

# BLACK BEAR HABITAT USE AT PRIEST LAKE, IDAHO

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**Abstract:** We studied black bear (*Ursus americanus*) habitat use patterns in northern Idaho from June 1980 to November 1981. Habitat availability was estimated with a random-dot technique and habitat use was determined from 676 radiolocations of 9 adult bears (5 female, 4 male). Black bears preferred selectively logged areas during spring, summer, and fall; clearcuts were avoided during all seasons. Habitat selection differed significantly between sexes. Female black bears preferred timber habitats and avoided roads; males used timber and roads in proportion to their availability.

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Black bear distribution in Idaho coincides with that of the coniferous forests (Beecham 1983). Little habitat use information is available for the geographically discrete black bear populations that inhabit these forests. Current silvicultural practices do not consider the potential impacts on black bear habitat and populations.

The Idaho Department of Fish and Game initiated a black bear habitat study at Priest Lake in 1980. The primary objective was to document seasonal habitat use emphasizing black bear-logging relationships. This paper summarizes our findings pertaining to these relationships.

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## STUDY AREA

The 228 km<sup>2</sup> study area is in the Selkirk Mountains in northern Idaho. Elevations range from 700 m at Priest Lake to 2,316 m at Twin Peaks. The topography is steep and rugged with exposed bedrock common above 1,675 m. The climate is influenced by Pacific Maritime air currents resulting in long, snowy winters and short, damp summers. Annual precipitation averages 82.5 cm.

Forests are dominated by the western hemlock (*Tsuga heterophylla*) potential climax series (Daubenmire and Daubenmire 1968) at lower (< 1,200 m) and middle (1,200-1,600 m) elevations. Pockets of the Douglas-fir (*Pseudotsuga menziesii*) series occur on xeric, low elevation sites. The western red cedar (*Thuja plicata*) series occurs on mesic sites at low to

mid elevations. Higher elevations (> 1,600 m) are dominated by the subalpine fir (*Abies lasiocarpa*) series; the subalpine fir/whitebark pine (*Pinus albicaulis*) series occurs above 1,800 m. An interspersed logging units, burned areas, and sidehill parks creates a diverse mosaic of plant communities in the area.

Timber production is the major land-use practice in the study area. Commercial logging began in the southern portions of the Selkirk Mountains during the mid-1940s. Harvesting proceeded northward until most of the commercially valuable timber had been logged by the mid-1960s. Parts of the study area have been commercially logged several times since the 1940s. White pine (*P. monticola*) saw logs (> 12 inches dbh) were selectively harvested initially. Subsequent harvests were primarily for poles (4 inches < dbh < 12 inches) or pulpwood in which a variety of tree species were removed. Other land uses at Priest Lake include backpacking, camping, hunting, fishing, snowmobiling, and firewood cutting.

Historically, wildfire was a significant factor affecting the Selkirk landscape, although effective fire suppression over the past 50 years reduced this influence (Zager 1981). Nevertheless, 2 large wildfires occurred in the Priest Lake area in 1967; the 20,000 ha Sundance burn bordering the study area on the south and the 5,000 ha Trapper Peak burn 18 km north of the study area.

## METHODS

We captured 9 adult black bears (5 female, 4 male) with foot snares, immobilized them with ketamine hydrochloride, and fitted them with radiotransmitters. Bear ages were estimated according to Stoneberg and Jonkel (1966). Each bear was located approximately once every 2 days and monitored until activity and the habitat component it occupied was determined. Radiolocations were used in the analysis when 1 or more of the following criteria were satisfied: instrumented bears were seen, heard, or estimated

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from signal strength to be less than 150 m from the observer (the accuracy of these estimates was checked by placing transmitters at known distances and estimating those distances from signal strength and by periodically checking signal strength against distances of instrumented bears that were seen); and if all of at least 3 compass bearings of a triangulation intersected at a single point within a large homogeneous habitat component. Radiolocations obtained at night were not used in the analysis.

Radio locations were stratified by season according to food habits. Spring (15 Apr–7 Jul) included the period after den emergence when their diet consisted primarily of herbaceous plants. Summer (8 Jul–15 Sep) commenced when bears moved to lower elevations to feed extensively on huckleberries (*Vaccinium globulare*). The fall season (16 Sep–1 Nov) began when bears switched from a diet of huckleberries to mountain ash (*Sorbus* spp.) and bearberry (*Arctostaphylos uva-ursi*), and continued until they entered their dens.

