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RESOLVING LANDSCAPE LEVEL HIGHWAY IMPACTS ON THE FLORIDA BLACK BEAR AND OTHER LISTED WILDLIFE SPECIES

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Abstract: District Five of the Florida Department of Transportation (FDOT) is a nine-county area totaling about 5.6 million acres in east central Florida. District Five had the greatest population growth in Florida during the past 10 years, and FDOT has initiated a major long-term program for highway expansion and improvements to accommodate this growth. The Ocala and St. Johns River black bear populations are found in District Five, and account for greater than 50 percent of the statewide bear roadkill since 1976. Highway capacity improvements are planned for many highways that are currently sustaining high bear roadkill levels. This inherent conflict between highways and wildlife has resulted in considerable opposition and long-term delays to FDOT's efforts to accomplish planned highway improvements.

This paper presents results of the successful resolution of fish and wildlife resource issues associated with the proposed six-laning of Interstate 4 (I-4), a major east-west transportation corridor that bisects regionally important habitat systems in east central Florida. Based on the results of an Environmental Assessment completed for the Federal Highway Administration in 2000, FDOT has completed design plans for two large wildlife underpasses, and a wildlife overpass, which will be constructed along a six-mile corridor of public lands in the area of Tiger Bay State Forest in Volusia County. Major issues which were addressed included: bear roadkills and habitat connectivity; impacts to public land; direct and secondary habitat loss; recreational access; and restoring historical hydrological connections originally severed by I-4 in the early 1960's. Key considerations involved in the planning, design, cost, and siting of the structures, and the animal-proof funnel fencing. Landscape-level mitigation for project habitat loss was also facilitated through a coordinated effort by the St. Johns River Water Management District and FDOT in the acquisition of over \$8 million of public land identified in FWC's Integrated Wildlife Habitat Ranking System maps. This paper highlights the need for interagency coordination in acquiring public land to re-establish habitat connectivity to enhance long-term protection and management opportunities for the black bear and other listed species when dealing with highway impacts.

Introduction

District Five of the Florida Department of Transportation (FDOT) is a nine-county area in east central Florida. Over three million people live within the District, and it contains the state's largest tourist attractions. The region totals 5.6 million acres and contains about 1.3 million acres of public lands, and 1.8 million acres of potential Florida black bear habitat.

The Florida black bear (*Ursus americanus floridanus*) is listed by the Florida Fish and Wildlife Commission (FWC) as a threatened species. Prior to European settlement, bears occurred throughout Florida, but the statewide population has now been reduced to six core areas (figure 1). The Ocala National Forest supports the state's largest bear population, and a portion of the St. Johns River population is located to the east in Volusia and Flagler counties. These two populations are connected when the secondary ranges are considered, and both are found within District 5.

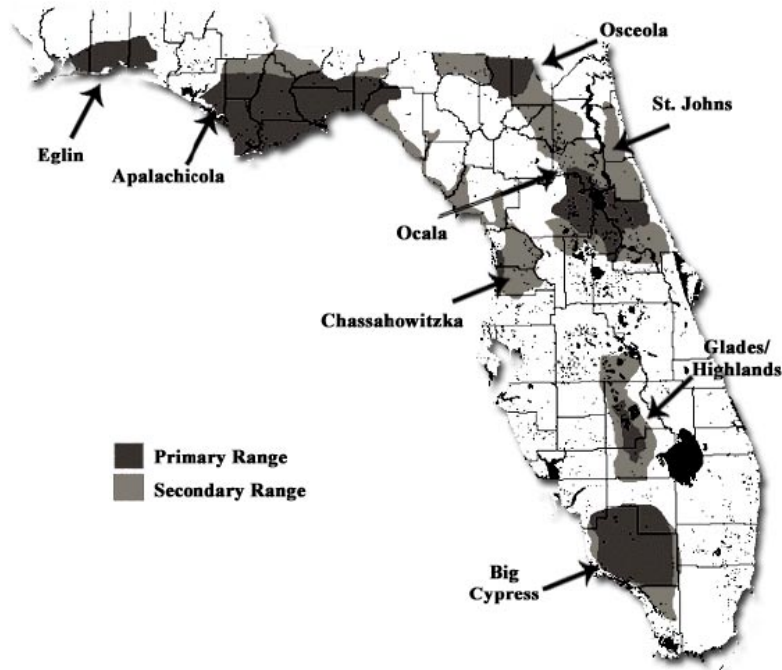


Fig. 1. Black bear distribution map (Courtesy of FWC).

