs
517	M	6.5	1983	Apr. 5	Apr. 18	-	
506	M	5.5	1984	Mar. 28	Apr. 3	-	
515	M	5.5	1984	Apr. 16	May 1-8	-	
523	F	8.5	1984	Mar. 31	Apr. 4	Cubs	present

Habitat Use

Black bear habitat use versus availability will be analyzed and summarized in the 1986 black bear summary report. No further data was gathered beyond May in 1984 as all collars were non-functional. All black bear habitat data from radio located bears is coded and available for computer analysis.

Population Data

Since, 1976 a total of 51 black bears and 44 black bears were captured and marked north and south of the Sun River respectively. A grand total of 95 black bears have been marked (Appendix E). Twenty-six (27.4%) are female and 69 (72.6%) are male.

No trapping occurred in the black bear core study area in 1984. Table 25 presents the number of black bears trapped, tagged, recaptured and hunter killed each year, 1977-84. Average percent

Table 25. Number of black bears captured, recaptured and hunter killed in core area 1977-84.

Year	Total Trapped	No. Bears Tagged	No. Tagged Bears Recaptured	Percent Recaptured	No. Tagged Bears Available	No. Tagged Bears Hunter Killed	Percent Return
1977	9		1	11.1	8	0	0.0
1978	5	3	2	40.0	11	0	0.0
1979	4	4	0	0.0	15	1	6.6
1980	10	6	4	40.0	20	3	15.0
1981	6	3	3	50.0	20	0	0.0
1982	10	6	4	40.0	26	4	15.3
1983	3	2	1	33.3	24	2	8.3
1984	0	0	0	00.0	22	1	4.5
TOTAL	47	32	15	46.8		11	

1/ Assumes all tagged bears surviving to den are available the following year.
(i.e. no natural mortality)

Table 26. Reported killed black bear from or in the core area, 1984.

	Tag No./Record #	Sex	Age	Date	Trap Location	Kill Location
Marked	506	M	5.5	Sept.	Pine Butte	
Unmarked	7	M	4.5	June	----	Birch Creek
	8	F	3.5	May	----	Ear Mtn.

return on tagged bears available from 1977-84 was 6.2 percent. Total known mortality from the core area was 3 black bear in 1984 (Table 26). For the period 1976-84 a total of 18 (18.9%) of the 95 marked bears have been killed and tags reported.

Production data from this black bear population are lacking. An average litter size of 26 black bear females observed north of the Sun River from 1980-84 is 1.65 cubs (Table 27). Black bear 509 radio monitored in 1981 with three cubs produced a second litter of three cubs in 1983 as she was observed with three yearlings in 1984. Little data exists on reproduction rates on East Front black bears.

Two years of intensive trapping in the area from Elk Creek to Sun River were conducted in 1983 and 1984. In 1983, 17 black bear were ear tagged in this area. In 1984 when the same area was trapped again 27 black bear were captured and seven (25.9%) were recaptures from the previous year. A total of two marked bears were reported as killed between the 1983 and 1984 trap season.

Table 27. Female black bears with cubs observed on the East Front, north of the Sun River, 1980-83.

Year	No. Bear Sightings	% Females W. Cubs Observed	Females	Cubs	Cubs/Female
1980	20	30.0	6	9	1.50
1981	50	08.0	4	5	1.25
1982	42	16.6	7	15	2.14
1983	50	08.0	4	6	1.50
1984	53	09.4	5	8	1.60
Avg.	43	14.4	5.2	8.6	1.65

MANAGEMENT RECOMMENDATIONS

General Recommendations

Management guidelines developed by the Interagency Wildlife Monitoring and Evaluation Program are presented in Appendix F. These guidelines were developed as a direct result of grizzly bear monitoring conducted on the east front. They represent guidelines that, when followed, will mitigate but not eliminate influences of human activities on grizzly bears and grizzly bear habitat. Human activities within grizzly bear range will have effects, however subtle, on grizzly bears. The fact that rapid distributional recession and declines in grizzly bear populations occurred with the development of increased human activity has been well documented in Europe and North America (Martinka 1980, US Fish and Wildlife Service 1981, Roben 1980, Cowen 1972, Mysterud 1980, Buchalczyk 1980, Markov 1980, Roth 1976, Elgmork 1978, Grachev 1976, Kaal 1976, Vereschagin 1976, Pearson 1975, Curry-Lindahl 1972, Stebler 1972, Zunino and Herrero 1971, Guilday 1968, Buss 1956 and Storer and Trevis 1955).

Recent studies in North America have echoed concerns regarding increasing human access and activities within grizzly bear habitat. The influences of timber harvest, livestock grazing, boneyards and dumps, recreation, sport hunting, road access, mining, subdivision, and hydrocarbon exploitation have been discussed (Craighead 1979, 1980, Craighead and Craighead 1967, 1971, 1973, 1974; Knight et al. 1975, 1976, 1977, 1978, 1980, 1980a, 1981; Chester 1976, Jonkel and Servheen 1977, Jonkel 1976, 1977, 1978, 1980; Harding and Nagy 1980; Schallenberger and Jonkel 1980, Knight and Judd 1980, Blanchard 1978, 1980; Servheen 1981, Pearson 1975, Reynolds and Hechtel 1980, Nagy and Russell 1978, Russell et al. 1978, Hamer et al. 1977, Mundy and Flook 1973). Each activity contributes an additive stress to grizzly bear populations. As such, it is essential that responsible land management agencies and state wildlife departments develop management programs to document and map each land use as it occurs. A cumulative impacts mapping has been conducted in some areas of Montana and should be implemented on the east front of the Rocky Mountains. This would be especially important on grizzly spring range where at present most of the impacts and activities are occurring. Such a project has widespread applicability to all species of wildlife concerned. Disturbance thresholds for management areas need to be determined and areas with overlapping activities identified. Both management and the resources would ultimately benefit from such a documentation and mapping.

To assess the cumulative impacts of management activities a complete data base on bear distribution and use as well as habitat is needed. On the East Front only 72,000 acres have been habitat component mapped. It is recommended that the East Front be completely component mapped by air photo interpretation or potentially by land sat imagery provided that ground truthing be

used to test the accuracy of such mapping. Mapping accuracy and consistency should be high if such a data base is to be used in project level cumulative effects analysis. Accuracy should exceed 90 percent for component maps to be useful. Resolution should be great enough to identify one acre sites which are important to bears. Important feed sites used by grizzlies (Aspen stands, seeps, and meadows) are often less than five acres in size. Therefore, if component mapping does not offer this level of resolution, the effects model will not provide protection in planning a project. Cumulative effects models and habitat component mapping of high levels of accuracy and resolution will require a long term commitment to these efforts and should allow for testing of biological soundness of these efforts before being applied in management planning. Premature application of inaccurate and lower than desirable resolution will result in poor models with limited predictability in planning.

The relationship of grizzly bears to all types of human activities as well as oil and gas development must be understood. Monitoring programs should be further directed and focused toward filling important gaps in the data base. A summary of existing data is needed to indicate where these gaps exist. A complete review of habitat preference, denning habits, distribution, food habits, movement and home range data should be conducted. Intensive efforts to gather data pertaining to livestock/bear relationships, population estimation, oil and gas development impacts, the role of sport hunting, the effects of animal depredation control programs, and the interaction of black and grizzly bears deserve further investigation. Field emphasis should be directed toward securing baseline data in the south half of Badger-Two Medicine, Sun River-south, and the remote backcountry areas.

A comprehensive livestock boneyard management program is in need of development in areas of the Teton River. Recent movement of grizzlies east toward Choteau has been observed in this study. Much of the use of the area in the lower Teton River is connected to the livestock boneyards present in the region. In some years over 90 cattle carcasses have been available for bears proving to be a powerful attractant. Agencies must develop a co-operative program with private landowners to relocate or eliminate boneyards to minimize human/bear interaction. Methods of treating carcasses (use of lime, etc.) need to be developed and applied in the Teton area. Further discussion and research of this problem is needed.

Appendix A. Portions excerpted from Kasworm (1981) and Ihsle (1982) climatological data.

Month	Station ^a	Temperature (°C)		Precipitation (cm)		
		Mean	Deviation (°C) from Long-term Average	Amount	Deviation (cm) from Long-Term Average	Snowfall (cm)
Oct. 1979	GD	8.9	+1.8	1.19	-1.78	0
	BL	8.3	+1.8	1.14	- .03	
Nov. 1979	GD	-.5	-1.2	.33	-2.72	3.05
	BL	-.2	+ .2	.51	-1.12	
Dec. 1979	GD	.4	+3.2	3.45	-1.09	30.5
	BL	-.1	+4.2	2.26	+ .86	
Jan. 1980	GD	-9.0	-3.5	3.23	+ .76	42.7
	BL	-10.6	-3.3	2.46	+ .91	
Feb. 1980	GD	-1.6	+1.4	2.08	+ .20	45.7
	BL	-2.9	+1.2	2.08	+ .56	
Mar. 1980	GD	-1.1	+ .5	1.17	-1.45	13.2
	BL	-2.5	-.7	2.21	+ .53	
Apr. 1980	GD	7.5	+3.4	5.84	+1.96	35.6
	BL	7.2	+3.5	5.33	+1.75	
May. 1980	GD	10.6	+2.0	15.47	+7.32	0
	BL	11.3	+2.2	10.26	+1.65	
June 1980	GD	12.5	+ .3	13.13	+2.57	0
	BL	-	-	-	-	
July 1980	GD	16.8	+ .3	1.70	-1.78	0
	BL	18.2	+1.2	.61	-2.97	
Aug. 1980	GD	13.9	-2.1	2.62	-1.02	0
	BL	13.9	-2.3	3.58	- .13	

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Appendix A continued.

Month	Station ^a	Temperature (°C)		Precipitation (cm)		
		Mean	Deviation (°C) from Long-term Average	Amount	Deviation (cm) from	
					Long-Term Average	Snowfall (cm)
Sept. 1980	GD	12.6	+1.2	3.48	- .43	
	BL	11.7	+ .3	2.84	+ .10	0
Oct. 1980	GD	8.2	+1.1	3.30	+ .33	-
	BL	8.1	+1.5	3.48	+2.31	7.6
Nov. 1980	GD	2.6	+1.9	1.17	-1.88	11.4
	CH	4.2	+3.2	.18	- .91	7.6
Dec. 1980	GD	-3.0	- .2	2.85	+ .48	24.1
	BL	-7.2	- 3.1	1.57	+ .15	2.8
Jan. 1981	GD	.1	+5.4	.41	-2.06	-
	BL	.1	+7.4	.84	- .71	-
Feb. 1981	GD	-1.1	+1.8	1.73	- .15	27.9
	CH	.4	+3.3	.23	- .66	3.8
Mar. 1981	GD	2.4	+4.0	2.11	- .51	-
	BL	2.2	+4.0	5.82	+4.14	-
Apr. 1981	GD	5.9	+1.8	.66	-3.23	0
	BL	6.2	+2.5	Trace	-3.58	Trace
May 1981	GD	9.3	+ .7	17.70	+9.55	0
	CH	11.6	+ .7	8.61	+2.97	0
June 1981	GD	11.7	- .5	4.11	-6.45	0
	CH	14.4	- .4	2.31	-5.97	0
July 1981	GD	16.6	+ .1	4.78	+1.30	0
	BL	17.4	+ .4	3.07	- .51	0

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Appendix A continued.

Month	Station ^a	Temperature (°C)		Precipitation (cm)		
		Deviation (°C) from		Deviation (cm) from		
		Mean	Long-term Average	Amount	Long-Term Average	Snowfall (cm)
Aug. 1981	GD	17.4	+1.5	4.04	+ .41	0
	BL	18.9	+2.6	5.61	-1.91	0
Sept. 1981	GD	12.8	+1.5	1.24	-2.67	0
	BL	13.2		.51		0
Oct. 1981	GD	5.89	-2.2	2.84	-0.05	-
	CH	7.89	-9.8	2.03	+0.37	4.0
Nov. 1981	GD	3.39	+2.72	0.51	-2.54	2.54
	CH	5.11	+4.11	T	-1.09	T
Dec. 1981	GD	-3.83	-0.99	2.39	+0.03	19.05
	CH	-3.22	-0.11	0.46	-0.38	0.0
Jan. 1982	GD	-8.72	-3.22	3.22	+1.07	57.91
	CH	-12.49	-6.44	0.86	+0.05	24.64
Feb. 1982	GD	-5.00	-2.05	4.85	+2.97	34.29
	CH	-5.50	-2.55	1.04	+0.15	15.24
Mar. 1982	GD	-0.99	+0.61	4.09	+1.47	59.69
	CH	-1.44	-0.61	0.76	-0.36	24.13
April 1982	GD	2.06	-1.99	2.34	-1.55	27.94
	CH	4.22	-1.50	0.56	-1.57	20.32
May 1982	GD	7.83	-0.78	3.68	-4.47	7.62
	CH	10.28	-0.61	3.76	-1.88	5.08
June 1982	GD	13.28	+1.05	5.92	-4.65	0.0
	CH	15.89	+1.05	6.48	-1.80	0.0

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Appendix A continued.

