INTEGRATED REGIONAL WETLANDS MONITORING (IRWM) PILOT PROJECT

Wetland Vegetation Mapping from Color Infrared Aerial Imagery

CALIFORNIA BAY-DELTA AUTHORITY
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PROBLEM STATEMENT

As part of the Integrated Regional Wetland Monitoring Pilot Project, the Landscape Ecology and Plant Teams are collaborating to produce vegetation maps of six study sites by using field data and remote sensing technologies to classify color infrared aerial photographs. These vegetation maps will be used to calculate pattern metrics to quantify wetland composition, structure, and change.

The production of accurate vegetation maps is a fundamental part of tracking change during the restoration process and a mandatory precursor to productive sampling design, model development, and spatial metric calculation.

Methodological considerations for vegetation map development include finding procedures that were most accurate with the least effort, including field data collection procedures, remote sensing methods, and map development.

OBJECTIVE

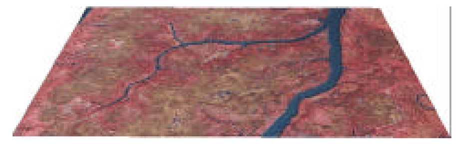
To develop accurate vegetation maps using remote sensing technologies for use by all IRWM teams, while developing strategies for map production during longer-term monitoring projects.

METHODS

Vegetation maps were produced in three phases.

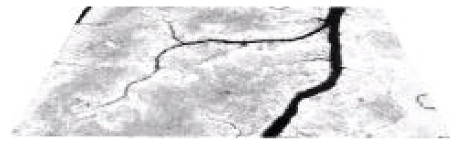
1. In the first phase, enhancements were performed on the raw image to extract spectral information. Then, automated (unsupervised) classifications were performed on the raw image plus enhancements, in order to divide unknown plant composition into classes based on spectral properties of the orthorectified color infrared imagery. Random "ground reference" points were assigned to each class and visited by field crews, where percent cover was recorded for every species found within a three-meter radius (relevé).

2. In the second phase, these samples were used to build the training sets for supervised classifications that rendered the final maps.



Raw image

+



NDVI vegetation index

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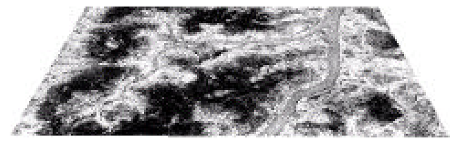
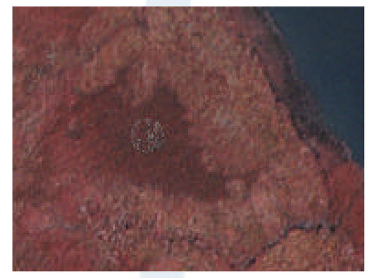
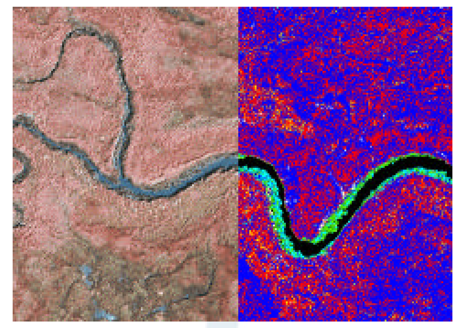


Principle Components Analysis (band 3)

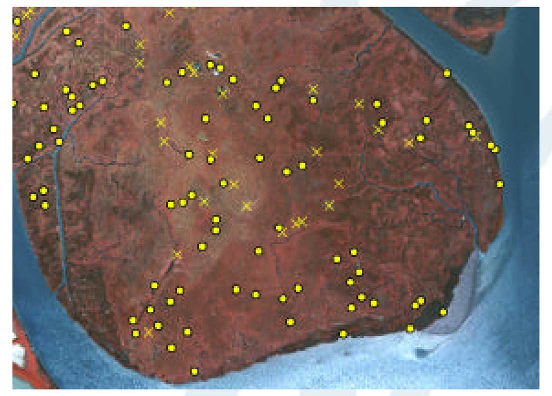


Building the training set

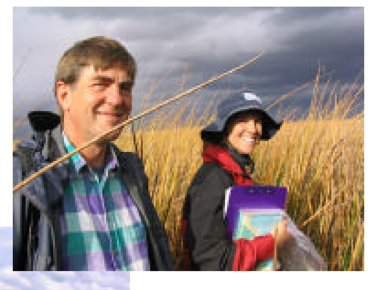


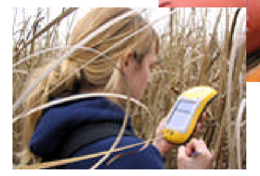
Left: Raw supervised classification of raw image. Right: Classification output before filter the smooth out the "salt-and-pepper" effect