Roadkill is a leading cause of known Black Bear mortality in Florida. Data collected by the Florida Fish and Wildlife Conservation Commission (FWC) from 1976 through 2002 show that approximately 53 percent of the total recorded statewide bear roadkill has occurred within the Ocala and St. Johns River core populations (FWC personal communication). Highway-related bear mortality has increased substantially during the past 27 years of monitoring, with a total of 1,115 roadkills recorded. The increase in roadkill over time is partly related to an increasing bear and human population, and bear movements due to dispersal and weather (FWC The “Bear” Facts Webpage). Other prominent factors include an increase in highway traffic volumes and vehicle speeds.

Research conducted by the Bear Management Section of the FWC in the Ocala National Forest indicates that bears are capable of crossing two-lane roads without sustaining high levels of mortality (McCown and Eason 2001). Consequently, simply looking at where bears cross unsuccessfully (i.e., roadkill locations), without evaluating successful crossings, may lead to an inaccurate assessment of bear movement patterns and travel corridors. In addition, roadways with lower levels of roadkills are likely to be more problematic when they are widened. Other impacts associated with highways, such as habitat loss, avoidance of secondary residential development, lower habitat quality, reduced connectivity of bear populations, and the cumulative effect of habitat isolation and fragmentation, may result in irreversible adverse impacts to the black bear population.

In 2003, Florida’s population exceeded 16 million people. Over the past 10 years, the 3.2 percent annual population growth rate within FDOT’s District 5 exceeded the statewide growth rate of 2.2 percent (FDOT website). In addition, while the state’s population has grown rapidly over the last 10 years, the state’s vehicle-miles-traveled rate has skyrocketed. VMT is an indicator of the level of travel on the road system. The total estimated VMT has increased 55 percent since 1992 (CUTR Website). The increase in Florida’s VMT surpasses the national average of 30 percent, and reflects factors other than population growth, such as a strong economy, relatively affordable auto travel costs, tourism, urban sprawl and low levels of public transit (CUTR Web site).

To address this increase in population growth and traffic demand, the local governments and Metropolitan Planning Organizations have identified in their long-range transportation plans capacity improvements for a number of roads that are currently sustaining high levels of bear road kills in the Ocala and St. Johns River bear population region (figure 2). The inherent conflict between highways and wildlife has resulted in considerable opposition and long-term delays to FDOT’s efforts to accomplish planned highway improvements. This paper presents results of the successful resolution of fish and wildlife resource issues associated with the proposed six-laning of Interstate 4 (I-4).

area of this landscape in the Tiger Bay and Deep Creek area, according to information in the FWC's Integrated Wildlife Habitat Ranking System (Endries et al. 2003 in press).

As a result of the recommendations made by the Environmental Advisory Group, a matrix was developed during the project's design phase to pinpoint the locations of the wildlife crossings. The matrix criteria are shown in APPENDIX A. The final sites were selected based on the matrix score, and coordination with the FWC and project engineers.

Wildlife Underpass and Overpass Designs

Several design options were explored to accommodate wildlife crossings within the corridor. These included overpasses, underpasses, box culverts and piling structures. Wildlife overpasses are not very common, with thirty worldwide and six in North America. Typically, overpass structures are installed in areas where an overpass is at, or close to, the natural grade, and the roadway is located in a valley or cut in the landscape. Wildlife overpasses like this have been constructed in New Jersey along Route 78, and in Banff National Park, British Columbia, Canada. These structures have varied in width from 50 to 100 feet, and are planted with native vegetation to provide cover for wildlife as they cross (Clevenger and McGuire).

A second type of overpass, in which the overpass is elevated above natural grade, has also been constructed in Canada and Europe. These overpasses have been constructed 150 feet in width and have natural soil floors and vegetation for cover. The elevated crossing is constructed with a 3:1 slope. These structures have documented usage by a variety of mammals, but have shown poor results with cougars (Clevenger and Waltho).

Wildlife underpasses are typically the structure of choice when the surrounding terrain is relatively flat. Wildlife underpasses have been constructed in South Florida along Interstate 75 and SR-29, and in Central Florida along SR-46. The design of the structures ranges from a large box culvert crossing to piling supported structures up to 70-80 feet in length. The typical box culvert crossing for a two-lane roadway is eight feet high and twenty-four feet wide. Both the box culvert and piling supported structures have shown good results with documented usage by small and large mammals, including black bears and Florida panthers.

