DETECTION OF SUBMERGED PLANTS USING CLOSE- RANGE HYPERSPECTRAL REMOTE SENSING

Sara Conard[1], Martha S. Ragwar[2], Melissa Larmer[1],
Angelique Carter[2], James Kelly[1], and Hyun J. Cho[1]

[1]Department of Biology, Jackson State University, Jackson, Mississippi, USA

[2]Department of Mathematics, Jackson State University, Jackson, Mississippi, USA

INTRODUCTION

Water Hyacinth (*Eichhornia crassipes* (Mart.) Solms) is a fast-growing floating aquatic plant that was originally introduced from South America. It is now identified as the most notorious aquatic invasive plant in fresh water environments globally in the tropics and subtropics, but also in some temperate regions. Its growth can cause significant environmental and economic damages as it covers the water surface, interfering with light penetration, gas transfer, boating, and fishing. Since the plants reproduce through both sexually and asexually, the propagules (viable fragments) and seeds can be transported to new habits via natural disturbances such as hurricanes.



SPECIFIC AIM AND RATIONALE

To compare the reflectance data between plants in healthy and non-healthy conditions.

To compare the reflectance among aquatic plants

To compare the reflectance of green leaves and flowers

Prior to any physical stresses that can be observed by human eyes, short-term plant stress can be detected through hyperspectral remote sensing.



METHODS

We collected the plants including Water Hyacinth and Alligator weed from local habitats near Natchez Trace Parkway, allowed them to grow in four experimental tanks, monitored the growth weekly, and scanned the hyperspectral upwelling energy over the tanks using a GER spectoradiometer.
Three replicate measurements were scanned at each depth and the upwelling energy was converted to reflectance (%) after calibrating with measurements made over a white spectralon. The reflectance data at all depths were plotted against the wavelength (400 -900 nm).

RESULTS

The reflectance signals of the floating leaves were similar to those of terrestrial plants. Near Infrared (NIR) reflectance of healthy water hyacinth ranged between 30-60%. Decreases in reflectance at the green and the NIR regions and increases in red reflectance were observed in the data collected from unhealthy plants.

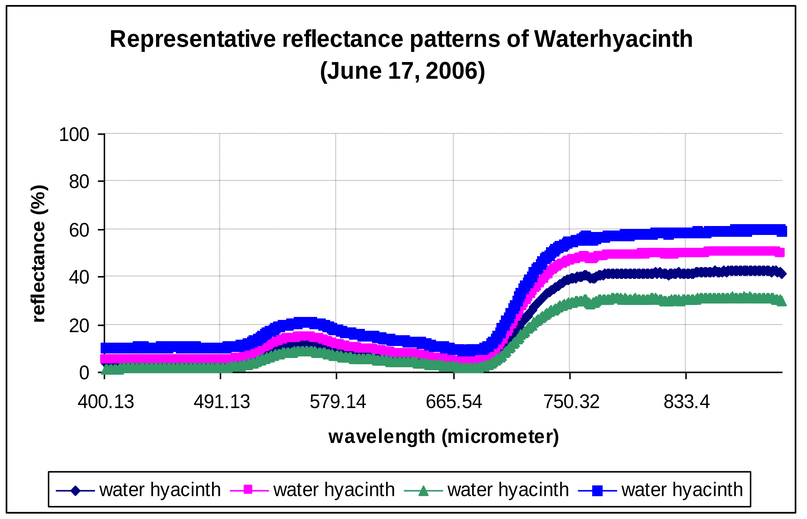
Purple flowers of Water hyacinth had higher reflected energy at the blue and red regions than the green region.

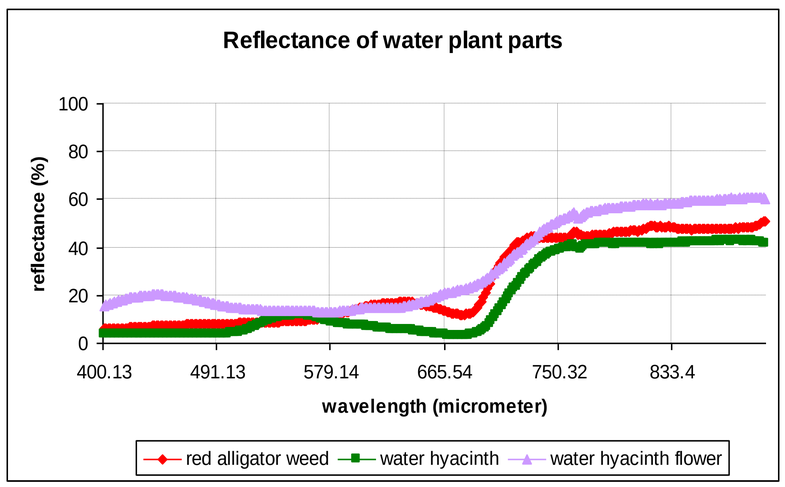


The growth and health of the Water Hyacinth was monitored beginning June 10, 2006



The growth of the Water Hyacinth on Jul 11, 2006.







FUTURE RESEARCH

The salinity of two of the tanks will be gradually raised using artificial sea salts. Hyperspectral measurements over water hyacinth in the salt-treated tanks as well as in the control tanks will be continued this summer and will be analyzed with the duration of the treatment and the intensity of salinity.

Acknowledgements

This research is supported by grants from the NOAA-ECSC (Grant No. NA17AE1626, Subcontract #27-0629-017 to Jackson State University), NSF-UBM, and The Center for University Scholars of Jackson State University.