# BLACK BEAR HABITAT IN NORTH GEORGIA: SOME IMPLICATIONS OF WILDERNESS DESIGNATION

W. MAC LENTZ, School of Forest Resources, University of Georgia, Athens, GA 30602
R. LARRY MARCHINTON, School of Forest Resources, University of Georgia, Athens, GA 30602
DAVID M. CARLOCK, Georgia Department of Natural Resources, Game and Fish Division, 2150 Dawsonville Hwy., Gainesville, GA 30501

*Abstract:* Telemetry information from 15 black bears (*Ursus americanus*) in northeastern Georgia were analyzed relative to den use, habitat type, elevation, and proximity to paved roads. Upland hardwoods, located at higher elevations and farther from paved roads, were preferred, especially by adult females during the denning season. These and other findings were used to evaluate the impact of proposed wilderness areas. Major advantages would include protection of den trees and hard mast supplies associated with mature hardwood stands. Reduced accessibility to humans should increase bear survival and allow emigration onto surrounding lands. Two major disadvantages would be possibly unreliable soft mast production, and the inability to do any corrective management should the habitat deteriorate.

Proc. Ann. Conf. S.E. Assoc. Fish & Wildl. Agencies 34:550-556

Black bears have been part of the history of the southern Appalachian Mountains since their settlement. Both the Indians and early settlers utilized this animal as a source of food and clothing. It is still an important tourist attraction (Burghardt et al. 1972), and in North Carolina and Tennessee, hunters contribute significantly to the rural Appalachian economy. Public pressure for increased bear hunting opportunities is significant, but a study of harvest characteristics in North Carolina (Collins 1974) suggests that the population is already being overharvested. Habitat loss may be the greatest single problem for bears in this area. Foresters and wildlife biologists are presently faced with managing forests and forest wildlife without full understanding of habitat requirements of black bears, especially during the important winter denning period when cubs are born.

With the RARE II program came the question of how wilderness areas will affect bear populations. The purpose of this paper is to present data from a study of black bear habitat utilization in northeastern Georgia, and to suggest some possible impacts of the creation of wilderness areas on this animal.

The authors gratefully acknowledge the help of R. P. Ernst during the planning of this study, and Georgia Game and Fish personnel who helped with the field work. We are also indebted to A. S. Johnson and K. E. Kammermeyer for critical review of the manuscript. This research was funded by Federal Aid to Wildlife Restoration Program, Pittman-Robertson Projects W-37-R-12, W-44-R, and W-46-R, Georgia Department of Natural Resources; and McIntire-Stennis Project GEO-0030-MS-E, School of Forest Resources, University of Georgia, Athens. This paper constitutes part of a thesis submitted in partial fulfillment of a Master of Science degree by the senior author.

## METHODS

The study area was the eastern half of the 283,300-ha Chattahoochee National Forest located in the southern extreme of the Blue Ridge physiographic province. The intermediate elevations (600-1200 m) of the study area are characterized by 2 principal forest groups: moist slope and cove forest, and dry slope and ridge forest. Major forest types in the mesic and submesic areas are oak-hickory (*Quercus* spp.-*Carya* spp.), northern red oak (*Quercus rubra*), and yellow poplar (*Liriodendron tulipifera*). Those of the more

xeric areas are oak-hickory, and oak-pine (*Quercus* spp.-*Pinus* spp.) (Braun 1950). Composition by "working-group," as defined by the U. S. Forest Service, is 52 percent upland hardwood, 20 percent yellow pine, 17 percent cove hardwood, 6 percent Virginia pine (*P. virginiana*), and 5 percent white pine (*P. strobus*). There is usually a well-developed heath layer with *Rhododendron*, *Kalmia*, *Vaccinium*, *Leucothoe* (Braun 1950) and *Gaylussacia* spp. often abundant.

Recent history of the forests in this area is characterized by 2 major events: the elimination of the once-dominate chestnut (*Castanea dentata*) by blight (*Endothia parasitica*), and a "high-grade" timber operation over most of the area in the early 1900's. These factors greatly reduced the amount of mature hardwood in the study area.

Trapping was accomplished with culvert traps mounted on boat trailers and baited with cooked meat scraps. Animals were immobilized using Sernylan (Phencyclidine hydrochloride) at a dosage rate of 1.5 mg/kg body weight; the drug was delivered with a $CO_2$ pistol. Collars containing 150-mHz range radio transmitters were placed on 15 selected bears, and tracking was accomplished with a hand-held, 3-element yagi antenna and a 12-channel receiver manufactured by AVM Instrument Company (Champaign, IL). Due to the mountainous topography, location of bears was accomplished by an airplane, as well as triangulation from the ground.