A 34-month research study just completed in Banff National Park, British Columbia, Canada concerning the usage of several wildlife crossings shows certain species are more likely to use one type of crossing versus another. The study shows that ungulates, such as deer, elk, and moose, prefer the openness of overpasses. Predator species, such as black bear and cougars preferred more constricted crossing structures, and favored underpasses to overpasses at a 4:1 ratio when given the option (Clevenger and Waltho). Furthermore the study also determined that usage of wildlife crossings was negatively affected by human use, noise, and surrounding development. Crossings located close to the Village of Banff, or crossings that were a shared facility, showed lower animal use than the crossings located away from human activity, regardless of design.

In coordination with FWC, FDOT selected two underpasses and an overpass for final design. The combination meets the need of all the target wildlife species found within the project corridor. Each underpass will consist of two 108-foot x 59-foot bridge structures at each location, with a head clearance of eight feet for wildlife. The horizontal opening for passage is approximately 100 feet. The 100-foot opening and an open median were chosen in order to minimize the tunnel effect and increase animal acceptance and use. The overpass is 223 feet x 150 feet with 3:1 slopes to existing ground level. Natural soil floors, and vegetative cover will be provided for all the structures. In addition to wildlife crossings, 10-ft-tall chain link fencing of the entire six miles of public lands is proposed to deter climbing animals, reduce roadkills, and funnel wildlife to the crossings. The Tomoka River Bridges were also increased in length and height to enhance habitat connectivity and allow for improved wildlife movement.

The estimated construction costs for the overpass and each of the underpasses are \$2.7 million each for a total cost of \$8.1 million. These costs include the cost of the structure, maintenance of traffic, and embankment. Fencing and landscape costs are additional.

Land Acquisition

Landscape-level mitigation for project wetland losses, (60 acres), was facilitated through a coordinated effort by the St. Johns River Water Management District (SJRWMD) and FDOT. In Florida, there are five regional water management districts that are responsible for protecting water resources. These state agencies have significant responsibilities and programs in land acquisition, environmental restoration, water supply planning, research and monitoring. The districts also regulate water use, stormwater runoff from land development, and wetland alteration.

In 1996 the Florida legislature revised the responsibilities of the agencies and made the water management districts responsible for design and implementation of wetland mitigation for most FDOT projects. However, FDOT remains responsible for avoidance and minimization of direct and secondary impacts as a part of the roadway design and planning process. The Florida Statute which set forth the FDOT mitigation program (section 373.4137, F.S.) directs the water management districts to “focus mitigation activities on projects which address areas of significant resource needs” to the extent that such projects comply with State and Federal mitigation requirements. Although FDOT funds are transferred through the district, the program is not in-lieu fee mitigation, as the water management districts provide project-specific mitigation, including the use of private mitigation banks, funding of locally implemented projects, or other options when appropriate.

Within the SJRWMD, land preservation and enhancement to restore natural communities is currently the dominant mitigation tool, both for FDOT projects, and other permit applicants. The reason this is the most prevalent mitigation option is that significant natural areas are still available for acquisition, and those which are not protected are likely to be developed in the immediate future due to population growth. The District realizes that regulatory programs can provide a reasonable level of protection, on a project-by-project basis for many of the water quality and water quantity functions of wetlands by standard engineering solutions, or standard mitigation tools such as on-site wetland creation. However, long-term maintenance of viable fish and wildlife populations will require more than the mandatory regulatory setback or buffer around non-impacted wetlands, or wetland creation within a developed landscape.

For the I-4 widening projects, the SJRWMD mitigation plan included purchase of credits from one of the private mitigation banks in the drainage basins, construction of an urban stormwater retrofit project, and land acquisition and management within the I-4 growth corridor to benefit the wildlife most affected by the roadway projects. Although the parcel had not been identified when the plan was developed, the land acquisition goals included protection of strategic habitat, expansion of public lands adjacent to the planned I-4 wildlife crossings, and establishment of a protected wildlife linkage between existing conservation lands. The mitigation plan was approved in May 2002. In July 2002 the District closed on the final acquisition area, which is a 19,377-acre parcel. The transaction includes 11,730 acres as a conservation easement and 7,647 acres as a fee simple acquisition. The acquisition was negotiated by the SJRWMD with two timber companies and is a shared acquisition/joint ownership partnership between the SJRWMD, Volusia County, and the State of Florida. FDOT funds from the I-4 improvements will be used for approximately 30 percent of the project, including long-term management of the publicly owned parcels, and oversight of the terms of the conservation easement.

