

# ***VQ2. Ecosystem Function, Physiology, and Seasonal Activity***

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## ***VQ2 Overarching Question:***

**What are the seasonal expressions and cycles for terrestrial and aquatic ecosystems, functional groups, and diagnostic species?**

**How are these being altered by changes in climate, land use, and disturbance?**

**Decadal Survey: Strategic Role of Ecosystem Observations:**  
**Observing Conditions and Trends**  
**Predicting Trajectories**  
**Managing Events**

## **VQ2 Thematic Subquestions**

**VQ2a:** How are ecosystems being altered by changes in climate, land use, and disturbance?

**VQ2b:** How are seasonal patterns of ecosystem function being affected by climate change?

**VQ2c:** How do changes in phenology affect productivity, carbon sequestration, and hydrological processes across ecosystems and agriculture?

**VQ2d:** How do environmental stresses affect the seasonality of the physiological function of water and carbon exchanges within ecosystems?

**VQ2e:** What is the seasonality and environmental impact of algal blooms in shallow water environments?

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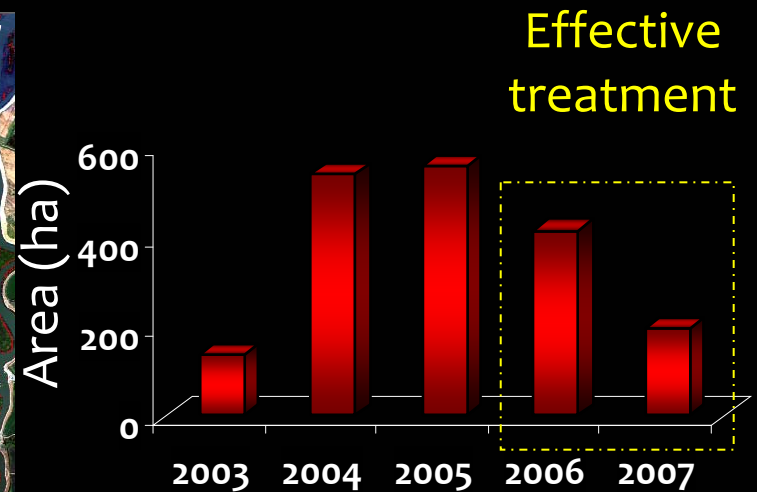
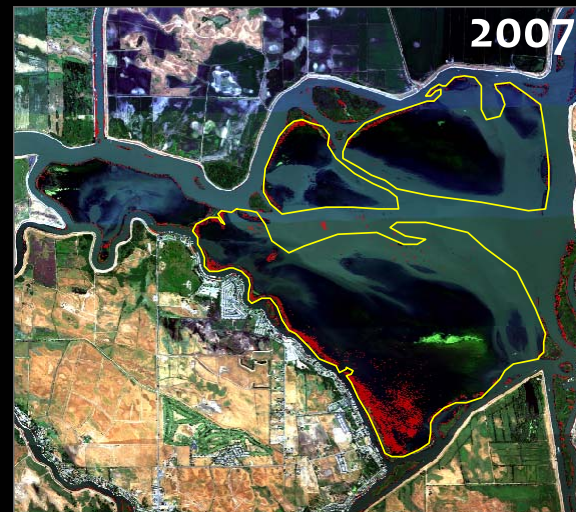
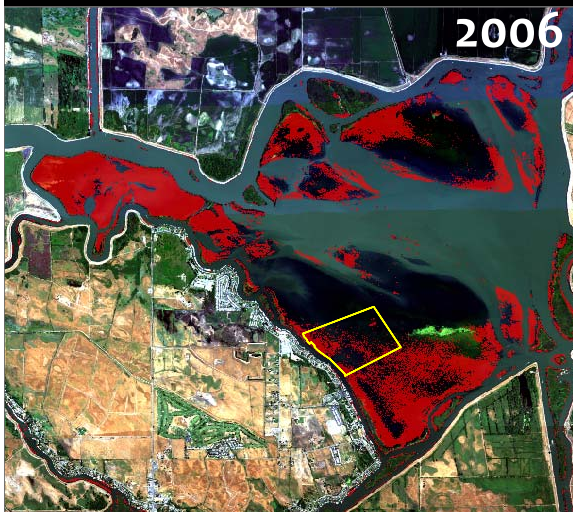
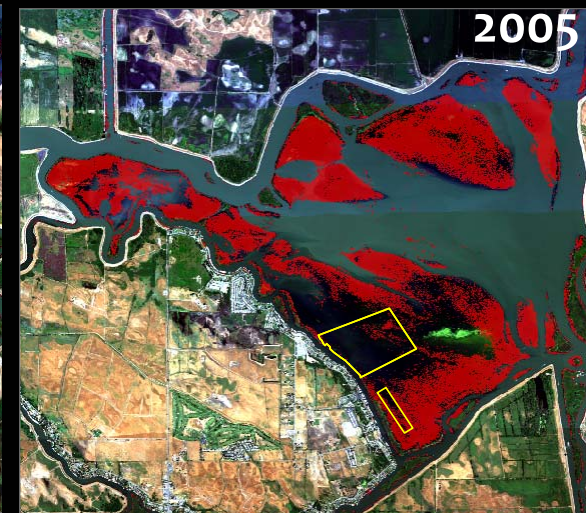
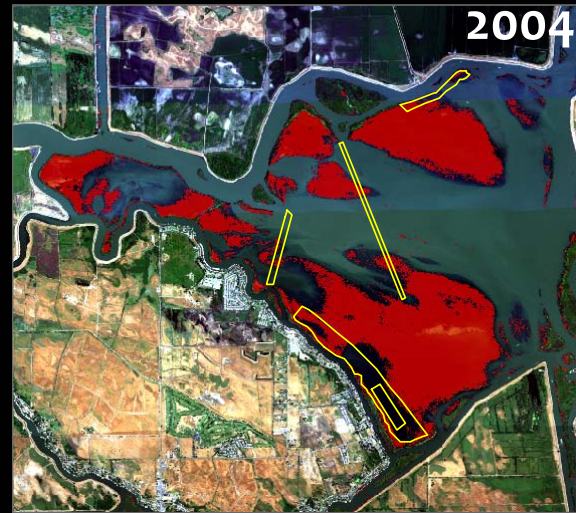
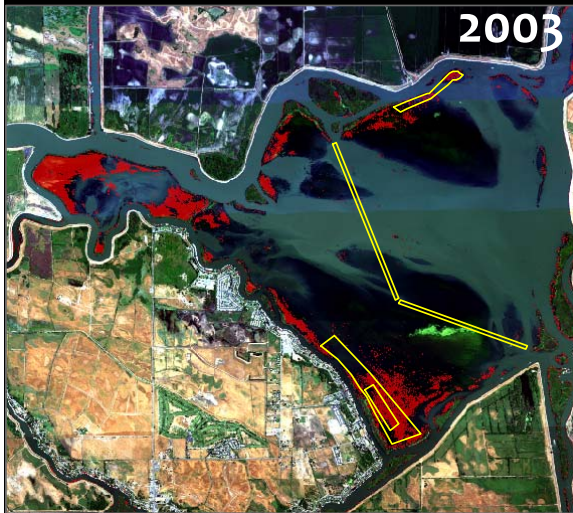
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# Submerged aquatic vegetation (HyMap data – June)



