

Developing Tools for the Control of Invasive *L. latifolium* Predicting and Mapping Pepperweed Habitat in the Alviso Salt Ponds

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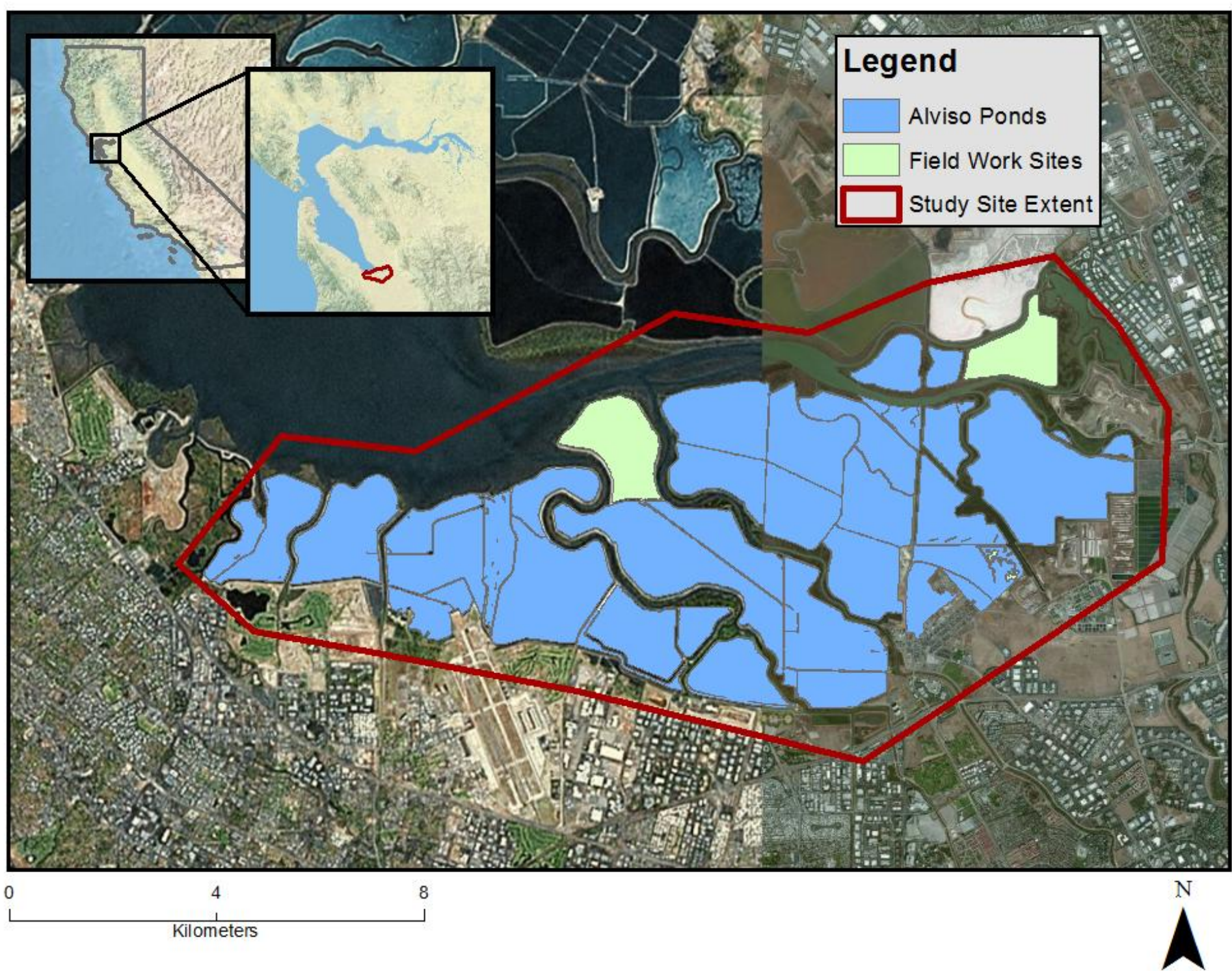
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OBJECTIVES

- Map the contemporary distribution of pepperweed in the study area using multispectral (ASTER) and hyperspectral (Hyperion) satellite images
- Create a multivariable predictive model using geographic information systems (GIS) and variables known to affect pepperweed spread

