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BLACK BEAR DENS IN THE BEARTOOTH FACE, SOUTH-CENTRAL MONTANA

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Abstract: Thirty-three black bear (*Ursus americanus*) dens were located on the Beartooth Face of south-central Montana during the winters of 1984/85 through 1986/87. Mean slope (28°) and elevation (2,239 m) of den sites did not significantly differ between males and females. Most (61%, $N = 33$) den sites were located on northerly (northeast, north, and northwest) aspects. Most (71%, $N = 16$) dens inspected required some form of excavation. In 1986, den entrance began the last week of September and lasted 4-5 weeks. The largest number of bears entered dens between 8-15 October. Twenty and 18% of radio-collared bears abandoned den sites and relocated to new dens during 1985-86 ($N = 15$) and 1986-87 ($N = 11$), respectively. Security of dens appeared to be important, especially for females with cubs, and was related to bears denning on high elevation, steep slopes away from disturbance.

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The importance of the black bear as a game animal in Montana (Aderhold 1984) and the concern over potential impacts of mining and timber operations in the Beartooth Face (Greer 1987) have increased the need for gathering ecological information on the black bear in this region. Accordingly, studies were undertaken to determine the status and describe the behaviors and habitat requirements of black bears in the Beartooth Face area (Rosgaard and Simmons 1982, Greer 1987, Mack 1988).

Although considerable information on den characteristics and denning chronology of black bears exists (Jonkel and Cowan 1971, Lindzey and Meslow 1976, Alt et al. 1980, Hamilton and Marchinton 1980, Tietje and Ruff 1980, Novick and Stewart 1982, Beecham et al. 1983, LeCount 1983, O'Pezio et al. 1983), I found no studies describing black bear denning characteristics in the east slope of the Rocky Mountains. In this paper, I describe den site characteristics of black bears in the Beartooth Face.

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STUDY AREA

Physiography

The 570-km² study area includes the northwestern portion of the Beartooth Mountains in south-central Montana (Fig. 1). The area is a topographically and geologically complex transition zone located between relatively flat, low elevation (approximately 1,250 m) plains to the north and the East Boulder Plateau and

Beartooth Mountains (approximately 3,000 m) to the south. Elevations on the study area increase from north to south and range from 1,676 m to 3,075 m on Iron Mountain. Steep, timbered drainages, rocky cliffs, exposed bedrock, and sparsely vegetated ridges and hill-sides characterize the area. Open grassy meadows are scattered throughout the study area on benches or in drainage bottoms.

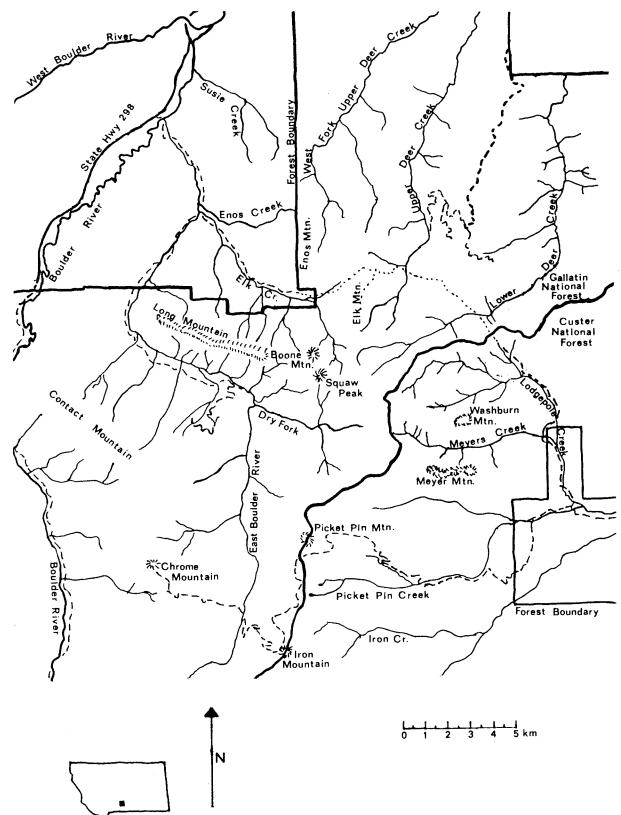


Fig. 1. Map of Beartooth Face study area, Montana, 1984-1987.