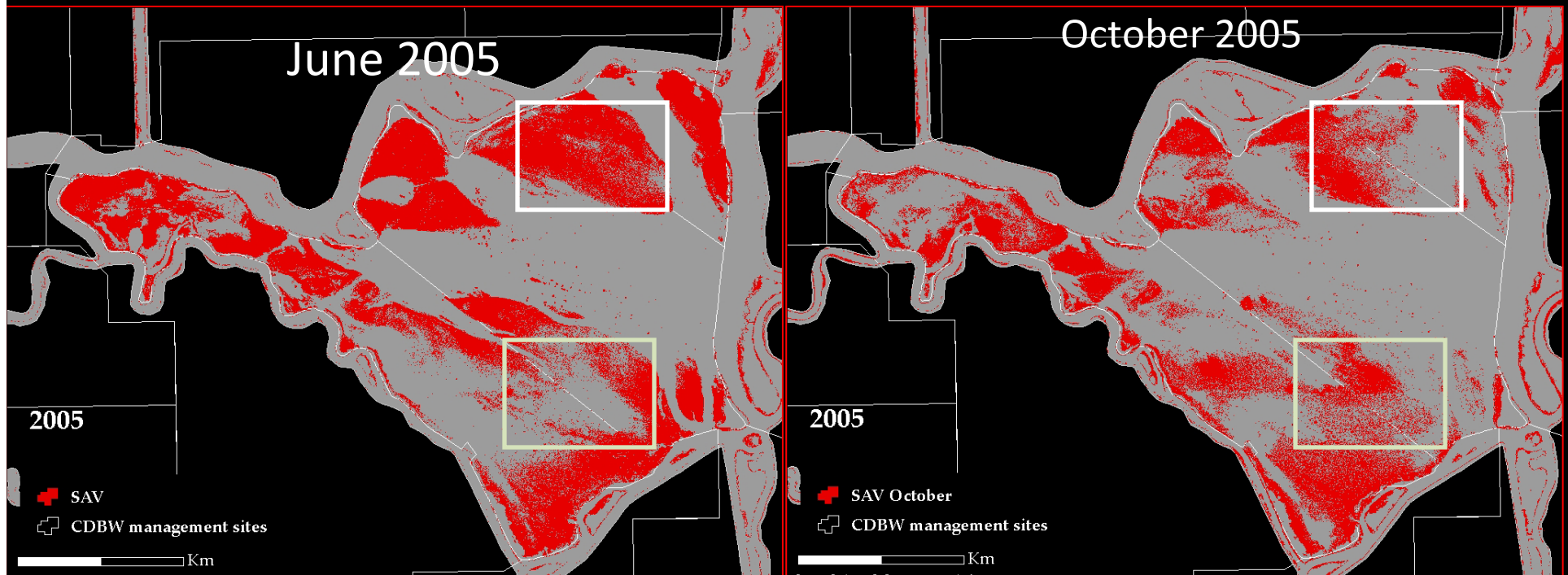
— Herbicide application areas  
SAV classification

Use of Hyperspectral Remote Sensing to Evaluate Efficacy of Aquatic Plant Management

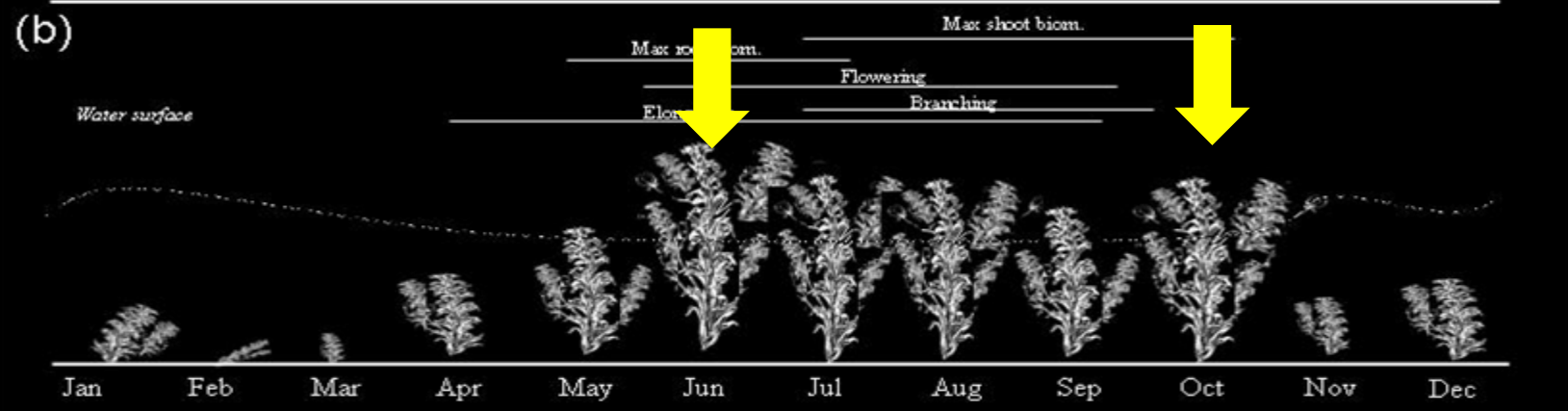
Maria J. Santos, Shruti Khanna, Erin L. Hestir, Margaret E. Andrew, Sepalika S. Rajapalse, Jonathan A. Greenberg, Lars W. J. Anderson, and Susan L. Ustin\*



# Seasonal Changes in Submerged aquatic vegetation in the Sacramento-San Joaquin Delta



(b)



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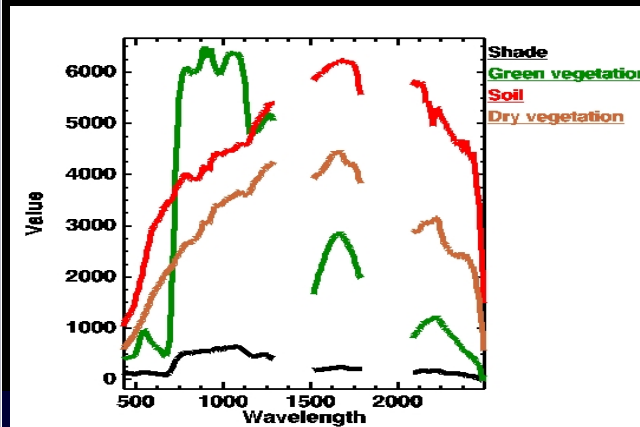
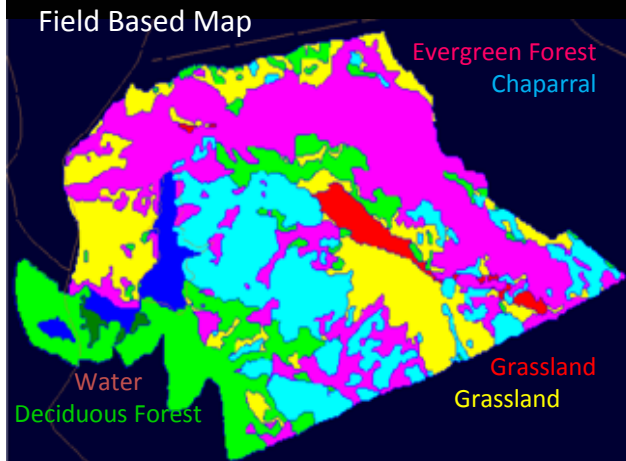
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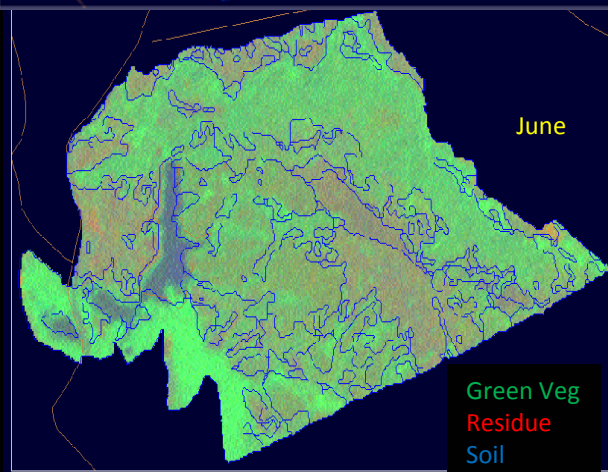
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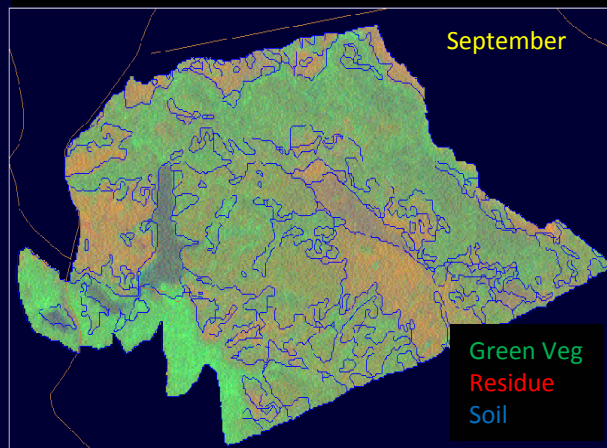
# Seasonal Vegetation Dynamics at Jasper Ridge Biological Field Station, California