Month	Station ^a	Temperature (°C)		Precipitation (cm)		
		Mean	Deviation (°C) from Long-term Average	Amount	Deviation (cm) from Long-Term Average	Snowfall (cm)
July 1982	GD	16.28	-0.27	2.18	-1.30	0.0
	CH	10.00	-0.05	2.03	-1.52	0.0
Aug. 1982	GD	16.88	+0.94	2.18	-1.45	0.0
	CH	19.55	+1.56	0.81	-1.93	0.0
Sept. 1982	GD	11.17	-0.17	6.68	+2.77	m
	CH	13.33	+0.55	3.68	+1.17	0.0
Oct. 1982	GD	7.05	-0.02	0.53	-2.44	1.27
	CH	8.72	+0.39	0.13	-0.97	0.0
Nov. 1982	GD	29.5	-3.7	0.55	-0.65	
	CH	30.3	-3.5	0.18	-0.25	
Dec. 1982	GD	27.8	-0.9	0.55	-0.38	
	CH	28.3	1.9	0.11	-0.22	
Jan. 1983	GD	33.0	11.8	0.49	-0.68	
	CH	33.7	13.8	0.05	-0.29	
Feb. 1983	GD	34.9	7.3	0.09	-0.68	
	CH	36.1	8.7	0.06	-0.24	
March 1983	GD	33.9	4.1	2.03	1.05	
	CH	36.1	4.5	0.47	0.11	
April 1983	GD	38.4	-0.5	0.61	-1.12	
	CH	42.2	0.3	0.11	-0.82	
May 1983	GD	47.5	-0.2	1.96	-1.15	
	CH	52.0	-0.2	0.65	-1.51	

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Appendix A continued.

Month	Station ^a	Temperature (°C)		Precipitation (cm)		
		Mean	Deviation (°C) from	Amount	Deviation (cm) from	Snowfall (cm)
			Long-term Average		Long-Term Average	
June 1983	GD	56.0	1.0	3.76	0.4	
	CH	60.0	0.0	1.16	-1.47	
July 1983	GD	60.9	-1.1	1.87	.47	
	CH	65.5	-1.3	1.84	.45	
Aug. 1983	GD	65.7	5.0	1.66	0.08	
	CH	72.1	7.0	0.50	-0.75	
Sept. 1983	GD	50.9	-1.9	1.17	-0.12	
	CH	54.2	-1.8	0.99	0.15	
Oct. 1983	GD	46.9	+2.0	.07	-0.91	0.0
	CH	49.9	+2.4	.22	-0.22	0.0
Nov. 1983	GD	----	----	----	----	---
	CH	35.5	+1.8	.29	-1.0	6.0
Dec. 1983	GD	9.3	-17.2	.41	-0.62	8.1
	CH	7.4	-18.9	.12	-0.21	4.5
Jan. 1984	GD	30.9	+9.7	.68	-0.49	5.0
	CH	31.3	+11.4	.17	-0.17	7.0
Feb. 1984	GD	36.3	+8.7	.01	-0.76	0.5
	CH	38.9	+11.5	T	-0.30	0.5
March 1984	GD	33.7	+3.9	.80	-0.18	5.0
	CH	36.0	+4.4	.04	-0.32	1.0
April 1984	GD	39.9	+1.0	3.33	+1.60	4.0
	CH	43.7	+1.8	.70	-0.23	3.0
May 1984	GD	48.8	+1.1	1.08	-2.03	0.0
	CH	52.5	+0.3	.59	-1.57	0.0

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Appendix A continued.

Month	Station ^a	Temperature (°C)		Precipitation (cm)		
		Mean	Deviation (°C) from Long-term Average	Amount	Deviation (cm) from Long-Term Average	Snowfall (cm)
June 1984	GD	55.1	+0.1	3.39	+0.03	
	CH	60.7	+0.7	1.67	-0.96	
July 1984	GD	63.7	+1.7	0.28	-1.12	
	CH	69.2	+2.4	0.41	-0.98	
Aug. 1984	GD	64.5	+3.8	1.79	+0.21	
	CH	70.4	+5.3	.55	-0.70	
Sept. 1984	GD	48.6	-4.2	2.37	+1.08	M 2.0
	CH	50.9	-5.1	.96	+0.12	9.0
Oct. 1984	GD	37.9	-7.0	1.02	+0.04	16.0
	CH	41.8	-5.7	.61	+0.17	7.0

a = GD - Gibson Dam, BL - Blackleaf, CH = Choteau

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Appendix B.

Preliminary Studies on the Effects of Cattle on Grizzly Bears and Their Habitat, Rocky Mountain East Front, Montana

Introduction

Historically, domestic livestock and grizzlies have clashed (Murie 1948, Storer and Trevis 1955, and Hubbard and Harris 1960). Prior to the development of the West, vast numbers of grizzlies roamed the great plains and mountains. As farming and ranching pushed westward, the grizzly was eliminated from the great plains where he had flourished at the time of the Lewis and Clark expedition (Wright 1909). Between 1800 and 1975 grizzly populations declined from an estimated one million to less than 1000 (USFWS 1980). The introduction of livestock to western ranges was a major factor leading to the population decline and the loss of effective habitat. The conflict between bear and man during this period was characterized by the attitude of early American stockmen expressed in Bailey (1931): "The destruction of these grizzlies is absolutely necessary before the stock business...could be maintained on a profitable basis". This attitude, although changing, is still persistent in some areas of the United States.

In addition to the direct conflicts leading to death for the bear, the influence of farming and ranching has been magnified by permanent degradation and/or loss of habitat as a result of excessive grazing or permanent mechanical alterations of habitat. Livestock have produced significant impacts on grizzly bear habitat for more than 125 years. These impacts continue to affect many areas where grizzlies thrive today.

In the past, research on grizzly/livestock conflicts has focused on the single problem of depredations on livestock by grizzlies (Murie 1948, Eide 1965, Johnson and Griffel 1980, Jorgenson 1979, Mystered 1980, and Knight and Judd 1980). Most of these efforts were aimed at quantifying the amount of depredation and resulting grizzly mortality occurring on a given range. Only a few studies have completely examined the depredation problem (causes, effects, behavior, and techniques) (Griffel and Basile 1981, Jorgenson 1979 and Mystered 1980). Useful and comprehensive mitigation methods for land managers to employ in reducing the probability of livestock/bear depredation problems have not yet been developed.

Many researchers have alluded to a second influence or impact livestock have on grizzly bears. That is, the competition for forage and degradation of grizzly habitat by livestock (Jonkel and Schallenger 1980, Mealey, Jonkel, and Demarchi 1977, Aune and Stivers 1982, and Knight et al. 1981). Negative population consequences as a result of past livestock grazing or particular patterns of grazing have been indicated in the literature for

virtually all wild ungulates (Mackie 1978). Since grizzly bears are omnivorous it is likely that grazing and habitat degradation by livestock does influence carrying capacity of grizzly habitat on a short term or long term basis.

DESCRIPTION OF THE STUDY AREA

The study area lies along the east face of the Continental Divide in northwestern Montana (Fig. 1). The northern boundary is highway 2 and the southern boundary is the Sun River. The study area is bounded on the west by the upper portions of the South Fork of the Flathead River, and the Middle Fork of the Flathead River within the Flathead, Lolo, and Helena National Forest's. The eastern boundary extends to approximately Range 6 West. BLM lands, Montana Department of Fish, Wildlife and Parks wildlife management areas, and private lands with federal oil, gas and mineral rights were the primary focus of the research.

The study area has been described in Picton (1960), Schallenger (1966), Knight (1970), Mudge (1972), Erickson (1972), Frisina (1974), Holdorf (1981), Schallenger (1974 and 1976), Schallenger and Jonkel (1978, 1979 and 1980), and USDA Forest Service (1977). Picton and Picton (1975), Schallenger (1974 and 1976), Dupuyer Centennial Committee (1977) and USFS (1977) present historical information from the study area. Information on grizzly bears in the region has been reported by Jonkel (1976 and 1977), Schallenger (1974 and 1976), Sumner and Craighead (1973), Hamlin and Frisina (1974), Schallenger and Jonkel (1978, 1979 and 1980) and Aune and Stivers (1981, 1982, and 1983).

Briefly described, elevations on the study area range from about 4200 ft. (1280 m) in river valleys east of the mountains to 9392 ft. (2863 m) on mountain tops. Sedimentary rocks of the limestone and dolomite types generally form the peaks and high ridges, while rocks of the sandstone type often underlie the valley bottoms. Alpine glaciers extensively modified landforms in the past.

Annual precipitation averages about 12 inches (31 cm) at Choteau and up to 65 inches (167 cm) near the Continental Divide. Approximately 80 percent of the precipitation falls as snow. Temperatures range from 90 F (32C) to about -50 F (-46C). The climate is characterized by long, cool winters, short, warm summers and strong southwest winds.

The major drainage systems within the study area include the Dearborn River, Sun River, Teton River, Birch Creek and Two Medicine River. Many of the drainages form a characteristic trellis pattern with narrow canyons joining main rivers at abrupt angles (Mudge 1982). Riparian vegetation extends into the high plains and provides food and cover for black and grizzly bears far from mountainous habitat (Schallenger and Jonkel 1980, Aune and Stivers 1981, 1982 and 1983).

Subalpine fir (Abies lasiocarpa) is dominant and represents climax on most of the timberline forest. Stands of spruce (Picea spp.), white-bark pine (Pinus albicaulis), lodgepole pine (Pinus contorta), Douglas fir (Pseudotsuga menziesii), limber pine (Pinus flexilis), aspen (Populus tremuloides), and cottonwood (Populus trichocarpa) are found on select locations, depending on landform, aspect and elevation. Natural grasslands cover the plains and foothills at lower elevations and intergrade westward into limber pine savanna (Schallenberger and Jonkel 1980).

Appendix B.
Figure 1. Map of the Study area North of the Sun River.

Methods

East Front Grizzly Studies 1980-84 provided the grizzly bear habitat use, food habits, and activity pattern data used for comparisons with cattle. Methods for gathering these data are presented in Aune and Stivers, 1984. Data are primarily a result of radio telemetry techniques and food habits analysis.

Cattle habitat use data and activity pattern was gathered by direct observation of cattle reported on observation field forms. Cattle habitat use data were summarized by season and put into tables. Cattle herd activities were categorized as grazing (60% of group grazing), bedding (60% of group bedded), or grazing and bedding (group mixed in activity patterns). Frequencies for each activity were separated into time of day. Morning was from sunrise to 10:00 a.m.; midday from 10:00 a.m. to 5:00 p.m.; and evening from 5:00 p.m. to sunset.

Cattle fecal samples were collected during each month of the field season from May to October. Samples were tagged with habitat data and date of collection on each tag. Fresh samples were usually taken. A total of 20 samples a month was taken in various habitats and location. Samples were frozen, then at a later date, dried and milled to a fine powder for micro-histological examination.

Microhistological analysis of cattle fecal samples followed methods described by Kasworm (1982). Data sets were sorted by month and season for the 2 years of sampling (1982 and 1983). Percent of diet for samples was sorted by species and by general plant categories (graminoids, forb, and browse). These were then compared to food habits data of grizzlies from the sampling area (Fig. 2) for the years 1982 and 83.

Availability of grazed vs ungrazed habitat was determined following methods of marcum and Loftsgaardin 1980. Analysis of utilization availability data followed Nve et. al. (1974) and Serveen (1981).

Results

Preliminary studies of livestock/bear relationships were designed to answer very basic questions regarding various aspects of habitat and behavior. First, data were analyzed to determine if bear and cattle habitat use overlapped seasonally. Second, if they do so, are bears and cattle utilizing similar foods and selecting similar habitats for protection and cover. Thirdly are these two species occupying these habitats at similar times. Finally, does livestock grazing affect the use of habitats by grizzly bears.

Comparison of Habitats Used by Cattle and Grizzly Bear

In 1982 cattle were observed on grizzly range in the foothill areas to determine their habitat selection. Table 1. presents the habitat selection by cattle by habitat types and components. In general, cattle preferred grassland habitat types and components. Cattle use of riparian communities appears to be highest during the summer season. Similar results are reported by Martin (1978), Bryant (1982), and Roath and Krueger (1982).