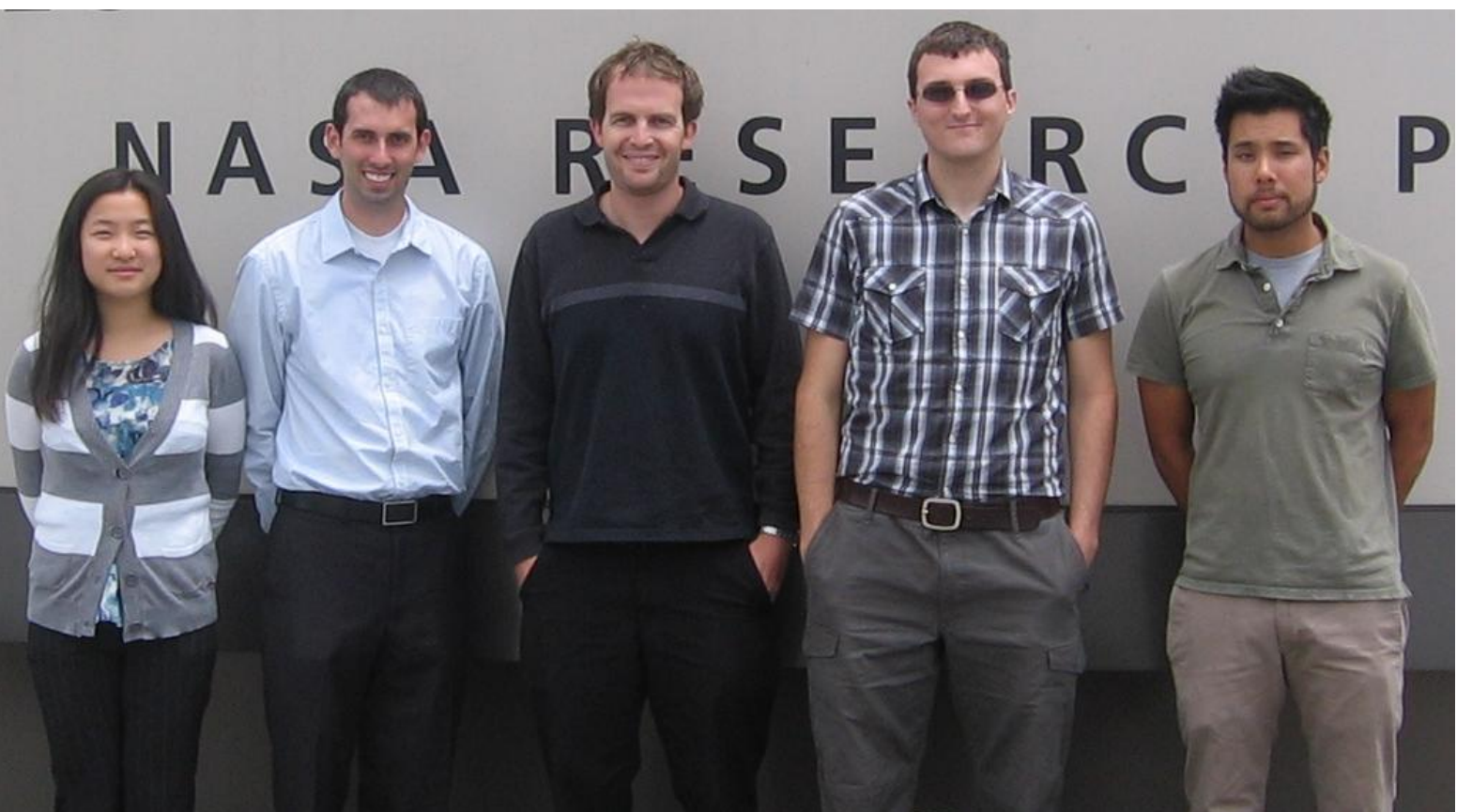
STUDY AREA



EARTH OBSERVATION SOURCES



TEAM MEMBERS



L to R: Sylvia Zhang (Yale University), Jarom Randall (Brigham Young University), Alexander Gole (Redlands University), Glade Dlott (California Polytechnic State University, San Luis Obispo), Andrew Nguyen (San Jose State University)