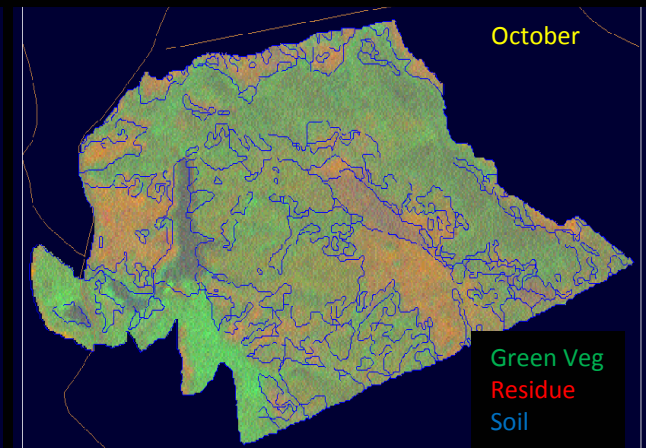
AVIRIS SMA Fraction Images



Red->NPV Green->GV Blue->Soil



Red->NPV Green->GV Blue->Soil

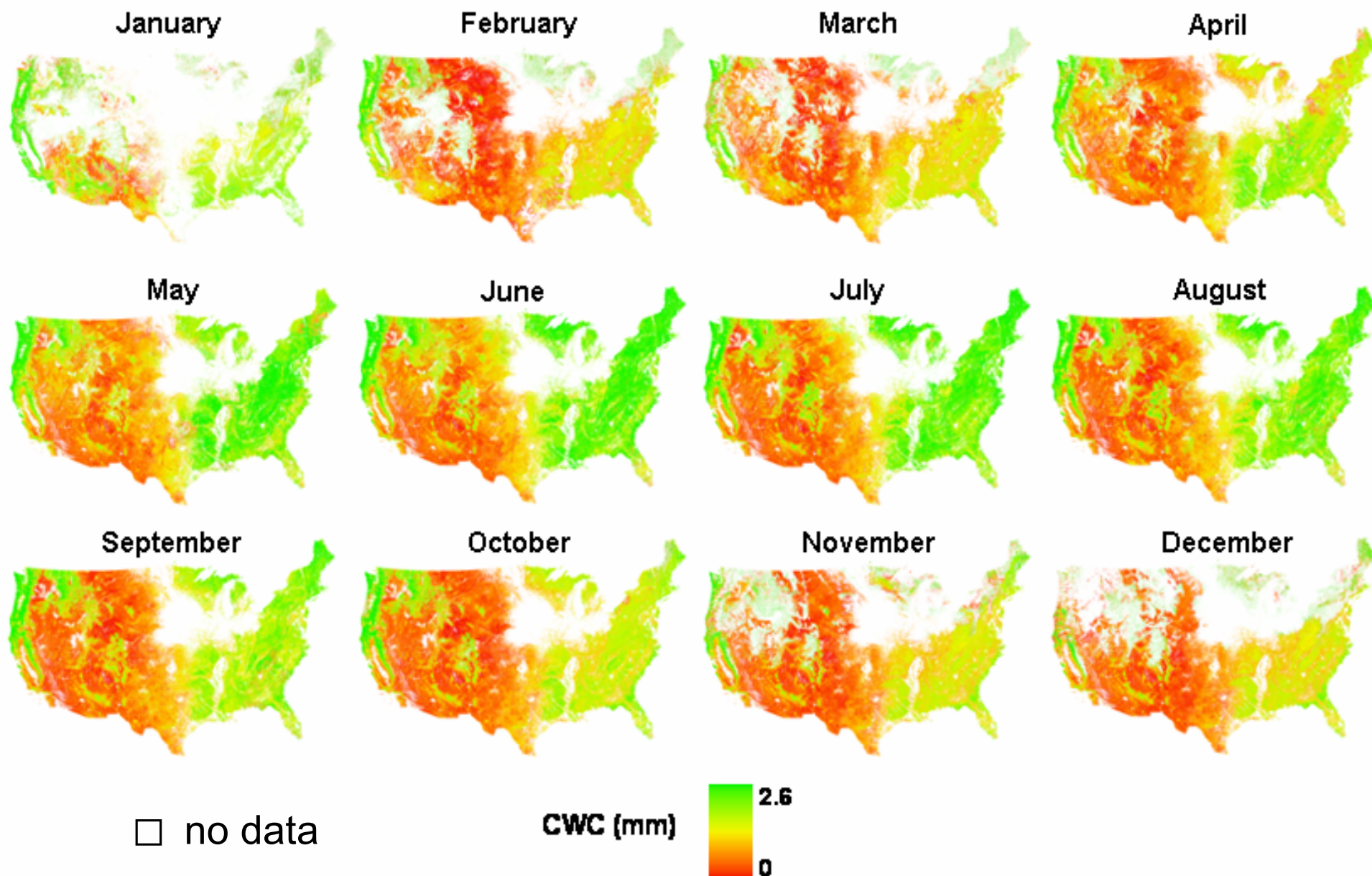


Red->NPV Green->GV Blue->Soil

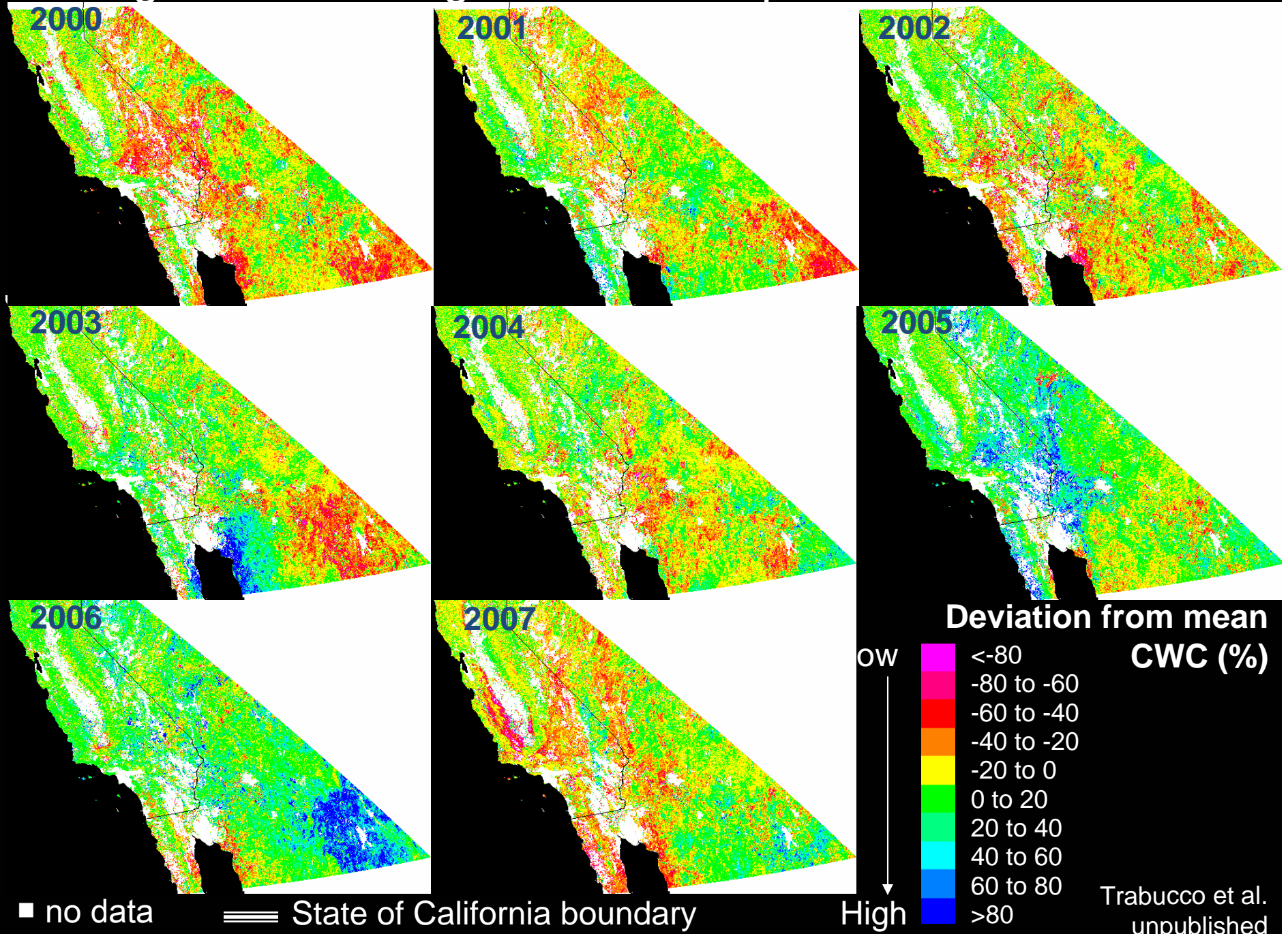
Ustin et al. 1999. in Remote Sensing Change Detection: Environmental Monitoring Applications and Methods, Pp. 163-180