This acquisition completes a wildlife linkage between Tiger Bay State Forest, the District’s Heart Island Conservation Area, Lake Woodruff National Wildlife Refuge and the Ocala National Forest (see figure 3). The majority of the parcel has been identified by the Florida Fish and Wildlife Conservation Commission as strategic habitat for the Florida Black Bear, and includes priority habitat for several other listed species (Endries, et. al. 2003 in press). The parcel comprises commercial pinelands, hardwood swamp, isolated cypress domes, herbaceous wetlands, and xeric communities. The upland areas encumbered by conservation easement are allowed to continue in sicultural land use with hunting; however, wetland timber harvest and future development is prohibited. The public parcels are planned generally to be managed to restore the historic ecosystems by implementation of a fire management program, thinning of the planted pine to a more appropriate density, allowing natural succession of the wetland systems, managing for at least a 40 percent aerial extent of mature (>80 yr.age class) pine flatwoods, and controlling non-native vegetation. Specific management plans for public use are being developed, but will be limited to uses which respect the intent of the acquisition as mitigation for the adverse effects of roadway impacts.

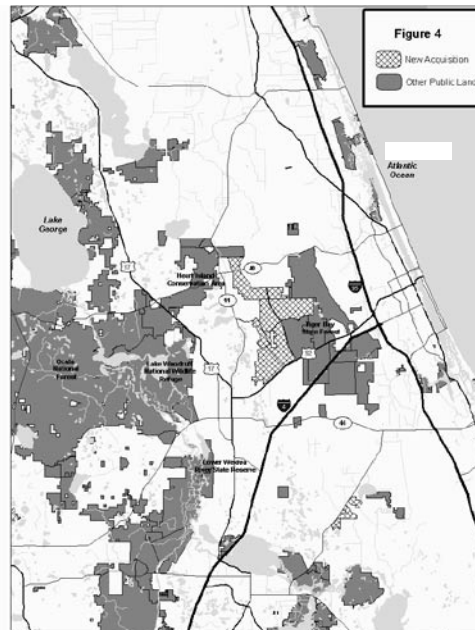


Fig. 3. SJRWMD Land Acquisition Map (Courtesy of SJRWMD)

This acquisition would likely not have occurred without the additional economic resources provided by mitigation funding from FDOT. Since the closing on this parcel, additional land acquisitions have been made that will help to maintain and enhance the long-term integrity of this conservation corridor system. South of I-4, FDOT has recently purchased a significant parcel, which may be strategic for a wildlife crossing of SR-44. The SJRWMD has a contract for purchase of an additional adjacent parcel. In addition, local public interest in preservation of conservation and recreation land is strong as evidenced by a voter-approved \$80-million bond issue for land acquisition in this region. One of the targeted acquisition areas is a 36,000-acre area defined as the Volusia County Conservation Corridor (VCCC) located just southeast of the project area.

Conclusion

FDOT is continuing to work with the FWC and the SJRWMD to establish landscape connectivity, and to minimize additional habitat fragmentation within the Ocala and St. Johns black bear population area. FDOT has committed to fund a \$75,000 hair snare study by the FWC's Bear Management Section for DNA analysis to determine an estimate of bear abundance in the region, and possibly to make additional management recommendations for the bear. An additional underpass on SR-46, south of the Ocala National Forest, is currently funded for design/build.

Landscape level mitigation and planning will be essential to maintain Florida's wildlife populations and ecosystems, given the state's expanding population and high level of travel on the road system. This is only achievable by public and private partnerships with combined economic resources, some flexibility and trust between the regulatory, resource, and transportation agencies, along with opportunity and good luck.