Locations were plotted on 1:24,000 U. S. Geologic Survey topographic maps. Elevation, slope aspect, and proximity to paved roads were recorded for each location. Climatological data were compiled from the National Weather Service, Blairsville Station.

Forest type was obtained from compartment and stand maps of the Chattahoochee National Forest, and categorized into habitat types. Percentage composition by forest type was determined for a 16,000-ha rectangle surrounding the center of each bear's telemetric locations for comparison of actual use and availability of habitat types. These data were obtained from a grid data base for the forest, developed at the School of Forest Resources, University of Georgia, in which 7.28-ha cells were classified according to forest type. In the event these rectangles included lands not under Forest Service ownership or for which forest type had not been mapped, rectangle size was reduced accordingly.

For analysis of telemetry data bears were separated into subadults (under 3.5 years) and adults (3.5 years or older) and by sex. There were 6 adult females, 3 adult males, 4 subadult females, and 2 subadult males (none of which were less than 2 years old). All locations were categorized by season, i.e. predenning (August-November), denning (December-March), postdenning (April-May), and breeding (June-July). Locations relative to habitat type were tested using Chi-squared analyses based on the amount of each type available in the rectangles. These data along with elevation and proximity to paved roads were then subjected to overall and one-way analyses of variance. Duncan's Multiple Range Tests were utilized to determine significance of differences between mean frequency values.

Radio-telemetry also was used to locate winter denning sites of bears. Eleven dens were studied, 3 of which were partially or completely destroyed during the study and yielded incomplete data. Topographic position (i.e., elevation, slope), forest stand information, and proximity to roads and logging operations were recorded for each den.

## RESULTS AND DISCUSSION

### Habitat Type Utilization

With the exception of subadult males, bears occurred most often in the upland hardwood habitat type and more often than expected on the basis of its availability ($P < 0.01$) (Table 1). This habitat was frequented most by bears during predenning and postdenning seasons, with greatest preference shown for it during the predenning season

Table 1. Mean frequency of occurrence by habitat for combined age-sex cohorts and seasons of black bears on the Chattahoochee National Forest, 1972 to 1978.[1]

| | Habitat type | | | | |
|---|---|---|---|---|---|
| | White pine | Virginia pine | Cove hardwood | Yellow pine | Upland hardwood |
| Adult males | 1.0b[2] | 2.0b | 0.3b | 0.7b | 8.0a |
| Subadult males | 0.5a | 1.5a | 0.0a | 2.0a | 3.5a |
| Adult females | 2.8bc | 1.3bc | 4.3b | 0.5c | 15.8a |
| Subadult Females | 0.2b | 0.5b | 0.2b | 0.0b | 7.2a |
| Predenning | 3.0b | 3.0b | 4.0b | 2.3b | 31.0a |
| Denning | 1.0a | | 1.0a | | 2.5a |
| Postdenning | 6.0a | 1.0a | 13.0a | 1.0a | 10.5a |
| Breeding | 5.0a | | 5.0a | 1.0a | 3.0a |

[1]Determined by Duncan's multiple range test.

[2]Any 2 means within a row followed by the same letter (1or more) are not significantly different at the 0.05 level.

($P \leq 0.05$). The limited use of the upland hardwood habitat type by subadult males may be a consequence of their low social status. This cohort is often forced to disperse by intolerant adult males (Jonkel and Cowan 1971, Kemp 1972), and some members move considerable distances (Alt 1978). Our records indicate that in north Georgia nuisance bears captured out of their normal range have usually been subadult males.

The preference of black bears in northeastern Georgia for upland hardwoods is not suprising. The importance of hard mast produced in these areas has been well recognized (Richards 1968, Barick 1970, Beeman and Pelton 1977). Beck (1977) found that mixed-oak stands in the southern Appalachians have an average annual production of well-developed acorns of 327 kg/ha, and that this is a major food contribution for many wildlife species.

Elevations Frequented by Bears

Mean elevation for all telemetry locations was 818 m. Adult females were found at higher elevations ($P \leq 0.05$) during the denning season than in any other season of the year (Fig. 1). Although the number of denning season locations for other cohorts was not sufficient to allow statistical comparison, adult females apparently denned substantially higher than other bears. Adult females were also found at higher elevations ($P \leq 0.05$) than adult or subadult males during the predenning season. The adult male cohort was located at higher elevations ($P \leq 0.05$) during the postdenning season than during the predenning season. No further significant differences between seasons or cohorts were observed.

