**NASA DEVELOP National Program**

****LaRC

**Summer 2015**

**Short Title:** North Carolina Ecological Forecasting

**Subtitle** Evaluating the Application of NASA Earth Observations to Detect Change in Wetland Types at a Regional Scale

**VPS Title:** Wetland Extent in the Albemarle Pamlico watershed

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Kenton Ross

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**Past or Other Contributors:**

**Partner Organizations**

Albemarle-Pamlico National Estuary partnership (APNEP), End User, Jim Hawhee

**Project Details**

**Applied Sciences National Applications Addressed:**

Ecological Forecasting

**Study Area:** Albemarle-Pamlico watershed located in Virginia (VA) and North Carolina (NC).

**Study Period:** 1990 - 2015

**Earth Observations & Parameters**

Landsat 7 ETM+ – Land cover

Landsat 8 OLI – Land cover

TerrSet – Digital Elevation Model

**Ancillary Datasets Utilized**

* (DEM) USGS EarthExplorer
* NOAA Coastal Change Analysis Program (C-CAP) - regional land cover
* Infrastructure – roads, buildings
* Soil Type
* State and County boundaries – shapefile
* Watershed boundary – shapefile

**Models Utilized**

* Random Forest Classification – Creators: Dr. Ned Norning and Dr. Martin Wegman
* Land Change Modeler – Idrisi TerrSet

**Software Utilized**

RStudio – RandomForest classification on Landsat imagery

Idrisi Terrset – future wetland extent prediction

ERDAS IMAGINE - land classification of Landsat imagery

ArcGIS - Raster Manipulation/Analysis, Image Enhancement & Map Creation of Landsat 7 and 8 imagery

**Project Overview**

**80-100 Word Objectives Overview**

This project looks at wetland extent in the Albemarle-Pamlico estuary over time. Using a supervised classification tree, land cover is mapped throughout the study area using Landsat scenes from 1990, 2000, and 2015 with a specific focus on wetland delineation. Change analysis is conducted between the three scenes to gain an understanding of how land cover has changed over time and assess the implications these changes have on wetland areas. A classification tree tutorial is provided to the partner organization to aid them in future assessments of the region’s wetlands.

**Abstract**

As a result of their sensitivity to sea level rise, wetlands are considered one of the most vulnerable ecosystems to climate change. In addition, wetland extents have diminished over time due to population increases and the associated land change patterns. This project partnered with the Albemarle-Pamlico National Estuary Partnership (APNEP) to determine land cover change within the Albemarle-Pamlico watershed from 1990 to 2015 using NASA Earth Observations (EO), specifically Landsat-7 and Landsat-8. Images were collected from 1990 (Landsat 7) and 2015 (Landsat 8), and classified based on a Random Forest classification tree analysis. Change analysis was conducted between the images to assess temporal trends in wetland extent throughout the study area. Historical and current land cover maps, change analysis statistics and reports, and a detailed classification tree tutorial were provided to APNEP to support the organization in implementing policies toward wetland monitoring, protection, and restoration.

**Community Concerns**

* The extent of Albemarle-Pamlico
* How much change has occurred

**Current Management Practices & Policies**

For this project the partnership with the Albemarle-Pamlico National Estuary Program (APNEP) will encompass interactions with U.S. Federal, State, and Local governments as well as non-governmental organizations (NGO), academia, and the public. In 1987 the Albemarle-Pamlico watershed region was considered an “estuary of national significance” and was among the first 28 National Estuary Programs (NEP) established by the U.S. Environmental Protection Agency (EPA) through amendments of the federal Clean Water Act (CWA). A recent implementation of an Ecosystem-Based Management (EBM) in addition to the Comprehensive Conservation Management Plan (CCMP) seeks to identify, protect, and restore the significant resources provided by the Albemarle-Pamlico estuary system. Conservation efforts are directed through a watershed approach including management practices at headwater, rivers, and streams all the way to the sounds, addressing a broad range of issues throughout the watershed. Currently N.C. Governor's Executive Order #133 provides advisory structure through a Policy Board, a Science and Technical Advisory Committee, and an Implementation Committee. North Carolina relies primarily on the 401 certification for state-level wetland regulation administered by the North Carolina Department of Environment and Natural Resources (NCDENR), and Division of Water Quality (DWQ). In 2001 a similar set of rules also administered by DWQ pertaining to isolated wetlands not regulated under Section 404 of the Clean Water Act requires a permit to be obtained for authorized activities that do not alter existing uses. North Carolina’s Coastal Area Management Act (CAMA) requires developments in “Areas of Environmental Concern” (AECs) to obtain a separate permit from NCDENR Division of Coastal Management. In 1997, North Carolina adopted Riparian area buffer rules which creates a 50-ft wide riparian buffer along waterways of the Neuse river basin, similar rules were adopted for the Tar-Pamlico river basin in 2000 and for the Randleman Lake basin in 2001.

**Decision Support Tools & Benefits**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Statistics give “From-to” Change | Landsat- 5,7, and 8 | Quantitative output that puts a number on the health the Albemarle-Pamlico wetlands. |
| Maps showing Landover change from 1990 – 2015 | Landsat- 5,7, and 8 | These maps can be used to demonstrate the change in wetland extent over the past 15 years. |
| Tutorial | Landsat- 5,7, and 8 | A tutorial that can be used to replicate the projects methodology and deliverables. |

**Project Imagery**

**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)