It should be noted that the cattle observation methods used in this study result in a bias of data. Use of dense cover is probably higher than what is reported in this study. Cattle use of habitat is also restricted by the available habitat in each pasture. Thus, data such as ours must be examined carefully and deserves more research to increase our understanding of cattle use of habitats within grizzly bear ranges.

Aune and Stivers (1981, 1982, 1983, 1984, 1985) discuss the use of habitat components by grizzly bears within the study area. Highly preferred components on the East Front are Populus stands, Riparian shrub, and timber components (Aune and Stivers 1985, Aune 1985, in press). Habitat components avoided by grizzly bears were prairie grassland and limber pine savanna's.

Based on limited data grizzly bears and domestic cattle commonly shared six components within the study area (Table 1). Cattle were observed mostly within Prairie grassland, Populus stands, and Riparian shrub components. Grizzlies were most often radio located in the Timber, Populus stand, and Riparian shrub components. The riparian components were used commonly by both species. Use of the riparian components was highest during spring for grizzlies while for cattle use was highest during summer.

Comparison of Grizzly and Cattle Food Habits Data.

Cattle diets were also examined. A total of 20 cattle fecal samples per month was collected from April-October, 1982-83. Samples were collected from two study areas (Figure 31). The Badger - Two Medicine Study area is an intermountain grazing allotment with interspersed riparian communities, primarily

Table 1. Comparisons of habitat selection by cattle and grizzly bears on the Rocky Mountain Front.

	Spring (%)		Summer (%)		Fall (%)		Total (%)	
	Cattle (N=1479)	Grizzly Bear (N=334)	Cattle (N=822)	Grizzly Bear (N=364)	Cattle (N=1516)	Grizzly Bear (N=287)	Cattle (N=3817)	Grizzly Bear (N=985)
<u>Habitat Type</u>								
FESC/AGSP	74.1	1.8	20.7	0.5	52.6	0.3	47.5	0.9
POFR/FESC	2.4	3.0	20.0	1.1	28.5	0.3	14.9	1.5
FEID/AGSP	0.0	0.0	0.0	0.0	3.8	0.0	1.3	0.0
SALIX/grass	2.4	3.6	26.8	3.0	0.2	1.0	7.1	2.6
SALIX/CAREX	7.6	6.0	12.5	0.8	4.1	2.8	7.3	3.1
BETULA/SALIX	0.3	7.5	0.0	5.8	1.2	4.9	0.5	6.1
POTRE/SALIX	5.3	18.9	6.8	20.9	28.5	11.1	13.1	17.4
POTRE/SYMPHO	3.2	6.9	5.5	1.9	0.5	1.4	2.7	3.5
POTRI/SYMPHO	4.7	0.3	0.0	0.8	0.0	0.3	1.9	0.5
ABLA series	0.0	14.7	7.7	25.7	0.0	61.4	1.7	32.4
PIFL series	0.0	4.1	0.0	4.6	6.2	1.0	2.1	3.5
		66.8		74.7		84.5		71.5
<u>Habitat Component</u>								
Prairie grassland	76.5	5.1	40.6	1.4	64.5	0.7	65.3	2.4
Mtn grassland	0.0	0.3	0.0	1.4	3.0	0.0	1.2	0.6
Meadows	0.0	0.3	4.9	0.3	0.0	0.3	1.1	0.3
Timber	0.0	36.2	2.8	36.7	0.0	64.3	0.6	44.6
Populus stands	13.3	27.5	12.3	25.0	23.1	17.7	17.3	23.8
Riparian shrub	10.2	17.4	39.4	9.9	4.4	10.5	14.5	12.6

utilized during the summer - fall period. The Antelope Butte - Pine Butte areas are primarily prairie grassland communities with interspersed riparian communities. Cattle fecal samples were primarily collected in or adjacent to the riparian communities known to be used by bears.

Table 2 presents the analysis results of 233 fecal samples from 1982 and 1983. Samples were pooled by month, season, and total. Overall graminoids composed 78.1 percent of cattles diet (81.3% in spring, 73.9% in summer, and 79.2% in fall). Forbs followed with a spring composition of 11 percent, summer showed 20.4 percent, and fall showed 15.2 percent of the diet. Total browse composed 6.4 percent of cattle diets. Common grasses included Festuca spp., Agropyron spp., Cyperaceae, Poa spp., and Bromus spp. Common forbs utilized include Tartaxacum spp., Trifolium spp., and Astragalus spp. Salix spp. and Juniperus spp. were the only browse composing more than one percent of cattle diets.

A total of 144 grizzly bear scats from years 1982-83 has been analyzed for the specific food habits study area (Fig. 2). Analysis results are reported in Table 3. Data results are pooled and analyzed by season and total year.

Important grizzly foods during spring came from our major taxonomic groups including graminoids, forbs, insects, and mammals. Important graminoids fed upon by grizzlies during spring are Carex spp., and Poa spp. Equisetum spp. was also important in spring. Taraxacum spp. was the important forb used by grizzlies. Domestic cattle provided the largest source of carrion, followed by deer. The consumption of ants was also important.

During summer, grizzlies relied heavily on foods from five major taxonomic groups. Shrubs (for berries) showed a dramatic increase in importance, becoming the most important taxonomic group used for food in summer. The next important group, showing a marked decline over spring, was graminoids. Forbs also declined and was the next important group, followed by mammals and insects. The most important berried fed upon include Shepherdia canadensis, followed by Amelanchier alnifolia, Prunus virginiana, then Cornus stolonifera. The most important graminoids remained Carex spp. and Poa spp. Domestic oats (Avena sativa) were heavily used on occasion. Important forbs used during summer were Taraxacum spp., Osmorhiza spp., and Trifolium spp. Domestic cattle provided the largest source of carrion. Ants provided the largest percentage of insect foods.

Table 2. Cattle diets as determined by microhistological analysis for the Rocky Mountain Front, 1982 and 1983.
Recorded by frequency and percent diet for each plant taxa by month and season.

Plant Taxa-1/	May N=50	June N=40	Spring N=90	July N=42	August N=40	Summer N=82	September N=46	October N=15	Fall N=61	Annual Total N=233
gropyron *	50/16.2	39/18.3	89/17.2	42/13.5	40/17.5	82/15.4	46/15.1	15/18.2	61/15.9	232/16.2
romus *	44/ 8.0	36/ 8.9	80/ 8.4	38/ 7.9	39/ 6.9	77/ 7.4	38/ 6.5	8/ 1.9	46/ 5.5	203/ 7.3
alamagrostis *	--	--	--	3/ 0.1	5/ 0.4	8/ 0.3	2/ 0.1	--	2/ 0.1	10/ 0.1
yperaceae *	50/21.6	40/13.0	90/17.8	41/ 9.4	40/11.8	81/10.4	46/13.7	15/15.1	61/14.0	232/14.2
anthonia	4/ 0.2	3/ 0.1	7/ 0.2	9/ 0.6	6/ 0.5	15/ 0.5	3/ 0.1	--	3/ 0.1	25/ 6.5
eschampsia	7/ 0.4	5/ 0.2	12/ 0.3	3/ 0.3	5/ 0.2	8/ 0.3	3/ 0.2	2/ 0.2	5/ 0.2	25/ 0.3
estuca *	50/15.7	36/18.3	86/16.9	41/25.6	40/19.1	81/22.2	46/23.2	15/32.1	61/25.4	228/21.0
eleria	32/ 2.7	23/ 1.7	55/ 2.3	9/ 0.5	25/ 2.9	34/ 1.7	25/ 2.1	11/ 4.5	36/ 2.7	125/ 2.2
uhlenbergia	2/ 0.1	1/ 0.1	3/ 0.1	--	--	--	--	--	--	3/ 0.03
hleum *	22/ 1.6	15/ 0.8	37/ 1.2	12/ 0.7	22/ 2.1	33/ 1.4	22/ 1.9	5/ 1.0	27/ 1.6	97/ 1.4
pa *	49/10.1	39/11.8	88/10.8	41/ 9.0	39/ 8.7	80/ 8.8	39/ 7.6	14/ 9.3	53/ 8.0	221/ 9.4
tipa	6/ 0.2	7/ 0.7	13/ 0.4	5/ 0.3	6/ 0.6	11/ 0.4	8/ 0.3	1/ 0.1	9/ 2.8	33/ 0.4
known grass	49/ 5.5	40/ 5.3	89/ 5.4	42/ 5.3	39/ 4.9	81/ 5.1	46/ 5.0	15/ 5.2	61/ 5.1	231/ 5.2
otal Graminoids	50/82.5	40/79.8	90/81.3	42/72.2	40/75.6	82/73.9	46/76.4	15/87.6	61/79.2	233/78.1
chillea	1/ 0.05	1/ 0.1	2/ 0.1	10/ 0.5	1/ 0.1	11/ 0.3	3/ 0.1	--	3/ 0.1	16/ 0.1
ndrosace	--	--	--	1/ 0.1	--	1/ 0.1	1/ 0.1	--	1/ 0.1	2/ 0.02
hemone	1/ 0.1	1/ 0.1	2/ 0.1	2/ 0.1	--	2/ 0.1	--	--	--	4/ 0.04
ngelica *	--	1/ 0.1	1/ 0.1	--	--	--	--	--	--	1/ 0.01
ntennaria	3/ 0.1	3/ 0.1	6/ 0.1	3/ 0.2	3/ 0.2	6/ 0.2	1/ 0.1	--	1/ 0.1	13/ 0.1
tenaria	--	--	--	--	2/ 0.1	2/ 0.1	1/ 0.1	1/ 0.3	2/ 0.1	3/ 0.04
rnica	--	--	--	1/ 0.1	1/ 0.1	2/ 0.1	--	--	--	2/ 0.02
stragalus	16/ 1.0	12/ 1.0	28/ 1.0	22/ 2.1	21/ 1.7	43/ 1.9	28/ 2.2	6/ 1.1	34/ 2.0	105/ 1.6
alsamorhiza	1/ 0.1	--	1/ 0.1	--	--	--	--	--	--	1/ 0.01
ragrinaceae	1/ 0.1	--	1/ 0.1	1/ 0.1	3/ 0.1	4/ 0.1	1/ 0.1	--	1/ 0.1	6/ 0.05
erastium	--	1/ 0.1	1/ 0.1	--	1/ 0.1	1/ 0.1	1/ 0.1	2/ 0.3	3/ 0.2	3/ 0.03
rsium *	--	--	--	2/ 0.1	1/ 0.1	3/ 0.1	1/ 0.1	--	1/ 0.1	4/ 0.04
llomia	--	--	--	--	--	--	1/ 0.1	--	1/ 0.1	1/ 0.01
mpositiac	4/ 0.3	6/ 0.4	10/ 0.3	20/ 1.5	7/ 0.7	27/ 1.1	12/ 0.8	5/ 1.1	17/ 0.9	54/ 0.8
uciferae	5/ 0.2	3/ 0.1	8/ 0.2	5/ 0.2	10/ 0.6	15/ 0.4	5/ 0.3	1/ 0.1	6/ 0.2	29/ 0.3
uglasia	--	1/ 0.1	1/ 0.1	3/ 0.1	1/ 0.1	4/ 0.1	1/ 0.1	--	1/ 0.1	6/ 0.05
riogonum	--	--	--	2/ 0.2	--	2/ 0.1	--	--	--	2/ 0.03
ragaria	3/ 0.1	7/ 0.5	10/ 0.3	20/ 2.0	10/ 1.0	30/ 1.5	8/ 0.8	--	8/ 0.6	48/ 0.8
asera speciosa	--	1/ 0.1	1/ 0.1	--	--	--	--	--	--	1/ 0.01

