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METHOD TO MONITOR TRAVEL CORRIDOR USE BY BLACK BEARS ALONG THE EASTERN BOUNDARY OF THE GREAT DISMAL SWAMP NATIONAL WILDLIFE REFUGE

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Abstract: Black bears and other wildlife species are impacted by highway systems and associated traffic loads in many ways. There is growing concern among government natural resource agencies, environmental groups and transportation agencies over the effects of roads on wildlife. Roads often cross animal travel corridors. Use of these corridors is difficult to monitor, and various methods have been devised to determine specific crossing points. I am using barbed wire stretched along a section of highway at a proposed expansion site to determine if bears cross the existing roadbed at predictable places at different times of the year. Also, hair samples collected from the wire will be subjected to DNA fingerprinting to determine the number of individuals crossing the road, how many times an individual crosses, and the sex of these individuals. Highway planners may then use these data to place bridges or culverts in places where bears and other species will use them. This study has only recently begun, but initial results are very promising. It may likely prove useful for monitoring travel corridor use of other species besides bears.

Funding source: U.S. Fish and Wildlife Service
Total budget: $50K/year for two years
Project period: June 2000-June 2002

Introduction

The Great Dismal Swamp National Wildlife Refuge (GDSNWR) is the last stronghold for black bears (*Ursus americanus*) in eastern Virginia. The area surrounding the GDSNWR is experiencing a phase of rapid urbanization. Suitable habitat for bears and other forest-dependent wildlife is shrinking rapidly. Urban and agricultural development has almost completely isolated the refuge bear population. The refuge is currently connected to other forested wetlands to the southeast by narrow linkages of similar habitat. Presumably, bears use these corridors to establish new home ranges, seek mates, and forage for seasonally or locally abundant food sources. The ability of these corridors to maintain genetic flow between bear populations also is poorly understood.

Carrying capacity is difficult to quantify for wild animal populations. When carrying capacity for a given area has been reached, competition for resources and dispersal will increase. Hellgren (1988) estimated 262-377 bears were in the refuge in 1987, using both open and closed population estimators. Evidence of a saturated population included a stable population growth rate (r = 0.0032). Bears dispersing from the refuge are likely to come into frequent conflict with people, causing an increase in both real and perceived damage. The Virginia Department of Game and Inland Fisheries (VDGIF) has recommended a limited harvest strategy on the refuge to reduce the number of agricultural and urban damage complaints occurring on the periphery of the refuge.

Study Area

The area of concern lies in southeastern Virginia and northeastern North Carolina. The 550 km^2 study area includes the Great Dismal Swamp National Wildlife Refuge, Dismal Swamp State Park (North Carolina), and various private land parcels bordering the refuge. The refuge is characterized as a 440 km^2 forested wetland with a severely modified hydrologic system due to numerous canals and ditches. The entire Dismal Swamp ecosystem has been logged completely several times since the eighteenth century. Whitehead (1972), Musselman (1977), and Gammon and Carter (1979) described the geology and major forest cover types of the swamp.

Justification

The Virginia Department of Transportation (VDOT) is currently planning to widen Highway 17 on the eastern border of the refuge. This highway crosses one of the last forested corridors connecting the refuge to isolated patches of habitat to the south. Currently, the road is a two-lane, paved highway connecting the Tidewater region of Virginia with the Outer Banks of North Carolina. This route is used by commuters, tourists, and freight shipping companies and serves as a hurricane evacuation route.

Originally, the existing roadbed was going to be used as the southbound route and two additional lanes were to be constructed beside the existing structure with a median between them. In order to avoid impacting a wetland site, the plan was modified to leave the existing roadbed in place and construct a new highway system approximately one kilometer eastward. The road will be modified from Dominion Boulevard south to the Virginia/North Carolina state line (approximately 17 kilometers). The new highway will include two northbound lanes, two southbound lanes, and an open median. The existing highway would be used for local traffic only.

Short-term movement patterns related to the acquisition of food or mates may be altered by the extensive construction project. The proposed highway design will allow for an increase in vehicular traffic (John McCambridge, VDOT, pers. comm.) and will at least triple the width of the existing road. Approximately 9,500 vehicles/day currently travel on Highway 17. If the new highway is built according to the current plan, an estimated daily average of 18,900 vehicles will travel this road by the year 2020 (John McCambridge, VDOT, pers. comm.). Not only will average daily traffic volume double, but the speed limit will likely increase from 88 km/hour to 104 km/hour. There are concerns that bears will be less likely to cross the new highway and bear/vehicle collisions will become more likely for those that do cross the road. Restriction of movement, combined with ongoing regional habitat loss, may cause long-term harm to the genetic viability of this bear population through random genetic drift and increased mutational load (Wilcove et al. 1986; Poethke et al. 1996).

