

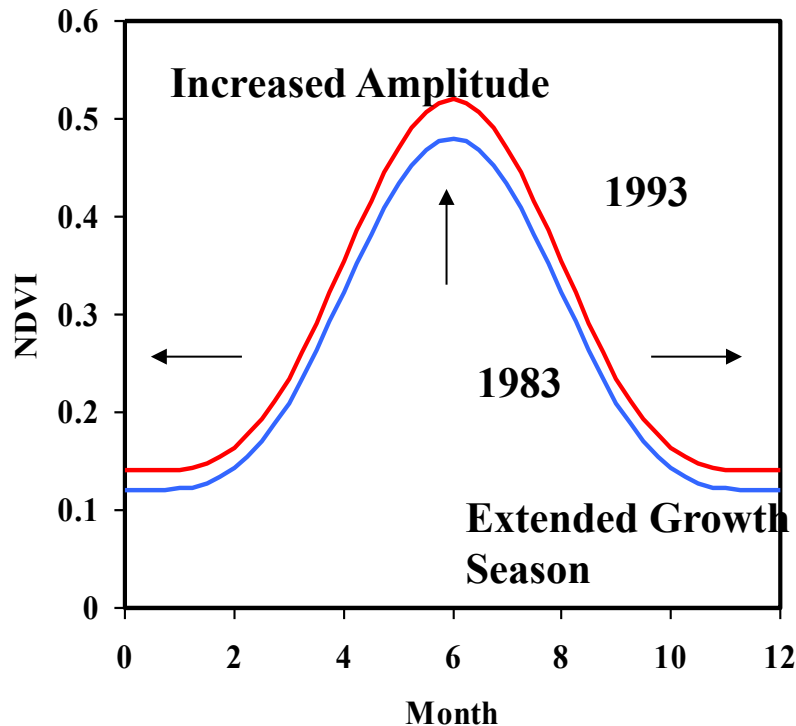
VQ2. Ecosystem Function, Physiology and Seasonal Activity

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?

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? [DS 191, 195, 203]



Science Issue:

Phenology appears to be changing for ecosystems around the world.

Tools:

Repeat sampling in key spectral bands
Diagnostic of seasonal physiological activity

Approach:

Use time series to evaluate changes in phenology for representative ecosystems

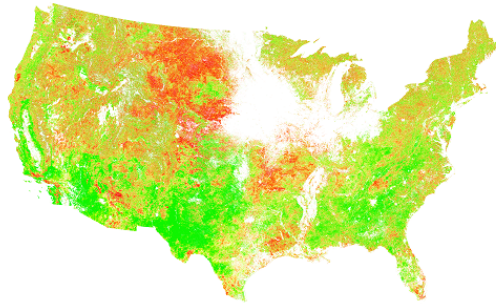
Myneni et al., 1997: Nature

Tucker et al., 2001: Int. J. Biometeorol

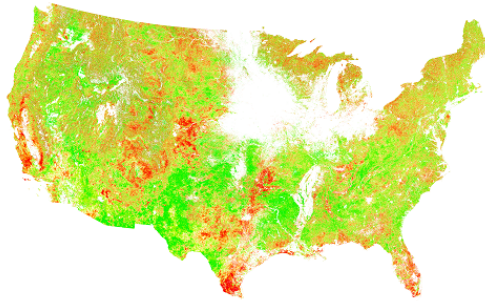
How does the seasonal activity of ecosystems and functional types vary across biomes, geographic zones, or environmental gradients between the equator and the poles?

How are seasonal patterns of ecosystem function being affected by climate change? [DS 205, 206, 210]

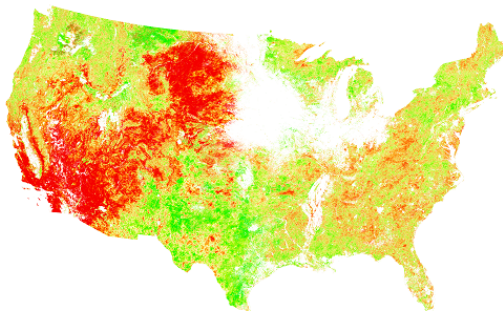
Niño periods – Normal periods (Winter)



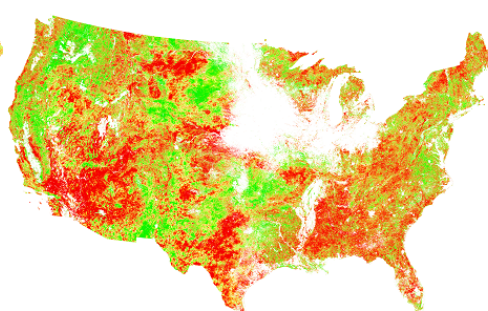
Niña periods – Normal periods (Winter)



Niño periods – Normal periods (Summer)



Niña periods – Normal periods (Summer)



Science Issue:

Improved “functional maps” are needed.

Tools:

Global sampling in key spectral bands diagnostic of physiological function.

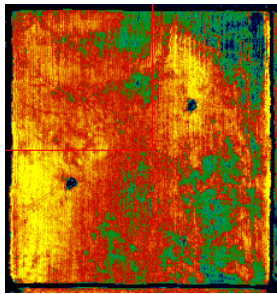
Approach:

Use global time series to develop improved functional maps and to detect impacts of disturbance and climate change.

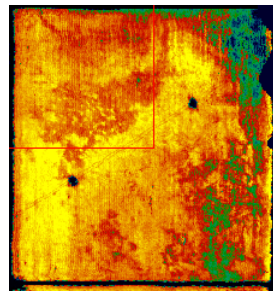
Climate Interactions w/ Canopy Water Content ,
2000 to 2007

Riaño et al., in prep.

