Title
Using GIS to showcase “endangered species and transportation” initiatives in Georgia

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Abstract: Section 7 of the Endangered Species Act (ESA) mandates federal agencies such as the Federal Highway Administration (FHWA) to insure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the secretary of the interior. ESA, therefore, has a significant effect on the selection of a roadway alignment and consequently the cost of the entire highway project. As evident in many parts of the country, developments experienced in the transportation industry have had a considerable impact on the environment and the general populace. This has resulted in significant changes in the use of land in many metropolitan regions in the country. Among the many environmental issues that transportation officials have to deal with is the issue of threatened and endangered species (TES). The study involved a review of best practices of TES issues as they relate to transportation. Three of such examples from the State of Georgia are presented as case studies in this paper. Geographic information system (GIS) applications were developed for all the projects used in the case studies, some of which are presented in this paper. The paper concludes by noting the influence of ESA on transportation projects.

Introduction
In the last half of the 20th century, the City of Atlanta, Georgia, has risen as the premier commercial, industrial, and transportation urban area in the southeastern United States. The rapid growth of the Atlanta area, particularly within the last 25 years, has made Atlanta one of the fastest growing metropolitan areas in the United States. The population of the Atlanta metropolitan area increased by 27 percent between 1970 and 1980, 33 percent between 1980 and 1990 [1], and 31 percent between 1990 and 2000 [2]. Corresponding to this rate of growth is the increasing demand for transportation infrastructure and services. As in many parts of the country, developments experienced in the transportation industry have had a considerable impact on the environment and the general populace. This has resulted in significant changes in the use of land in the metropolitan region. Trends in the loss of vegetation have contributed significantly to the environmental degradation in the region. There are issues of water quality, noise pollution from motor vehicles, serious problems of air quality, soil erosion and similar environmental problems. While such changes present physical and measurable environmental consequences, other environmental concerns that need to be addressed relate to the issue of threatened and endangered species. “With more and more of our native landscape being displaced by invasive non-native plants or lost to shopping malls, office buildings, suburbs and other developments, it is vital that we save whatever parcels or fragments of native vegetation we have. And the fragments of native vegetation within the 12 million acres of highway corridors in this country are valuable parcels of habitat for many rare, native plants and animals” [3].

Section 7 of the Endangered Species Act (ESA), mandates federal agencies such as FHWA to insure that any action authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the secretary of the interior [4]. In this study, geographic information systems (GIS) was used as the platform to provide a visual interpretation of existing locations of TES and the corresponding highway projects.

Methodology
A general literature review revealed that ESA issues play a significant role in highway-related projects. Issues range from lawsuits, such as the case between “National Wilderness Institute vs. FHWA et al., on the Potomac River Project [5] and the National Regional Planning Committee vs. Vermont Fish &Wildlife on the Missisquoi Bay Bridge Project in Vermont [6]; mitigation of ESA-related bridge projects, such as the “Florida Black Bear Underpass and Wekiva River Bridge” [7], and the “East Brady Replacement Bridge” over the Allegheny River in Pennsylvania [8]; and best practices relating to the restoration of TES, such as the use of highway-right-of-way for restoration of rare plant habitat in coastal Virginia [9]. A case study approach was used to showcase examples of how the Georgia Department of Transportation (GDOT) is dealing with TES-related issues. While many projects were studied in this study, brief summaries of the findings of three of those projects are presented here in this paper. The following paragraphs and GIS maps provide a quick overview of the projects, the TES issues involved and some of the management practices used to deal with the issue.

Case Study #1: Widening of US 19 through Taylor, Schley, and Sumter Counties in Georgia
Atlantic white cedar and the Sweet Pitcher plant were found in the vicinity of the project area. The major issue of concern was the Atlantic white cedar.
To save the habitat while also taking care of other environmentally related issues such as wetlands, the entire alignment was changed. Thus a change in alignment may sometimes be the best solution in dealing with TES issues. Figure 1 shows the relative locations of US19 and the three-County project area.

**Case Study #2: The Reconstruction and Relocation of US 27/SR1: The Summerville Bypass in Chattooga County in Georgia**

Habitats for the Large Flowered Skullcap were found at multiple locations in the project area. In consultation with the Fish and Wildlife Service (FWS), the Georgia Department of Transportation adopted different measures to solve the TES issues. Some of the measures included the purchase of a piece of land to preserve the Skullcap population and the use of erosion control and vegetation maintenance measures to reduce the impact of construction and road maintenance activities on the Skullcap population in the area. Figure 2 is a GIS map showing one of the Skullcap populations in the project area.

**Case Study #3: The Reconstruction of the I-95 Corridor in Glynn and McIntosh Counties in Georgia**

The Florida Manatee, Shortnose Sturgeon, Bald Eagles and Wood Stocks were the TES issues encountered on this project. While construction has not yet started, the TES issues have been resolved. Special provisions to be followed by contractors, such as stopping construction upon sighting a bald eagle within 100 yards of the construction site, is one of the precautionary measures being taken to deal with the ESA issues on this project. Figure 3 is a GIS map showing the project areas in the two counties.

**Conclusion**

ESA issues take a considerable amount of time in the implementation of highway projects. There are also quite a number of cases and examples of best practices in ESA issues. The best method though is to visit a state DOT and take a look at its projects file to determine how these issues are resolved. Most of such information is hard copy correspondence and meeting minutes that may be stored in folders in the department. Also, using GIS as a tool provides an excellent way of looking at the problems as it provides a visual representation of the spatial entities and their relationship with the project. Transportation planners can, therefore, use GIS to determine alternatives that satisfy existing needs while simultaneously managing the balance between transportation development and the preservation of natural and social resources.
Biographical Sketch: Robert A. Baffour, Associate Professor, Clark Atlanta University. Dr. Baffour is a professor of civil and transportation engineering at Clark Atlanta University. He teaches courses in transportation engineering and GIS. Dr. Baffour’s research projects focus on the applications of spatial data technologies such as GIS and GPS in transportation and environmentally-related issues.

References