A habitat component hierarchy (Zager et al. 1980, Servheen 1981, Zager 1981) was modified to classify black bear habitat at Priest Lake (Table 1). Habitat components were used rather than habitat types because they provide a better description of the vegetation currently occupying a site and provide a means of classifying nonforest and seral plant communities used by bears. Habitat components were delineated from aerial photographs and ground-truthed. We randomly sampled the vegetation in habitat components using 0.04 ha circular plots and estimated the canopy cover of the major overstory and understory plant species (Pfister et al. 1977). Overstory density was measured with a spherical densiometer (Paul E. Lemmon, Forest Densimeters, 2413 Kenmore Street, Arlington, Va.). The number of trees (> 10 cm dbh) per hectare was estimated from the number of trees counted in the sample plot. We used a non-mapping, random-dot grid technique (Marcum and Loftsgaarden 1980) to determine habitat component availability within a composite home range of instrumented bears. We also determined habitat component availability within respective male and female composite home ranges. Home ranges were estimated using the minimum area method (Mohr 1947).

We determined habitat use patterns from radiolocations of instrumented bears. Incidental sitings were not used in the analysis because of inherent biases. We used the chi-square test to detect significant differences between habitat component avail-

Table 1. Habitat component classification system.

Habitat component	Definition
Timber (T)	Closed canopy timber with tree cover > 60%.
Open timber (OT)	Open timber with tree canopy cover 30–60% and understory dominated by shrubs.
Selection cut (SC)	Sparsely timbered to open timbered sites created by selective logging. Small openings and patches of timber are commonly dispersed throughout the cuts. Dominated by shrubs. Tree cover < 30%.
Clearcut (CC)	Open sites disturbed through timber harvesting. Dominated by shrubs.
Slabrock (SR)	Naturally open to sparsely timbered sites with exposed blocks of glaciated bedrock. Sites mesic to xeric with shallow soils. Shrubs predominate.
Open shrubfield (OS)	Naturally open sites that may be created and maintained by wildfire. Shrubs predominate. Generally at high elevations.
Timber shrubfield (TS)	Same as OS except with sparse timber. Tree canopy < 30%.
Sidehill park (P)	Naturally open sites on moderate to steep slopes at low to mid elevations. Shallow soils with exposed bedrock common. Generally xeric sites dominated by graminoids and forbs.
Timbered park (TP)	Mosaic created by an interspersed of sidehill parks and timber.
Riparian zone (RZ)	Hydrologically active sites with moving water which may be ephemeral. Mesic vegetation predominates.
Scree/talus/rock (STR)	Slopes of loose rock fragments of various size or extensive areas of exposed rock. Timber, shrubs, and herbaceous vegetation may occur sparsely.
Road (RD)	Open disturbed areas, cleared or graded.
Wet Meadow (WM)	Naturally open sites with relatively flat topography. Dominated by graminoids and forbs. Mesic.
Snowchute shrubfield (SS)	Naturally open sites on steep slopes at high elevations created by periodic movements of snow. Dominated by shrubs.

ability and use. We used a modified  $z$  statistic (Marcum and Loftsgaarden 1980) to determine preference and avoidance of habitat components. A "selected" or "preferred" habitat component was used significantly more than expected ( $P < 0.10$ ) based on availability data; a habitat component "selected against" or "avoided" was used significantly less than expected ( $P < 0.10$ ).

## RESULTS

We recorded 791 radiolocations of 9 black bears during 1980–81 (Table 2). Six hundred seventy-six radiolocations were used in the habitat use analysis. We had visual contact with the bears on 106 (13%) occasions.

Overall, we found a significant difference in black bear habitat use ( $X^2 = 191.6$ ,  $df = 6$ ,  $P < 0.001$ ) when compared to availability in the study area.

