**NASA DEVELOP National Program**

****Langley Research Center

**Summer 2015**

**Short Title:** North Carolina Ecological Forecasting

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

**VPS Title:** Delineated wetland extend in the Albemarle Pamlico Estuary System

**Project Team & Partners**

**Project Team:**

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**Advisors & Affiliations**

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Michael Bender (NASA DEVELOP National Program)

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**Partner Organizations**

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

National Oceanic and Atmospheric Association (NOAA), Contributor, Don Field

North Carolina Department of Environmental and natural Resources, Contributor, (NCDENR), Dean Carpenter, Bill Crowell, Cyndi Karoly

**Project Details**

**Applied Sciences National Applications Addressed:** Ecological Forecasting

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

**Study Period:** 2000 - 2015

**Earth Observations & Parameters**

Landsat 5 TM – Land cover

Landsat 7 ETM+ – Land cover

Landsat 8 OLI – Land cover

**Ancillary Datasets Utilized**

* USGS Dataset – Digital Elevation Model (DEM)
* North Carolina Department of Transportation (NCDOT) – Roads -Shapefile
* U.S. Census Bureau - State and County boundaries - Shapefile
* Albemarle-Pamlico National Estuary partnership (APNEP) - Watershed boundary – Shapefile

**Software Utilized**

TerrSet Idrisi – Pre-processing and analysis

ERDAS IMAGINE – Pre- processing and analysis

ArcGIS - Raster Manipulation/Analysis, Image Enhancement & Map Creation of Landsat- 5, 7, and 8 imagery

DNPPY – Raster Analysis tool kit

**Project Overview**

This project looks at wetland extent in the Albemarle-Pamlico estuary over time. Using a dense time stacking of Landsat Imagery, wetland extent will be mapped throughout Albemarle Pamlico watershed between the years 2000 – 2015. NASA Earth Observing Systems(EOS), in particular Landsat-5, 7, & 8, will be used to collect imagery. Two indices will be used, one that measures change in water extent over the years and one that will measure the relative health of the wetlands themselves. This two pronged approach seeks to capture both natural and anthropogenic effects on the Albemarle Pamlico estuary system.

**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 associated land change patterns. This project, partnered with the Albemarle-Pamlico National Estuary Partnership (APNEP), seeks to delimitate wetland extent within the Albemarle-Pamlico watershed from 2000 to 2015 using NASA Earth Observing Systems (EOS), specifically Landsat-5, 7, and 8. Images were collected for each year from 2000 to 2015. After pre-processing the images, indices that measure water extent and wetland health were calculated for each image. Form these indices wetland extent and relative health can be measure more rapidly than classification methods. A tutorial was provided to APNEP to support the organization in implementing policies toward wetland monitoring, protection, and restoration.

**Community Concerns**

* Expands a large geographic area (25 counties in NC and 10 counties in VA)
* Second largest Estuary System
* Impact of wetland degradation on local ecosystems
  + Water Filtration, Nursery for juvenile fish, carbon sequestration
* Impact of wetland degradation on local and regional economies
  + Eco-tourism, fishing industry

**Current Management Practices & Policies**

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. Current 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** | Landsat-5, 7, and 8 | **Benefit & Impact** |
| Statistics showing water extent and wetland health over time | Landsat-5, 7, and 8 | Quantitative output regarding the health of the Albemarle-Pamlico wetlands. |
| Maps showing Landover change from 2000 – 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**

Landsat 8 imagery path 14 row 35, North Carolina Ecological Forecasting