FIELD WORK

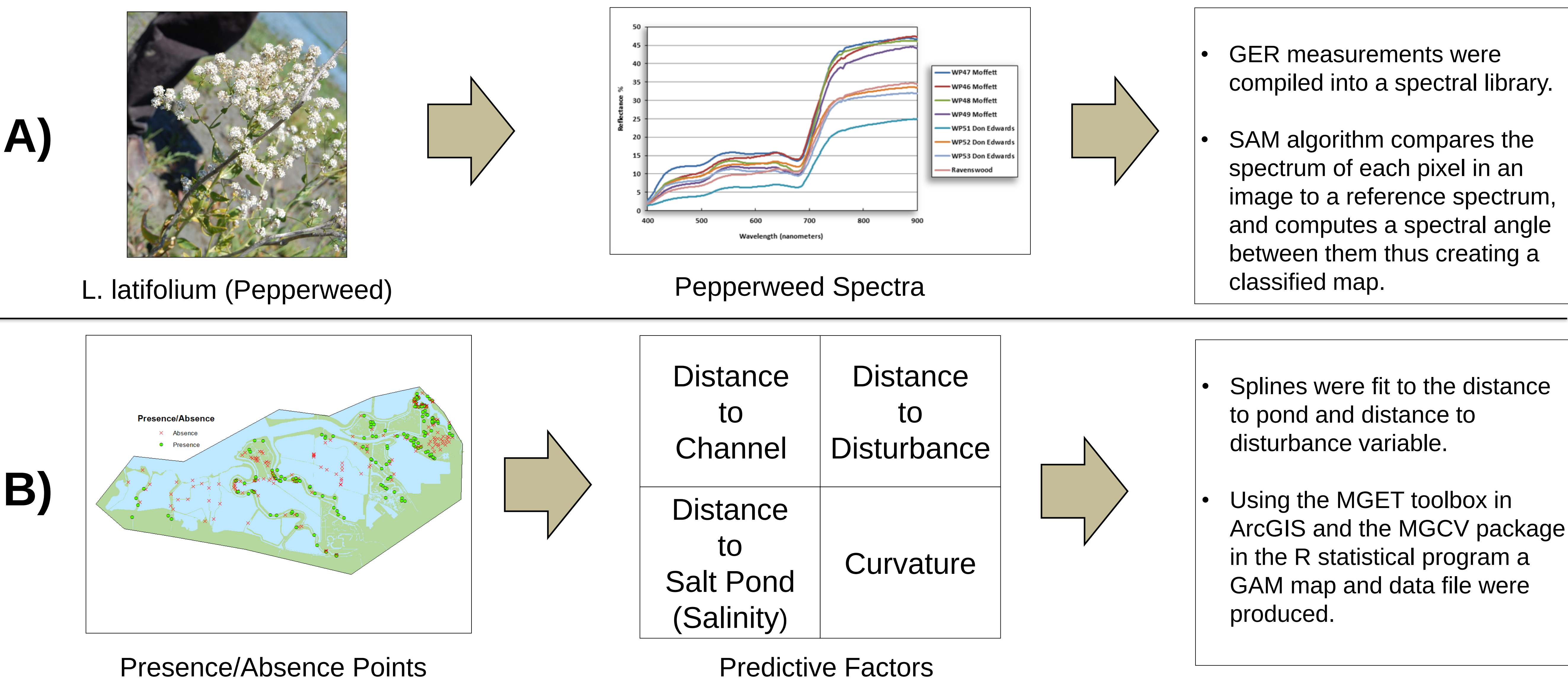


In July 2011, the team collected spectral measurements, presence and absence data, and soil samples.

ABSTRACT

Invasive perennial pepperweed (*Lepidium latifolium*) has spread rapidly throughout the western United States in the past fifteen years. Pepperweed outcompetes many native species for water and nutrients, disturbing sensitive ecosystems. The purpose of this study is to map the contemporary distribution of pepperweed throughout the wetland ecosystem of the restored South San Francisco Bay Salt Ponds and create a habitat suitability model to predict future spread. Pepperweed reflectance data were collected *in-situ* with the GER 1500 spectroradiometer along with presence and absence pepperweed GPS data points. A Spectral Angle Mapper (SAM) classification algorithm (Method A) was used to distinguish pepperweed spectra and map its distribution on an EO-1 Hyperion image of the study area. Similarly, a supervised classification was run on an ASTER image of the study area. A GIS multivariate habitat suitability model was created to predict areas most susceptible to pepperweed colonization. Variables incorporated into the model were tidal extent, propensity for disturbance, pond salinity, proximity to levees and channels, and terrain curvature. A Generalized Additive Model (GAM) was also used to generate a suitability map (Method B) and investigate the statistical probability that each variable contributed to predict pepperweed spread. Results from the GAM revealed distance to channels, distance to disturbance factors, extreme pond salinity and curvature as statistically significant in determining the locations of suitable pepperweed habitats.