### Seasonal Habitat Use

Black bear habitat use differed significantly ( $X^2 = 46.7$ ,  $df = 10$ ,  $P < 0.001$ ) among seasons. Selectively logged areas (selection cuts) were the only habitats preferred by black bears during all seasons (Fig. 1); clearcuts were the only habitats avoided during all seasons. Open timber and scree/talus/rock were avoided during spring and summer, but were used in proportion to availability during fall. Roads were avoided during summer and fall but were used in proportion to availability during spring. All other habitat components were used in proportion to their availability during spring, summer, and fall. Although timber was used in proportion to availability, it was 2nd to selection cuts in terms of black bear use. Timber accounted for 28.9% ( $N = 249$ ) of the

spring radiolocations, 21.6% ( $N = 310$ ) during summer, and 36.8% ( $N = 117$ ) during fall.

### Habitat Use by Sex

Black bear habitat use differed significantly ( $X^2 = 21.9$ ,  $df = 11$ ,  $P < 0.005$ ) between sexes even though there was no significant difference ( $X^2 = 5.65$ ,  $df = 13$ ,  $P > 0.05$ ) in habitat availability within composite home ranges of male and female black bears. Male bears used roads in proportion to their availability, while females avoided roads (Fig. 2). Both sexes preferred selection cuts and avoided open timber, clearcuts, and scree/talus/rock.

## DISCUSSION

### Seasonal Habitat Use

Black bears at Priest Lake exhibited seasonal changes in habitat use patterns. It appears that seasonal variation in food availability resulting from the temporal distribution of key foods was responsible for this pattern. Seasonal changes in grizzly bear (*U. arctos*) (Martinka 1972) and black bear (Amstrup and Beecham 1976) habitat use were also related to food habits. Jonkel and Cowan (1971), Kelleyhouse (1980), and Novick and Stewart (1982) documented similar patterns in other areas.

Black bears in the Pacific Northwest exploit berry-producing shrubs commonly found in seral plant communities (Jonkel and Cowan 1971, Shaffer 1971, Lindzey and Meslow 1977). Historically, wildfire played a major role in creating and maintaining such communities. Wildfire removes the tree canopy, resulting in increased growth and productivity of the shrub stratum. Martinka (1972), Minore (1975), and

Table 1. Sex, age, reproductive condition, and radio location data for 9 instrumented black bears at Priest Lake, Idaho.

Bear	Sex	Age <sup>a</sup>	No. cubs		No. of locations	Date of 1st location	Date of last location
			1980	1981			
269	M	10	—	—	31	12 Jun 1980	5 Sep 1980
528	M	5	—	—	77	8 Jun 1980	16 Sep 1981 <sup>b</sup>
568	M	6	—	—	131	15 Oct 1980	22 Oct 1981
570	M	9	—	—	73	5 Jun 1981	11 Oct 1981
650	F	6	0	1	177	11 Jun 1980	22 Oct 1981
680	F	4	0	1	137	11 Jun 1980	22 Oct 1981
688	F	6	0	0	12	10 Jun 1980	1 Jul 1980 <sup>c</sup>
694	F	13	0	1	61	23 Jul 1980	21 Oct 1981
810	F	3	0	0	92	6 Jun 1981	21 Oct 1981

<sup>a</sup> Age in 1980.

<sup>b</sup> Collar slipped off around 15 April 1981 and was replaced 9 July 1981.

<sup>c</sup> Killed around 1 July 1980.