Plant Taxa- ^{1/}	May N=50	June N=40	Spring N=90	July N=42	August N=40	Summer N=82	September N=46	October N=15	Fall N=61	Annual Total N=233
Galium	--	4/ 0.2	4/ 0.1	11/ 0.6	8/ 0.4	19/ 0.5	10/ 0.5	2/ 0.2	12/ 0.4	35/ 0.3
Geranium	1/0	4/ 0.2	5/ 0.1	7/ 0.3	1/ 0.1	8/ 0.2	4/ 0.3	1/ 0.1	5/ 0.2	18/ 0.2
Geum	--	2/ 0.1	2/ 0.1	5/ 0.2	1/ 0.1	6/ 0.1	1/ 0.1	--	1/ 0.1	9/ 0.09
Hedysarum *	4/ 0.2	4/ 0.2	8/ 0.2	19/ 1.4	9/ 0.7	28/ 1.0	2/ 0.2	1/ 0.3	3/ 0.2	36/ 0.5
Heracleum *	1/ 0.1	1/ 0.1	2/ 0.1	--	--	--	--	--	--	2/ 0.03
Liatris	--	--	--	--	--	--	1. 0.1	--	1/ 0.1	1/ 0.01
Liliaceae *	7/ 0.3	13/ 0.8	20/ 0.5	13/ 0.8	9/ 0.5	22/ 0.6	13/ 0.6	4/ 0.6	13/ 0.4	55/ 0.5
Lomatium *	--	--	--	--	1/ 0.1	1/ 0.1	--	--	--	1/ 0.01
Lupinus	13/ 1.0	13/ 0.8	26/ 0.9	18/ 1.5	19/ 1.8	37/ 1.6	15/ 0.9	1/ 0.3	16/ 0.8	79/ 1.1
Osmorhiza *	--	1/ 0.1	1/ 0.1	7/ 0.7	1/ 0.1	8/ 0.4	1/ 0.1	--	1/ 0.1	10/ 0.2
Oxytropis	--	--	--	--	--	--	--	1/ 0.1	1/ 0.1	1/ 0.01
Penstemon	--	--	--	--	--	--	1/ 0.1	--	1/ 0.1	1/ 0.1
Phlox	9. 04	6. 04	15/ 0.4	9/ 0.7	12/ 0.6	21/ 0.6	14/ 1.2	7/ 1.6	21/ 1.3	57/ 0.7
Potentilla	--	--	--	2/ 0.1	--	2/ 0.1	--	--	--	2/ 0.03
Root (Forb)	3/ 0.1	2/ 0.2	5/ 0.1	--	--	--	1/ 0.1	--	1/ 0.1	6/ 0.06
Sedum	1/ 0.1	--	1/ 0.1	1/ 0.1	--	1/ 0.1	--	--	--	2/ 0.02
Selaginella	--	--	--	1/ 0.1	--	1/ 0.1	--	--	--	1/ 0.01
Taraxacum *	8/ 0.3	19/ 1.3	27/ 0.8	25/ 2.8	23/ 2.7	48/ 2.7	24/ 2.0	3/ 0.4	27/ 1.6	102/ 1.7
Thalictrum	--	--	--	1/ 0.1	--	1/ 0.1	--	--	--	1/ 0.01
Tragopogon *	--	--	--	1/ 0.1	--	1/ 0.1	--	--	--	1/ 0.01
Trifolium-										
Medicago *	19/ 2.4	16/ 2.1	35/ 2.3	8/ 0.5	14/ 1.3	22/ 0.9	9/ 1.4	--	9/ 1.0	66/ 1.5
Vicia *	1/ 0.1	1/ 0.1	2/ 0.1	1/ 0.1	--	1/ 0.1	1/ 0.1	--	1/ 0.1	4/ 0.04
Unknown Forb	45/ 2.6	31/ 3.0	76/ 2.8	40/ 5.0	40/ 4.6	80/ 4.8	44/ 4.5	14/ 3.3	58/ 4.2	214/ 3.9
Total Forbs	50/ 9.9	37/12.4	87/11.0	42/22.8	40/17.8	82/20.4	46/16.9	15/10.0	61/15.2	230/15.4
Abies	--	--	--	--	--	--	1/ 0.1	--	1/ 0.1	1/ 0.01
Acer	--	--	--	--	--	--	1/ 0.1	--	1/ 0.1	1/ 0.01
Amelanchier *	1/ 0.1	--	1/ 0.1	1/ 0.1	1/ 0.1	2/ 0.1	2/ 0.1	--	2/ 0.1	5/ 0.05
Arctostaphylos *	--	--	--	1/ 0.1	--	1/ 0.1	1/ 0.1	--	1/ 0.1	2/ 0.02
Artemisia										
frigida	10/ 0.7	2/ 0.7	12/ 0.4	--	2/ 0.3	2/ 0.2	6/ 0.4	--	6/ 0.3	20/ 0.3
Berberis *	--	--	--	4/ 0.4	1/ 0.1	5/ 0.2	4/ 0.5	2/ 0.4	6/ 0.4	11/ 0.2
Juniperus	19/ 2.6	14/ 1.2	33/ 1.9	12/ 1.2	7/ 0.5	19/ 0.9	10/ 0.5	4/ 0.7	14/ 0.6	66/ 1.2
Pinus	10/ 0.9	2/ 0.2	12/ 0.6	11/ 0.9	9/ 1.5	20/ 1.2	11/ 1.1	1/ 2.9	12/ 0.9	44/ 0.9
Populus	8/ 0.5	12/ 1.6	20/ 1.0	9/ 0.6	7/ 0.6	16/ 0.6	12/ 1.1	1/ 0.3	13/ 0.9	50/ 0.8

Plant Taxa ^{1/}	May N=50	June N=40	Spring N=90	July N=42	August N=40	Summer N=82	September N=46	October N=15	Fall N=61	Annual Total N=233
Potentilla fruticosa	2/ 0.2	8/ 0.5	10/ 0.4	10/ 0.6	6/ 0.4	16/ 0.5	4/ 0.2	1/ 0.1	5/ 0.2	31/ 0.4
Prunus *	1/ 0.1	2/ 0.1	3/ 0.1	--	1/ 0.1	1/ 0.1	1/ 0.1	--	1/ 0.1	5/ 0.05
Pseudostuga	1/ 0.1	--	1/ 0.1	1/ 0.1	--	1/ 0.1	2/ 0.3	--	2/ 0.2	4/ 0.09
Ribes *	1/ 0.1	--	1/ 0.1	--	--	--	--	--	--	1/ 0.01
Rosa *	--	3/ 0.2	3/ 0.1	--	--	--	--	--	--	3/ 0.03
Salix	21/ 1.1	22/ 2.3	43/ 1.6	7/ 0.4	21/ 1.8	28/ 1.1	13/ 1.1	1/ 0.1	14/ 0.8	85/ 1.2
Shepherdia *	1/ 0.1	5/ 0.9	6/ 0.4	6/ 0.3	2/ 0.2	8/ 0.3	2/ 0.1	--	2/ 0.1	16/ 0.3
Symphoricarpos	1/ 0.1	3/ 0.3	4/ 0.1	3/ 0.2	2/ 0.1	5/ 0.1	2/ 0.1	--	2/ 0.1	12/ 0.1
Unknown browse	19/ 1.0	14/ 0.8	33/ 0.9	14/ 0.8	22/ 1.4	36/ 1.1	27/ 1.3	4/ 0.6	31/ 1.1	100/ 1.0
Total Browse	46/ 7.3	34/ 7.8	80/ 7.5	36/ 5.0	35/ 6.6	71/ 5.8	40/ 6.7	8/ 2.4	48/ 5.7	199/ 6.4

* Plant Taxa identified as east front bear foods.

^{1/} Data is presented as frequency over percent of diet.

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Table 3. Food habits of grizzly bear determined from analysis of 144 scats collected within the cattle food habits study area, 1982 and 83.

ITEM NAME	ITEM PART	FREQ		TOTAL VOLUME	VOL %	% COMP	IMPUT VALUE	IMPUT VALUE %
		NO.	%					
PINUS ALBICAULIS	3	3	2.08	150.00	1.04	50.00	.02	.15
TOTAL TREES		3	2.08	150.00	1.04	50.00	.02	.06
ARCTOSTAPHYLOS	3	4	2.78	374.00	2.60	93.50	.07	.51
ARCTOSTAPHYLOS	6	2	1.39	11.00	.08	5.50	.00	.01
SUB TOTAL		6	4.17	385.00	2.67	64.17	.11	1.06
ROSA	3	1	.69	100.00	.69	100.00	.00	.03
AMELANCHIER ALNIFOLIA	3	2	1.39	130.00	.90	65.00	.01	.09
AMELANCHIER ALNIFOLIA	6	7	4.86	530.00	3.68	75.71	.18	1.27
SUB TOTAL		9	6.25	660.00	4.58	73.33	.29	2.73
CORNUS STOLONIFERA	6	2	1.39	170.00	1.18	85.00	.02	.12
CORNUS STOLONIFERA	7	1	.69	30.00	.21	30.00	.00	.01
SUB TOTAL		3	2.08	200.00	1.39	66.67	.03	.28
PRUNUS VIRGINIANA	3	5	3.47	355.00	2.47	71.00	.09	.61
PRUNUS VIRGINIANA	6	1	.69	75.00	.52	75.00	.00	.03
SUB TOTAL		6	4.17	430.00	2.99	71.67	.12	1.19
SHEPHERDIA CANADENSIS	3	3	2.08	41.00	.28	13.67	.01	.04
SHEPHERDIA CANADENSIS	6	23	15.97	1760.00	12.22	76.52	1.95	13.86
SHEPHERDIA CANADENSIS	17	1	.69	100.00	.69	100.00	.00	.03
SUB TOTAL		27	18.75	1901.00	13.20	70.41	2.48	23.63
VACCINIUM GLOBULARE	6	1	.69	80.00	.56	80.00	.00	.03
ARCTOSTAPHYLOS UNV-URSI	3	4	2.78	345.00	2.40	86.25	.07	.47
ARCTOSTAPHYLOS UNV-URSI	6	2	1.39	60.00	.42	30.00	.01	.04
SUB TOTAL		6	4.17	405.00	2.81	67.50	.12	1.12
TOTAL SHRUBS		54	37.50	4161.00	28.90	77.06	10.84	30.07
EQUISETUM	1	15	10.42	669.00	4.65	44.60	.48	3.44
TOTAL SPOROPHYTES		15	10.42	669.00	4.65	44.60	.48	1.34

Table 3. Continued.

ITEM NAME	ITEM PART	FREQ		TOTAL VOLUME	VOL %	% COMP	IMPUT VALUE	IMPUT VALUE %	
		NO.	%						
GRAMINOID	1	5	3.47	295.00	2.05	59.00	.07	.50	
CAREX	6	1	.69	30.00	.21	30.00	.00	.01	
FESTUCA	14	1	.69	15.00	.10	15.00	.00	.01	
MELICA	4	1	.69	5.00	.03	5.00	.00	.00	
POA	1	2	1.39	25.00	.17	12.50	.00	.02	
POA	14	3	2.08	50.00	.35	16.67	.01	.05	
SUB TOTAL		5	3.47	75.00	.52	15.00	.02	.17	
GRASS/SEDGE	0	1	.69	90.00	.63	90.00	.00	.03	
GRASS/SEDGE	1	46	31.94	1798.00	12.49	29.09	3.99	28.32	
GRASS/SEDGE	7	3	2.08	150.00	1.04	50.00	.02	.15	
SUB TOTAL		50	34.72	2038.00	14.15	40.76	4.91	46.91	
TOTAL GRAMINIDS		62	43.06	2458.00	17.07	39.65	7.35	20.40	
FORB	1	4	2.78	30.00	.21	7.50	.01	.04	
FORB	4	1	.69	15.00	.10	15.00	.00	.01	
SUB TOTAL		5	3.47	45.00	.31	9.00	.01	.10	
ANGELICA	6	1	.69	60.00	.42	60.00	.00	.02	
CIRSUM	1	1	.69	50.00	.35	50.00	.00	.02	
HEDYSARUM	4	1	.69	35.00	.24	35.00	.00	.01	
HERACLEUM	7	1	.69	50.00	.35	50.00	.00	.02	
LATHYRUS	1	4	2.78	180.00	1.25	45.00	.03	.25	
OSMORHIZA	1	2	1.39	130.00	.90	65.00	.01	.09	
OSMORHIZA	14	2	1.39	190.00	1.32	95.00	.02	.13	
SUB TOTAL		4	2.78	320.00	2.22	80.00	.06	.59	
POLYGONUM	3	1	.69	1.00	.01	1.00	.00	.00	
TARAXACUM	1	1	.69	20.00	.14	20.00	.00	.01	
TARAXACUM	14	13	9.03	466.00	3.24	35.85	.29	2.07	
TARAXACUM	17	1	.69	95.00	.66	95.00	.00	.03	
SUB TOTAL		15	10.42	581.00	4.03	38.73	.42	4.01	
UMBELLIFERAE-APIACEAE	1	5	3.47	185.00	1.28	37.00	.04	.32	
CLAYTONIA LANCEOLATA	14	1	.69	10.00	.07	10.00	.00	.00	

Table 3. Continued.