# Monthly MODIS CWC for Continental U.S. in 2005



# Regional-San Diego Wildfires September 2007: CWC



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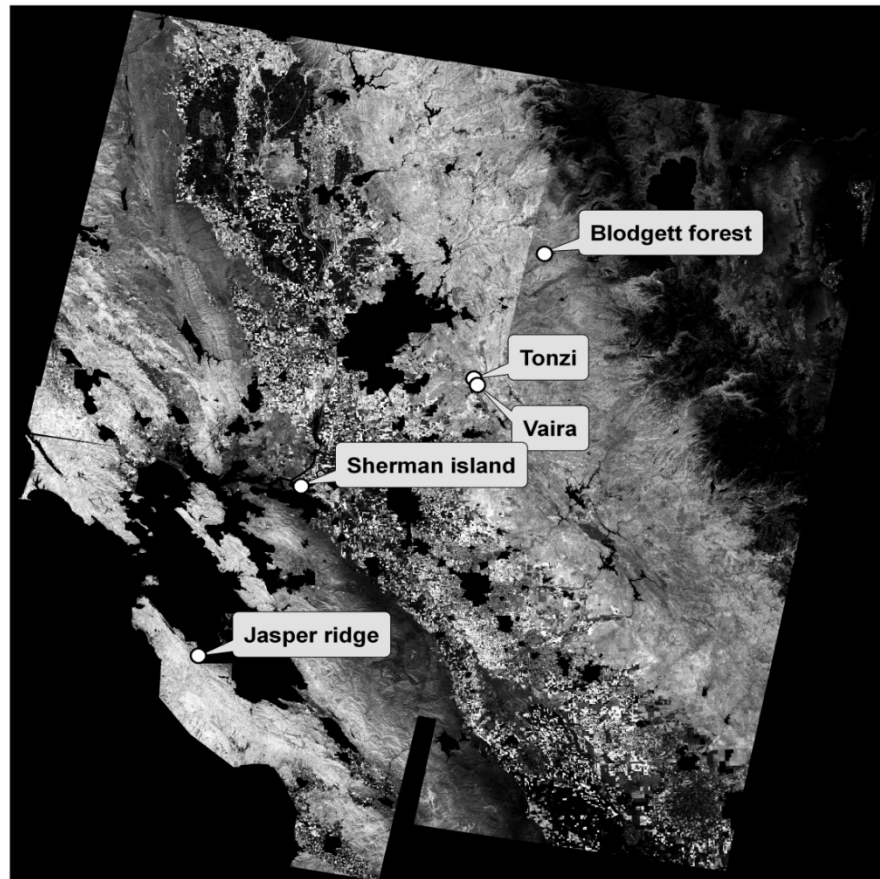
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# NDVI image March/April 2007



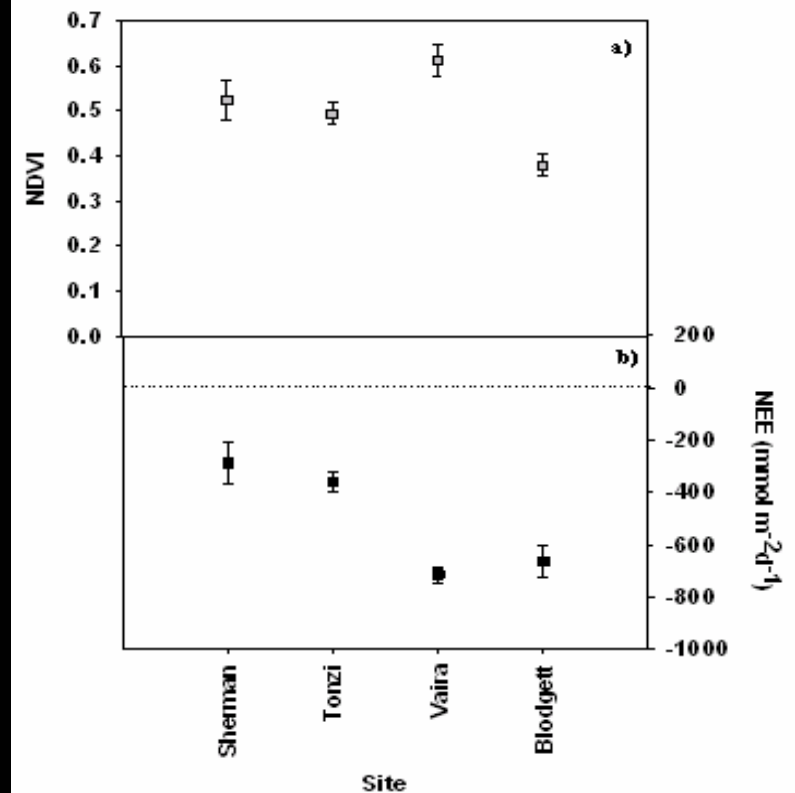
NDVI values  
Landsat NDVI March/April  
Value



0 12.5 25 50 75 100  
Kilometers

Donatella Zona et al.  
In prep.

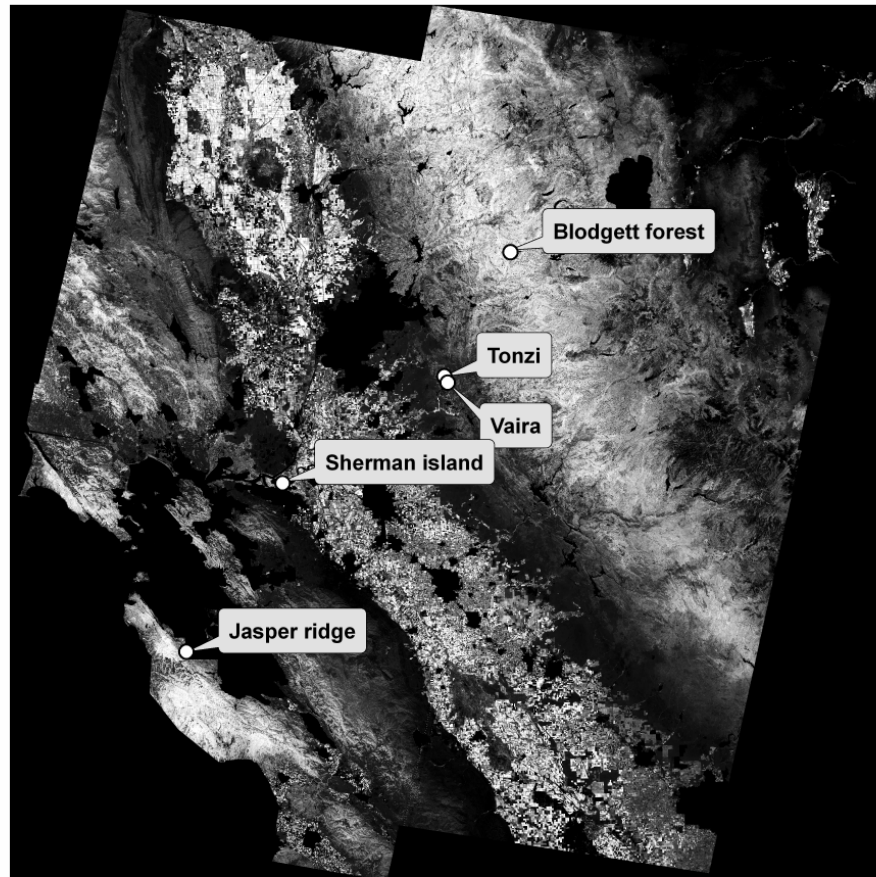
## NDVI and Corresponding monthly flux tower data