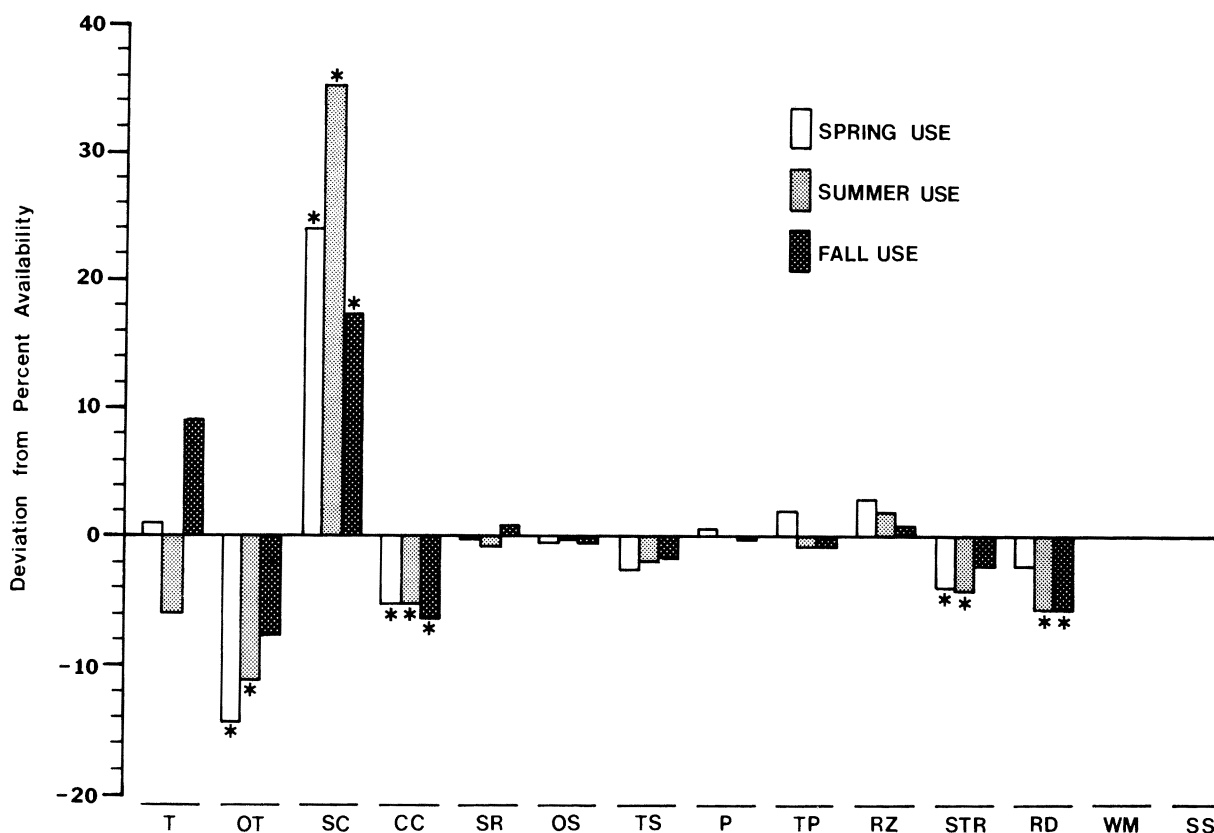


Fig. 1. Black bear habitat selection patterns at Priest Lake, 1980-81, determined from radiolocations classified by season. An "\*" indicates a significant deviation from availability ( $P < 0.10$ ). Percent availability of respective habitat components is presented above the habitat component abbreviation.

Martin (1979) documented greater and more consistent huckleberry production on burned sites than under a mature forest canopy. Serviceberry (*Ame-lanchier alnifolia*) also increases after wildfire (Muegler 1965, Franklin and Dyrness 1973). Hemmer (1975) found serviceberry most dense in old burns where adequate moisture was available. Furthermore, Franklin and Dyrness (1973) characterized mountain ash as a pioneer species that resprouts vigorously after fire.

Studies by Hagar (1960) and Ahlgren (1966) showed that wildlife responses to logging may be similar to those seen after wildfire, suggesting that these disturbances may have a similar affect. Furthermore, Zager (1980) stated that certain timber harvest methods may influence grizzly bear habitat in the same manner as wildfire, and that the open canopy created by wildfire may be simulated by logging. Several studies have shown that concentrations of bear foods are commonly found in seral plant communities after logging (Rogers 1976, Lindzey and Meslow 1977, Zager 1980). Mealey (1977) reported

selection cuts have the highest importance (based on availability of key bear foods) among logged habitats in his northwest Montana study area. We found selection cuts were the most important habitat component at Priest Lake and attributed this to the high concentrations of key bear foods found there.

Although commercial logging began in the early 1900s at Priest Lake, logging activity has increased since the 1940s. From 1940 to 1960 most timber was selectively logged (R. Greene, pers. commun.). Thus, most selection cuts on the study area are 20-40 years old. Zager (1980) noted that the canopy cover of shrubs considered to be key grizzly bear foods in northwest Montana (the same species were important to black bears at Priest Lake) was higher on sites burned by wildfire 35-70 years earlier and Martin (1979) found that the productivity of huckleberries on high elevation sites was highest in stands that were burned 25-60 years before. Assuming that wildfire and selective logging have similar ecological effects on bear habitat, then productivity of key bear foods should be high on selection cuts at Priest Lake.