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Vegetation

Forests dominate the study area. Climax communities included dry, low sites of limber pine (*Pinus flexilis*) and Douglas-fir (*Pseudotsuga menziesii*) and moist high sites of spruce (*Picea* spp.) and subalpine fir (*Abies lasiocarpa*). Below 2,743 m, lodgepole pine (*Pinus contorta*) is a seral species. Patches of aspen (*Populus tremuloides*) occur in areas with a high water table. In the upper subalpine zone, whitebark pine (*Pinus albicaulis*) is found in homogeneous stands or in association with subalpine fir and lodgepole pine (Pfister et al. 1977).

Non-forested areas include dry grassland, sagebrush (*Artemisia* spp.), wet site forb, and sedge (*Carex* spp.) communities. Sparsely vegetated alpine tundra occurs above 2,926 m.

Climate

The study area has a continental montane climate. Mean annual temperature ranges from approximately 5.5 C at lower elevations to 3.7 C at the highest elevations. Precipitation varies from about 51 cm at lower elevations to 178 cm at higher elevations (Johnson 1977). Fifty percent and 75-80% of the precipitation is in the form of snow at lower and higher elevations, respectively (Dakotas Planning Team 1978).

Administration and Land Use

The Gallatin and Custer National Forests control nearly 100% of the study area (Fig. 1). Private land surrounds all but the southern portion of the study area. Small scattered tracts of private land are located in the East Boulder River and Elk Creek drainages. Cattle and domestic sheep grazing (especially on private land) are the primary agricultural activities in the study area.

Timber harvest is occurring in the East Boulder River drainage and roads have been completed for future harvest in the Upper Deer Creek drainage. Exploratory mining operations are scheduled in spring 1989 for a platinum-palladium mine located near the East Boulder River. Except for hunting, minimal recreational activity occurs on the study area due to limited public access.

METHODS

Bear Capture

Black bears were captured in steel cable foot snares, immobilized, and eartagged. Colored armortite streamers were placed in each ear to allow identification of individual bears. In an effort to study adult bears, only females heavier than 41 kg and males heavier than 68 kg

were radio-collared with transmitters (150-152 MHz, AVM Inc., Champaign, IL).

Denning Data

Other than universal transverse mercator (UTM) locations obtained for den sites in 1984 and 1985, the most intensive den work was done in the spring 1986 and winter 1986-87. Den entrance and emergence dates were determined using radio-telemetry locations from aircraft flights and ground work. Elevation, aspect, and slope were determined for each den from locations plotted on topographic maps. For dens inspected on foot, aspect was determined with a compass. Analysis of variance and the Student's *t*-test were used to determine significant ($P < 0.025$) differences in physical characteristics of den sites.

RESULTS

Den Structures

Locations of 33 bear den sites were made from fixed-wing aircraft during the winter months of 1984-87. Types of black bear den cavities were identified at 16 sites: 4 were inspected on foot by MDFWP personnel before 1985, 4 were identified from an aircraft, and 3 and 5 den sites were inspected on foot by me in 1986 and 1987, respectively (Table 1).

Slope, Elevation, and Aspect

Fifty-eight percent of 33 den sites were associated with moderately steep (20°-40°) rock or talus outcrops. Mean slope and elevation of den sites did not differ between sexes or between years (Tables 2 and 3). Mean slope and elevation was 27.8° and 2,239 m, respectively. Most (61%) dens were located on northerly (northwest, north, northeast) aspects (Fig. 2). Thirty percent were located on southerly aspects and 3% each were located on east, west, and flat aspects.

Table 1. Types of black bear den cavities examined on the Beartooth Face, Montana, 1984-1987. Twelve den sites were visited on foot and 4 were visually observed from fixed-wing aircraft.

