Object-oriented Classification of Wetland Vegetation: Mapping Faster on a Budget on the Kissimmee River Floodplain

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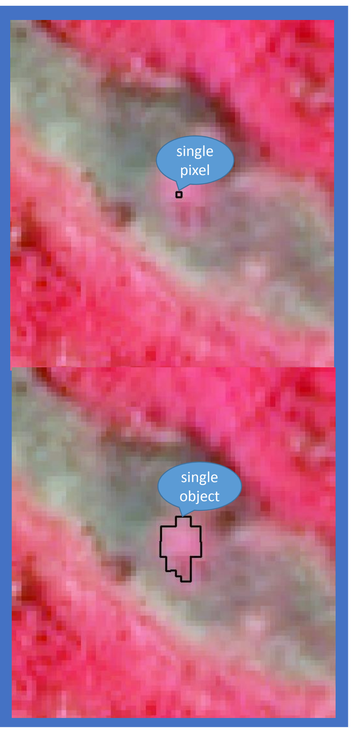
Introduction

Overview of Object-Oriented Classification:

Traditional **pixel**-based classification methods (supervised or unsupervised) work on an individual **pixel** level and assign class values to each **pixel** separately based on spectral or other characteristics. **Object**-oriented classification differs from this by joining adjacent pixels with close spectral and textural signatures into **"objects**." This is known as segmentation, and creates numerous **objects** that can then be classified using a semi-automated procedure for placing each type of **object** into a particular class. Users can change the threshold for joining pixels and can also use other numeric attributes such as height, elevation, or NDVI as input signatures for machine-based **object** segmentations. For vegetation classification, segmented **objects** should mimic natural **objects** that can be seen in the images, such as natural populations or groupings of trees, shrubs, or herbs, or water courses.



Data Collection

Field Data Collection:

Field crews collected multiple field signatures for each map class throughout the area to be mapped using **airboats and helicopters**. These samples are to be used for map classification and accuracy assessment.

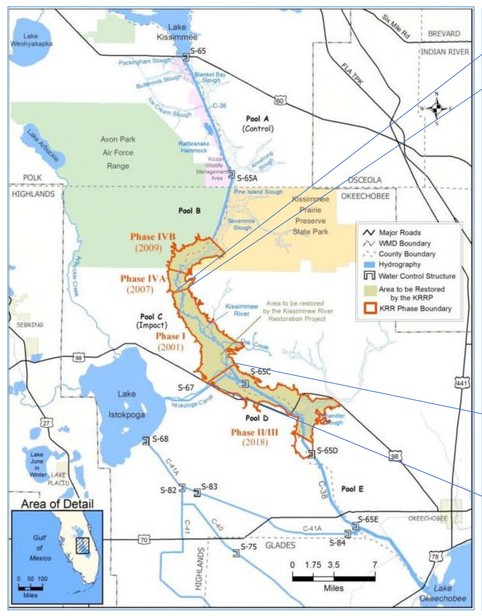
Accuracy assessment points were assigned randomly and set aside before mapping commenced. Classification points are used throughout the mapping process to assist both human- and machine-made class assignments.

Methods

2015 Imagery Classification: From imagery to vegetation map using objects

SFWMD acquired aerial imagery of the Kissimmee River floodplain in 2015 for the purpose of vegetation mapping (Figure 1). We are carrying out the classification and mapping of vegetation with this imagery using **object-oriented** map classification. This is being done using **Trimble eCognition** software, which allows for iterative model creation and will result in an algorithm that allows for coherent map classification throughout the Phase I area of the Kissimmee River Restoration. Algorithms entail multiple steps, first involving a dichotomous (branched) winnowing of broad classes into narrower classes (e.g., Land into Forest/Shrub vs. Non-woody vegetation, etc.) using threshold values of image characteristics such as brightness, spectral intensity, height, or texture attributes that show difference among these classes. Later steps involve separating finer-scale (community-level) classes using Nearest Neighbor classes based on ground data points collected at the community level.