METHODOLOGY



CONCLUSIONS

- Areas predicted to have low or no suitability for pepperweed are not completely immune to pepperweed spread and also need to be observed.
- Areas that have little vegetation are of most concern because of the ability of pepperweed to quickly colonize an area due to its extensive root system.
- The three factors contributing most to pepperweed spread as observed in the modeling process, were proximity to water, soil salinity (distance to salt pond), and soil disturbance factors.
- The Hyperion sensor's hyperspectral capabilities were successful at detecting pepperweed in general areas.
- Images with a higher spatial resolution would be more effective in detecting pepperweed distribution.
- Predictive modeling can be useful in assessing pepperweed spread, but more factors contributing to growth and spread may increase accuracy results.

ACKNOWLEDGEMENTS

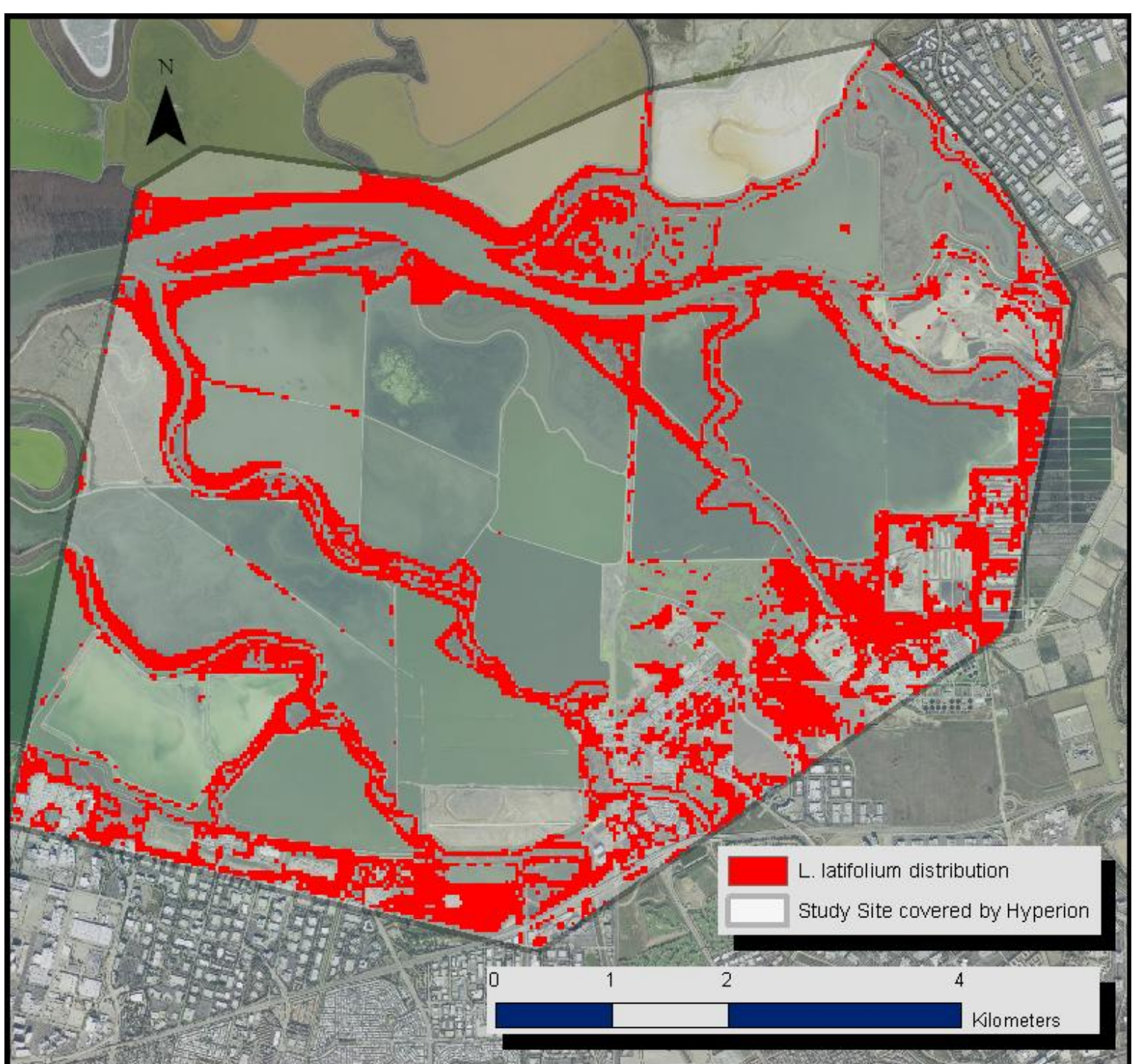
Brian Fulfrost, Brian Fulfrost and Associates
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PROJECT PARTNERS