NDVI isn't predictive of  
the net  $\text{CO}_2$  flux



# NDVI image August 2007



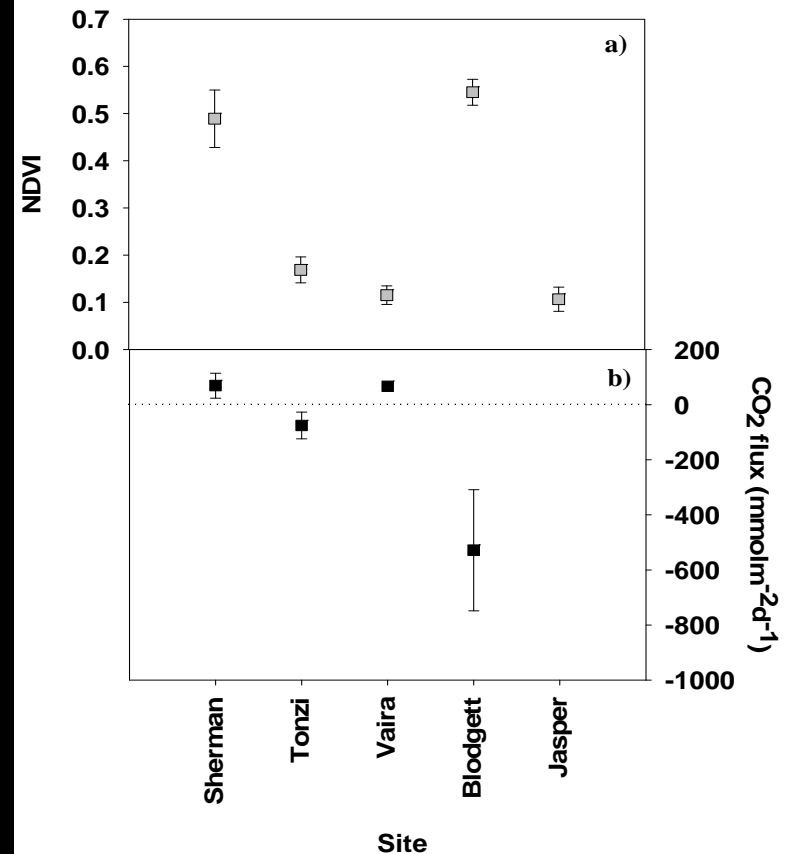
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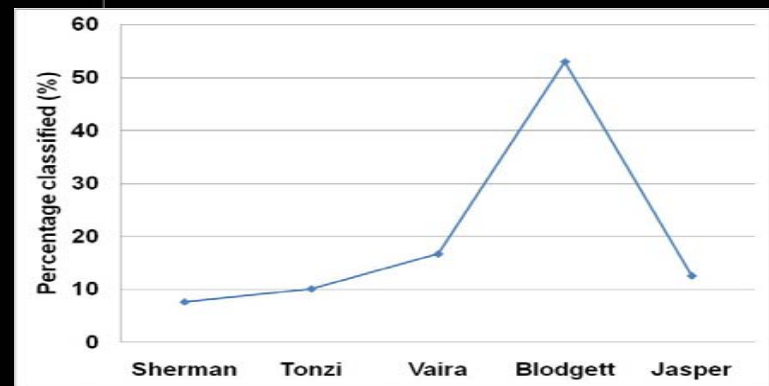
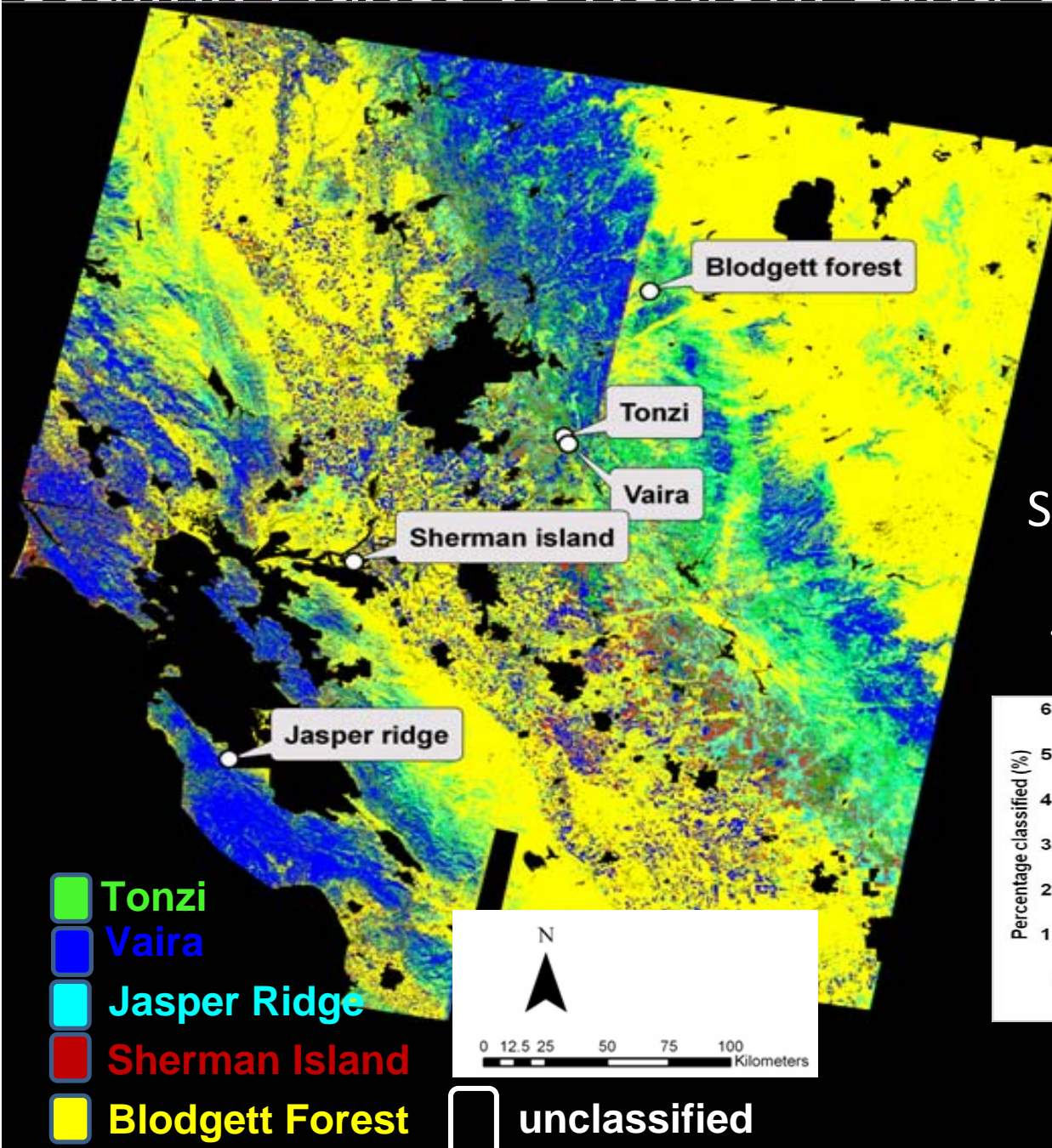


NDVI isn't predictive of  
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# Scaling Fluxes to Region: Land Cover Classification

March-April

SAM classification AVIRIS  
trained of 5 eddy flux  
tower footprint classes

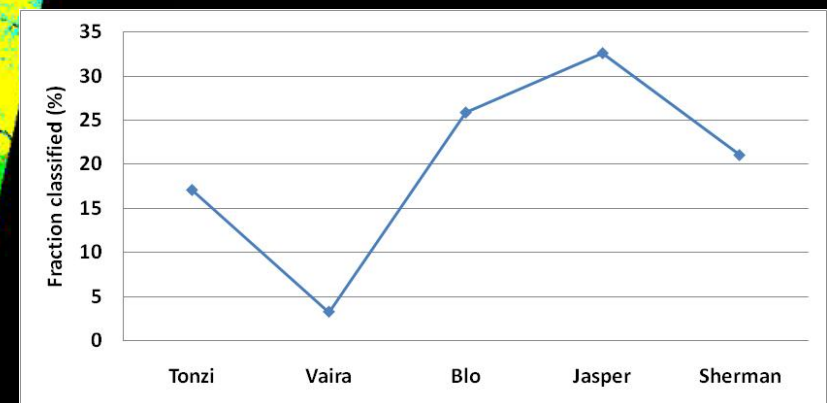
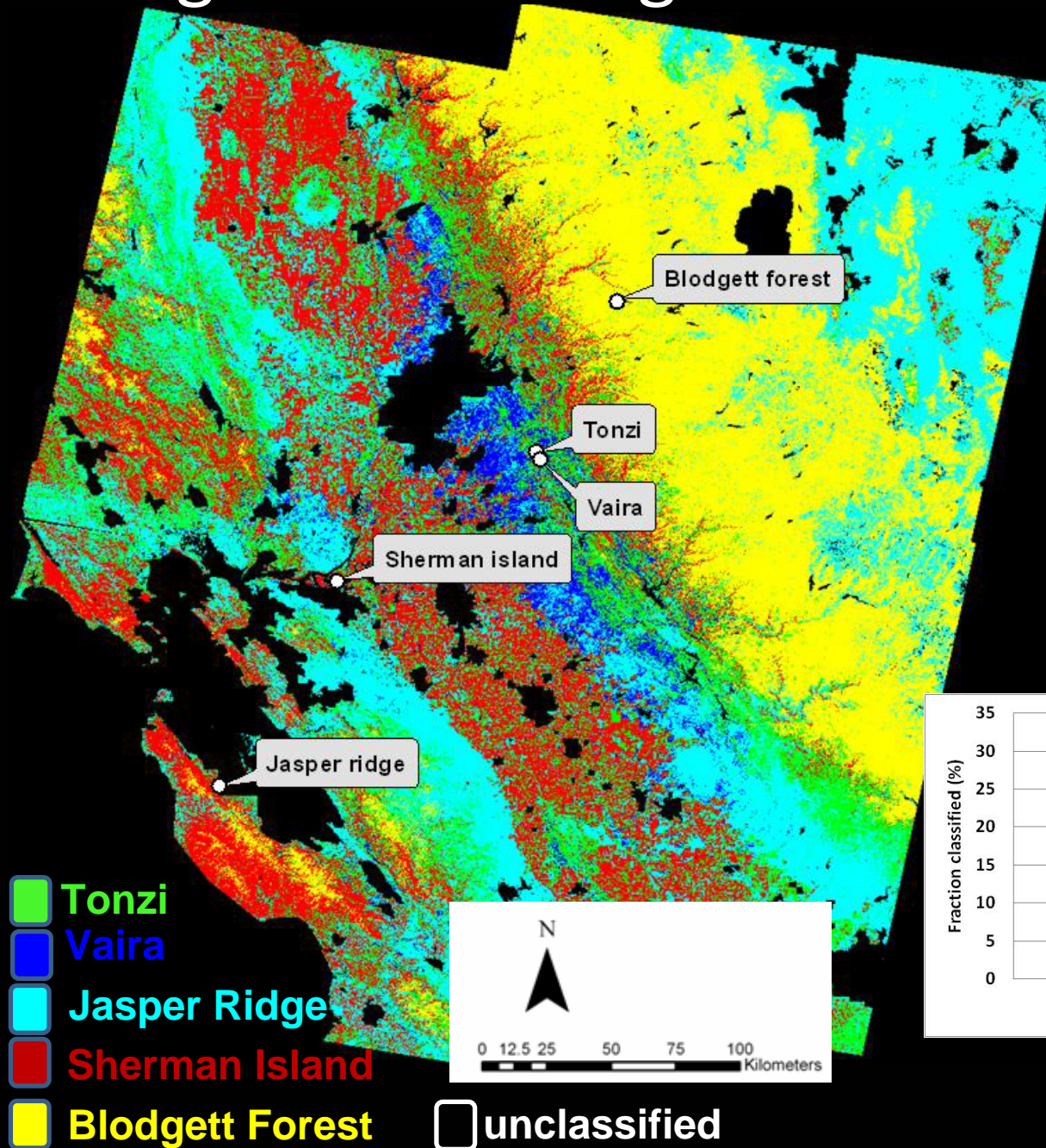


