**NASA DEVELOP National Program**

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University of Georgia

**Summer 2015**

**Short Title: Southeast U.S. Ecological Forecasting**

**Subtitle:** Utilizing NASA Earth Observations and Proximal Remote Sensing for Mapping the Spatio-temporal Distribution of *Hydrilla verticillata*

**VPS Title:**

**Project Team & Partners**

**Project Team:**

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**Advisors & Mentors:**

Dr. Deepak Mishra (University of Georgia)

Dr. Susan Wilde (University of Georgia)

**Past or Other Contributors:**

Benjamin Page

**Partner Organizations**

J.W. Jones Ecological Research Center, End-user, POC: Dr. Stephen W. Golladay, Associate

Scientist

Henry County Water Authority, End-user, POC: Ken Presley, Assistant Reservoir Manager

Georgia Power, End-user, POC: Anthony Dodd, Environmental Specialist

**Project Details**

**Applied Sciences National Applications Addressed:**

Ecological Forecasting, Water Resources

**Study Area:** Lakes Thurmond, Seminole, Goat Rock, Oliver, and Harding: AL, FL, GA

**Study Period:** 2013 - 2015

**Earth Observations & Parameters**

Landsat 8, OLI - Hydrilla distribution and vegetation indices

**Ancillary Datasets Utilized**

* Unmanned aerial system, DJI Phantom 2 Vision +, Center for Geospatial Research, UGA - Hydrilla distribution for validation
* Hyperspectral digital camera Basler acA1300, University of Georgia -
* Ocean optics non-imaging hyperspectral radiometer, University of Georgia - above water remote sensing reflectance (Rrs) measurements
* *Hydrilla verticillata* field data - locations, density per area, and plant height data

**Models Utilized**

* Deepak Mishra, UGA Radiative Transfer Models (Benthic Mapping)
* Deepak Mishra, UGA Green NDVI

**Software Utilized**

ACOLITE - Atmospheric Correction of Landsat 8 data

ENVI FLAASH – Atmospheric correction of Landsat 8 data

ArcGIS - Map creation

Matlab and Excel - Model calibration and validation

**Project Overview**

**80-100 Word Objectives Overview**

The overall objective of this project is to utilize remote sensing data from multiple sources to create a current hydrilla distribution map of the study areas, and to develop a model that partners can use to determine hydrilla distribution in the future. This model will be a low cost method used to guide management practices for hydrilla, an invasive aquatic plant that causes decreased water quality in many lakes in the southeastern United States.

**Abstract**

*Hydrilla verticillata*, commonly known as hydrilla, is an invasive aquatic plant that has become a serious threat to native vegetation and water quality in the southeastern United States. Current management practices used to control the spread of hydrilla include chemical applications, which have adverse effects on ecosystems, and the introduction of biological controls such as triploid Grass Carp *(Ctenopharyngodon idella)*. The NASA DEVELOP Southeast U. S. Ecological Forecasting team partnered with the Henry County Water Authority, the J. W. Jones Ecological Research Center, and the Georgia Power Company to develop a multi-platform approach for mapping the spatial and temporal distribution patterns of hydrilla in several inland water bodies in Georgia and Florida. The project utilized a wide range of remote sensing data including NASA’s Landsat 8 Operational Land Imager (OLI) imagery, unmanned aerial system (UAS) imagery, and in situ hyperspectral reflectance measurements of hydrilla. The results were used to create a benthic model for measuring hydrilla distribution using Landsat 8 OLI data. This model provided the partners with a low-cost approach to monitoring that they can use to mitigate the threat of hydrilla in lakes across the Southeastern United States.

**Community Concerns**

* Hydrilla outcompeting native plants and forming surface canopies that block sunlight intensifying lake stratification and causing anoxic conditions.
* Harboring toxic epiphytic cyanobacteria that disrupts the food chain causing wildlife fatalities.
* Clogging boat motors disrupting transport and recreation and creating hazardous conditions for swimming.
* Obstructing water withdrawal for drinking water, irrigation, and power generation.

**Current Management Practices & Policies**

Currently, chemicals are used to manage *Hydrilla verticillata*, including copper, diguat, endothall, and fluridone. Applying these chemicals can have adverse effects on the lake ecosystem. A lower impact strategy has been to introduce triploid (sterile) Grass Carp *(Ctenopharyngodon idella),* a species of fish which consumes aquatic plant material including hydrilla. Because triploid Grass Carp are sterile, their populations can be controlled after introduction to an ecosystem. Partners currently use traditional monitoring practices involving visual analysis, rake collection and sonar analysis.

**Decision Support Tools & Benefits** **Support Tools & Benefits**

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| --- | --- | --- |
| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Landsat 8 Benthic Model for Hydrilla Mapping | Landsat 8 OLI | Model will allow end-users to continually track hydrilla distribution using NASA EO data for mitigation efforts |
| Hydrilla Distribution Maps | Landsat 8 OLI | Define areas where lake managers can target mitigation efforts |

**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)