ITEM NAME	ITEM PART	FREQ		TOTAL VOLUME	VOL %	% COMP	IMPUT VALUE	IMPUT VALUE %
		NO.	%					
HEUCHERA CYLINDRICA	1	3	2.08	55.00	.38	18.33	.01	.06
VICIA AMERICANA	1	1	.69	15.00	.10	15.00	.00	.01
CLATONIA MEGARHIZA	4	4	2.78	290.00	2.01	72.50	.06	.40
TARAXACUM OFFICINALE	16	1	.69	65.00	.45	65.00	.00	.02
TOTAL FORBS		37	25.69	1942.00	13.49	52.49	3.47	9.62
LARGE MAMMAL-UNIDENT	21	2	1.39	70.00	.49	35.00	.01	.05
LARGE MAMMAL-UNIDENT	22	2	1.39	30.00	.21	15.00	.00	.02
LARGE MAMMAL-UNIDENT	23	1	.69	5.00	.03	5.00	.00	.00
LARGE MAMMAL-UNIDENT	27	1	.69	40.00	.28	40.00	.00	.01
SUB TOTAL		6	4.17	145.00	1.01	24.17	.04	.40
SHEEP-DOMESTIC	30	1	.69	45.00	.31	45.00	.00	.02
DEER	22	1	.69	20.00	.14	20.00	.00	.01
DEER	26	1	.69	90.00	.63	90.00	.00	.03
DEER	30	3	2.08	70.00	.49	23.33	.01	.07
DEER	32	1	.69	20.00	.14	20.00	.00	.01
SUB TOTAL		6	4.17	200.00	1.39	33.33	.06	.55
DOMESTIC CATTLE	0	2	1.39	15.00	.10	7.50	.00	.01
DOMESTIC CATTLE	22	5	3.47	45.00	.31	9.00	.01	.08
DOMESTIC CATTLE	26	4	2.78	185.00	1.28	46.25	.04	.25
DOMESTIC CATTLE	30	16	11.11	631.00	4.38	39.44	.49	3.46
DOMESTIC CATTLE	37	5	3.47	290.00	2.01	58.00	.07	.50
SUB TOTAL		32	22.22	1166.00	8.10	36.44	1.80	17.18
HORSE	30	1	.69	70.00	.49	70.00	.00	.02
LAGOMORPH	22	1	.69	10.00	.07	10.00	.00	.00
LAGOMORPH	30	1	.69	70.00	.49	70.00	.00	.02
SUB TOTAL		2	1.39	80.00	.56	40.00	.01	.07
SMALL MAMMAL-UNID	23	2	1.39	35.00	.24	17.50	.00	.02
SPERMOPHILUS-CITELLUS	22	1	.69	5.00	.03	5.00	.00	.00
MICROTINAE	30	2	1.39	35.00	.24	17.50	.00	.02
TOTAL MAMMALS		49	34.03	1781.00	12.37	36.35	4.21	11.68

Table 3. Continued.

<u>ITEM</u> <u>NAME</u>	<u>ITEM</u> <u>PART</u>	<u>FREQ</u>		<u>TOTAL</u> <u>VOLUME</u>	<u>VOL %</u>	<u>% COMP</u>	<u>IMPUT</u> <u>VALUE</u>	<u>IMPUT</u> <u>VALUE %</u>
		<u>NO.</u>	<u>%</u>					
ANT	0	56	38.89	1108.00	7.69	19.79	2.99	21.24
BEE	0	1	.69	10.00	.07	10.00	.00	.00
TOTAL INSECTS		56	38.89	1118.00	7.76	19.96	3.02	8.38
DEBRIS	0	37	25.69	1061.00	7.37	28.68	1.89	13.44
WOOD	0	12	8.33	184.00	1.28	15.33	.11	.76
T-BAIT	0	1	.69	50.00	.35	50.00	.00	.02
DIRT	0	28	19.44	484.00	3.36	17.29	.65	4.64
ROCKS	0	19	13.19	292.00	2.03	15.37	.27	1.90
NEEDLES	0	4	2.78	50.00	.35	12.50	.01	.07
TOTAL OTHER		65	45.14	2121.00	14.73	32.63	6.65	18.45

During fall, shrubs (for berries) further increased in importance, becoming the most important taxonomic food group for the total season. Graminoids remained about as important as in summer, and forbs dropped in importance again. The most important berries were those of Prunus virginiana, followed by Shepherdia spp., then Amelanchier alnifolia. Trifolium spp. was the most important forb. Use of carrion and insects showed a trace.

Comparisons between the above fecal and scat analysis show some degree of overlap in diets of cattle and grizzly bears. Argropyron spp., Cyperaceae, and Poa spp. were graminoids eaten by both cattle and grizzlies. Poa spp. ranked high for both animals. Cyperaceae is very hard to distinguish in scat macro analysis and probably should show higher importance to grizzly bears and a stronger degree of overlap. Of the forbs, Cirsium spp., Hedysarum spp., Heracleum spp., Osmorhiza spp., Taraxacum spp., and Trifolium spp. were eaten by both bears and cattle. Taraxacum spp. and Trifolium spp. were the forbs showing the strongest degree of overlap. The graminoids and forbs that were present in the diets of cattle and grizzly bears, are graminoids and forbs that either occur within the Populus Stand and Riparian Shrub habitat components or in the riparian ecotones just adjacent.

Bear scat and cattle fecal analysis have limitations in determining diet, in that the techniques are limited in being able to key many plant food items to genus and species. The degree of dietary overlap between cattle and grizzly bears on the study area is possibly greater than these techniques or sample sizes can yield.

Comparison of Activity Pattern of Cattle and Grizzly Bears.

Table 4 presents the gross diurnal activity patterns of cattle by each season determined by observation methods. Cattle were generally active and feeding in evening and morning. During midday heat, they commonly bedded for short periods, grazing occasionally. It was during these midday periods when cattle most commonly were observed within riparian components. Clark (1978) and Bryant (1982) noticed similar patterns of activity.

During the night cattle apparently bed down often out in open meadows or grasslands unless the weather is poor (K. Aune pers. obs.). Cattle appear to be mostly crepuscular in their activity pattern.

Aune and Stivers (1984) discuss grizzly bear activity patterns within the cattle/bear study area. Bears monitored within this area were mostly active during the night with minimal activity during the day. Only in fall when feeding on berries was midday activity recorded.

Table 4. Gross diurnal activity patterns of cattle herds observed on the Rocky Mountain East Front, 1982.

	Spring (%) (N=36)	Summer (%) (N=23)	Fall (%) (N=21)	Total (%)
Feeding ^{1/}				
Morning ^{4/}		100.0	100.0	100.0
Midday ^{7/}		30.8	69.2	51.4
Evening ^{6/}		88.9	100.0	95.0
Bedding ^{2/}				
Morning ^{4/}		0.0	0.0	0.0
Midday ^{7/}		46.1	7.7	22.9
Evening ^{6/}		11.1	0.0	5.0
Feeding and Bedding ^{3/}				
Morning ^{4/}		0.0	0.0	0.0
Midday ^{7/}		23.1	33.3	25.7
Evening ^{6/}		0.0	0.0	0.0

- 1 - Feeding = 60% or more of a group is engaged in grazing activities
- 2 - Bedding = 60% or more of group is engaged in bedding
- 3 - Feeding and bedding = 40-60% of group is engaged in either feeding or bedding
- 4 - Morning = Sunrise until 10:00 a.m.
- 5 - Midday = 10:00 a.m. - 5:00 p.m.
- 6 - Evening = 5:00 p.m. - sunset

Both cattle and grizzly bears preferred to be inactive and selected bedding areas in the moist riparian areas during the heat of midday. This was observed primarily during the June to August period. In some cases cattle and grizzly bears were observed bedded and inactive in the same riparian cover.

Availability/Utilization of Grazed/Ungrazed Habitats

Within the study area a large portion of the habitat is grazed by cattle, sheep, or horses. The exceptions are Montana Department of Fish, Wildlife and Parks Wildlife Management Areas, portions of the Lewis and Clark Forest, some private and residential land, and a small amount of habitat on private lands inaccessible due to steepness, inundation, or extremely thick cover.

Availability/utilization analysis was conducted in the area North of the Sun River from Deep Creek to Birch Creek (Fig. 3). A total of 5673 randomly located points were used to generate availability data for habitat components for this area. A statistically sound sampling rate for determining the proportion

Appendix B.
Figure 3.

of each of 17 different components was applied (Aune and Stivers 1985).

Table 5 presents the number and percent of grizzly bear radio locations found on lands grazed by cattle, sheep or horses, plus the availability of lands grazed by these classes of livestock. Fifty three percent of 1478 grizzly bear radio locations were within areas influenced by the management and grazing of livestock. An availability analysis showed that 49.6 percent of the area is grazed by either cattle (44.1%) horses (5.2%), or sheep (0.3%) under some type of grazing program.

Table 5. The number and percent of grizzly radio locations and the availability of grazed-ungrazed lands by each class of livestock on the study area, 1977-84.

	<u>Spring Availability</u>	<u>Spring Use</u>	<u>Summer/Fall Availability</u>	<u>Summer Use</u>	<u>Fall Use</u>	<u>Total Use</u>
Ungrazed	1345/34.8	203/40.3	2856/50.3	188/40.9	268/58.3	686/46.4
Grazed	2521/65.2	301/59.7	2816/49.7	272/59.1	192/41.7	792/53.6
Cattle	2281/59.0	294/58.3	2504/44.1	269/58.5	184/40.0	775/52.4
Horses	221/5.7	3/0.6	293/5.2	0/0.0	4/0.9	8/0.5
Sheep	19/0.5	4/0.8	19/0.3	3/0.7	4/0.9	9/0.6

A chi square test shows that grizzly bears did not use grazed/ungrazed lands in proportion to its availability seasonally. [Chi square, spring = 6.6, Summer = 16.5, and fall = 11.5, 1 df.]. Although grazed/ungrazed lands were not used in proportion to their availability, significant (P less than 10) avoidance or preference for these categories of land were not present. Grazing management alone did not explain the disproportionate use of grizzly habitat.

A larger proportion of spring range is grazed than summer or fall range. Increased ranging of cattle and the opening of Forest Allotments in summer result in a greater proportion of habitats affected by grazing than during spring or fall.

Tables 6, 7, and 8 compare the use and availability of three preferred components of the grizzly bear. Use of these components which have been grazed over several years was not significantly different than use of ungrazed components. The largest differences in use versus availability were grazed populus stands during the spring and ungrazed riparian shrub in the fall. Both grazed populus stands and riparian shrub components were used in fall more than expected, although not significantly. No evidence is yet available to determine if grazing may be a factor increasing berry producing shrubs. It is hypothesized that grazing may decrease forb and grass production thereby increasing the opportunity for hardy browse species to dominate the understory of some riparian areas. Many of these species would produce fruit which is preferred during the fall by grizzly bears.

Table 6. Availability/utilization of grazed and ungrazed populus stand components.

	<u>Spring Availability</u>	<u>Spring Use</u>	<u>Summer/Fall Availability</u>	<u>Summer Use</u>	<u>Fall Use</u>	<u>Total Use</u>
Grazed	122/80.3	89/67.9	122/80.3	79/79.0	72/91.1	240/77.4
Ungrazed	<u>30/19.7</u>	<u>42/32.1</u>	<u>30/19.7</u>	<u>21/21.0</u>	<u>7/8.9</u>	<u>70/22.6</u>
	152/	131/	152/	100/	79/	310/

Table 7. Availability/utilization of grazed and ungrazed riparian shrub components.

	<u>Spring Availability</u>	<u>Spring Use</u>	<u>Summer/Fall Availability</u>	<u>Summer Use</u>	<u>Fall Use</u>	<u>Total Use</u>
Grazed	113/86.3	95/93.1	113/86.3	92/92.9	55/96.5	242/93.8
Ungrazed	<u>18/13.7</u>	<u>7/6.9</u>	<u>18/13.7</u>	<u>7/7.1</u>	<u>2/3.5</u>	<u>16/6.2</u>
	131/	102/	131/	99/	57/	258/

Table 8. Availability/utilization of grazed and ungrazed closed Timber components.

	<u>Spring Availability</u>	<u>Spring Use</u>	<u>Summer/Fall Availability</u>	<u>Summer Use</u>	<u>Fall Use</u>	<u>Total Use</u>
Grazed	222/20.5	51/38.3	302/17.5	43/37.1	46/21.0	140/29.9
Ungrazed	<u>859/79.5</u>	<u>82/61.7</u>	<u>1422/82.5</u>	<u>73/62.9</u>	<u>173/79.0</u>	<u>328/70.1</u>
	1081/	133/	1724/	116/	219/	468/

The relationship of grazing in the timber components are complex and vary probably between sites. No hypothesis is advanced as to why grizzlies used grazed timber components more than expected during the summer. Further detailed field study is needed.

Discussion

The denudation of riparian plant communities and the resultant inability of grizzly bears to utilize them, may be a significant factor affecting grizzly bear populations in the lower 48 United States. Grizzly bears depend on riparian areas in the studied area for feeding, bedding, traveling and breeding. They rely on these plant communities throughout spring, summer, and fall.

Probably the most important reasons for use of the riparian plant communities by cattle is because of the high productivity of highly palatable and preferred foods, and the presence of water and shade for thermal regulation of body temperature. Though cattle in this study area prefer open grasslands, their use of the riparian plant communities is high, probably high enough to negatively impact grizzlies.