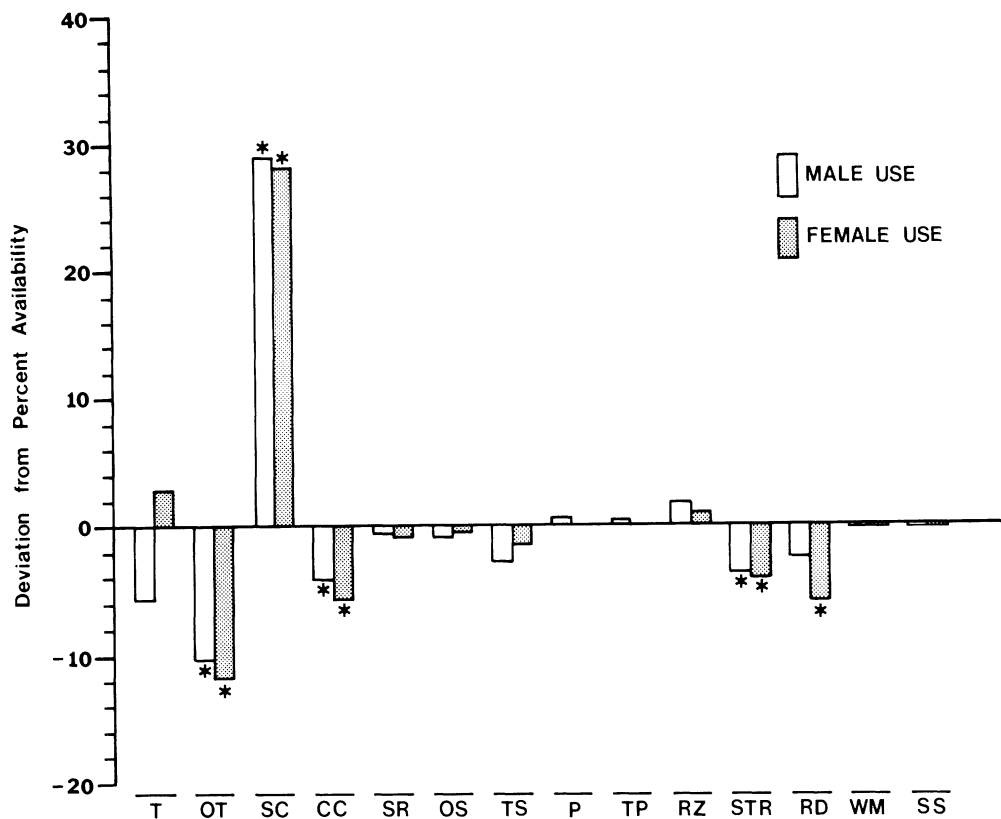


Fig. 2. Black bear habitat selection patterns at Priest Lake, 1980-81, determined from radiolocations classified by sex. An "\*" indicates a significant deviation from availability ( $P < 0.10$ ). Percent availability of respective habitat components is presented above the habitat component abbreviation.

Concentrations of highly productive fruit-bearing shrubs partly explains black bear preference for selection cuts during summer and fall when their diet consisted mainly of berries. But black bears at Priest Lake also preferred selection cuts during spring when their diet consisted primarily of grasses. On several occasions, instrumented bears were observed feeding on pinegrass (*Calamagrostis rubescens*) and were often monitored as they fed in areas devoid of spring foods other than pinegrass. Pinegrass is rhizomatous and often proliferates when the tree canopy is removed (Pfister et al. 1977). We surmised that the proliferation of pinegrass after selection logging was a major factor resulting in the use of this habitat during spring.

Scarification caused by road construction may also have influenced bear use of selection cuts during spring. Jonkel and Cowan (1971) and Zager (1980) found that certain species of grasses uncommon to old-growth stands and old burns were typically found in disturbed soil along roads. They also noted that horsetails (*Equisetum* spp.), common in the spring

diet of Priest Lake black bears, responded positively to logging and were found along moist skid roads.