3. In the final stage, hundreds of additional points were gathered to assess map accuracy.



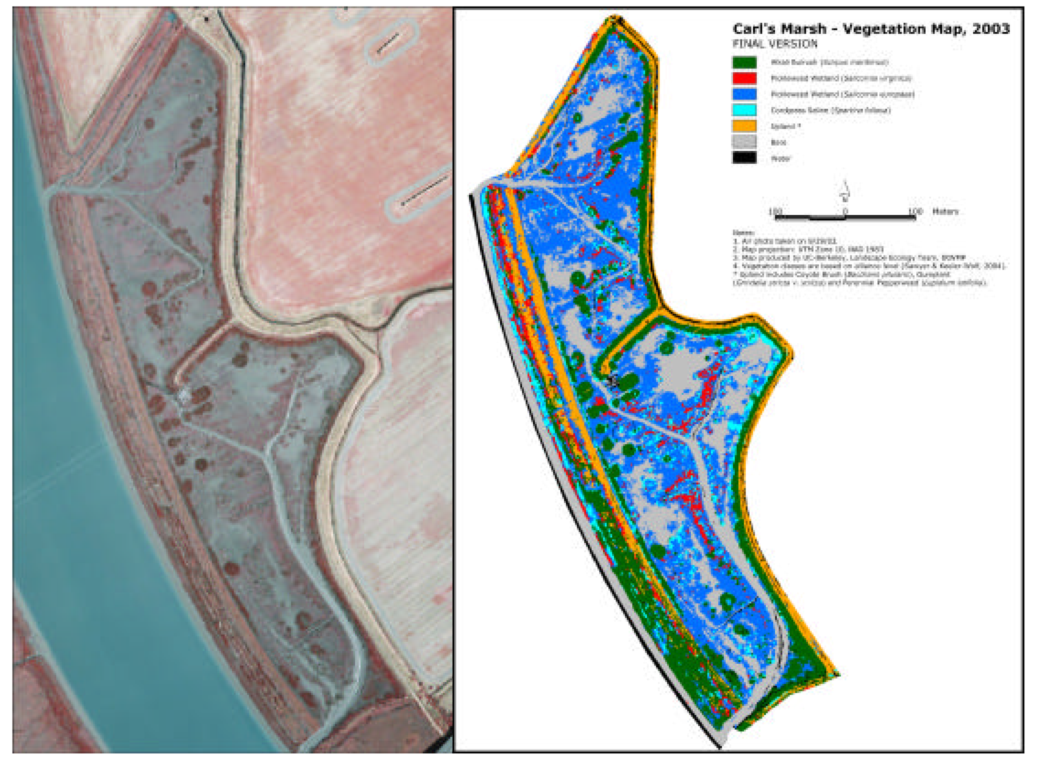
Random field points for accuracy assessment