% of Class in Image



# Scaling Fluxes to Region: Land Cover Classification

August

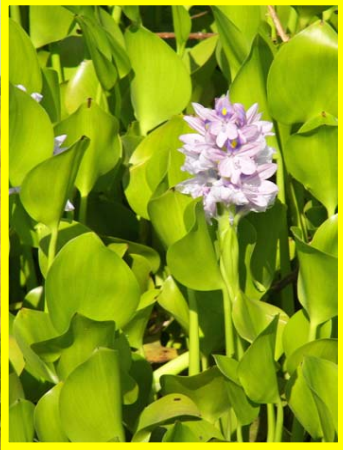


% of Class in Image



# Mapping Invasive Species: Co-occurrence of multiple phenologic stages

August: Water hyacinth with vertical leaves



Summer: Water hyacinth: flowering



June: Water hyacinth with short rounded leaves

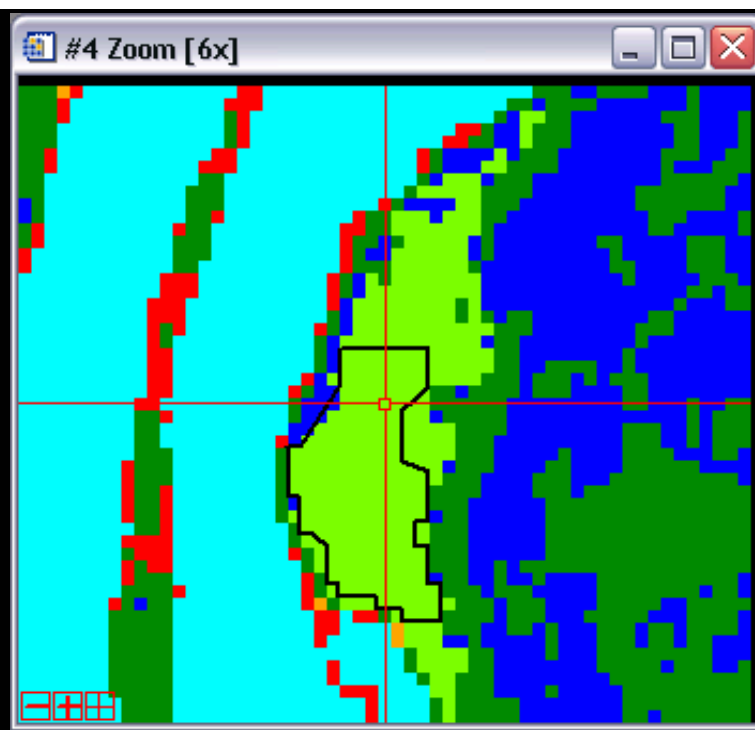
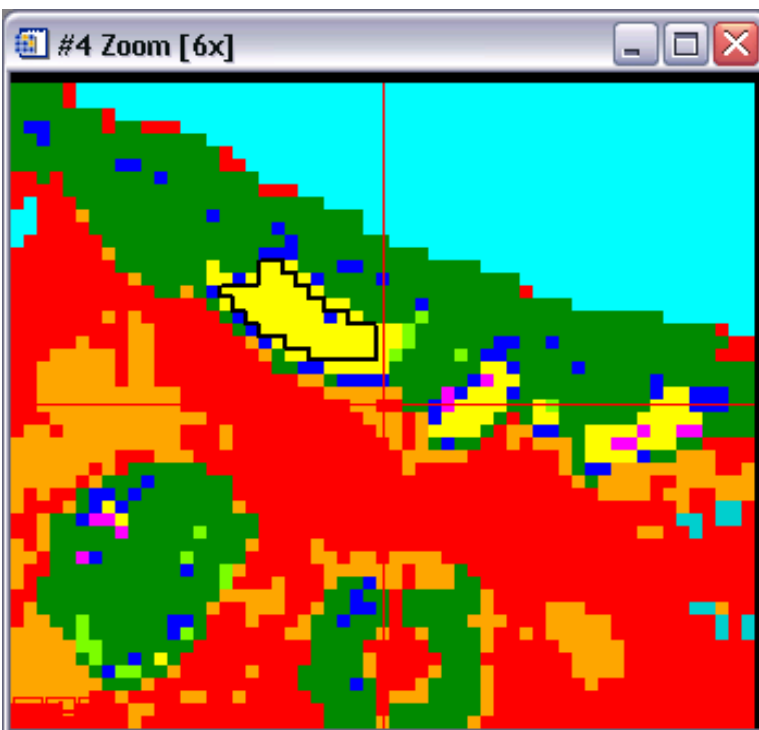


October: Senescent foliage



February: Water hyacinth residue





Pennywort (gold)

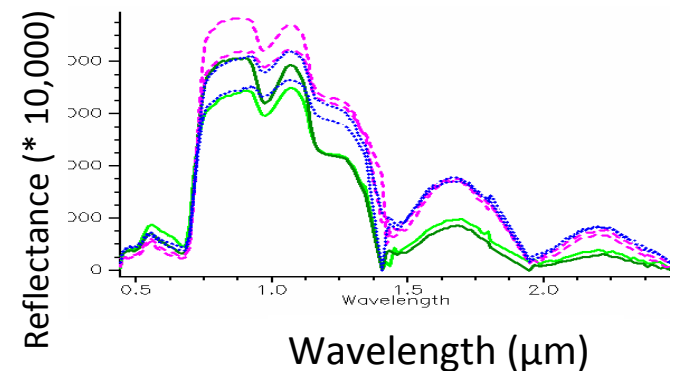
Water Hyacinth (yellow green)

# Floating Species

## Challenges:

Water hyacinth is spectrally similar:

- co-occurring floating & emergent species
- sunlit portions of tree crowns
- multiple phenological stages at any acquisition time



