INCORPORATING PEDOLOGY INTO TRANSPORTATION-RELATED COASTAL RESTORATION AND MITIGATION PROJECTS

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ABSTRACT

Coastal mitigation and shoreline restoration are a part of Florida transportation activities. Soils-based information could improve success if incorporated into the planning and the design of mitigation/restoration projects. Pedology, the branch of soil science focused on soil/landscape relationships, can provide a framework through which soils information can be obtained and applied. However, pedology has not traditionally focused on submerged lands. In 2006, the Florida Department of Transportation (FDOT) partnered with the University of Florida Soil and Water Science Department to explore the expansion of pedology into estuarine habitats. Since then, the FDOT has funded several pedological research projects in Florida coastal waters. These projects share the common goal of developing soils-based knowledge aimed at improving the location and design of coastal mitigation and restoration. The first project focused on exploring soil/landscape relationships of the shoreline and seagrass flats in the Gulf of Mexico. The objective was to create the first ever Southeastern United States (US) subaqueous soil survey map. Technical guidelines were established for the collection and modeling of bathymetric data, sampling of soils, and design of soil map units. The resulting map served as a proof-of-concept for subaqueous soil survey. It also provided guidance for future FDOT seagrass research projects and other projects focused on shellfish aquaculture. The next project extended pedology eastward to the Indian River Lagoon, FL. Soil/landscape relationships were similar to those observed in the Gulf. Future work will include mapping, but the initial focus was on a spoil Island that was mostly removed in 2005. The remaining island was contoured into subtidal and intertidal habitats. Five years after completion, the island was abundant in mangroves and seagrasses. This success demonstrates the potential benefit of spoil islands to transportation. Design lessons learned are to use Spartina alterniflora (Marsh Grass) for shoreline stabilization and mangrove recruitment, creating elevation heterogeneity to enhance natural recruitment of mangroves and seagrasses, and integrating wide flushing channels to enhance flow in/out of the site. The use of geospatial modeling provided additional insight into the growth patterns of target species. Projects in the Florida Keys have provided an opportunity to investigate soil properties that control seagrass growth. In Lake Surprise, FL transplants of Halodule wrightii (Shoal Grass) were grown in various soil types. Particle size distribution, organic matter content, and phosphorous concentration controlled the growth of the transplants. In Boca Chica, FL seagrass was observed growing in an impoundment recently connected to the Atlantic ocean. Large, dense seagrass beds were observed near flow structures, around snags, and along shorelines where trapping of suspended particles occurs. Soil was thicker and had higher phosphorous, organic matter, and fine particles in these areas. These pedological projects have provided the FDOT with much needed ecological and design information. They also provide guidance for a future effort by the US Natural Resource Conservation Service to extend soil survey into aquatic habitats throughout the US. These future maps will in-turn provide beneficial planning information for transportation activities.

BIOGRAPHICAL SKETCH

Rex Ellis has worked as a Research Assistant professor at the University of Florida Soil and Water Science Department since 2008. Rex is a pedologist focusing on soil and water landscape relationships in the Southeastern Coastal Plain of the U.S. His research involving soils supporting seagrasses and mangroves has supported coastal restoration and mitigation efforts for the Florida Department of Transportation. Additionally, he studies soils supporting shellfish aquaculture, terrestrial wetland soils, and carbon dynamics of forest soils drowned by rising sea level. Rex integrates a geostatistical approach to these research projects in order to elucidate spatio-temporal trends and their effect on the aforementioned ecosystems.