A MODIS Based Decision Support Tool for Gulf Coast Salt Marsh Conservation and Restoration

By

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Objective

- Developing and testing a suite of MODIS based algorithms as decision-support models allowing coastal managers to monitor the 'health' of coastal salt marshes

- Developing prototype weekly composite salt marsh biophysical products including distributions of Chl content, vegetation fraction, and green LAI using MODIS 250 and 500-m data which should serve as a valuable addition to the NASA suite of deliverables

The proposed work is significant because it will allow us for the first time to use MODIS data to study the biophysical characteristics of salt marshes in the Gulf Coast which in turn, has the potential of increasing our predictive capability with respect to carbon sequestration in these ecosystems

Study sites

Spartina Alterniflora

Juncus Romerianus

Cocodrie, Terrebonne Parish, Louisiana

Blind Lagoon, St. Bernard Parish, Louisiana

Old Oyster Bayou, Terrebonne Parish, Louisiana

Grand Bay NERR, Jackson County, Mississippi

Weeks Island NERR, Baldwin County, Alabama

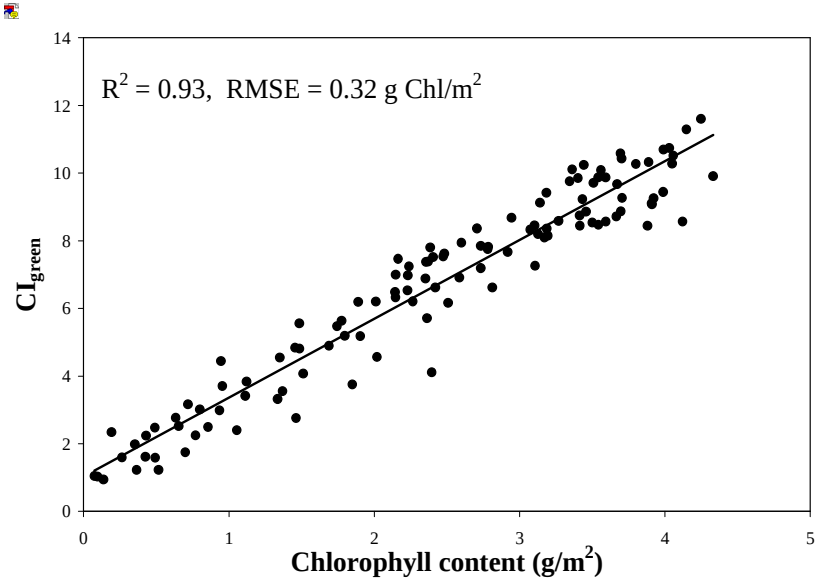
St Marks NWR, Wakulla County, Florida

Theoretical Basis

$$Chl \propto [R^{-1}(\lambda_1)-R^{-1}(\lambda_2)]\times R(\lambda_3)$$

$$CI_{green} = [R_{green}^{-1}-R_{NIR}^{-1}]\times R_{NIR} = a_1[(R_{NIR}/R_{green})-1]+b_1$$

$$CI_{red\text{-}edge} = [R_{red\ edge}^{-1}-R_{NIR}^{-1}]\times R_{NIR} = a_2[(R_{NIR}/R_{red\ edge})-1]+b_2$$



Chl content estimation in maize (after Gitelson et al., 2005)

