**NASA DEVELOP National Program**

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NASA Langley Research Center

**Fall 2015**

**Short Title: North Carolina Ecological Forecasting**

**Subtitle:** Reassessment of NOAA C-CAP Wetland Delineation and Further Disaggregation of Land Use Classes using Remote Sensing

**VPS Title:** Remote Sensing for the Wetlands: Landsat 8, Lidar and Soil for Land-Use in the Albemarle-Pamlico Watershed

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Emily Adams (Center Lead)

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**Past or Other Contributors:**

Zand Bakhtiari (Team Lead)

Stephen Zimmerman

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Brad Gregory (USAF)

**Partner Organizations:**

Albamerle-Pamlico National Estuary Partnership (APNEP) (End-User), POC: Bill Crowell; End-User

APNEP (End-User), POC: Dean Carpenter; End-User

**Project Details**

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

**Study Area:** NC, VA

**Study Period:** May 2000 - Nov 2015

**Earth Observations & Parameters:**

Landsat 8, OLI – land cover

**Ancillary Datasets Utilized:**

* USGS National Land Cover Dataset (NLCD) - land cover
* NOAA Coastal Change Analysis Program (C-CAP) - regional land cover
* National Hydrological Dataset
* USGS Digital Elevation Model
* Soil Survey Geographic Database (SSURGO)

**Models Utilized:**

* Remote Sensing for Biodiversity and Conservation, R Random Forest Model

**Software Utilized:**

ERDAS IMAGINE - land classification of Landsat imagery

ArcGIS - raster manipulation/analysis, image enhancement & map creation of Landsat 8. Selection of Training sites for supervised land-use classification in R random forest model.

**Project Overview**

Landsat 8 imagery in consort with Lidar, DEMs, soil data and ground truthing provide powerful tools in this land classification project. Data is used to classify land use types, update NOAA’s C-CAP program and identify additional land cover categories such as  areas impacted by the invasive species, phragmites.

**Abstract:**

This project focuses on ecological forecasting in the Albemarle-Pamlico watershed in Northern North Caronlina and Southern Virginia. The Albemarle-Pamlico watershed encompasses the second largest estuary system in the United States. Knowing and understanding land cover types and uses is incredibly important in managing the plethora of uses and stressors on this valuable resource.  In partnership with the Albemarle-Pamlico National Estuary Partnership (APNEP), this project aim is to provide an updated version of NOAA’s Coastal Change Analysis Program (C-CAP) land-use classification, with a specific focus on delineation of wetland types within the watershed. The project also intends to further disaggregate land cover types such as crop varieties and the invasive species, phragmites. The team is utilizing a supervised land classification methodology run in ERDAS Imagine and ESRI ArcGIS and cross-referencing findings by ground truth, Lidar or DEMs and soil datasets.  The end goal of the project is to produce maps and a methodology by which APNEP can continually update wetland types and phragmites extent within the watershed and better inform policy and management decisions.

**Community Concerns:**

* Data and resources Limitations
* Existing active wetland monitoring programs are limited in their utility for ecosystem-based management
* C-CAP is helpful but does not cover upper portion of Albemarle-Pamlico region and is only updated on approximately a five year cycle

**Current Management Practices & Policies**:

According to APNEP, they utilize an ecosystem-based approach to watershed management. This is with the intention of incorporating a broad range of actors and encompassing a wide spectrum of uses from human to environmental to protect, conserve and restore wetland resources. The group also works throughout the entire watershed, aiming to employ a diverse body of partnerships for management, protection and remediation. While the organization utilizes NOAA’s C-CAP data, use of remote sensing data remains fairly limited, primarily due to the issues listed in Community Concerns above. Much of their research and data relies on field work and partner-organizations, which while invaluable to any management strategy, could likely be augmented and highly benefited by additional use of data like Landsat 8.

**Decision Support Tools & Benefits:**

|  |  |  |
| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Land use classification and wetland type map | Landsat 8 OLI | Aid in describing focus areas and wetland types for protection/conservation or remediation efforts |
| Methodology for continuously updating C-CAP  | Landsat 8 OLI | C-CAP is only updated by NOAA once every 5 years so this would enable APNEP to update wetland types and other classifications such as phragmites more regularly  |
|  |  |  |

**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 do the tools your project is creating fall within? [Category I to V]

If your decision support tools fall within Category IV, fill out this section:

**Software Title:** Insert here (ex. DEVELOP National Program Python Package)

**Software Abbreviation:** Insert here (ex. dnppy)

**Technical Point of Contact:** Insert full name, permanent email, and node here. Also include whether employed through SSAI or Wise County. (Team member who knows the most about the software.)

**Brief Description of the Software:** Insert here (ex. The dnppy package will be used to functionalize common programming tasks in the geospatial community, specifically for working with NASA data products. It will include functions for processing satellite data and assist in structuring analysis to reduce the startup time for DEVELOP teams to learn programming and create tools for end users.)

**Type of Code:** *Executable Code* and/or *Source Code* (Select one or both)

**Will the software include any embedded computer databases?** *Yes* or *No* (Select one)

**Does the software use or call any open software or libraries?** *Open Source* and/or *Proprietary/Commercial* (Select one or both)

**List the software or libraries used, under what license they were obtained, and the URL for the license in the table below:**

|  |  |  |
| --- | --- | --- |
| **Name** | **License** | **License URL** |
| Ex. Arcpy module | Ex. group license through ArcGIS | http://www.esri.com/software/arcgis |
| Ex. Python | Ex. Open source license | http://opensource.org/licenses/Python-2.0 |
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**Full Software Description and Plan**

**Introduction/Objective:**

What motivated the creation of this software, what problem does it address?

**Applications and Scope:**

Where and how will this software be used to influence decisions?

**Capabilities:**

What can it do better than what was previously available?

**Interfaces:**

How is one expected to use the software? For example, command line, GUI, script execution, etc.

**Assumptions, limitations, & Errors:**

What areas that the software could be improved upon in the future? This is where limitations of the theory, model, science, etc should be briefly documented. If the tools only work for a specific scenario, say so.

**Testing:**

What validation techniques and testing strategy will be used to build confidence in the software?