Black bear preference of selection cuts during spring may also be due to the inclusion of huckleberry flowers in their diet at this time of year. Huckleberry leaves and flowers were found in 45% and 29% of the scats collected in May and June 1981, respectively (Beecham 1982). Several of these scats were composed entirely of huckleberry leaves. Food habits studies are biased against delicate plant tissues, such as flowers, because they are easily digested. Based on the occurrence of leaves and stems of huckleberry in scats, we suspect that bears at Priest Lake were feeding consistently on huckleberry flowers during spring, but that these flower parts were digested and did not show up in our food habits analysis. In June 1981, an instrumented male black bear was observed as he fed on the flowers of huckleberry. The abundance of huckleberry in selection cuts provided an almost unlimited source of huckleberry flowers for bears during the spring and resulted in increased use of this habitat component.

Several studies showed the importance of cover in black bear habitat selection (Lindzey and Meslow 1977, Novick and Stewart 1982). Lindzey and Meslow (1976) found that bears selected older cutting units with more cover even though younger cutting units provided more foods. The shrub stratum in selection cuts at Priest Lake was extremely dense, often seemingly impenetrable. On numerous occasions we could hear, but not see, instrumented bears in selection cuts because they were obscured by the dense understory.

Selection cuts at Priest Lake had an average of 543 trees/ha scattered singly or in small groups. Herrero (1972) considered trees significant in the daily existence of the black bear, particularly in respect to the safety provided by tree climbing. Lindzey and Meslow (1977) reported that a significant percentage of their bear locations in clearcuts were along edges, suggesting that trees were important to bears for safety.

We concur with Lindzey and Meslow (1976) that cover (i.e., hiding and security) and food availability are important in black bear habitat selection. Selection cuts at Priest Lake received extensive use by black bears because they provided the best combination of food and cover of available habitats.

We observed a different response by black bears to clearcut logging than to selection logging. Instrumented bears avoided clearcuts during spring, summer, and fall. Jonkel and Cowan (1971) reported that black bears did not use clearcuts in the *Picea-Abies/Pachistima* association (Daubenmire and Daubenmire 1968) or areas that had recently been logged. Lindzey and Meslow (1977) found that black bear use of 6–11 year old clearcuts in Washington was less than expected, but 15–24 year old clearcuts were used more than expected.

Clearcutting has been the dominant timber harvesting method employed at Priest Lake since the 1960s. Slash was burned in most cases, and some sites were scarified extensively to enhance tree regeneration (Zager 1981). Zager (1981) estimated it would take 10–20 years for minimally scarified sites in the Priest Lake area to recover in terms of food and cover for bears; extensively scarified sites require much more time. The oldest clearcuts on the study area were about 20 years old, but most were more recent. These clearcuts are not old enough to provide adequate cover for black bears.

Martin (1979) found cover and huckleberry volume in scarified clearcuts the lowest of 8 different habitats

sampled in northwestern Montana. Scarification damages the rhizomes and root crowns of vegetatively reproducing shrubs such as huckleberry (Zager 1980). Clearcuts were generally moderately to heavily scarified at Priest Lake (Zager 1981). Clearcuts at Priest Lake had an average huckleberry cover class value of 1 (1%–5%), compared with an average cover class value of 2 (5%–25%) for selection cuts. Tisch (1961) reported that recent clearcuts provided very little black bear food in the Whitefish Range of northwestern Montana. We suspect the same situation exists at Priest Lake.

Grasses and forbs, which were important to bears during spring, usually increased in abundance after scarification (Zager 1980). Grasses and forbs were abundant in scarified clearcuts at Priest Lake, but these sites were not used by black bears during spring, possibly because there was little cover in these units or because the species that increase after logging are not those preferred by bears. This suggests again that food availability and cover are important requirements for black bear habitat selection.

Habitat diversity appears to be an important element of black bear habitat (Jonkel and Cowan 1971, Kemp 1979, Lawrence 1979). Zager (1980) stated that “wildfire historically burns in a mosaic pattern which results in an interspersion of habitats, and ensures heterogeneity of environments.” Wildfire and logging practices that simulate wildfire increase the productivity and abundance of bear foods, and are instrumental in creating and maintaining habitat diversity.