Data Preparation



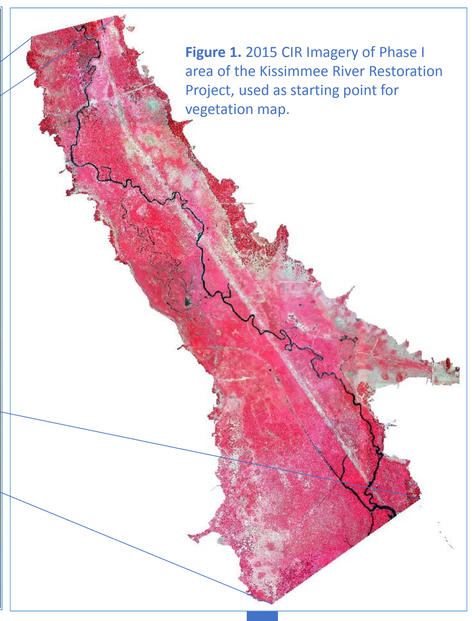


Figure 1. 2015 CIR Imagery of Phase I area of the Kissimmee River Restoration Project, used as starting point for vegetation map.

Classification Steps:

Starting with a source image (a mosaic of ortho-rectified color infra-red (CIR) images) (Figure 1), we carried out a stepwise separation and classification of vegetation types (Figure 2) based on differences among **spectral**, **texture**, and **elevation** signatures for each class. Each step below from left to right represents a successively more complex map, but within each step, class separation is based on simple dichotomous differences (see box at right):

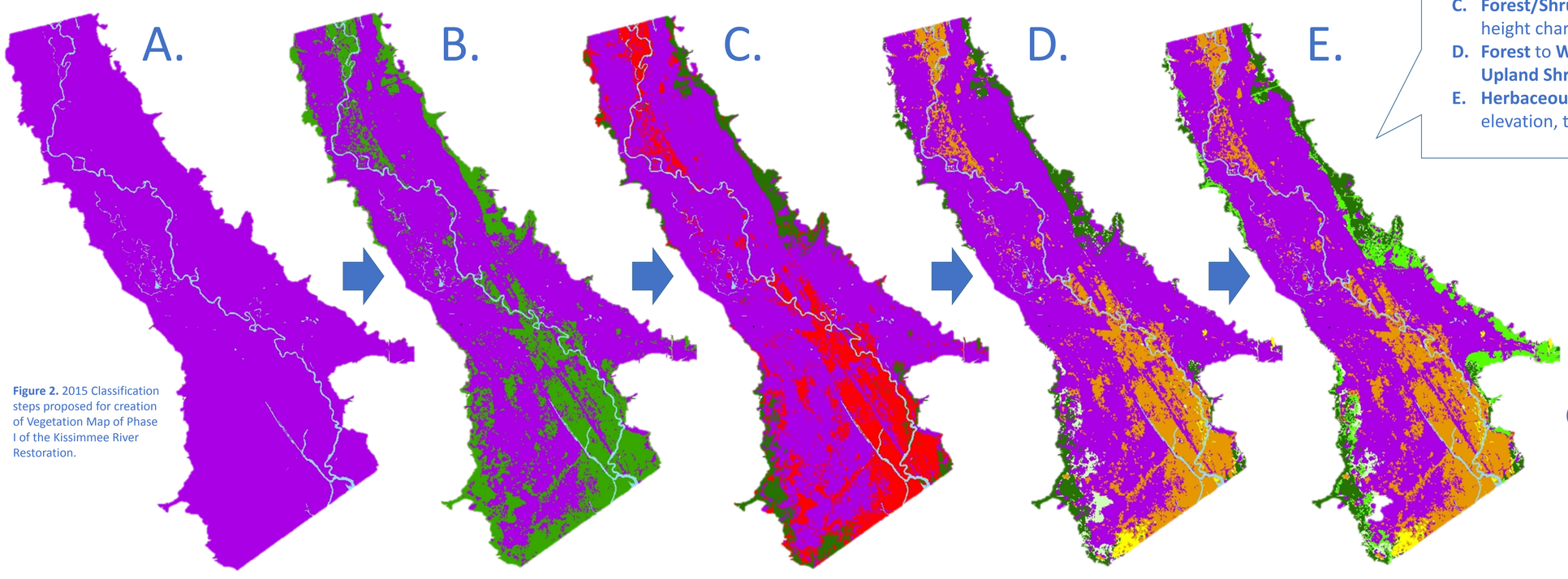


Figure 2. 2015 Classification steps proposed for creation of Vegetation Map of Phase I of the Kissimmee River Restoration.