Ellison and Houston (1958) noted an apparent preferential use of open grasslands by livestock grazing an aspen-grassland mix. However, if aspen or other riparian community types are isolated and comprise only a small portion of the range, this relationship may be reversed (USDA 1970), probably because of the use of these areas for shade. Thus, the sizes and relative amounts of the riparian plant community types within the grazing allotment will probably control the amount, season, and nature of the impacts.

When cattle are turned into aspen communities during the peak of the growing season, utilization will commonly reach half or more of the annual production of palatable forage (DeByle, in press). On ranges in good condition, this consumption of key species is considered acceptable (USDA 1970). If prolonged over grazing is allowed, a loss of productivity and diversity will result in the aspen communities (Houston 1954, Costello 1944, and Beetle 1974).

The most palatable plant species within riparian communities are often sought and usually the first to decrease under continued grazing pressure. Under prolonged grazing, then, riparian community plant composition changes gradually to a mix of fewer species and greater abundance of plants low in palatability. And since grizzlies aren't ruminants, they prefer the more palatable plants within the riparian community.

For grizzly bears it appears that food selection is governed by nutrient content and digestibility as well as by availability; i.e., graminoids are of high diet importance and relatively low nutritional value but are the most available food source during spring. The frequency and percent of such succulent forbs as Heracleum spp., Angelica spp., and Osmorhiza spp. in the grizzly diet for the study area is lower than expected. These three forbs show a higher nutritional availability index ranking than do graminoids (Sizemore 1980). The low availability of these three forbs has been observed on the study area. Their occurrence is generally limited to areas within a pasture that

are inaccessible to cattle, or occur in riparian communities adjacent to hay meadows, where the grazing of that pasture is deferred until after the hay is put up, thus having allowed the plants to reach seed ripe stage.

It has been observed that cattle trample vegetation, crush the litter cover on the soil surface, and compact the mineral soil. Trampling damage to some plant communities can occur whether or not the plants are grazed. This applies to riparian plant communities where an abundance of species grow in a loose, friable soil. This condition is very susceptible to alteration by trampling. After years of trampling, combined with over grazing, the diversity of plant species within the riparian plant community will be much different than that of an undisturbed site. The combined effects of trampling and over grazing probably increases the occurrence of shrubs, graminoids and such forbs as Taraxacum spp. and Trifolium spp., while decreasing the availability of Heracleum spp., Osmorhiza spp., and Angelica spp.

Food habits studies have shown that feeding on berries by grizzlies is the most important taxonomic food group for grizzlies on the study area. Browsing on these berry producing shrubs of Prunus virginiana, Cornus stolonifera, Amelanchier alnifolia, and Shepherdia canadensis within the study area probably is not of a magnitude to negatively affect their availability. Serviceberry and chokecherry can do quite well with 60 percent browsing of current annual growth (Shepherd 1971). In fact grazing may be increasing the occurrence of such species in the riparian areas. DeByle and Winokur (in press) state that if grazing in aspen stands is moderate to heavy, browsing generally will be also. Where cattle congregate in riparian areas and consume most of their preferred foods they will shift to browsing, and if extensive enough, can reduce the availability of these berry producing shrubs. The heaviest impact on the shrubs is when heavy browsing occurs early in the growing season when carbohydrate reserves are the lowest (Schier 1976).

Aspen is a preferred browse in the west. It is heavily used in the autumn and moderately used the rest of the year (Smith 1952). Browsing on aspen suckers may be threatening the aspen community type on the study area. Regeneration in the all-aged aspen stand is generally sparse and comparatively slow-growing. Browsing pressure can impact these sucker stems more severely and for a longer time than it would a dense stand of fast-growing even-aged suckers. Yet, the older aspen stands are dependent on these low-density, slower-growing aspen suckers in the understory for its perpetuation. In Wyoming, undulate browsing in mature aspen stands was enough to effectively prevent regeneration even as the stands break up (Beetle 1974). A loss of the aspen community would result in a loss of the forbs so highly palatable and preferred by grizzly bears.

It would be inappropriate not to mention the most significant positive effect of managing livestock on grizzly habitat. Although cattle may reduce the forage available to grizzlies they may provide the single most important source of carrion available to grizzlies. On the study area at least six major boneyards and many carcasses of dead cattle provide important protein for bears especially during spring as winter losses and calving losses develop. During one severe winter storm over 90 cows and calves were lost by three operators along the Teton River. Further study and analysis of energetic budgets would determine if protein provided by management of cattle offsets negative effects of cattle on bear forage. Certainly best management of cattle to protect riparian areas but retain positive values of cattle operations should be a management alternative to land managers.

Management Recommendations

These preliminary studies suggest that livestock could significantly impact bear habitat, yet research has not been conducted to evaluate this problem. Short term studies to evaluate forage competition and long term studies of habitat quality trends are needed to develop and improve grazing management systems in bear habitat. Land managers are in need of guidelines and biologically sound recommendations to mitigate negative effects of grazing and enhance the positive effects of grazing within grizzly bear range.

A third potential impact of livestock could be competition for space. This addresses a behavioral response of bears toward livestock and the associated activities. Recent studies have discussed the displacement of bears by human activities such as timber harvest, hydrocarbon exploration, recreation, mining, road access, and subdivision. (Craighead 1979, 1980, Craighead and Craighead 1967, 1971, 1973, 1974; Knight et al. 1975, 1976, 1977, 1978, 1980, 1980a, 1981; Chester 1976, Jonkel and Servheen 1977, Jonkel 1976, 1977, 1978, 1980; Harding and Nagy 1980; Schallenberger and Jonkel 1980, Knight and Judd 1980, Blanchard 1978, 1980; Servheen 1981, Pearson 1975, Reynolds and Hechtel 1980, Nagy and Russell 1978, Russell et al. 1978, Hamer et al. 1977, Mundy and Flock 1973). Behavioral responses of grizzlies to livestock activities have not yet been determined.

Several management options have been proposed to protect bears and bear habitat from conflicts with livestock. Several authors have suggested eliminating grazing allotments, primarily sheep on federal lands where bear conflicts have occurred (Schallenberger and Jonkel 1980, Aune and Stivers 1982, and Knight et al. 1980). Alternative methods of protection discussed in the literature include special herding techniques, fencing stock out of prime habitat, altering season of use, reducing stocking rates, rest rotation and deferred grazing systems, and placement of salt and/or water sources to alter livestock distribution. All of these methods have been suggested or even implemented without scientific studies to evaluate their success in providing habitat

protection, reducing depredations or increasing bear food availability. It is, therefore, recommended that research be conducted to evaluate short and long term impacts of livestock on grizzly bears and determine the proper methods of protection for bears and bear habitat from these impacts and to enhance the positive values of cattle management to bears.

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Appendix C

ROCKY MOUNTAIN FRONT GRIZZLY BEAR HABITAT MAPPING PROJECT

SUN RIVER SOUTH STUDY AREA - DEARBORN RIVER DRAINAGE

Completed by Michael J. Madel and David DelSordo, Montana Department of Fish, Wildlife and Parks, 1 October, 1984.

Habitat component code definitions for orthophotograph base maps (quads #1-5). Component descriptions are in the 1984 Annual Monitoring and Investigations Report (Aune, K., T. Stivers, and M. Madel. 1984).

<u>Blue</u>	PG or PrGr	Prairie grassland
	Hay Mdw	Irrigated and subirrigated hay meadow
	AGRI	Plowed agricultural lands
	M	Mountain grassland M3 - Well developed grass and forb layer M2 - Moderately developed M1 - Poorly developed
	GSP	Graminiod sidehill park
<u>Purple</u>	P1	Dry aspen POTRE/SYAL
	P2	Wet aspen POTRE/Salix
	P3	Cottonwood stands
<u>Green</u>	S	Snowchutes S1 - Xeric, graminiod dominated S2 - Mexic, forb and shrub dominated
	WM	Wet meadow
	M	Marsh
<u>Red</u>	S1	Shrubfield, dominated by <u>Sheperdia canadensis</u>
	S2	Shrubfield, dominated by mixed shrub species
	RS	Riparian shrubfield
	RC	Riparian complex
<u>Black</u>	OT	Open timbered
	CT	Closed timbered

TS	Timbered shrubfield
RTS	Rock, talus, scree
C1	Clearcuts and various cutting units that are dominated by graminoids with sparse regeneration
C2	Cutting units dominated by shrub species with moderate regeneration

Appendix D. Grizzly bears captured on the East Front, 1977-1984

DATE OF CAPTURE	NO.	SEX	AGE (1984)	LOCATION	EAR TAG (TYPE)	FATE
5/04/77	257	F	15½	Blackleaf	Orange/Yellow (metal)	Recaptured & Radioed 6/13/80 Recaptured & radioed w/ helicopter in August, 1982.
5/07/77	110	F	2½*	Blackleaf	Red/Yellow (metal)	Recaptured 6/9/77, relocated, dead 1977.
5/25/77	271	M	7½*	Teton River	Blue/Yellow (metal)	Recaptured 5/20/78 & 5/9/79. Poached 1979.
6/08/77	273	F	10½	Teton River	Yellow (metal)	Recaptured 5/16/81 & radioed. Illegally killed 9/23/84
5/20/78	218	M	14½	Teton River	Blue/Red (metal)	Radio nonfunctional, possibly alive.
5/29/78	531	M	9½	Blackleaf	Silver/Orange (metal)	Relocated 1978 to Flathead.
6/16/78	282	M	8½	Elk Cr.	Red (metal) & Green (rototag)	Recaptured & radioed 5/4/83. Hunter killed 10/24/84.
6/17/78	229	M	10½*	Elk Cr. / Dearborn	Blue/Yellow (metal)	Hunter-kill 1979
5/17/79	332	M	21½	Elk Cr.	Red/Yellow (metal)	Relocated to British Columbia
5/20/79	220	F	23½	Teton area	Yellow/Blue (metal)	Recaptured 6/8/79 & 4/29/81 & reradioed w/helicopter in May 1983.
5/22/79	333	M	6½	Blackleaf to Badger Cr.	Blue/Yellow (metal)	Recaptured 6/10/80 & 4/21/81. Lost collar in August, 1982.
5/23/79	203	M	6½	Teton area	Orange/Green (metal)	Sighted in 1981.
7/27/79	347	M	5½*	Dearborn area		Killed in 1980 by sheepherder
5/14/80	348	M	4½*	Blackleaf	Silver/Red (metal)	Killed in 1980 by USFWS near Lincoln, Montana.
5/20/80	335	F	6½	Blackleaf to Birch Cr.	Red/Orange (metal)	Recaptured 5/29/81 & radioed. Radio malfunctioned May 1984.
6/10/80	291	F	7½	Blackleaf	Red/Green (metal)	Fate unknown, radio nonfunctional.
8/14/80	223	M	9½	Blackleaf to Badger Cr.	Yellow/Blue (metal)	Fate unknown, radio nonfunctional.
8/07/80	430	F	2½*	Badger Cr.		Relocated & dead in 1980.
5/20/82	529	M	2½*	Teton to Sun River	Blue (rototag)	Recaptured & radioed 5/25/82. Hunter-kill, N. Fk. Sun River, 1982.
5/26/82	550	M	3½*	Blackleaf to Two Medicine	Blue (rototag)	Lost collar in July, 1982. Hunter-kill, Sept. 1983 after relocation.
6/18/82	518	F	3½	Teton to Deep Cr.	Red (rototag)	Far-tag transmitter. Recaptured in 1983. Hunter-kill 10/21/84.
6/27/82	519	M	1½*	Teton area	Blue (rototag)	Hunter-kill, Teton River, 1982
6/28/82	544	M	4½	Teton area	Blue (rototag)	Radioed in 1982, still functional. Recaptured 1984, Killed Sept, 1984 illegally.

* = age at death

Appendix D. Grizzly bears captured on the East Front, 1977-1984

DATE OF CAPTURE	NO.	SEX	AGE (1984)	LOCATION	EAR TAG (TYPE)	FATE
8/17/82	548	F	12½	Deep Cr.	Blue (rototag)	Captured & radioed w/helicopter, recaptured in 1983. Radio malfunctioned. Unknown
5/03/83	522	F	2½	Pine Butte	Red (rototag)	
5/27/83	524	F	2½	Rinkers Cr.	Red (rototag)	Radioed w/ear-tag transmitter; 1983. Radio malfunctioned.
5/31/83	500	F	5½	Teton River	Green (rototag)	Radioed, still operate, 1984.
6/10/83	498	M	5½	Willow Cr.	Green (rototag)	Radioed, still operate, 1984.
7/10/83	485	M	8½	Whiterock Creek	Green (rototag)	Radioed, still operate, 1984.
4/06/84	328	M	2½	Teton	Green (rototag)	Recaptured 6/26/84. Radioed, recaptured 5/19/84.
6/20/84	313	F	3½	Two Medicine	Green (rototag)	Radioed
6/26/84	366	F	5½	Two Medicine	Green (rototag)	Radioed
7/06/84	355	M	8½	Two Medicine	Green (rototag)	Radioed
8/23/84	378	M	2½	Teton	Green (rototag)	Helicopter darted, radioed, recaptured 9/27 at depredation site relocated to S. Fk. Flathead
9/10/84	317	F	3½	Teton	Green (rototag)	Radioed
9/18/84	372	F	8½	Alice Ck.	Green (rototag)	Radioed, relocated to S. Fk. Flathead - returned.
9/18/84	343	M	½	Alice Ck.	Green (rototag)	Cub of bear 372
9/25/84	392	M	2½	Teton	Green (rototag)	Radioed
10/02/84	326	M	1½	Teton	Green (rototag)	Radioed, collar slipped in November, 1984

Table 2. Grizzly bears relocated to the East Front, 1977-1983.