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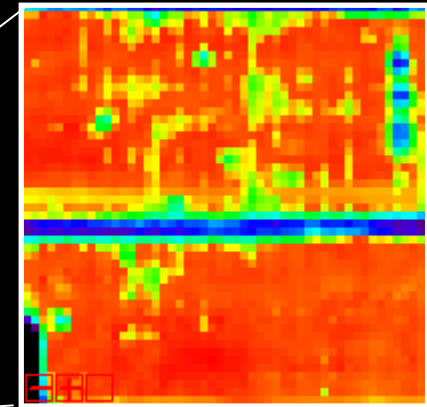
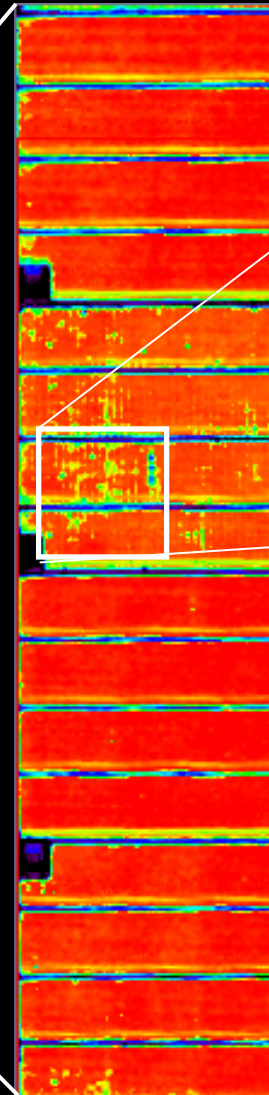
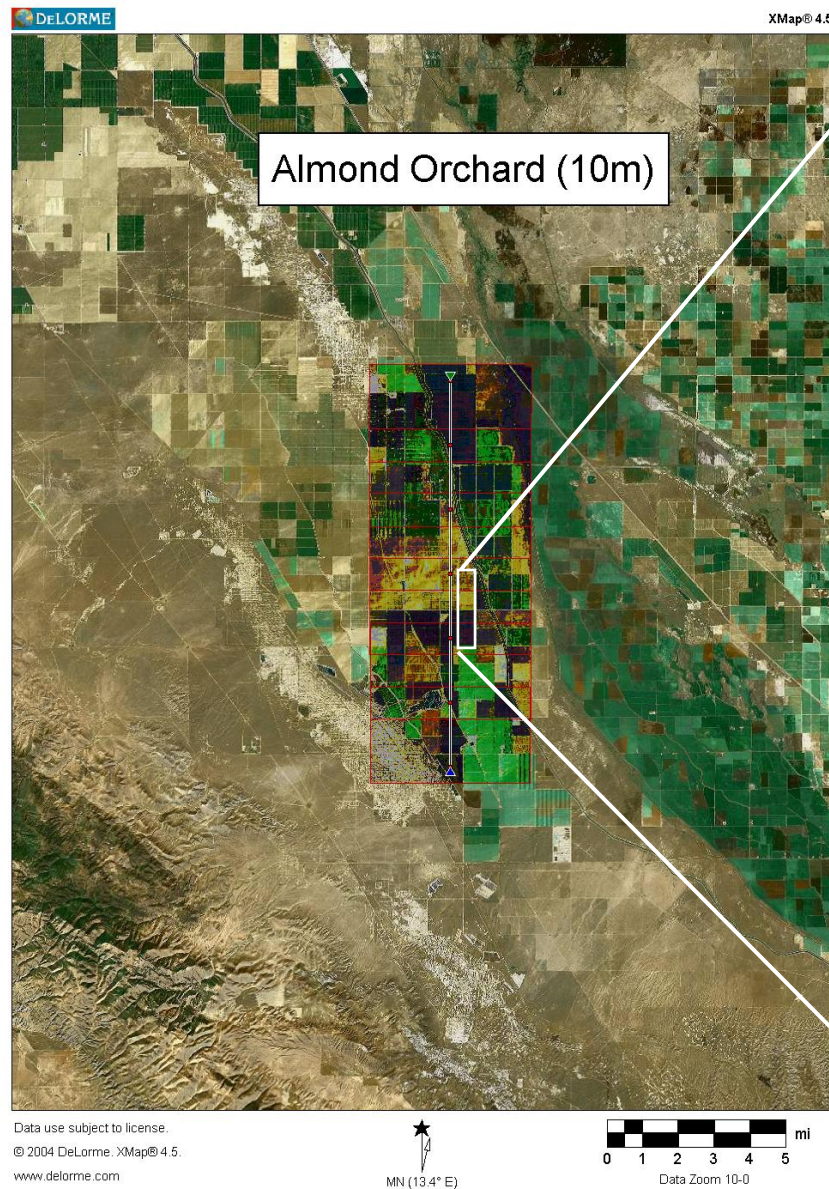
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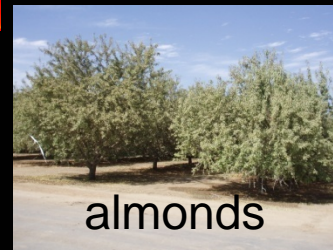
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# Agriculture and Water Demand

## ET estimated using MASTER data and SEBS



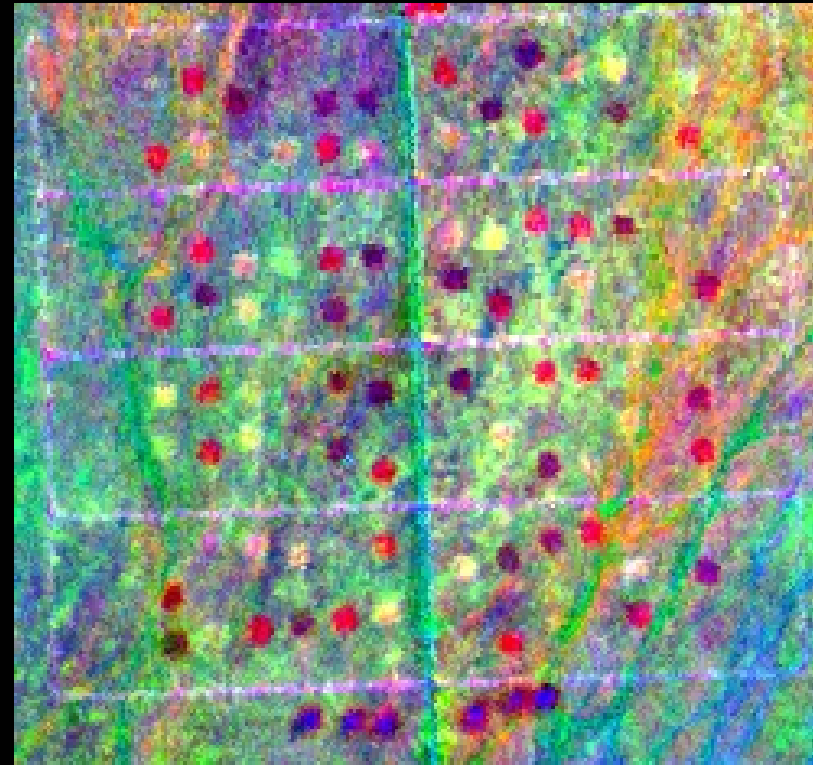
Max. Irrigation



# Biological soil crust under simulated climate change



**False Color Infrared**  
~3m spatial resolution



**MNF Transform**

- MNF Band 4
- MNF Band 5
- MNF Band 9

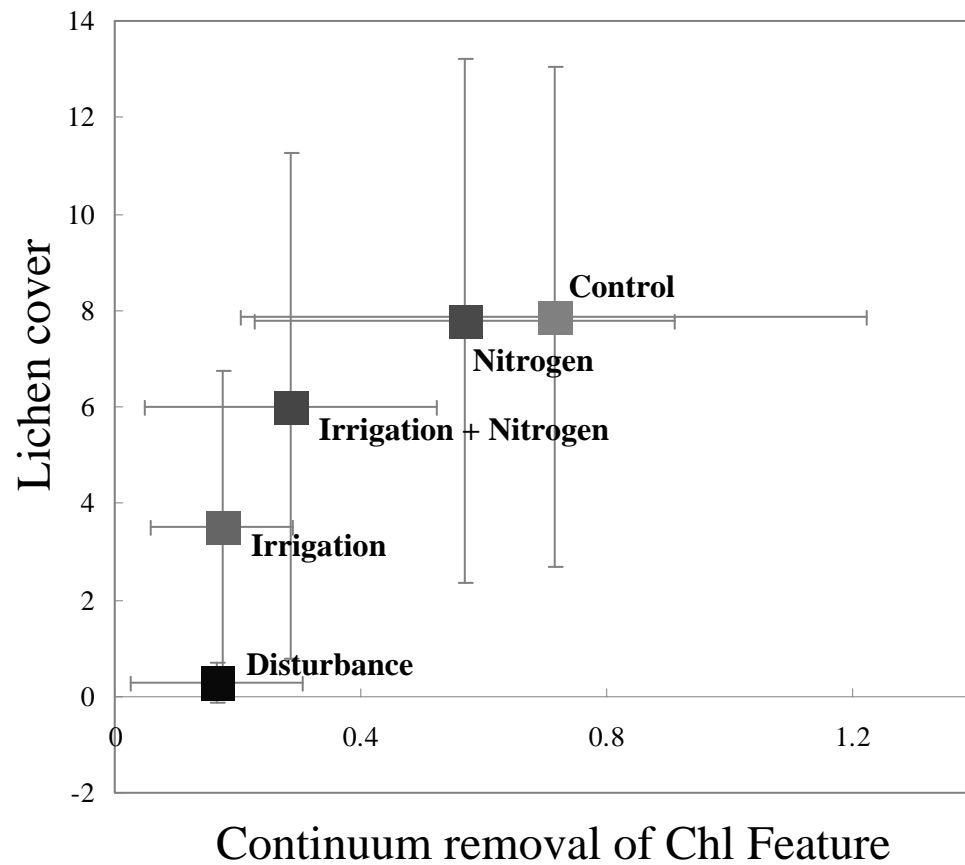
- Irrigation & Disturbance
- Irrigation
- Disturbance & Nitrogen