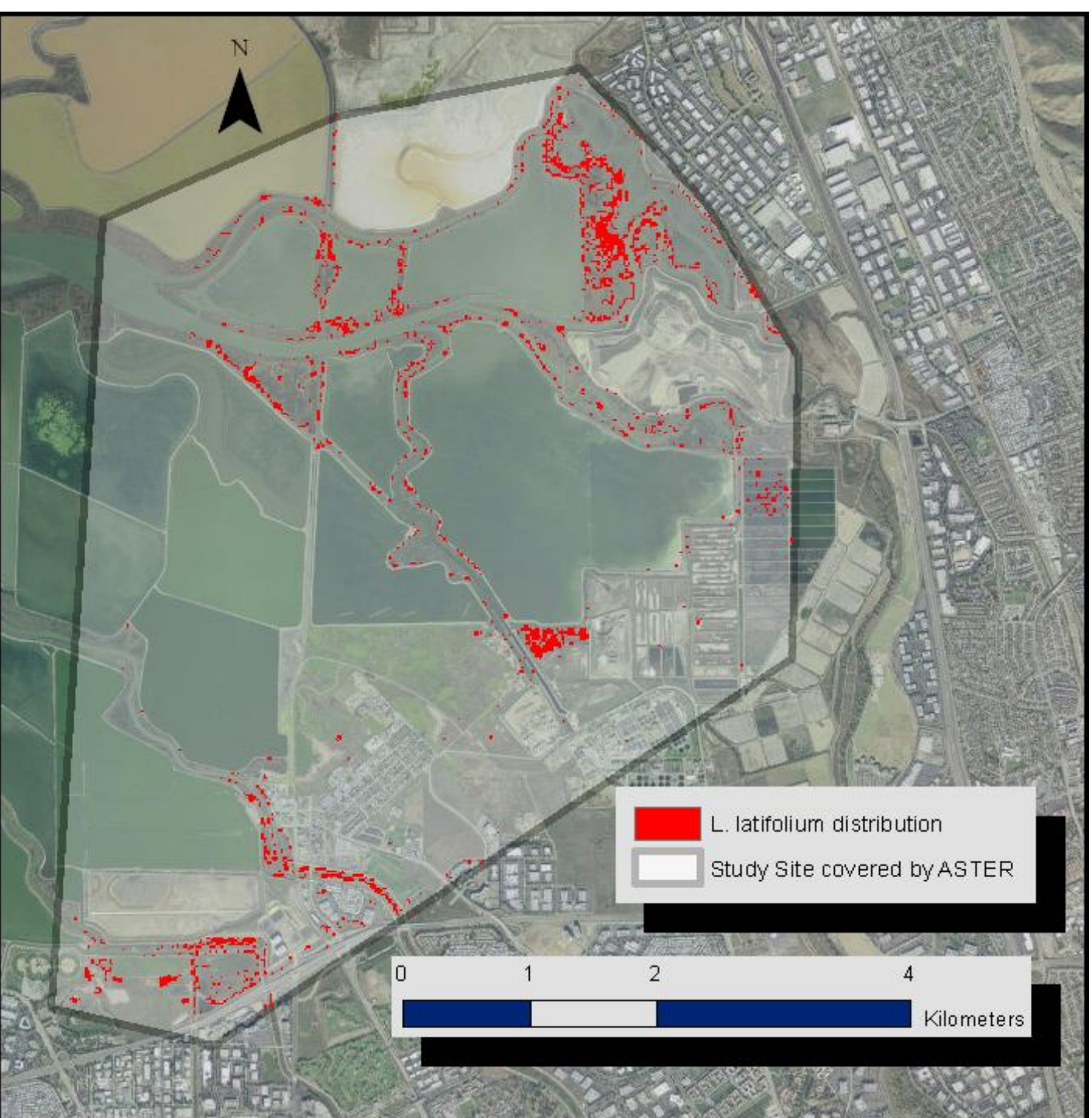
RESULTS

Hyperion SAM Classification
Total Accuracy: 57.7 %