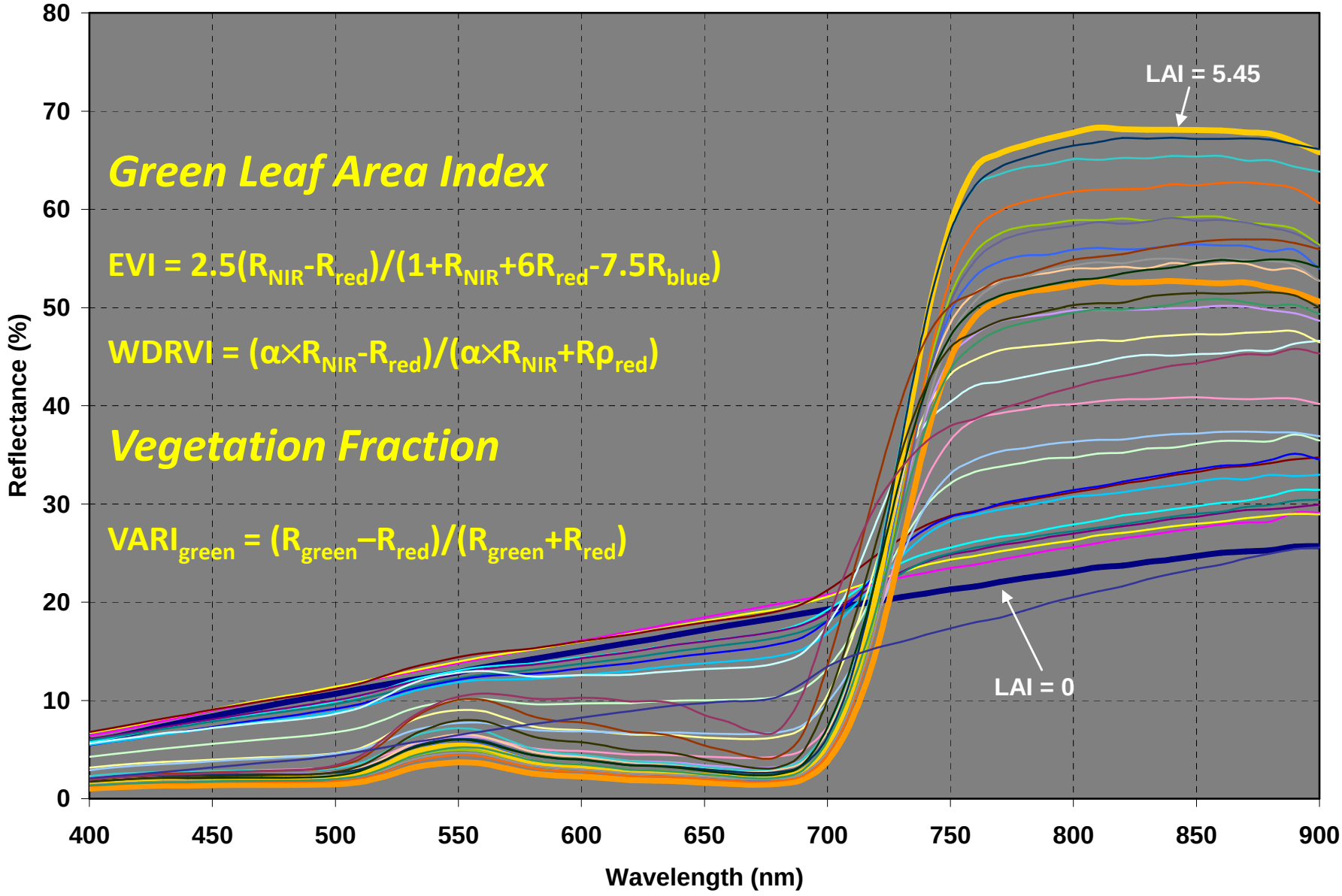
CI = Chlorophyll Index

R_{green} = vegetation reflectance at green wavelength

R_{NIR} = vegetation reflectance at NIR wavelength

$R_{red\ edge}$ = vegetation reflectance at red edge wavelength

Other indices to be used in the study



Field Data Collection

- Top of Canopy (TOC) reflectance using Ocean Optics (USB 4000) hyperspectral radiometer

- Leaf level reflectance measurement using Ocean Optics and leaf clip and chlorophyll content retrieval from reflectance data

- Leaf level chlorophyll content reading using SPAD chlorophyll meter

- Green LAI readings using LiCOR's LAI meter (Plant Canopy Analyzer)

- Canopy level chlorophyll content calculating as Chl_{upper} ×green LAI techniques (technique may vary from species to species, therefore
- suitable technique will be investigated

- VF readings using digital photographs (*see* Gitelson et al., 2002 *for details*)

Model calibration

- MODIS 250-m (R, NIR) and 500-m (G, NIR) TOC reflectance vs. Ocean Optics G, R and NIR TOC reflectance (to validate the atmospheric correction accuracy of MODIS)