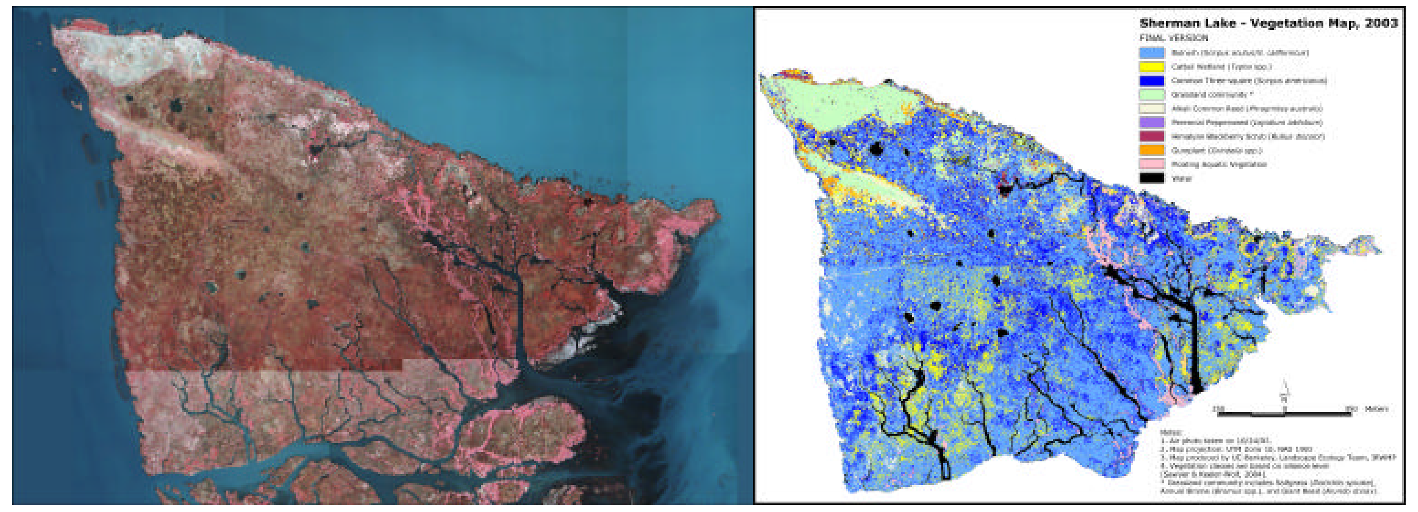


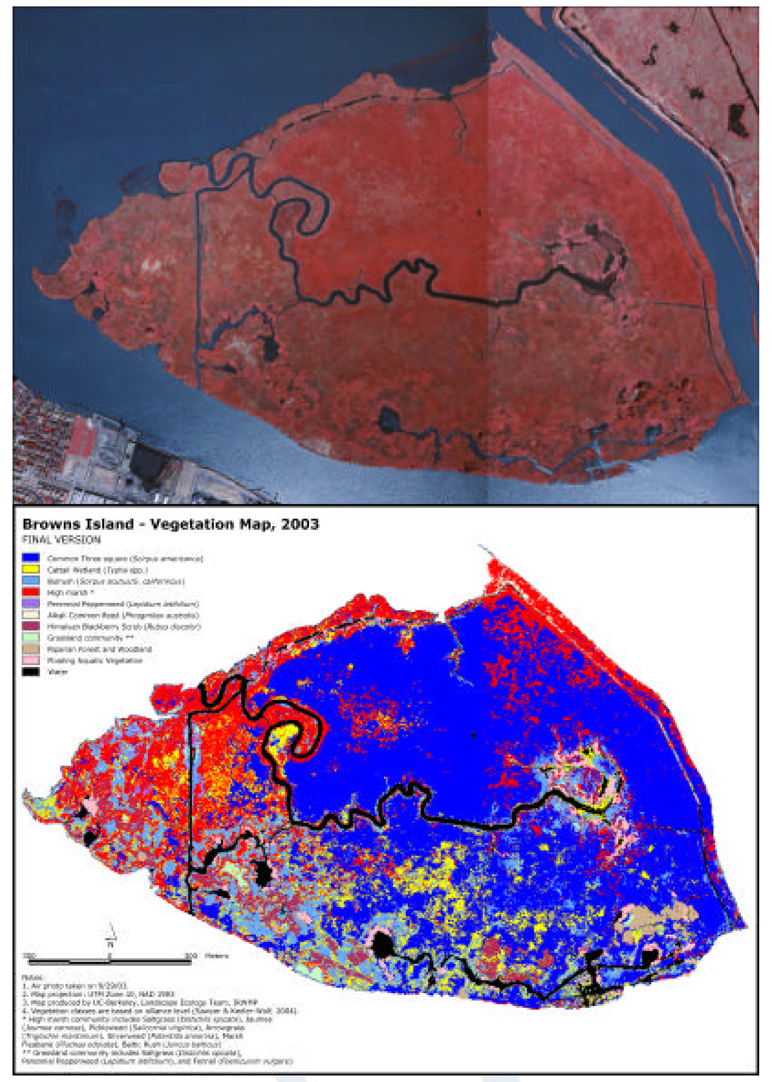


RESULTS & CONCLUSIONS

We have identified various issues involved in vegetation mapping, including scale, timing, and access, sources of error, and plant identification, especially in highly diverse brackish marshes. Therefore, close collaboration with the Plan Team for plant identification and data collection throughout the vegetation mapping process has been a necessary and effective requirements to produce accurate vegetation maps. In addition, each site requires its own procedure for classifying vegetation with the most accuracy.