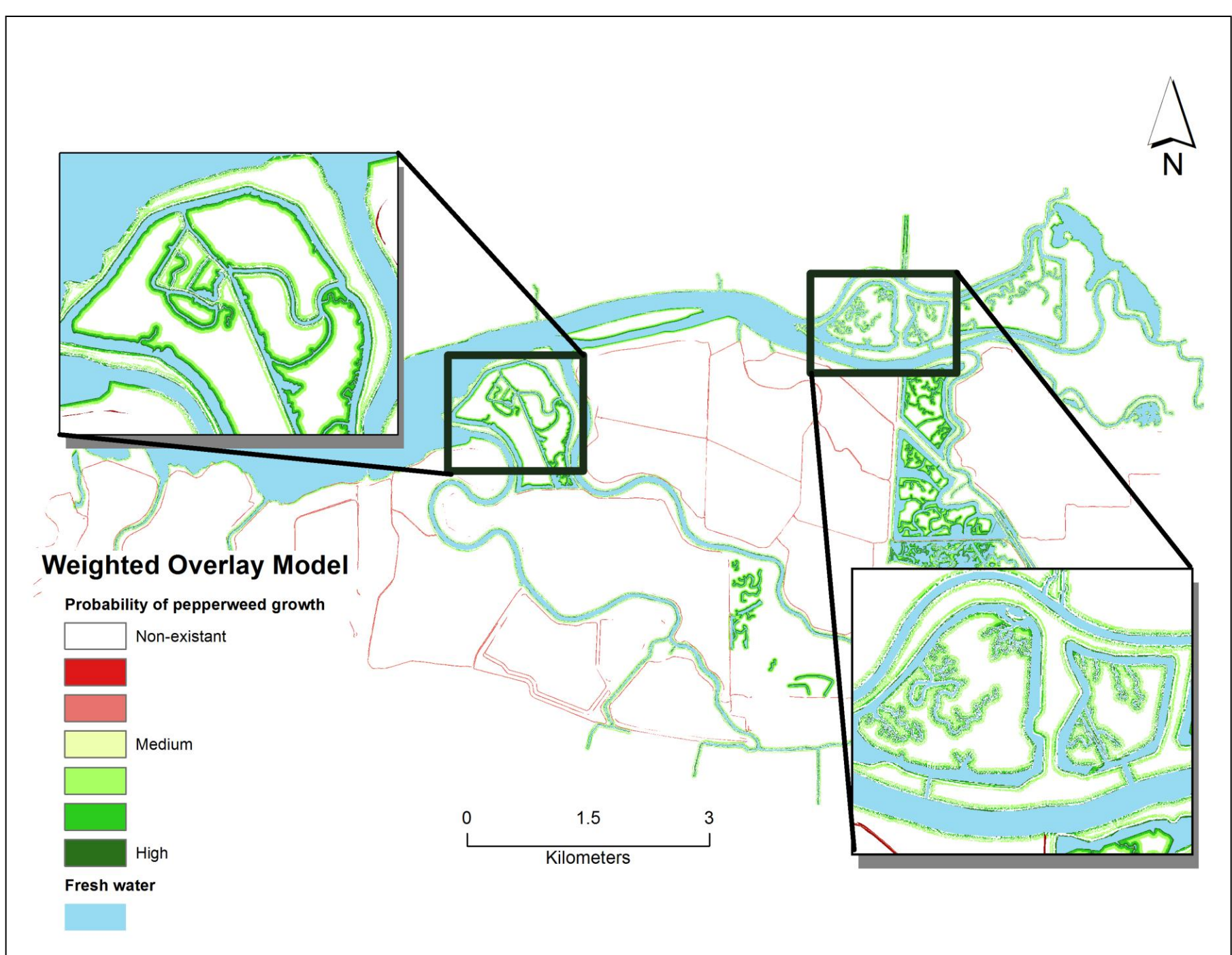
Pepperweed was over predicted in this image due to the low spatial resolution.