Type of den cavity	Number	Percent
Rock crevice	3	18.75
Rock outcrop/talus	4	25.00
Under boulder	4	25.00
Under stumps/roots	3	18.75
Excavation in hillside	2	12.50

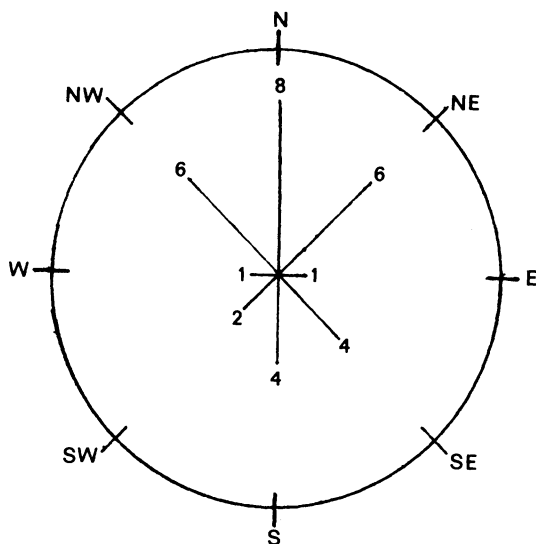


Fig. 2. Number of bear dens located at 8 compass directions on the Beartooth Face from 1984-85, 85-86, and 86-87. One den site was considered flat.

Denning Chronology

Den emergence dates were determined for the spring of 1986 only. That year, all black bears were still in dens the first week in March. However, 1 barren adult female did emerge from her den on 7 March as a result of human research disturbance. This female relocated to a new den site. Bears began emerging from dens by the first week of April. By the second week of April, 8 of 13 radio-collared bears had emerged from their dens and by the first week in May all bears had emerged from their dens.

Black bear den entrance dates were determined for the fall of 1986 only. Entrance dates appeared to occur over a period of 4-5 weeks with most bears (10 of 11) denned by 31 October. One adult male denned sometime between 24 September and 7 October. Peak denning occurred between 8-15 October when 4 (36%) bears denned. Three bears denned between 16-22 October and 2 more denned between 23-31 October. The last radio-

Table 2. Mean slope (in degrees) of den sites for male and female black bears for winters 1984-85, 1985-86, and 1986-87 along the Beartooth Face. Sample size is in parentheses. Student's *t*-test was used to determine significant differences between males and females.

Year	Mean slope				Both sexes	<i>P</i>
	Males	Range	Females	Range		
1984-85	31.3 (3)	26-37	29.0 (4)	26-31	30.0 (7)	0.77
1985-86	28.4 (5)	26-31	27.0 (9)	14-44	27.5 (14) ^a	0.62
1986-87	20.3 (3)	13-28	28.9 (8)	20-36	26.6 (11)	0.04
1984-87 ^b					27.8 (32)	0.52

^a Slope could not be determined for 1 den site.

^b Analysis of variance was used to determine significant differences of the combined sexes between years.

collared bear (a subadult female) denned between 1 November and the next radio-location flight on 4 February 1987.

Den Abandonment

Five cases of den abandonment occurred during the study; 3 (20%) in 1985-86 and 2 (18%) in 1986-87. All 5 individuals relocated to new dens. Three of 5 cases of den abandonment followed human disturbance. Two of the 3 were females with yearlings, the other was a barren female referred to above. In 1986, 1 female abandoned her first den and relocated to a second den where she was observed with cubs. One subadult male abandoned his den in April 1986; the cause was unknown.

DISCUSSION

Denning

Dens of black bears in the Beartooth Face were located on steep slopes (94% between 20-40°, *N* = 32) and high elevations (\bar{x} = 2,239 m, *N* = 33). Beecham et al. (1983) found 52% of all dens on 20°-40° slopes in west-central Idaho. LeCount (1983) found 68% of all dens in central

Table 3. Mean elevation (m) of den sites for male and female black bears for winters 1984-85, 1985-86, and 1986-87 along the Beartooth Face. Sample size is in parentheses. Student's *t*-test was used to determine significant differences between males and females.

Year	Mean elevation				Both sexes	<i>P</i>
	Males	Range	Females	Range		
1984-85	2,266 (3)	2,042-2,591	2,274 (4)	2,073-2,499	2,270 (7)	0.48
1985-86	2,233 (6)	1,768-2,682	2,159 (9)	2,073-2,408	2,189 (15)	0.29
1986-87	2,352 (3)	1,920-2,789	2,265 (8)	2,085-2,621	2,289 (11)	0.31
1984-1987 ^a					2,239 (33)	0.54

^a Analysis of variance was used to determine significant differences of the combined sexes between years.