Summer irrigation, nitrogen, and disturbance treatments simulate predicted climate and environmental change conditions





# Lichen cover vs global change treatment



Ustin et al., RSE 2009

## VQ2 Thematic Subquestions

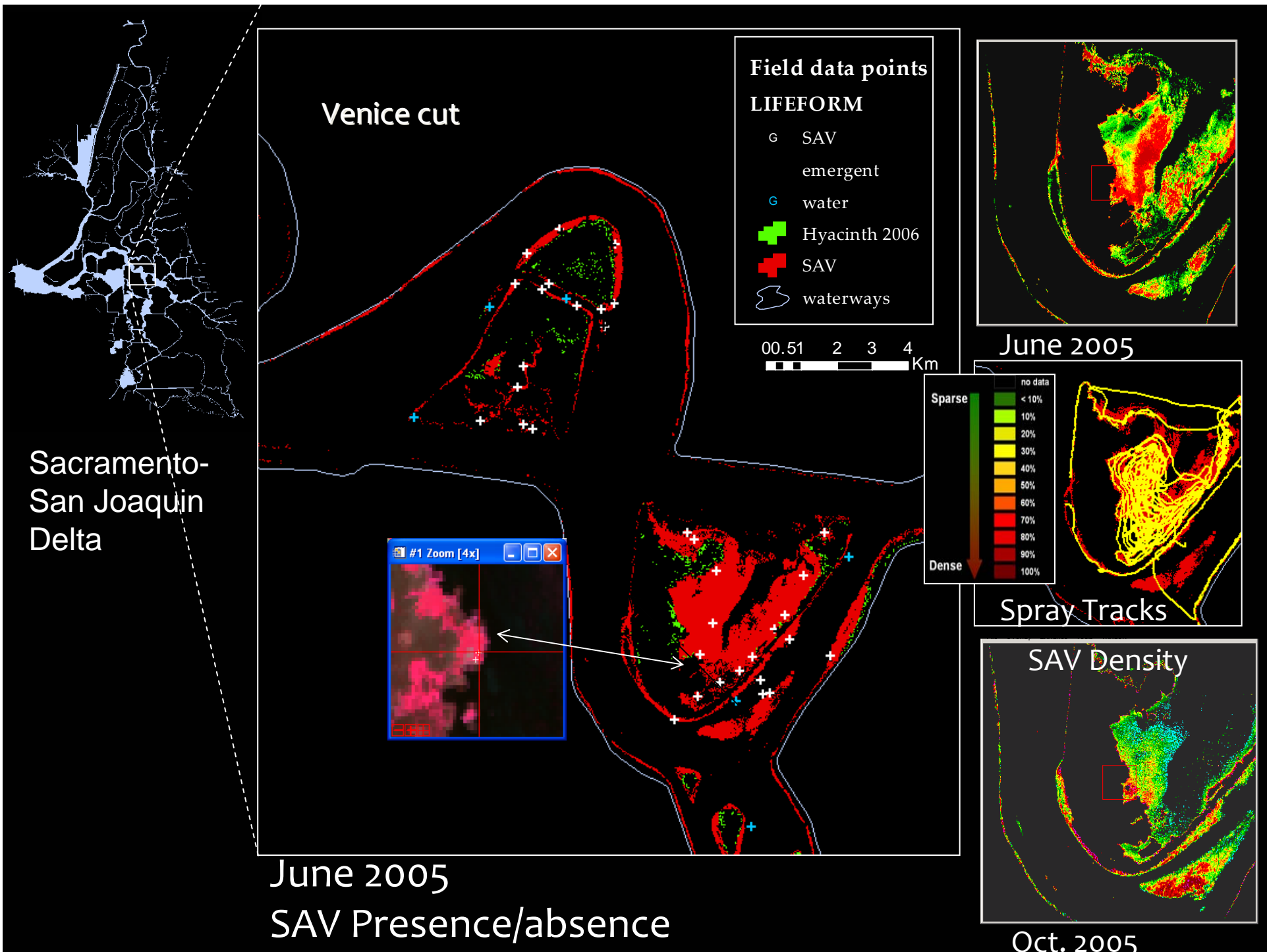
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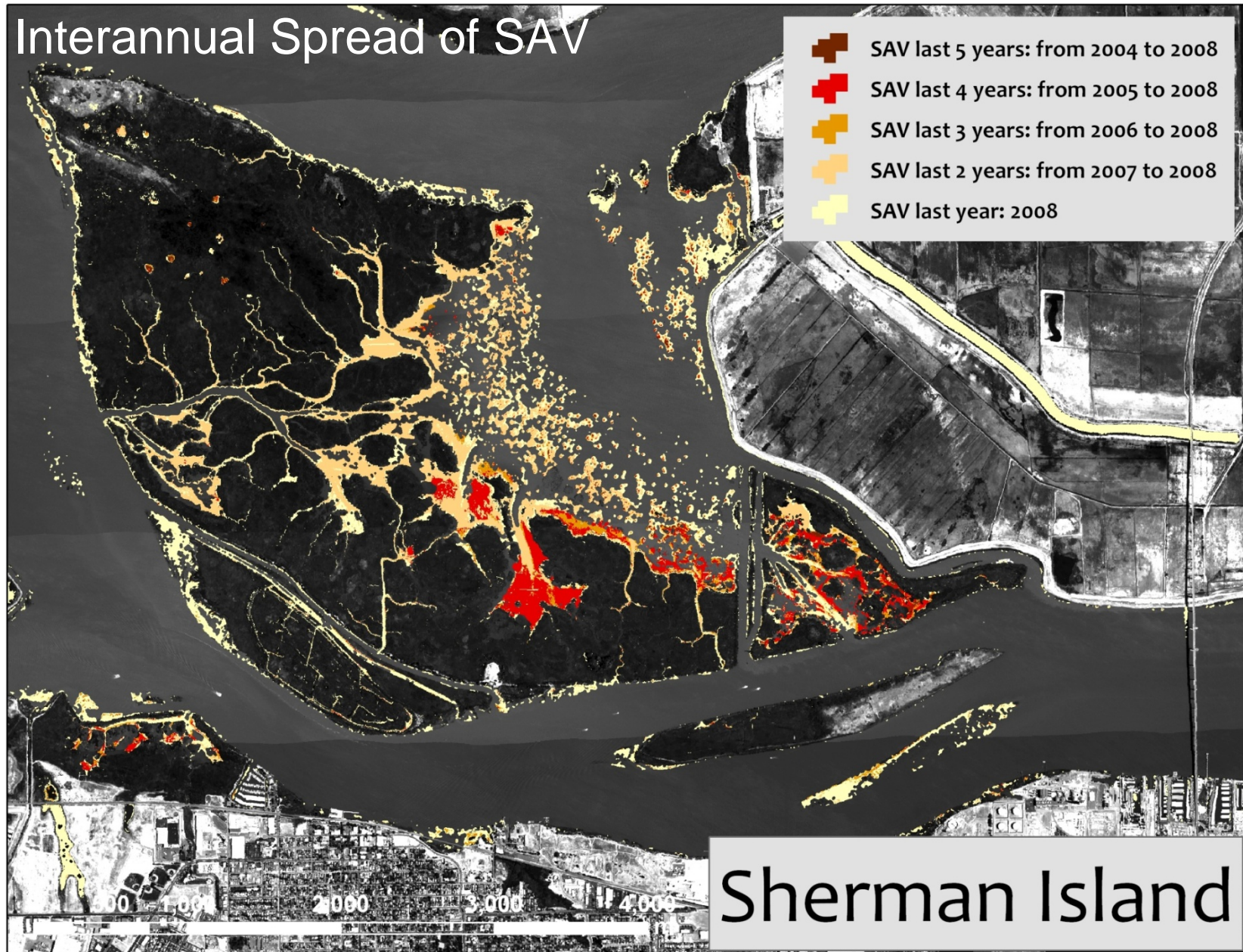
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# Interannual Spread of SAV



Maria Joao Santos et al., in prep.