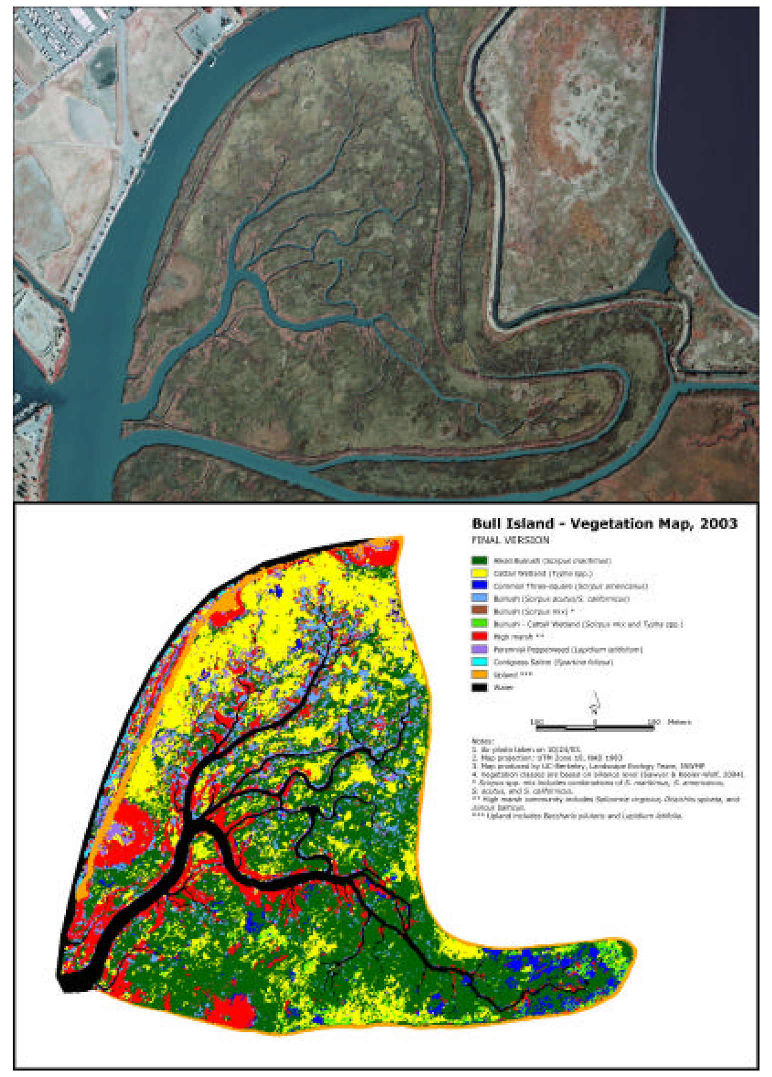


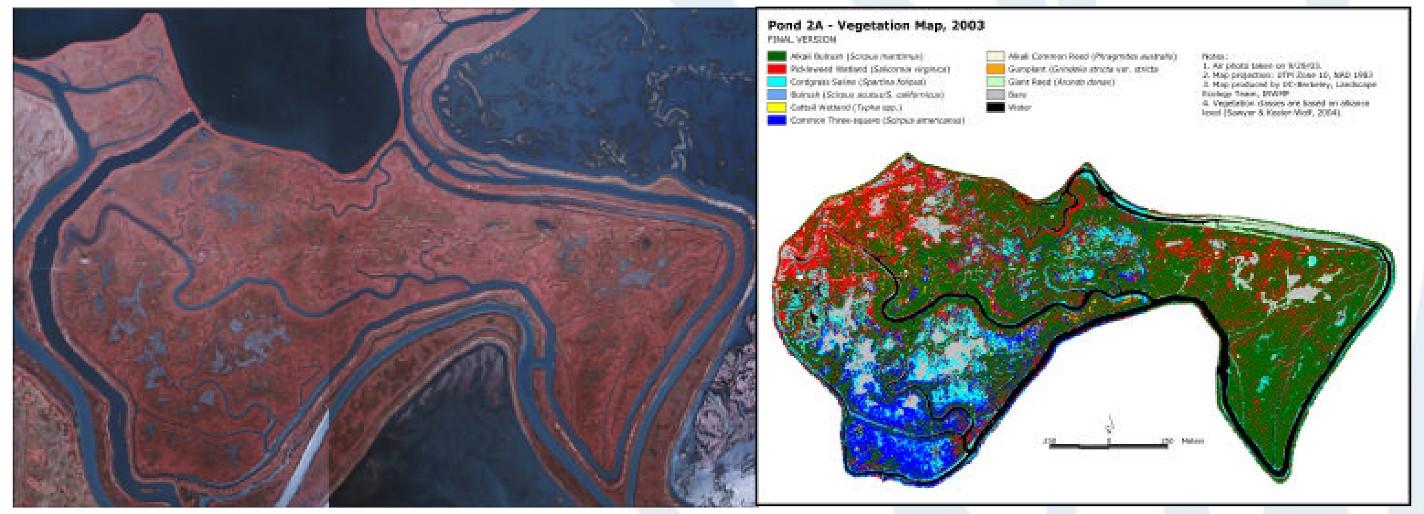
IRWM Project Study Sites

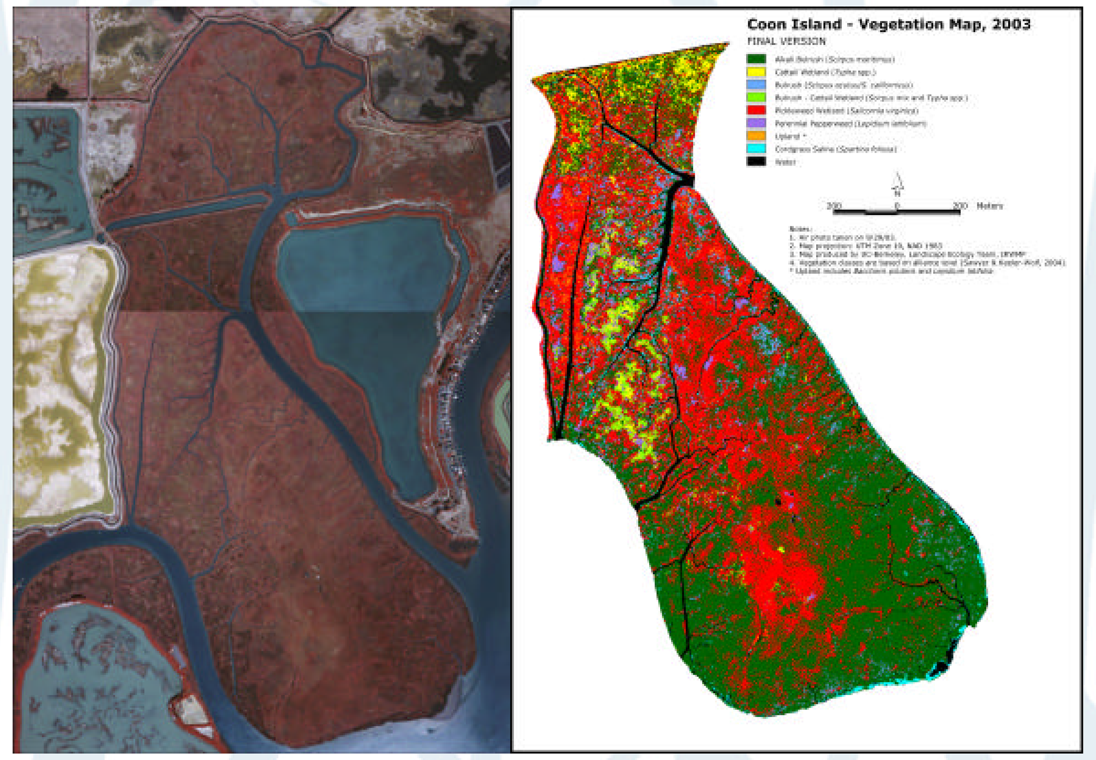
Clockwise from top-left: Carl's Marsh (AKA Petaluma River Marsh, Petaluma River); Sherman Lake (AKA Lower Sherman Island, Delta); Browns Island (Delta); Coon Island (Napa River); Pond 2A (Napa River); and Bull Island (Napa River).

Color infrared imagery was acquired for each site once between 8/14/2003 – 10/14/2003. Imagery was scanned at 1,200 dpi and orthorectified with sub-meter accuracy. All photographs are 1:9,600 (pixel resolution = 0.67 ft), except for Carl's Marsh, which is 1:7,200 (pixel resolution = 0.5 ft).

Color infrared imagery has three bands: near-infrared (NIR), red and green. The NIR band is very effective at extracting spectral signatures for vegetation. These images are displayed in false color, so that near-infrared reflectance is depicted in a range of red, red reflectance is depicted in a range of green, and green reflectance is shown in a range of blue color. Red color indicates green vegetation, with the deeper and richer reds showing greener, healthier vegetation.







For more information, visit: **www.irwm.org**

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