**NASA DEVELOP National Program**

****Mobile County Health Department

**Spring 2016**

**Short Title: Mobile Bay Ecological Forecasting**

**Subtitle:** Monitoring Marsh Conditions in Coastal Alabama Using NASA Earth Observations to Support the Alabama Coastal Foundation’s Restoration and Conservation Initiatives

**VPS Title:** Mission to Marsh: Using NASA Satellite Data to Monitor Coastal Conditions

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Kenton Ross (NASA Langley Research Center)

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**Partner Organizations:**

Alabama Coastal Foundation (End-User), POC: Mark Berte; Boundary Organization

Dauphin Island Sea Lab (Collaborator), POC: Dr. Just Cebrian

**Project Details**

**Applied Sciences National Applications Addressed:** Ecological Forecasting, Water Resources

**Study Area:** Mobile and Baldwin counties, AL

**Study Period:** January 1984 – January 2016

**Earth Observations & Parameters:**

Landsat 5, TM – vegetation indices

Landsat 7, ETM+ – vegetation indices

Landsat 8, OLI – vegetation indices/land classification

Aqua/Terra, MODIS – vegetation indices

**Ancillary Datasets Utilized:**

* USGS National Land Cover Dataset (NLCD) – land cover
* NOAA Coastal Change Analysis Program (C-CAP) – regional land cover
* NOAA Coastal LiDAR – DEM and bathymetry
* NOAA NCDDC – land use/land cover (1984-2008)
* US Fish and Wildlife Serrvice National Wetlands Inventory– wetland identification
* USDA Forest Service ForWarn Near-Real-Time Change Maps – NDVI profiles
* Alabama Coastal Foundation Watershed Data – watershed boundaries

**Models Utilized:**

* TerrSet Geospatial Monitoring and Modeling System Land Change Modeler (LCM)

**Software Utilized:**

ERDAS IMAGINE, 2015 - Land classification of Landsat imagery, LiDAR analysis

ArcGIS 10.3.1, 2015 - Raster manipulation/analysis, image enhancement & map creation of

 Landsat ETM+, NPP VIIRS, and Aqua/Terra MODIS

dnppy - Converting Landsat data to TOA reflectance

TerrSet - Land Modelling & Forecasting of Marshes

**Project Overview**

**Objective:**

The objective of this project was to apply NASA satellite data to assess historical and current marsh conditions within priority watersheds. Landsat 5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper Plus (ETM+), Landsat 8 Operational Land Imager (OLI), and Aqua/Terra MODIS data were used to perform marsh health trend analyses and to produce a land use land cover map to assist Alabama Coastal Foundation in their decision-making process for future conservation initiatives designed to protect and restore marshland.

**Abstract:**

Mobile and Baldwin counties encompass the region known as Coastal Alabama. The fresh, brackish, and saltwater marshes of this area shelter a wide variety of species and provide valuable ecosystem services. Over several decades, this area has experienced extensive wetland loss due to a combination of anthropogenic and natural stressors. This project partnered with the Alabama Coastal Foundation (ACF) and the Dauphin Island Sea Lab (DISL) to address community concerns of ecosystem decay within Coastal Alabama marshland. NASA’s Earth observations data helped to identify areas that are suitable for restoration and conservation projects. Landsat 5 Thematic Mapper (TM), Landsat 7 Enhanced Thematic Mapper Plus (ETM+), Landsat 8 Operational Land Imager (OLI), and Aqua/Terra MODIS data assisted in extracting vegetation indices and established baseline conditions for marsh health. These findings will support the ACF by providing data and maps of marsh health trend analyses, which will focus future restoration projects in appropriate areas.

**Community Concerns:**

* Marshland provides valuable habitat for many wildlife species. Of the 50 US states, Alabama ranks 5th in terms of different endemic species, 4th in terms of endangered species, and 2nd in terms of extinct species (Handely, et al. 2007).
* Marsh degradation affects the entire estuarine ecosystem where the harvest of shrimp, crab, and oysters are a major local industry (Handley, et al. 2007).
* Between 1954 and 2002, 54.4% of emergent wetlands were lost due to urban expansion, erosion, and saltwater intrusion, of which 32.8% were salt marshes (Handley, et al. 2007).

**Current Management Practices & Policies**:

The Dauphin Island Sea Lab (DISL) monitors the marshlands through the Mobile Bay National Estuary Program, which identifies, restores, and protects estuaries that are significant to the Mobile Bay area. In 2013, these organizations developed a 5-year plan for the conservation and management of Alabama's coast. In this plan, it was determined that anthropogenic factors are the main cause of stress for intertidal marshes and riparian buffers. The DISL evaluated the watersheds and, with public input, selected watersheds on which to focus. Another aspect involved using a combination of ground surveys and remotely sensed data in order to determine the health of these watersheds. In order to work effectively, this plan partially depends on combining the efforts of various groups to assess, monitor, and process data regarding the watersheds. The Alabama Coastal Foundation (ACF) also aims to educate government institutions, businesses, and the public about the state of Alabama’s coastal environments in order to facilitate cooperation and involvement in protecting these environments. These organizations function as advocates for preserving and improving environments along the Alabama coast. Additionally, the ACF encourages free information exchange among concerned parties that may prove useful for the protection and improvement of coastal habitats.

**Decision Support Tools & Benefits:**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Marsh Health Trend Analysis Maps | Landsat 5 (TM), 7(ETM+), 8 (OLI) and Aqua/Terra (MODIS) | Assist the Alabama Coastal Foundation in deciding where to focus future protection, restoration, and mitigation efforts based on historical patterns of marsh health characteristics |
| Current Marsh Health Map | Landsat 5 (TM), 7(ETM+), 8 (OLI) and Aqua/Terra (MODIS) | Current marsh health to be used as input for predictive modeling |
| Marsh Health Forecast Maps | Landsat 5 (TM), 7(ETM+), 8 (OLI) and Aqua/Terra (MODIS) | Aid the Alabama Coastal Foundation with decision-making for future protection, restoration, and mitigation projects of marshland initiatives |
| Current Land Use/Land Cover Map | Landsat 8 (OLI) | Aid the Alabama Coastal Foundation with decision-making for future protection, restoration, and mitigation projects of marshland initiatives |

**Project Imagery**

**[Insert image here]**

**Caption:** [Insert Caption Here. Max of 25 words.] Image Credit: [Insert project short title] Team.

**Image:** File Name (Please submit your image as a separate .jpeg as well as inserting it in this document)

**Software Release Requirements**

What category does the tools your project is creating fall within? Category III