- **A. Unclassified** to **Land** and **Water**, based on spectral brightness;
- **B. Land** to **Forest/Shrub** and **Herbaceous** based on height;
- **C. Forest/Shrub** to **Forest** and **Shrub** based on more refined height characteristics;
- **D. Forest** to **Wet** and **Upland Forest** and **Shrub** to **Wet** and **Upland Shrub** using elevation and texture characters;
- **E. Herbaceous** to **Wetland** and **Upland Herbaceous** using elevation, texture, and spectral brightness characters.

Final Classifications

Using Nearest Neighbor classifications, we carry out multiple class separations in this step and create a final map similar to the one shown in Figure 3. This step is used to separate the previously-classified and very diverse **Wetland Herbaceous** class into **Broadleaf Marsh**, **Wet Prairie**, **Emergent Aquatics**, and **Miscellaneous Wetland** types.

Because of recent changes to the extant floodplain vegetation communities, for the 2015 mapping effort we are attempting to map to a finer scale than that shown in Figure 3, splitting the Wet Prairie class further into several Exotic and Native grass classes.

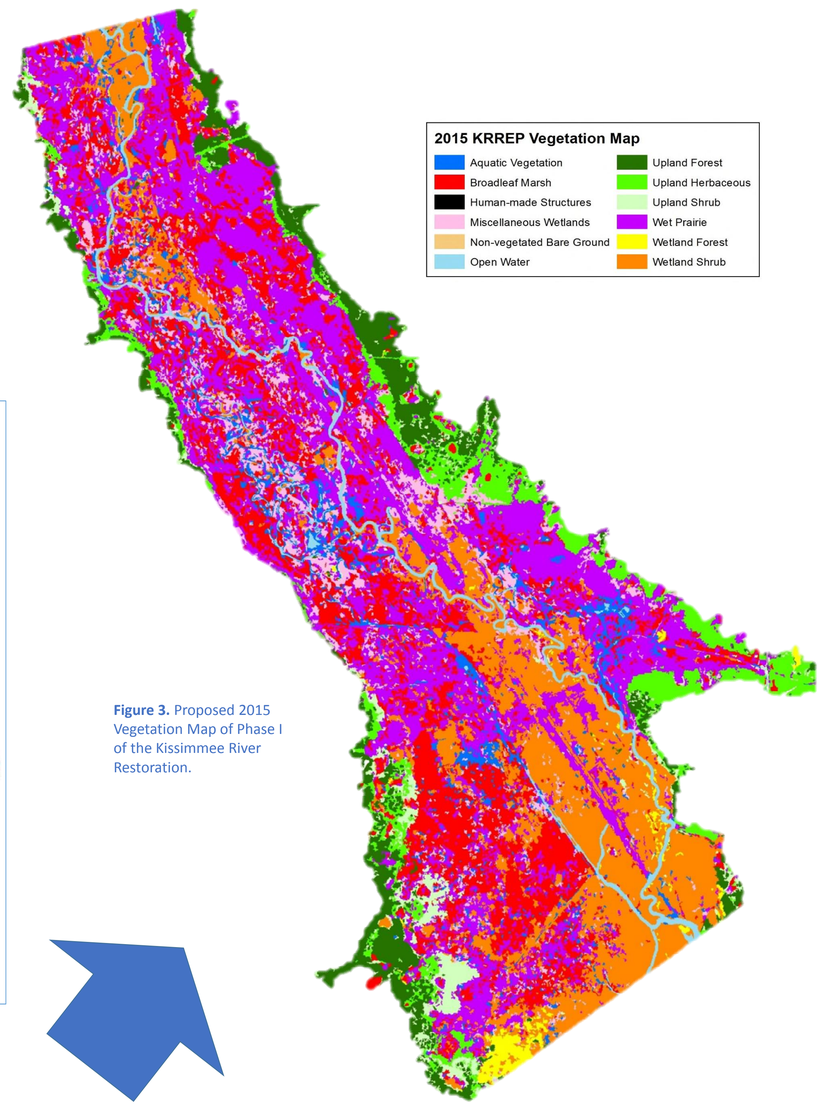


Figure 3. Proposed 2015 Vegetation Map of Phase I of the Kissimmee River Restoration.

Conclusions

Overall, this vegetation mapping protocol using object-oriented vegetation classification algorithms iteratively shows promise for future mapping projects in the Kissimmee Basin. The project has made it clear that one of the most important parts of a mapping project such as this is the field verification point collection protocol. It is highly important to collect field data as close to the time of imagery acquisition as possible and that these data be accurate, match the level of detail of the classification scheme, and include enough points to be useful for both map signature generation and accuracy assessment.

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