Higher elevations are associated with increased isolation in the study area and contain more potential den trees, possibly as a result of the inability to harvest at these elevations during the early 1900's (Pelton et al. 1977, Johnson and Pelton 1980). These areas tend to be used most often during the denning season, especially by adult females, which are more selective of denning sites (Cahalane 1947, Erickson 1964, Johnson and Pelton 1980).

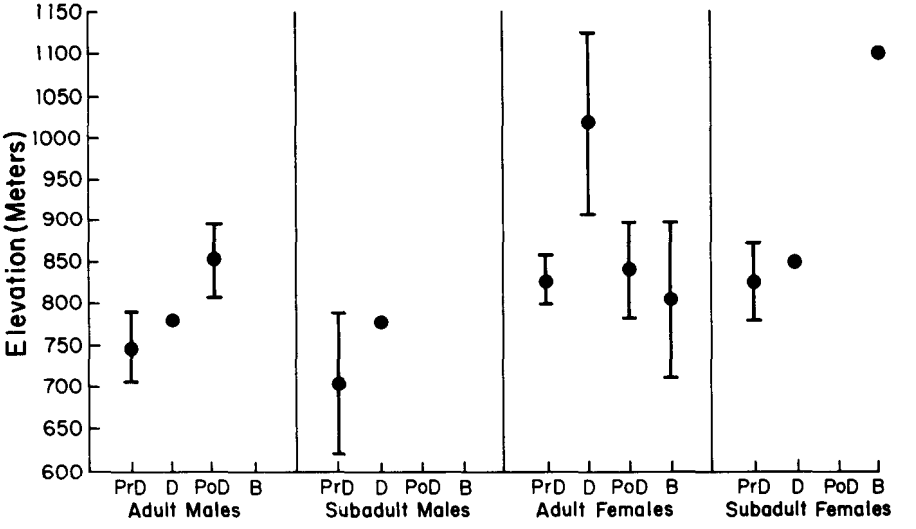


Fig. 1. Mean elevation separation by seasons for combined age-sex cohorts of black bears on the Chattahoochee National Forest, 1972 to 1978. Ninety-five percent confidence intervals are shown where sufficient data were available (PrD=Predenning, D=Denning, PoD=Postdenning, and B=Breeding Seasons).

### Relationship of Bear Locations and Distance to Paved Roads

In general bears in our study utilized areas far from paved roads ($\bar{x}$ = 2.9 km), although, there were seasonal and cohort differences. The average distance adult males were located from a paved road was greater ($P \leq 0.05$) during the postdenning than the predenning season (Fig. 2), and during the postdenning season they were farther ($P \leq 0.05$) from paved roads than were adult females. Subadults were located farther from paved roads ($P \leq 0.05$) during the predenning season than adults. During the breeding season subadult females were located farther from paved roads ($P \leq 0.05$) than adult females. No other significant differences between seasons or cohorts were observed.

In summary, bears tended to be farther from paved roads during the colder months and nearer during the warmer ones. This is supported by most bear sightings occurring in May and June.

### Den Site Characteristics

Bears denned at a mean elevation of 891 m. Den sites were generally on the upper half of slopes, which on the study area were normally associated with increased den tree availability and seclusion. Mean distance to any road accessible year-round was 490 m. Dens were most often located in the upland hardwood habitat type, which was composed primarily of immature or sparse stands, resulting from "high-grade" harvest operations. All dens were associated with large, mature trees (standing or fallen), which had either been culled or were too inaccessible to harvest. Eight of the 11 dens examined were in standing hollow trees, chestnut, chestnut oak (*Q. prinus*), or southern red oak (*Q. falcata*). The remaining 3 were in a hollow log, under a log, and under an upturned stump. The relative infrequency that fallen trees and stumps were used, considering their abundance, suggests that they are less desirable. An annual examination of known dens throughout the seven-year study period revealed no reuse.

## WILDERNESS AREAS AND BEAR MANAGEMENT

Bears have large home ranges and low population densities relative to other species. This dictates management of large areas, within which the basic needs including food, water, escape cover, and den sites must be provided. The results of our study suggest that designation of wilderness areas in northern Georgia could provide some advantages as well as disadvantages relative to present management systems.