Underpasses may facilitate the movement of bears both into and out of the refuge and allow for the exchange of genetic material between bears in the refuge and populations southward. Underpasses also may reduce the likelihood of bear/vehicle collisions. Underpass placement should be based on hydrologic needs as well as seasonal and spatial use patterns of bears. Information on travel corridor use by bears is currently unavailable for the Great Dismal Swamp ecosystem.

Highway 17 crosses the paleo-drainage of the Northwest River. This river corridor is one of the last forested corridors connecting the refuge to other patches of bear habitat. Also, it is an area of proposed mitigation for the highway modification project. The installation of a bridge and one to two concrete culverts are being considered. Highway planners have requested information regarding bear travel corridor use for this specific stretch of highway in order to place underpasses in areas where they might be used.

Literature Review

In Tennessee and North Carolina black bears were less likely to cross roadways with higher traffic volume than roadways with lower traffic volume (Brody and Pelton 1989), and in Montana black bears avoided areas adjacent to roads (Kasworm and Manley 1989). Various methods have been used to determine where animals cross roadways. These include radio telemetry, historic road-kill information, known migratory paths, attractive landscape features, analysis of landscape scale features, and track counts (Singer and Doherty 1985; Foster and Humphrey 1995; Sheick and Jones 1999). Often, more than one method is considered to determine road-crossing patterns. Corridors used by animals may decrease the risk of extinction if they aid in dispersal (Beier 1993), yet the role that corridors play in facilitating animal movement has been questioned (Simberloff et al. 1992). Installing highway underpasses is a common method to minimize blockage of animal corridors by roads. Installation of underpasses during initial construction is far easier and less expensive than retrofitting them to existing roads. Highway underpasses designed for use by wildlife have been implemented for mountain goats (*Oreamnos americanus*) (Singer and Doherty 1985), Florida panthers (*Felis concolor*), black bears (Foster and Humphrey 1995), and various large carnivores and ungulates (Clevenger 1998).

Methods

To determine bear crossing areas along the section of Highway 17 adjacent to the GDSNWR, I will string two strands of barbed wire (15.5 gauge, double strand, 4 barbs/cluster) between Highway 17 and the eastern

boundary of the refuge. I will string a 12.8-kilometer-long strand on the western edge of the Dismal Swamp Canal (DSC), which forms a border between the GDSNWR and Highway 17. This wire strand will begin where Big Entry Ditch drains into the DSC and will continue southward along the DSC to the northern border of the Edge property, a private farm on the eastern side of the refuge. I will string a second strand of wire on the western side of Highway 17, at least three meters from the edge of the road. This wire strand will be attached to wooden anchor posts beginning at the intersection of Cornland Road and Highway 17 and will continue southward for 2.3 kilometers. The second strand of wire spans the width of the paleo-Northwest River. Both strands of wire will be placed approximately 50 centimeters above ground level along their entire length in order to capture hair samples from bears. An effort will be made to follow dips in the terrain along the DSC caused by several small ditches and other irregularities of the canal bank.

The wire strands will be geo-referenced by placing a sequentially numbered aluminum tag and flagging on trees or anchor posts used as reference markers. I will use a GPS receiver to obtain UTM coordinates for the reference markers. I will note the location of all samples collected from the strands of wire by using the numbered reference markers.

The 12.8-kilometer long strand of wire will be checked approximately every 30 days from summer 2001 to spring 2002. The 2.3-kilometer long strand of wire will be checked every 7 days beginning in August 2001. Any bear hair samples with five or more follicles will be collected. Hair from a barb cluster will be treated as one sample, even if multiple, consecutive barbs have hair on them.

Closing Remarks

This method of monitoring travel corridor use has yet to be proven, yet holds a great deal of promise for certain species. Hair samples have been snagged on the barbed wire from various species including white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), and woodchucks (Marmota monax). The potential exists to obtain spatial and seasonal patterns of road crossings as well as determine the number of individuals crossing the road and their sex using DNA fingerprinting. It is hoped that other natural resource professionals will test the effectiveness of this method on various mammals to determine applicability in other ecosystems.

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