ASTER Supervised Classification
Total Accuracy: 71.8 %



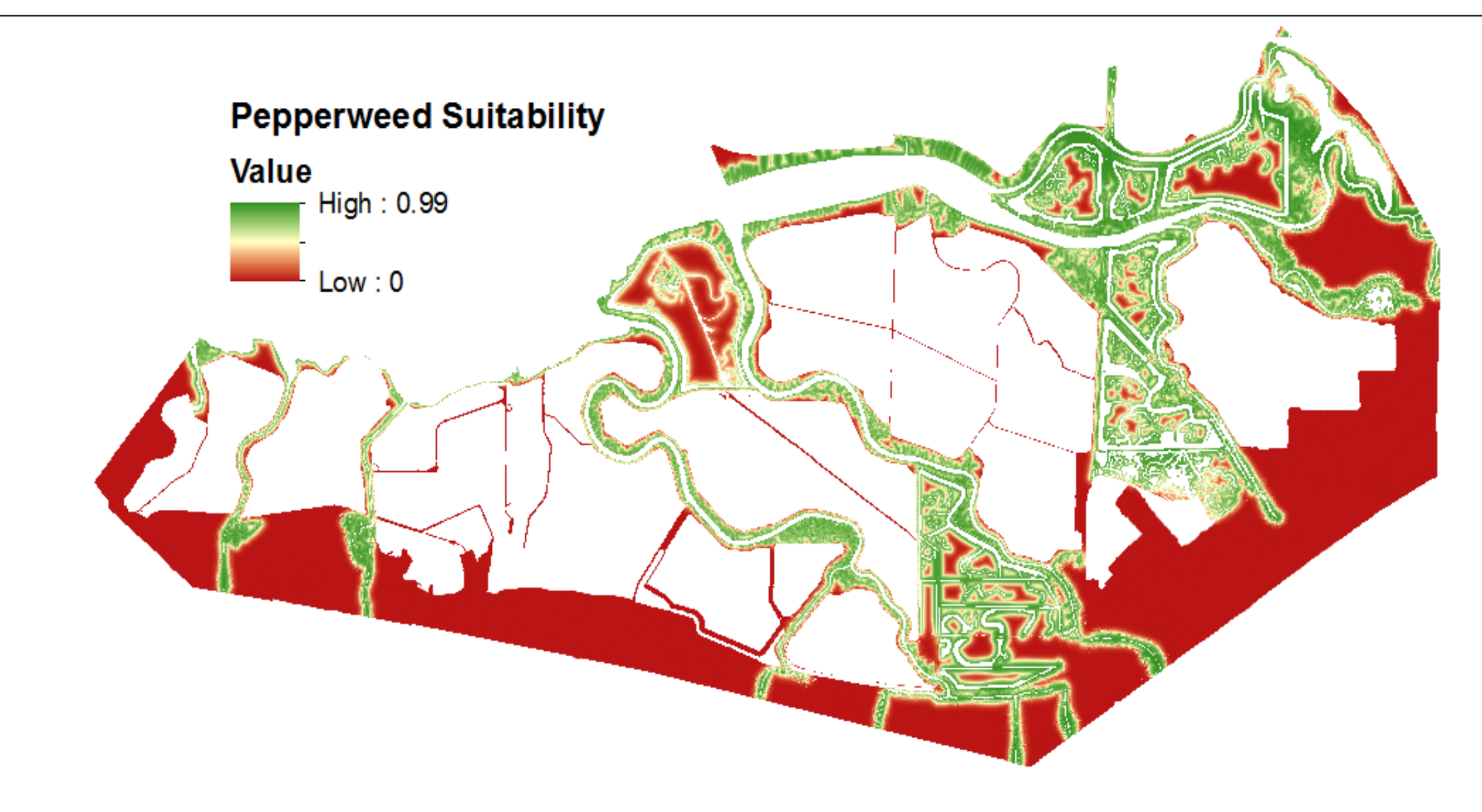
Pepperweed was under predicted slightly in this classification due to low spectral and spatial resolution.

Weighted Overlay Analysis
Pepperweed Habitat Suitability



6 classes red = low, green = high
Factors used: curvature, distance from water, distance from levee, and distance from upland.

Generalized Additive Model Output Map
Accuracy = 81 %



All four factors were statistically significant in contributing to the model.