RELOCATION DATE	NO.	SEX	AGE (1984)	LOCATION	EAR TAG (TYPE)	FATE
10/12/80	512	F	4½	Sun River	Red/Silver (metal)	Moved back into Hungry Horse Res.
10/16/80	540	F	20+	Sun River	Red (rototag)	Hunter-kill in Sun River, 1981
10/16/80	541	?	2½	Sun River	Blue (rototag)	Unknown
10/16/80	542	?	2½	Sun River	Blue (rototag)	Unknown

Appendix E. Black bears captured on the East Front, 1976-1984.

DATE OF CAPTURE	NO.	SEX	AGE (1984)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
9/15/76	190	F	14½	Badger Cr.	Blue/Green (metal)	Black	Recapture 6/27/77
9/20/76	153	F	Adult	Badger Cr.	Red/Green (metal)	Black	Recapture 10/16/76
10/01/76	150	M	Adult	Badger Cr.	Red/Blue (metal)	Black	Unknown
10/02/76	2	M	Adult	Badger Cr.	Yellow (metal)	Black	Unknown
10/07/76	3	M	10½	Badger Cr.	Yellow (metal)	Brown	Unknown
4/30/77	117	M	12½	Dupuyer Cr.	Yellow/Blue (metal)	Black	Recapture 5/ 3/77
5/09/77	173	M	10½	Dupuyer Cr.	Yellow/Blue (metal)	Black	Unknown
5/09/77	262	M	16½	Dupuyer Cr.	Yellow/Orange (metal)	Brown	Recapture 6/ 3/78
5/22/77	207	F	9½	Teton River	Blue/Orange (metal)	Brown	Unknown
5/23/77	201	M	5½*	Teton River	Orange (metal)	Black	Killed 1980
5/27/77	265	M	7½*	Teton River	Blue/Yellow (metal)	Brown	Recapture 5/10/78
6/05/77	274	M	9½	Teton River	Yellow/Blue (metal)	Black	Hunter-kill 1980 Unknown
6/08/77	209	F	20+	Teton River	Orange/Silver (metal)	Brown	Unknown
6/19/77	213	M	9½	Badger Cr.	Blue/Green (metal)	Black	Unknown
6/25/77	219	M	15½	Badger Cr.	Blue/Green (metal)	Black	Recapture 6/28/77
6/26/77	204	M	10½	Badger Cr.	Orange/Silver (metal)	Black	Unknown
5/10/78	256	M	6½*	Teton River	Orange/Red (metal)	Brown	Killed 6/ 3/79
5/12/78	211	M	17½	Teton River	Yellow/Orange (metal)	Black	Relocated/Blackleaf 8/21/80
6/06/78	212	M	7½*	Blackleaf	Blue/Red (metal)	Black	Recaptured 9/25/80 & 6/23/81 & radioed Recaptured 5/24/82 Hunter-kill 7/11/82
6/13/78	202	M	13½	Elk Cr.	Orange/Blue (metal)	Brown	Recapture 5/2/84 @ Elk Creek
6/14/78	205	M	Adult	Elk Cr.	Orange/Red (metal)	Black	Unknown
5/20/79	288	M	15½	Blackleaf	Green/Red (metal)	Brown	Recaptured 5/10/80 & 6/29/82 & radioed. Radio off Sept. 1982

* = age at death

806/3/5

Appendix E. Black bears captured on the East Front, 1976-1984, (continued).

DATE OF CAPTURE	NO.	SEX	AGE (1984)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
5/28/79	255	F	8½	Teton River	Orange/Silver (metal)	Brown	Recaptured 5/16/82
6/09/79	115	M	12½	Teton River	Yellow/Green (metal)	Brown	Unknown
6/09/79	294	M	9½*	Teton River	Green/Orange (metal)	Black	Recaptured 5/23/82
5/19/80	329	M	5½*	Blackleaf	Yellow/Red (metal)	Black	Hunter-kill 5/23/82 Hunter-kill 8/6/80 @ Cave Mtn.
5/21/80	223	M	7½	Blackleaf	Blue (rototag)	Brown	Unknown
5/28/80	538	M	5½*	Blackleaf	Blue (rototag)	Brown	Hunter-kill June 83 @ Ford Cr.
5/30/80	505	M	6½	Blackleaf	Red (rototag)	Black	Recaptured 9/1/80
6/07/80	542	M	5½*	Blackleaf	Blue (rototag)	Black	Hunter-kill 10/28/82 @ Green Timber Gulch
6/09/80	509	F	13½	Blackleaf	Red (rototag)	Black	Recaptured 5/14/81 & radioed, observed 8/22/84
5/20/81	545	F	6½	Blackleaf	Blue (rototag)	Black	Recaptured 5/21/81
5/23/81	546	F	6½	Blackleaf	Blue (rototag)	Brown	Unknown
5/27/81	516	M	6½	Blackleaf	Red (rototag)	Brown	Unknown
5/02/82	539	M	4½*	Teton River	Blue (rototag)	Brown	Shot 11/3/83 Patricks Basin
5/17/82	513	M	4½	Teton River	Red (rototag)	Brown	Recaptured 6/19/83, 5/17/84 on Sun River GMA
5/17/82	514	M	2½*	Teton River	Red (rototag)	Brown	Recaptured 6/26/82 Hunter-kill 10/2/82 @ Jones Cr.
5/22/82	531	F	6½	Dupuyer Cr.	Blue (rototag)	Black	Unknown
6/19/82	523	F	8½	Teton River	Red (rototag)	Black	Radioed until 5/25/84 when collar was cast
6/24/82	517	M	6½	Teton River	Red (rototag)	Black	Radioed also recaptured May, 1983, collar dead
7/12/82	533	F	10½*	Badger Cr.	Blue (rototag)	Brown	Shot 10/19/83 in Badger Cr.

* = age at death

Appendix E. Black bears captured on the East Front, 1976-1984, (continued).

DATE OF CAPTURE	NO.	SEX	AGE (1984)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
4/30/83	530	M	7½	Blubber Cr.	Blue/Green (rototag)	Brown	Recaptured 5/27/83, 5/4/84, renumbered 354 on 6/3/84.
4/30/83	535	M	4½	Blubber Cr.	Blue/Green (rototag)	Black	Recaptured 6/17/83, renumbered 365 on 5/12/84
5/18/83	536	M	11½	Blubber Cr.	Blue (rototag)	Black	Recaptured 5/27/83 & 6/15/83, 5/12/84
5/19/83	506	M	5½*	Pine Butte	Red (rototag)	Black	Radioed, Hunter-kill Sept. 84 at Jones Creek
5/24/83	515	M	5½	Rinkers Cr.	Red (rototag)	Black	Radioed until 5/11/84, collar dead.
5/27/83	537	M	3½	Blubber Cr.	Blue (rototag)	Black	Unknown
6/11/83	532	M	5½*	Willow Cr.	Blue (rototag)	Black	Hunter-kill on April 21, 1984 at Ford Creek
6/12/83	525	F	5½	Blubber Cr.	Red (rototag)	Black	Unknown
6/13/83	534	M	4½	Sun River Game Range	Blue (rototag)	Black	Recaptured 6/27/83, 5/11/84
6/16/83	478	M	4½	Sun River Game Range	Green (rototag)	Black	Unknown
6/17/83	479	F	2½	Beaver Cr.	Green (rototag)	Black	Unknown
¹ 6/18/83	520	M	3½	Blubber Cr.	Red (rototag)	Black	Unknown
6/20/83	507	M	2½	Blubber Cr.	Red (rototag)	Black	Recaptured 6/22/83, 5/17/84
6/21/83	477	F	11½	Willow Cr.	Green (rototag)	Brown	Unknown
6/25/83	491	F	3½	Beaver Cr.	Green (rototag)	Black	Unknown
6/25/83	492	M	6½	Beaver Cr.	Green (rototag)	Brown	Unknown
6/27/83	494	F	11½	Rose Cr.	Green (rototag)	Black	Unknown
6/27/83	476	M	4½	Willow Cr.	Green (rototag)	Black	Unknown
¹ 7/12/83	520	M	4½	N. Fk. Badger Cr.	Red (rototag)	Cinnamon	Unknown
7/12/83	547	M	6.5*	Whiterock	Blue (rototag)	Black	Recaptured 6/4/84 Hunter-kill September 1984 at Badger Creek
8/05/83	401	F	5½	S.F.K. Teton	Green (rototag)	Black	Nuisance bear captured at 8. Bear moved to Blackleaf.

¹ Two black bears inadvertently #'d the same - one is cinnamon and one is black.

Appendix E. Black bears captured on the East Front, 1976-84, (continued)

DATE OF CAPTURE	NO.	SEX	AGE (1984)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
5/02/84	327	M	10½	Willow Cr.	Green (rototag)	Brown	Unknown
5/05/84	352	M	7½	Beaver Cr.	Green (rototag)	Black	Unknown
5/07/84	455	M	2½	Blubber Cr.	Green (rototag)	Cinnamon	Unknown
5/08/84	353	M	2½	Beaver Cr.	Green (rototag)	Cinnamon	Unknown
5/08/84	475	M	7½	Elk Cr.	Green (rototag)	Black	Unknown
5/10/84	364	F	2½	Sun River Game Range	Green (rototag)	Brown	Unknown
5/10/84	339	M	9½	Ford Cr.	Green (rototag)	Brown	Unknown
5/10/84	344	M	1½	Beaver Cr.	Green (rototag)	Blonde	Unknown
5/12/84	332	M	2½	Blubber Cr.	Green (rototag)	Cinnamon	Unknown
5/13/84	375	M	14½	Sun River Game Range	Green (rototag)	Black	Unknown
5/14/84	331	F	5½	Willow Cr.	Green (rototag)	Brown	Unknown
5/19/84	388	M	2½*	Smith Cr.	Green (rototag)	Brown	Hunter-kill in October 1984 Elk Creek
5/22/84	380	F	20½	Shed Cr.	Green (rototag)	Cinnamon	Unknown
5/22/84	387	M	1½	Shed Cr.	Green (rototag)	Black	Unknown
5/23/84	389	F	2½	Beaver Cr.	Green (rototag)	Black	Unknown
5/26/84	393	M	9½*	Elk Cr.	Green (rototag)	Black	Hunter-kill on August, 1984 Elk Cr.
6/02/84	383	M	3½	Blubber Cr.	Green (rototag)	Black	Unknown
6/03/84	399	M	4½*	Elk Cr.	Green (rototag)	Brown	Hunter-kill October 19, 1984, Bighorn Lake
6/04/84	318	M	2½	Cross Cr.	Green (rototag)	Black	Unknown
6/05/84	360	M	2½	Hyde Cr.	Green (rototag)	Black	Unknown
6/07/84	356	F	4½	Mettler Coulee	Green (rototag)	Black	Unknown
6/09/84	345	F	4½	Cyanide Cr.	Green (rototag)	Blonde	Unknown
6/11/84	336	F	8½	Mettler Coulee	Green (rototag)	Black	Unknown
6/19/84	322	M	5½	Mettler Coulee	Green (rototag)	Cinnamon	Unknown

Appendix E. Black bears captured on the East Front, 1976-84, (continued)

DATE OF CAPTURE	NO.	SEX	AGE (1984)	LOCATION	EAR TAG (TYPE)	COLOR	FATE
6/19/84	386	F	2½	Hyde Cr.	Green (rototag)	Black	Unknown
6/24/84	349	M	13½	Hyde Cr.	Green (rototag)	Black	Unknown
6/25/84	348	M	2½	Box Cr.	Green (rototag)	Black	Unknown
6/28/84	397	M	9½	Mettler Coulee	Green (rototag)	Black	Unknown
6/28/84	330	M	2½	West Fork Sun R.	Green (rototag)	Blonde	Unknown
7/01/84	400	F	2½	S. Fk. Sun River	Green (rototag)	Black	Unknown
7/03/84	390	M	12½	West Fork Sun R.	Green (rototag)	Brown	Unknown
8/26/84	376	M	2½*	Simms	Green (rototag)	Black	Relocated to SRGR, Hunter-kill 9/11/84 in Sun River Canyon
10/07/84	340	M	2½	Smith Cr.	Green (rototag)	Cinnamon	Relocated to Beartooth GMA.