Timber was the 2nd most used habitat component at Priest Lake, although its use was in proportion to availability. Bray and Barnes (1967), citing earlier studies, also noted that forested habitat was an important component of black bear habitat. Herrero (1972) discussed the importance of timber in black bear evolution. Kelleyhouse (1980), in California, reported that mixed conifer forest received considerable use by black bears during all seasons except late August. Novick and Stewart (1982) found that black bears in California used the conifer forest in proportion to availability during spring and summer and slightly more than expected during fall. Lindzey and Meslow (1977) noted that over half of their black bear locations in timber were on edges, suggesting that timber provided resting and escape cover for bears that normally foraged in clearcuts. We suspect that timber functions primarily as cover for black bears at Priest Lake. Greater use of timber during spring and fall, seasons in which instrumented bears

spent most of the day bedded, supports this conclusion.

We expected greater use of riparian zones, wet meadows, and avalanche chutes by black bears during spring than we observed (bears used these habitat components in proportion to availability). Riparian zones were normally narrow and shaded by the forest canopy, resulting in an understory comprised of plant species similar to the adjacent habitat component (Tisch 1961). Therefore, riparian zones offered bears little more in the way of succulent spring vegetation than adjacent areas, accounting for less use than expected.

Use of wet meadows and avalanche chutes by Priest Lake black bears was also less than we expected. We expected substantial use of these habitats because of the succulent foods they provide (Tisch 1961, Zager 1980). Wet meadows and avalanche chutes covered approximately 0.2% of the study area, and were normally located at high elevations in inaccessible areas. Perhaps, this resulted in a biased estimate of their use by black bears.

#### Habitat Use by Sex of Bears

We believed it was important to identify differences in habitat use between male and female bears because females are the most important segment of the population. Black bear habitat use differed significantly when stratified by sex. The most dramatic difference was greater use of timber by females as compared with males. Herrero (1972), discussing the evolutionary strategy of cub production in black bears, stated that "females with cubs are reluctant to leave trees." Perhaps this behavioral trait was responsible for the difference in use of timber by male and female bears at Priest Lake. Although 3 of 4 instrumented females were accompanied by cubs in 1981, use was not significantly different ( $z = 0.4$ ,  $P > 0.2$ ) from that of 1980.

The tendency for male black bears to use roads in proportion to availability and female black bears to avoid roads has strong management implications. This tendency makes male black bears more susceptible to harvest by hound hunting from vehicles, a popular method in the Priest Lake area. Avoidance of roads by female bears may also be a function of innate maternal instincts to avoid open roads. Zager (1980) documented a female grizzly bear with cubs avoiding roads on his study area in northwestern Montana.

If roads serve as travel routes, differential use of roads between sexes may be related to differences in the mobility of male and female bears. Male black bears show greater mobility than females (Amstrup and Beecham 1976, Reynolds and Beecham 1980); their greater use of roads may be a function of this.

#### MANAGEMENT RECOMMENDATIONS

Recommendations for wildfire and timber management in northern Idaho to maintain or enhance bear habitat are presented below. This list is based on our data from Priest Lake and studies used for comparison; it is not all-inclusive.

1. Black bear food production should be maintained or enhanced using a let-burn fire management policy and prescribed burns where feasible.
2. Black bear food production should be maintained or improved on logged sites. Slash should be broadcast burned or not treated. Soil scarification should be minimized to prevent damage to vegetatively-reproducing food species.
3. Disturbances to black bears should be minimized by coordinating logging activities with seasonal habitat use patterns of bears. For instance, logging activities near high elevation shrubfields should be avoided in late summer.
4. Timber should be retained near potential or existing feeding areas. Timber is important to bears as resting, escape, and security cover. Cover may be retained by creating "leave patches" and "leave strips" within cutting units. We recommend clearcuts with irregular borders because they provide greater cover.
5. Logging activities should be coordinated to maintain an acceptable mix of different aged cutting units. The juxtaposition of these units will influence the density and dispersion of bears in the area.
6. Mature, standing trees should be left in cutting units to provide safety to bears by tree climbing.

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