Arizona were located on slopes between 20° and 40°. He also found elevation varied but 71% of all dens were found at elevations between 1,200 and 1,678 m. I found no differences between sexes in mean elevation or slope. Similarly, Beecham et al. (1983) found no differences in mean slope or elevation for male or female dens.

Most (61%) black bear dens in this study were located on northerly aspects. LeCount's (1983) data showed only 58% of the black bear dens in his study area were on northerly aspects. Beecham et al. (1983) found only 51% of dens in west-central Idaho on northerly aspects. Tietje and Ruff (1980) found more den sites faced north than south aspects in a relatively flat area in Alberta. Novick and Stewart (1982) found 7 of 8 dens in the San Bernardino Mountains of southern California on south aspects. In Yellowstone National Park, 10 of 11 grizzly (*Ursus arctos*) dens were located on northerly aspects (Craighead and Craighead 1972). Craighead and Craighead (1972) proposed that due to southwest winds, snow accumulated on north aspects and provided insulation for dens. This would reduce the probability of water entering the dens during warming periods, which may result in den abandonment (Hamilton and Marchinton 1980, Rogers 1987). This hypothesis, plus the observation that steep slopes provide better soil drainage characteristics (Beecham et al. 1983), may explain why bears in my study area denned on northerly aspects having relatively steep slopes.

Most dens observed in the Beartooth Face were associated with rock structures. Similarly, Novick and Stewart (1982) and LeCount (1983) found most dens in California and Arizona, respectively, were associated with rocks. In northwestern Montana, only 17% of dens were in rock caves whereas 55% were associated with hollow trees (Jonkel and Cowan 1971). LeCount (1983) suggested bears denned in rocks because of the lack of large trees, which may explain why bears in the Beartooth Face den in rock outcrops.

Arguments that black bears choose dens that are well concealed (Beecham et al. 1983, LeCount 1983) and inaccessible to humans (Novick and Stewart 1982) may explain why bears in my study area denned on high elevation, steep slopes that were not likely to be disturbed. Studies show and my results verify that bears readily abandon dens following human disturbance (Lindzey and Meslow 1976, Hamilton and Marchinton 1980, LeCount 1983). Hence, bears may minimize winter fat loss by denning in remote undisturbed areas. Tietje and Ruff (1980) found that following den abandonment, bears lost 25% of their body weight compared to a 16% loss for bears that did not abandon dens. Pregnant

females may experience considerable weight loss if disturbed, which could influence cub production and survival. If fat reserves drop too low, embryo implantation of fetal development may be halted (Rogers 1976).

In the Beartooth Face, most bears apparently enter dens during a 4- to 5-week period from late September through October. In southwestern Washington, bears entered dens over a 5-week period beginning 21 October (Lindzey and Meslow 1976). In Alberta, bears entered dens over a 4- to 5-week period beginning the first week of October (Tietje and Ruff 1980).

Some researchers believe fall food supply, not adverse weather conditions, influences den entrance (Tietje and Ruff 1980, Beecham et al. 1983, O'Pezio et al. 1983). However, Lindzey and Meslow (1976) felt the effects of weather did govern denning entrance. LeCount (1983) found denning chronology did not vary in relation to the severity of weather or the availability of food. I could not adequately relate food supply or weather to the onset of denning in the Beartooth Face in 1986.

Seclusion from humans and conspecifics may be reproductively important for females with cubs. In early spring, females with cubs were associated with steep, sparsely vegetated, dry, rocky areas. During spring, most bear hunters do not hunt in these relatively inaccessible areas and females with cubs have security there. Adult male black bears may prey upon young cubs (Schullery 1980) and it is possible females with cubs utilized these sparsely vegetated areas to avoid large aggressive bears.

Management Considerations

Human activity, such as logging, mining, and recreation, will probably continue to increase on the Beartooth Face in Montana. Despite the encroachment, however, much steep, rocky, terrain should remain inaccessible to humans, particularly during winter and early spring. This should provide an abundance of secure denning sites for black bears (particularly females) in the area.

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