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Appendix F. Grizzly bear management guidelines, East Slope, Rocky Mountain Front.

Introduction

The Interagency Rocky Mountain Front Wildlife Monitoring/Evaluation Program was initiated in 1980. A principal goal of this program was to sponsor study efforts; whereby wildlife management guidelines, based on sound scientific findings, could be developed to aid land managers in their planning of human activities along the Rocky Mountain Front.

The original charter for this program specified that management guidelines were to be considered "interim" until five years of study had been incorporated into them. However, the guidelines developed thus far are currently being used as firm guidance by the involved agencies. Further, at the end of this five year period these guidelines should not be locked in concrete by the term "final". It is highly likely that studies will continue and additional findings will dictate new or revised guidelines. Therefore, these two terms will not be used and the management guideline development process and associated document are to be considered part of a dynamic planning process subject to periodic review and modification as additional study findings become available and as long as the need for them is present.

In the event that on-going monitoring results in the need for a new guideline or the modification of an existing guideline, it can be submitted at anytime by the procedures described and on the form given on the last two pages of this document.

The following management guidelines are based on the best information currently available. They are a result of current or recently completed studies on selected wildlife species. Field investigators conducting the studies have completed extensive literature reviews on the various species considered. The guidelines which have been formulated and presented in this document are not only the result of study findings and literature review, but incorporate the professional judgement of the technical personnel involved.

Objective

The need for management guidelines is predicated on management concerns involving the effects of existing and proposed land uses and human activities upon various wildlife species and their habitat. The objective of the development and application of management guidelines is to avoid or minimize the following effects of human related activities which may adversely impact some or all of the selected wildlife species being considered:

- A. Physical destruction of important wildlife habitat components.

- B. Human disturbance that would displace various wildlife species from important seasonal use areas.
- C. Increased direct human caused mortality.
- D. Increased stress due to higher human activity levels.
- E. Direct mortality or physical impairment resulting from environmental (chemical) contaminates.
- F. Increased wildlife/human interaction resulting from habitat intrusion or displacement.

Management Guidelines

Management guidelines provide coordination measures designed to avoid or minimize the potential conflicts previously identified between human related activities and wildlife. Although many of the guidelines are applicable to a variety of human activities, some of them are specific to a single activity. Oil and gas exploration and development has received special emphasis due to the relatively high level of activity in recent years. As a result, some of the guidelines apply specifically to that activity.

Approved management guidelines will be included in permits, contracts or other formal authorizations for human activities as applicable. Omissions or modifications of applicable guidelines in such authorizations will be documented in an EA report or other appropriate document concerning the activity involved.

Monitoring

A majority of the radio tracking and habitat survey data collected to date has been baseline information including the identification of seasonal ranges, reproduction areas, breeding areas and migration corridors. Future studies will place increasing emphasis on the monitoring of effects of increased human activity levels, particularly those associated with oil and gas exploration, on the wildlife species being studied. The management guidelines presented in this document are only partially based on monitoring information collected during the current studies on the Rocky Mountain Front. An important consideration in further monitoring efforts will be to test and validate the guidelines as to their effectiveness and applicability.

PART A. General Management Guidelines

The following general management guidelines are applicable coordination measures that will be considered when evaluating the effects of existing and proposed human activities in identified seasonally important habitats for a variety of wildlife species.

1. Identify and evaluate for each project proposal the cumulative effects of all activities, both existing uses and

other planned projects. Potential site specific effects of the project being analyzed are a part of the cumulative effects evaluation which will apply to all lands within a designated biological unit. A biological unit is an area of land which is ecologically similar and includes all of the year long habitat requirements for a sub-population of one or more selected wildlife species.

2. Avoid human activities or combinations of activities on seasonally important wildlife habitats which may adversely impact the species or reduce the habitat effectiveness.
3. Space concurrently active seismographic lines at least nine (9) air miles apart to allow an undisturbed corridor into which wildlife can move when displaced. One line survey crew will be allowed to work between active lines in order to reduce the total time of activity in any one area (Olson, G. 1981).
4. Establish helicopter flight patterns of not more than one-half (½) mile in width along all seismographic lines, between landing zones and the lines, and between landing zones and other operations, unless flying conditions dictate deviations due to safety factors.
5. Because helicopters produce a more pronounced behavioral reaction by big game and raptors than do fixed-wing aircraft, helicopters will maintain a minimum altitude of 600 feet (183 meters) above ground level when flying between landing zones and work areas where landing zones are not located on seismic lines, unless species specific guidelines recommend otherwise (Hinman, H., 1974; McCourt, K.H., et al 1974; Klein, D.R., 1973; Miller, F.L. and A. Guinn, 1979).
6. Designate landing zones for helicopters in areas where helicopter traffic and associated human disturbances will have the minimum impact on wildlife populations. Adequate visual and/or topographic barriers should be located between landing zones and occupied seasonal use areas.
7. The use of helicopters instead of new road construction to accomplish energy exploration and development is encouraged.
8. Base road construction proposals on a completed transportation plan which considers important wildlife habitat components and seasonal use areas in relation to road location, construction period, road standards, seasons of heavy vehicle use, road management requirements, etc.
9. Use minimum road and site construction specifications based on projected transportation needs. Schedule construction times to avoid seasonal use periods for wildlife as designated in the species specific guidelines.

10. Locate roads, drill sites, landing zones, etc. to avoid important wildlife habitat components based on a site specific evaluation.
11. Insert "dog-legs" or visual barriers on pipelines and roads built through dense vegetative cover areas to prevent straight corridors exceeding one-fourth ($\frac{1}{4}$) mile where vegetation has been removed (Stubbs, C.W. and B.J. Markham, 1979).
12. Roads which are not compatible with area management objectives and are no longer needed for the purpose for which they were built will be closed and reclaimed. Native plant species will be used whenever possible to provide proper watershed protection on disturbed areas. Wildlife forage and/or cover species will be utilized in rehabilitation projects where deemed appropriate.
13. Keep roads which are in use during oil and gas exploration and development activity closed to unauthorized use. Place locked gates and/or road guards at strategic locations to deter unauthorized use when activities are occurring on key seasonal ranges.
14. Impose seasonal closures and/or vehicle restrictions based on wildlife or other resource needs on roads which remain open.
15. Bus crews to and from drill sites to reduce activity levels on roads. Shift changes should be scheduled to avoid morning and evening wildlife feeding periods.
16. Keep noise levels at a minimum by muffling such things as engines, generators and energy production facilities.
17. Prohibit dogs during work periods.
18. Prohibit firearms during work periods or in vehicles traveling to and from work locations.
19. Seismographic and exploration companies should keep a daily log of activities. Items such as shift changes, shut down/start up times, major changes in noises or activity levels, and the location on the line where seismic crews are working should be recorded.

PART B: Species Specific Management Guidelines

The species specific management guidelines which follow provide coordination measures necessary to protect important habitats or seasonal use areas for several wildlife species which were selected for intensive baseline surveys on the Rocky Mountain Front Study Area. Monitoring of the effects of human activities

on these species and their habitats will continue to receive special study emphasis.

Maps which delineate the seasonally important habitats for which timing restrictions are specified have not been included in the management guideline document and are not available for general distribution. Copies of these maps are available for inspection at the offices of the four Agencies involved in the Rocky Mountain Front Wildlife Monitoring Program.

These guidelines together with the "general management guidelines" will minimize, but not eliminate, the impacts of disturbances caused by human activities on these species. Species specific guidelines are currently available for grizzly bear, mountain goat, bighorn sheep, elk, mule deer and raptors.

Grizzly Bear

Study results documented to date along the east Rocky Mountain Front are the basis for the development of management guidelines for grizzly bear and their habitat. During the period from 1977-1979, research was carried out by the Border Grizzly Project under a contract with the Bureau of Land Management.

Since 1980 the Montana Department of Fish, Wildlife and Parks has assumed the intensive grizzly bear monitoring work with funding continuing from the Interagency Monitoring Group, private industry (American Petrofina, Williams Exploration, Superior Oil Co., Sun Exploration) and the Nature Conservancy.

These guidelines are based on the intensive grizzly bear monitoring information collected in recent years on the Rocky Mountain Front Study Area. They will be considered tentative and subject to revision as long as radio monitoring studies and associated habitat surveys are continued on grizzly bear in the area. Much of the information collected to date is concentrated in the area between the Teton River and the North Fork Dupuyer Creek. Intensive monitoring work will be expanded to other areas as funding becomes available. These guidelines were developed as a direct result of grizzly bear monitoring conducted on the east front. They represent guidelines that, when followed, will mitigate but not eliminate influences of human activities on grizzly bears and grizzly bear habitat. Human activities within grizzly bear range will have effects, however subtle, on grizzly bears.

All previously mentioned "general management guidelines" are applicable coordination measures that should be considered when evaluating human activities in grizzly bear habitat. The following are additional species specific guidelines.

1. Avoid human activities in identified grizzly bear habitat constituent elements or portions of constituent elements

containing specific habitat values during the following seasonal use periods (see data summarization):

- A. Spring habitat (concentrated use areas)----April 1 - June 30
 - B. Breeding areas-----May 1 - July 15
(Currently identified breeding areas include upper Muddy Creek, the head of Rinkers Creek, the Far Mountain area, and the head of the North Fork Dupuyer Creek)
 - C. Alpine feeding sites-----July 1 - September 15
 - D. Subalpine fir/whitebark pine habitat types--August 1 - November 30
 - E. Denning habitat-----October 15 - April 15.
- 2. Avoid human activities in grizzly bear habitat components which provide important food sources during spring and early summer, April 1 - July 15. These habitat components include riparian shrub types, Populus stands, wet meadows, sidehill parks, and avalanche chutes. Maintain an undisturbed zone of at least $\frac{1}{4}$ mile between activities and the edge of these habitat components where many important bear foods occur.
 - 3. Establish flight patterns in advance when activities require the use of helicopters. Flight patterns should be located to avoid seasonally important grizzly bear habitat constituent elements and habitat components during the designated seasonal use periods.
 - 4. No seismic or exploratory drilling activities should be conducted within a minimum of one mile of den sites during the October 15 - April 15 period (Reynolds, P.E., et al, 1983).
 - 5. Seismic permits should include a clause providing for cancellation or temporary cessation of activities, if necessary, to prevent grizzly/human conflicts.
 - 6. Scheduling of well drilling on adjacent sites, within important grizzly bear use areas, should be staggered to provide a disturbance free area for displaced bears.
 - 7. Pipeline construction required for the development of a gas or oil field should be condensed into the shortest time frame possible and subject to seasonal restrictions when conducted in important grizzly bear habitat.
 - 8. Field operation associated with seismic or oil/gas exploration activities should be placed carefully to avoid seasonally important habitat components or constituent elements. Such placement of sites is necessary in order to avoid direct or potential conflicts between man and grizzly bear.

9. Retain frequent dense cover areas adjacent to roads for travel corridors and security cover necessary to protect important habitat components. Three sight distances are desirable to provide visual security for grizzlies. A sight distance is the average distance at which a grizzly or other large animal is essentially hidden from the view of an observer by vegetation cover. The same security cover guidelines also applies to timber harvest units.
10. No off-duty work camps will be allowed within occupied seasonally important constituent elements.
11. Incinerate garbage daily or store in bear proof containers and remove to local landfill dumps daily.
12. Commercial activities permitted on public land should be planned and coordinated to avoid conflicts with grizzly bear trapping operations being conducted under the monitoring program. General public use of areas where trapping operations are active will be controlled through appropriate administrative actions by the agencies involved.

The following are grizzly bear management guidelines specifically oriented toward livestock grazing:

1. Livestock grazing on important spring habitat for grizzly bears should be deferred until after July 1.
2. Boneyards and livestock dumps are prevalent along the east front and are frequented by grizzly bears. Ranchers and landowners should be encouraged to place carcasses of dead livestock and garbage on remote areas of their land. Dead cows and calves should be hauled a considerable distance from calving grounds to discourage bears from feeding on carrion and newborn calves.
3. Sheep grazing allotments in management situation No. 1, as defined in the Yellowstone Guidelines, on lands administered by government agencies should be eliminated.
4. In riparian habitats that receive high amounts of bear use, fencing to exclude livestock grazing and trampling may be necessary where livestock turn-out dates prior to July 1 are allowed.

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