In wilderness areas, under natural succession, overmature trees predisposed to heart-rot and den cavity formation would be continually supplied. All dens in our study were associated with old growth timber. They were either American chestnut that had been killed by blight or cull trees that were left during early "high-grade" timber operations. Three of the 11 dens observed were destroyed during the study, 1 by a timber harvesting operation, 1 by road construction, and 1 from natural causes. Pelton et al. (1977) suggested a high attrition rate for den trees and emphasized the importance of tree cavities to black bears in the Southern Appalachians. It, therefore, seems possible that availability of suitable dens could become a factor limiting bear population size under present management.

The wilderness areas proposed for northern Georgia are generally at high elevations and with the roadless provisions of wilderness designation would provide increased remoteness. Bears in our study tended to utilize areas farthermost from roads and at high elevations particularly during the denning season. The desirability of inaccessible den sites has been shown in Michigan by Erickson (1964) who reported large numbers of bears being killed in their dens by hunters. In Georgia, there is one report (Ernst, personal communication) of a female with cubs being illegally killed while denning. Illegal kills are probably an important mortality factor throughout the year. The decrease in accessibility provided by wilderness designation should make bears less vulnerable to both illegal and legal harvest.

If bear hunting is prohibited on some wilderness areas they could function as "sanctuaries". The value of sanctuaries and their potential in black bear management has been pointed out by Sanders (1978). Relatively high densities could develop with excess bears, primarily subadult males (Alt 1978, Zytaruk and Cartwright 1978), emigrating into surrounding less populated areas. Due to the relatively restricted movement patterns of females (Alt 1978, Zytaruk and Cartwright 1978, Landers et al. 1979), this would offer bear hunting opportunities outside of the sanctuary without danger of eliminating the breeding nucleus.

The importance of escape cover to bears is primarily dependent on the extent of harassment by man and dogs (Landers et al. 1979). Also, Pelton and Nichols (1972) reported dense understories as characteristic of all bear habitat in the southeast. It follows that the amount of accessibility could directly affect the need for this habitat component. Wilderness areas would provide less accessibility but the climax type forests associated with them may result in reduced rhododendron and laurel thickets.

The impact of wilderness designation on food resources is also not entirely clear. Our data revealed heavy use of the upland hardwood habitat type particularly during the predenning period. These areas are prime sources of hard mast. Wilderness area designation would insure adequate supplies of hard mast particularly during the predenning period. On the other hand, the amount and availability of soft mast (utilized in the spring and summer) would probably be much less reliable and would depend upon successional arrest caused by fire, disease, and wind or ice damage. Depending upon the timing and extent of these successional changes, habitat unsuitable for bears on a year-round basis may result. If, however, the areas designated as wilderness are not too extensive, soft mast requirements might be met on the periphery.

Of course, the primary disadvantage of wilderness area designation is that it will

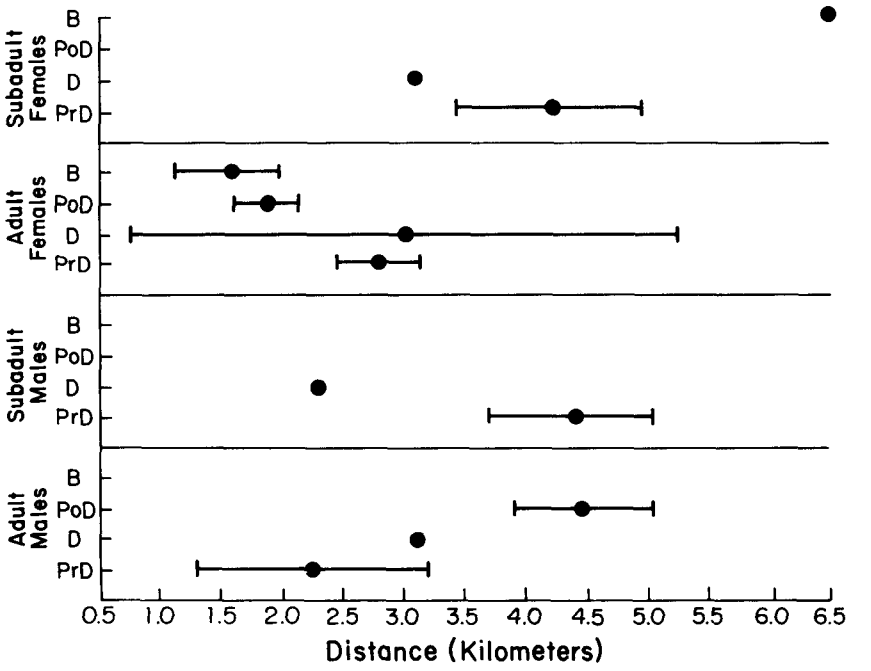


Fig. 2. Mean distances to nearest paved roads separation by seasons for combined age-sex cohorts of black bears on the Chattahoochee National Forest, 1972 to 1978. Ninety-five percent confidence intervals are shown where sufficient data were available (PrD=Predenning, D=Denning, PoD=Postdenning, and B=Breeding Seasons).