Biographical Sketch: Letitia Neal has worked as an environmental scientist for the Florida Department of Transportation for the past 10 years. Her expertise includes the development of transportation projects in compliance with the National Environmental Policy Act. She is particularly interested in reducing the effects of roads on wildlife populations. Letitia received her B.S. in biology from Tulane University and her M.S. in soil science from the University of Florida. Terry Gilbert has worked as a wildlife biologist with the Office of Environmental Services of the Florida Fish and Wildlife Conservation Commission for the past 28 years in fresh and saltwater environments addressing such issues as avoidance, minimization and mitigation measures for highway impacts on wildlife populations and habitat systems, acquisition of conservation land, habitat restoration on lands strip-mined for phosphate, limestone, sand, and heavy minerals, and large-scale projects including channel dredging, and commercial and residential developments. He received a B.S. in wildlife ecology and forestry from the University of Florida, and an M.S. from Auburn University in wildlife management and fisheries biology.

Thomas Eason is a wildlife biologist who has spent most of his career studying the American black bear. Thomas has completed his B.S. and M.S. in wildlife science and his Ph.D. in ecology. He began research on black bears during the summer of 1992 and has continuously studied various aspects of bear ecology since that time. Thomas continues his nine years of research and management of bears as the leader of the Bear Management Section for the Florida Fish and Wildlife Conservation Commission.

Lisa Grant has worked as an environmental scientist for the St. Johns River Water Management District for the past 17 years. She is currently the technical program manager for the FDOT Mitigation Program. She has a B.S. in biology from the University of West Florida.

Tom Roberts has worked as a biologist with EMS Scientists, Engineers, Planners, Inc., for 13 years and currently serves as director of environmental assessment. He specializes in the assessment and mitigation of environmental issues associated with roadway corridors (existing and new) through natural lands, and locating, assessing and permitting mitigation banks and regional mitigation sites in Florida and other southeastern states. He has a B.A. in biology from Stetson University.

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APPENDIX A - Proposed Wildlife Crossing Matrix Scoring Sheet

Project:

Project Location:

Wildlife Crossing Number:

Scoring Date:

CRITERION	SCORE
Documented Bear Kill Sites	
No recorded bear kills within 1,000 feet = 0	
Five or less recorded bear kills within 1,000 feet = 1	
More than five recorded bear kills within 1,000 feet = 2	
Suitable Habitat	
Suitable habitat not present on either side of crossing = 0	
Suitable habitat present on one side of crossing = 1	
Suitable habitat present on either side of crossing = 2	
Development Density	
Medium or high density residential, commercial or industrial = 0	
Low density residential or agricultural land = 1	
Minimal to no development = 2	
Human Use of Structure	
Moderate / regular use of structure anticipated = 0	
Low / infrequent use of structure anticipated = 1	
No use of structure anticipated = 2	
Predicted Wildlife Movement Routes¹	
Not lying within a predicted wildlife movement route = 0	
Lying within a predicted wildlife movement route = 1	
Wildlife Hot Spots – Target Focal Species² - Bear	
Habitat Score < 4 = 0	
Habitat Score 4 - 6 = 1	
Habitat Score > 6 = 2	
Wildlife Hot Spots – Identified Regional Hot Spots³	
Potential for focal species < 3 = 0	
Potential for focal species 3-4 = 1	
Potential for focal species > 4 = 2	
Field Observations	
No observations of wildlife trails = 0	
Non-target wildlife species observed on wildlife trails = 1	
Target wildlife species observed on wildlife trails = 2	
Linkage to Public Lands	
Public lands not present on either side = 0	
Public lands present on one side = 1	
Public lands present on both sides = 2	
Design Constraints	
Design constraints lead to a fatal flaw = NO BUILD	
Design constraints exist = 1	
No obvious constraints exist = 2	
Physical Barriers to Wildlife Movement	
Bear kills documented along parallel facility/ large physical barrier present in proposed wildlife pathway = 0	
Bear kills may occur along parallel facility/ physical barrier present in proposed wildlife pathway = 1	
Parallel facility/ physical barrier not present in proposed pathway = 2	
Fencing	
Less than ½ mile of fencing in all quadrants	
At least ½ mile of fencing in 1 or more quadrants	
At least ½ mile of fencing in all quadrants	
TOTAL SCORE	

¹From *Ecological Characterization of Identified High Priority Highway—Ecological Interface Zones Including the Inventory and Evaluation of Existing Florida Department of Transportation Highway Facilities Within These Zones*

²From *Closing the Gaps in Florida's Wildlife Habitat Conservation System* Figure 49

³From *Closing the Gaps in Florida's Wildlife Habitat Conservation System* Figure 166c