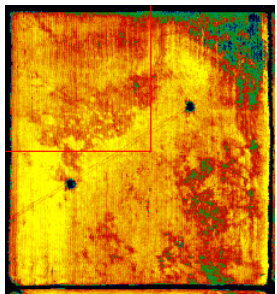
How do changes in phenology affect productivity, carbon sequestration, and hydrological processes across ecosystems and agriculture? [DS 195, 205, 210]



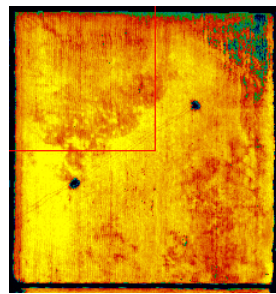
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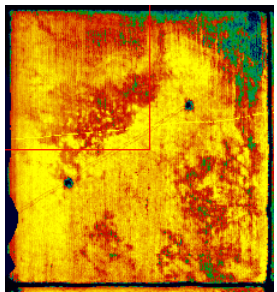
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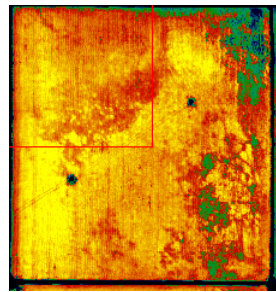
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Science Issue:

Productivity and carbon sequestration are affected by current environmental conditions

Tools:

Repeat sampling in key spectral bands diagnostic of water status and carbon exchange

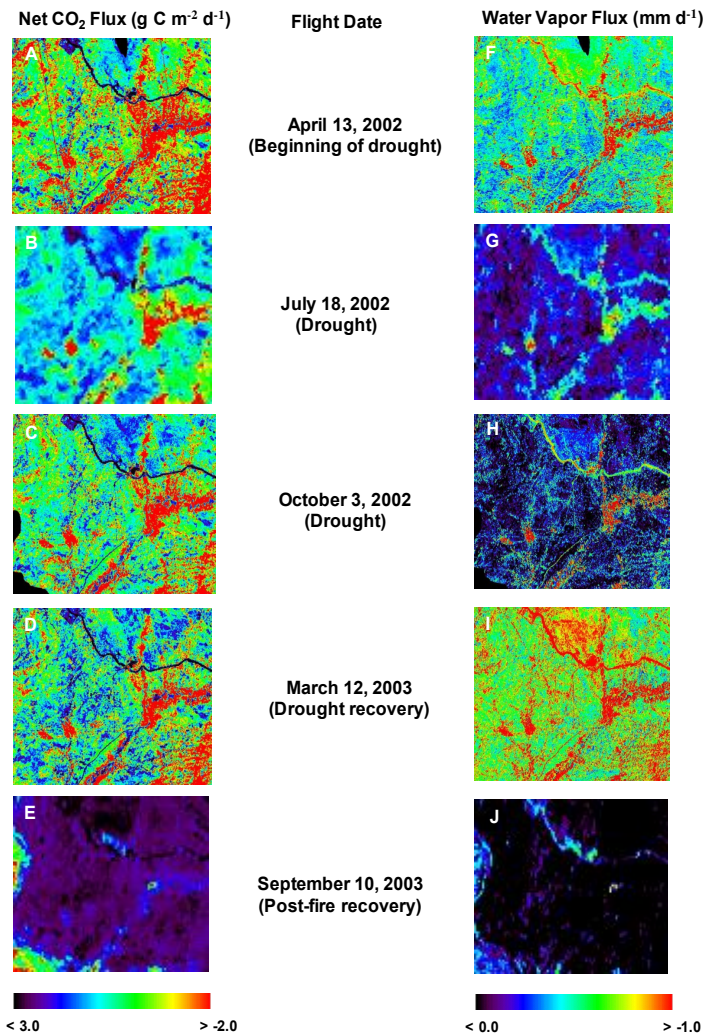
Approach:

Use time series to evaluate changing productivity, hydrology and carbon sequestration

Time Series of Red Edge Spectral Index over Growing Season.

Zarco-Tejada & Ustin, Unpublished

How do environmental stresses affect the seasonality of physiological function of water and carbon exchanges within ecosystems? [DS 203, 206, 210]



Science Issue:

Changing disturbance patterns (drought, fire...) alter surface-atmosphere exchanges.

Tools:

Repeat sampling in key spectral bands providing input to flux models.

Approach:

Use time series to evaluate changing biosphere-atmosphere gas exchange.

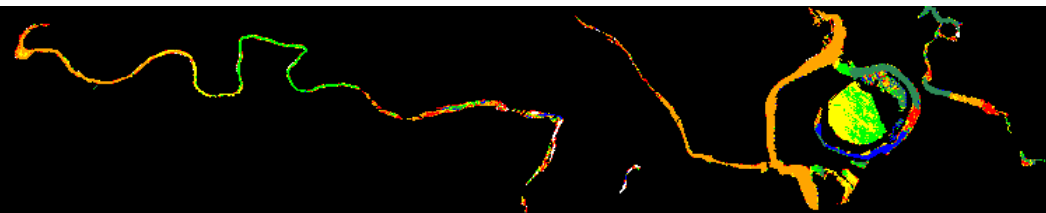
Impacts of drought and fire on carbon and water vapor fluxes (Fuentes et al. 2006)

What is the seasonality and environmental impact of algal blooms in shallow water environments? [DS 201, 208]

True color image



Microcystis bloom density



Science Issue:

Increased incidence of harmful algal blooms due to altered hydrology and runoff.

Tools:

Sampling in key spectral bands diagnostic of algal species

Approach:

Map spatial and temporal patterns of algal populations.