eliminate the possibility of any form of active habitat management. The advantages accruing from wilderness could be gained within the framework of current management systems. If management continues under the current systems (without wilderness areas), they need to insure perpetuation of large areas with limited access. These areas should encompass significant amounts of upland hardwood habitat and be managed to contain both the red and white oak groups to decrease the possibility of a complete mast failure. Clearcuts or other silvicultural treatments should be relatively small and well-separated. Remote areas should be allowed to undergo natural succession, with little or no silvicultural modification, to provide for continual replenishment of den trees.

## LITERATURE CITED

ALT, G. L. 1978. Dispersal patterns of black bears in northeastern Pennsylvania—A preliminary report. Pages 186-199 *in* R. D. Hugie, ed. Proc. 4th eastern black bear workshop. 409pp.

BARICK, F. B. 1970. Bear study progress report. Wildl. in North Carolina. 10:10-11.

BECK, D. E. 1977. Twelve-year acorn yield in southern Appalachian oaks. USDA For. Service Res. Note SE-244. 8pp.

BEEMAN, L. E., and M. R. PELTON. 1977. Seasonal foods and feeding ecology of black bears in the Smoky Mountains. Proc. 4th Int. Conf. on Bear Research and Management. Kalispell, Montana. (In press).

BRAUN, E. L. 1950. Deciduous forests of eastern North America. Hafner Press, New York. 596pp.

BURGHARDT, G. M., R. O. HIETALA, AND M. R. PELTON. 1972. Knowledge and attitudes concerning black bears by users of the Great Smoky Mountains National Park. Pages 255-273 *in* S. Herrero, ed. Bears—their biology and management. Int. Union Conserv. Nat. New Series Publ. 23. 371pp.

CAHALANE, V. H. 1947. Mammals of North America. MacMillan Co., New York. 682pp.

COLLINS, J. M. 1974. Some aspects of reproduction and age structures in the black bear in North Carolina. Proc. Southeast Assoc. Game Fish Comm. 27:163-170.

ERICKSON, A W. 1964. An analysis of black bear kill statistics for Michigan. Pages 68-102 *in* The black bear in Michigan. Mich. State Univ. Agric. Exp. Stn. Res. Bull. 4. 102pp.

JOHNSON, K. G., AND M. R. PELTON. 1980. Selection and availability of dens for black bears in Tennessee. J. Wildl. Manage. (In press).

JONKEL, C. J., AND I. MCT. COWAN. 1971. The black bear in the spruce-fir forest. Wildl. Monogr. 27. 57pp.

KEMP, G. A. 1972. Black bear population dynamics of Cold Lake, Alberta, 1968-1970. Pages 26-31 *in* S. Herrero, ed. Bears—their biology and management. Int. Union Conserv. Nat. New Series Publ. 23. 371pp.

LANDERS, J. L., R. J. HAMILTON, A. S. JOHNSON, AND R. L. MARCHINTON. 1979. Foods and habitat of black bears in Southeastern North Carolina. J. Wildl. Manage. 43:143-153.

PELTON, M. R., AND R. G. NICHOLS. 1972. Status of the black bear *(Ursus americanus)* in the Southeast. Pages 18-23 *in* R. L. Miller, ed. Proc. of the 1972 black bear conference. 56pp.

PELTON, M. R., L. E. BEEMAN, AND D. C. EAGAR. 1977. Den selection by black bears in the Great Smoky Mountains National Park. Proc. 4th Int. Conf. on Bear Research and Management. Kalispell, Montana. (In press).

RICHARDS, E. V. 1968. Should we manage the black bear? Virginia Wildl. 29(3):8-9.

SANDERS, O. T., K. G. JOHNSON, AND J. RIEFFENBERGER. 1978. An evaluation of black bear sanctuaries. Pages 278-292 *in* R. D. Hugie, ed. Proc. 4th eastern black bear workshop. 409pp.

ZYTARUK, B., AND D. CARTWRIGHT. 1978. Black bear movements and food habits in New Brunswick. Pages 277-239 *in* R. D. Hugie, ed. Proc. 4th eastern black bear workshop. 409pp.