American Water Resources Association
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GIS & Water Resources VI
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Tuesday, March 30
10:30 AM – 12:00 Noon
SESSION 16: Remote Sensing

Using Hyperspectral Imagery to Detect Submerged Aquatic Imagery in the St. Johns River - Courtney Hart, Ide Integration, Jacksonville, FL (co-authors: Charles Jacoby)

Airborne hyperspectral imagery was collected in the mainstem portion of the lower St. Johns River basin to identify and map the spatial extent of submerged aquatic vegetation (SAV). Imagery was initially collected in 2003 to test the technology and its utility for identifying SAV. We describe the image-processing methodology and resulting maps developed from the 2003 imagery. We will also discuss the modified methodology and results for the subsequent 2006 and 2008 imagery. To process the 2003 imagery, five hyperspectral images and their associated ground-truth data, along with reflectance data collected in the field, were used in the creation of a spectral library that was applied to the full collection of hyperspectral images acquired in 2003. The spectral library was used to classify the entire image set for SAV, open water, terrestrial vegetation, and "urban". This approach was utilized as a basin-wide SAV mapping tool, which appeared to successfully map SAV distribution throughout the basin. Classification results were comparable to SAV estimates made from independently collected transect data. When grassbed widths estimated from imagery-derived maps were compared to in situ transects it appeared that the imagery underestimated grassbed extent by 22%. Hyperspectral data was again collected in 2006 using an instrument with higher sensitivity and finer spatial resolution. Using the lessons learned from the 2003 analysis, a more appropriate band set was selected for the 2006 imagery analysis and significantly more ground truthing was collected during the image acquisition phase. For the 2008 imagery, the methodology and band set remained the same; however, the amount of ground truthing data was increased significantly again. Results from the analysis of the 2006 data show increased classification accuracy for SAV mapping compared to results from the 2003 results. We will discuss the potential of identifying SAV species in addition to identifying the presence or absence of SAV in the 2008 imagery. Overall, hyperspectral imagery has been shown to be a valuable tool for identifying the extent of SAV in the darkly stained St. Johns River.

Fractional Vegetation and Impervious Surface Dynamics in the Wetland-Urban-Agriculture Interface Systems of South Florida: A Remote Sensing Perspective - Assefa Melesse, Florida International University, Miami, FL (co-author: F. Miralles-Wilhelm)

The highly interfaced ecosystems of urban, agriculture and wetlands of South Florida are unique in their setting and play a very important role in regulating the fluxes of water, energy and nutrients. The ever-expanding urban areas as well as expansion of nearby agricultural areas result in impacts on fluxes of water, sediment and nutrients to the Everglades, posing a unique set of conditions worth studying. This analysis uses temporal Landsat imagery of South Florida that covers the Everglades, water conservation areas, the greater Miami area and also the Everglades and Homestead agricultural areas to evaluate the dynamics of fractional vegetation cover (FVC) and fractional surface impervious surface (FIS) area over a 20 years period of time (between 1985 and 2005). The images were processed (radiometric, geometric and atmospheric corrections) and grid-based FVC and FIS values were generated using ERDAS Imagine. The analysis also looked into some selected hydrographs and nutrient fluxes to see any temporal and spatial trends resulting from land use changes. The results indicate an increase in impervious surface area of Miami with west-ward expansion into the wetlands. The FVC also showed a slight increase in some parts of the wetlands which may be attributed to the ongoing Everglades restoration efforts. The hydrographs and nutrient flux data from selected stations showed some changes, but attributing these to land use changes or restoration efforts of the Everglades will require more analysis.

Value of NDVI as a Tool to Monitor Vegetation Recovery on Restored Wetlands - D. Samuel Rajasekhar, Idea Integration/onsite consultant at St. Johns River Water Mana, Palatka, FL (co-author: Melinda Donnelly)

Impounded wetlands in the Indian River Lagoon (IRL) estuarine system are being restored to near original/natural state by mechanical means. The resultant surface is barren. Within a month of substrate leveling, vegetation colonizes the surface and progresses through establishment and growth. However, coastal wetlands are slow to recover and recovery monitoring is needed to understand the recovery process of these restored wetlands. Normalized Differential Vegetation Index (NDVI), a remote sensing technique is used to map and monitor vegetation over large tracts of land, even on a continental scale. The difference in reflectance values from Near Infrared and red bands is normalized by the equation NDVI = (NIR - Red) / (NIR + Red) The outline of restored wetlands is mapped by visual means (i.e., heads-up digitization of color infra red digital photographs). NDVI is calculated in ERDAS Imagine using the spatial modeling process. Certain range of NDVI values classify vegetation and others barren surface. The vegetation map produced for the restored surfaces is used to monitor the recovery/progress of vegetation and to measure the changes using time-series imagery. Not only is the area of restored vegetation calculated by NDVI, but also the percent incremental growth over time assessed. Several restored wetlands were monitored with ground-based methods in 2006 and 2008. GPS coordinates were collected for these monitoring sites. For one restored site, the points were used as a measure of accuracy. The agreement with NDVI as well as the error of omission & error of commission was estimated. The proportion of NDVI as well as the proportion of vegetated to non-vegetated points was also estimated. For another restored site, the NDVI histogram threshold was increased because the error of omission is much higher than that of error of commission. Results indicate that ground monitoring data can be used to adjust the NDVI thresholds as well as assess the accuracy of NDVI method. NDVI along with ground-based methods is a practical, robust, low cost method to monitor vegetation recovery trajectory on restored wetlands.

SeaWIFS-Based Chlorophyll-A Concentration in Coastal Waters of Everglades - Assefa Melesse, Florida International University, Miami, FL (co-authors: F. Miralles-Wilhelm, A. Thomas)

The level of productivity in the coastal water of Everglades is highly linked to land processes (land use, water management, water and nutrient fluxes). A comparative study using the SeaWIFS-based data and also measured concentrations of chlorophyll-a focused on the temporal and spatial variability of chl-a observations in the coastal waters of Everglades (Florida Bay). Seasonality as well as spatial variability (using cross-sections) were evaluated and the results showed that chl-a values were highly variable for the selected months of June, September and December, 2008. Indicative of the effect of land surface fluxes of nutrients, chl-a values were higher closer to coastal areas in the Florida bay. Comparison of the SeaWIFS chl-a value to that of the measured concentrations showed very good agreement.