- MODIS 250-m NDVI, WDRVI, and EVI vs. canopy level Chl content

- MODIS 500-m NDVI, WDRVI, EVI and CI_{green} vs. canopy level Chl content

- MODIS 250-m EVI and WDRVI vs. green LAI

- MODIS 250-m NDVI, EVI vs. VF

- MODIS 500-m NDVI and VARI vs. VF

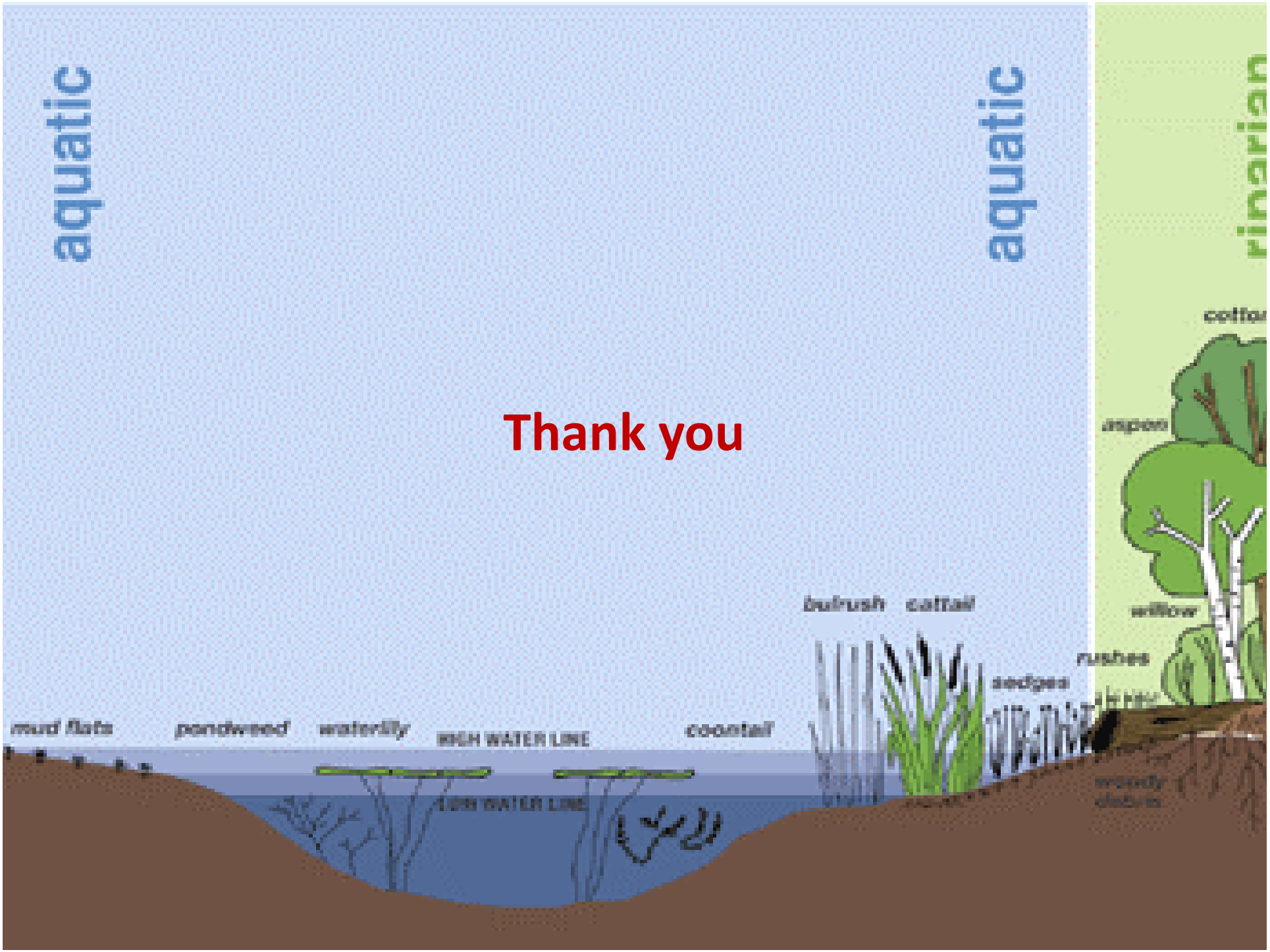
Model validation

- Canopy level Chl content retrieved from marsh vs. Chl predicted by MODIS 250m NDVI, WDRVI, and EVI indices

- Canopy level Chl content retrieved from marsh vs. Chl predicted by MODIS 500m NDVI, WDRVI, EVI and Ci_{green}

- MODIS predicted green LAI using EVI and WDRVI vs. measured green LAI

- MODIS predicted VF using NDVI and VARI vs. measured VF


aquatic
aquatic
riparian
Thank you
aspen
willow
rushes
bulrush
cattail
sedges
mud flats
pondweed
waterlily
HIGH WATER LINE
LOW WATER LINE
coontail