Recent Results and Collection 6 Refinements for the Land Cover and Land Cover Dynamics Products

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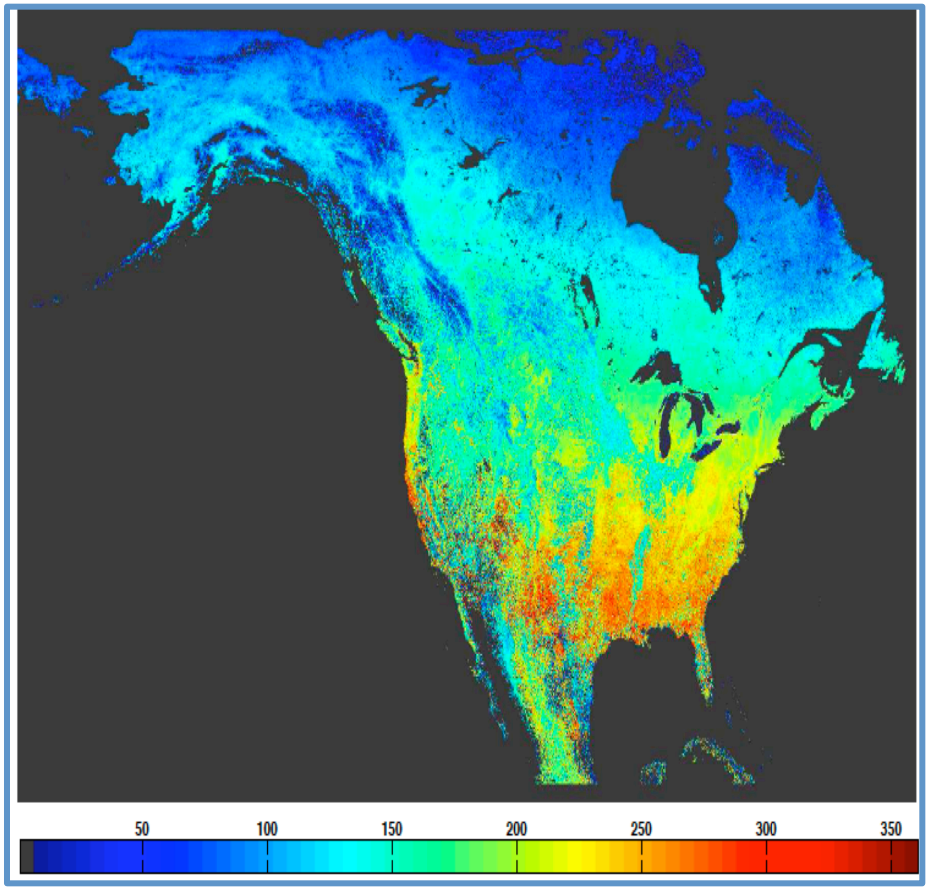
MCD12 Products

MCD12Q1 – Global Land Cover Type

North American land cover from MODIS
(MODIS Land Cover mage courtesy National Geographic)

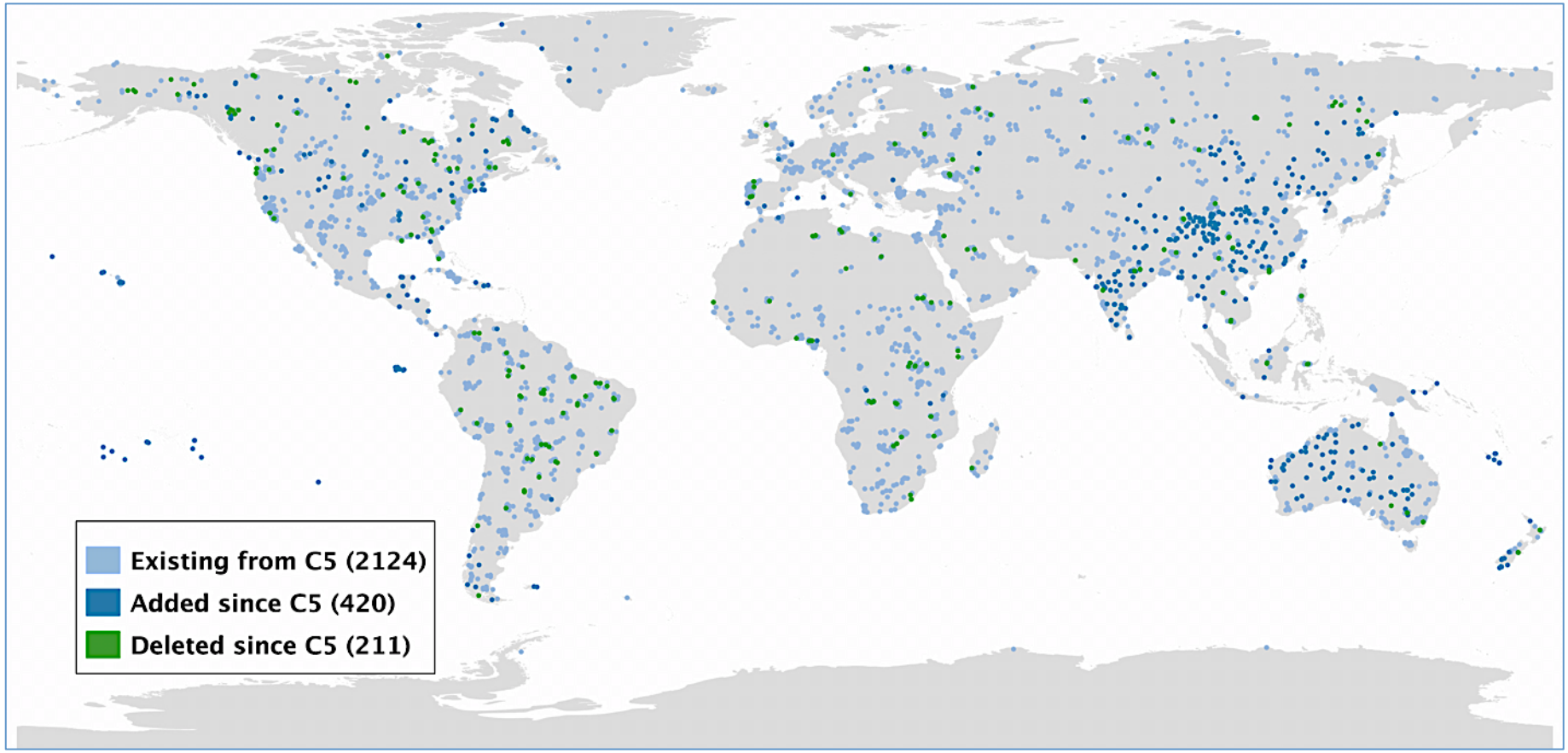
MCD12Q2 – Global Land Cover Dynamics



North American growing season length
(Ganguly et al., RSE, 2010)

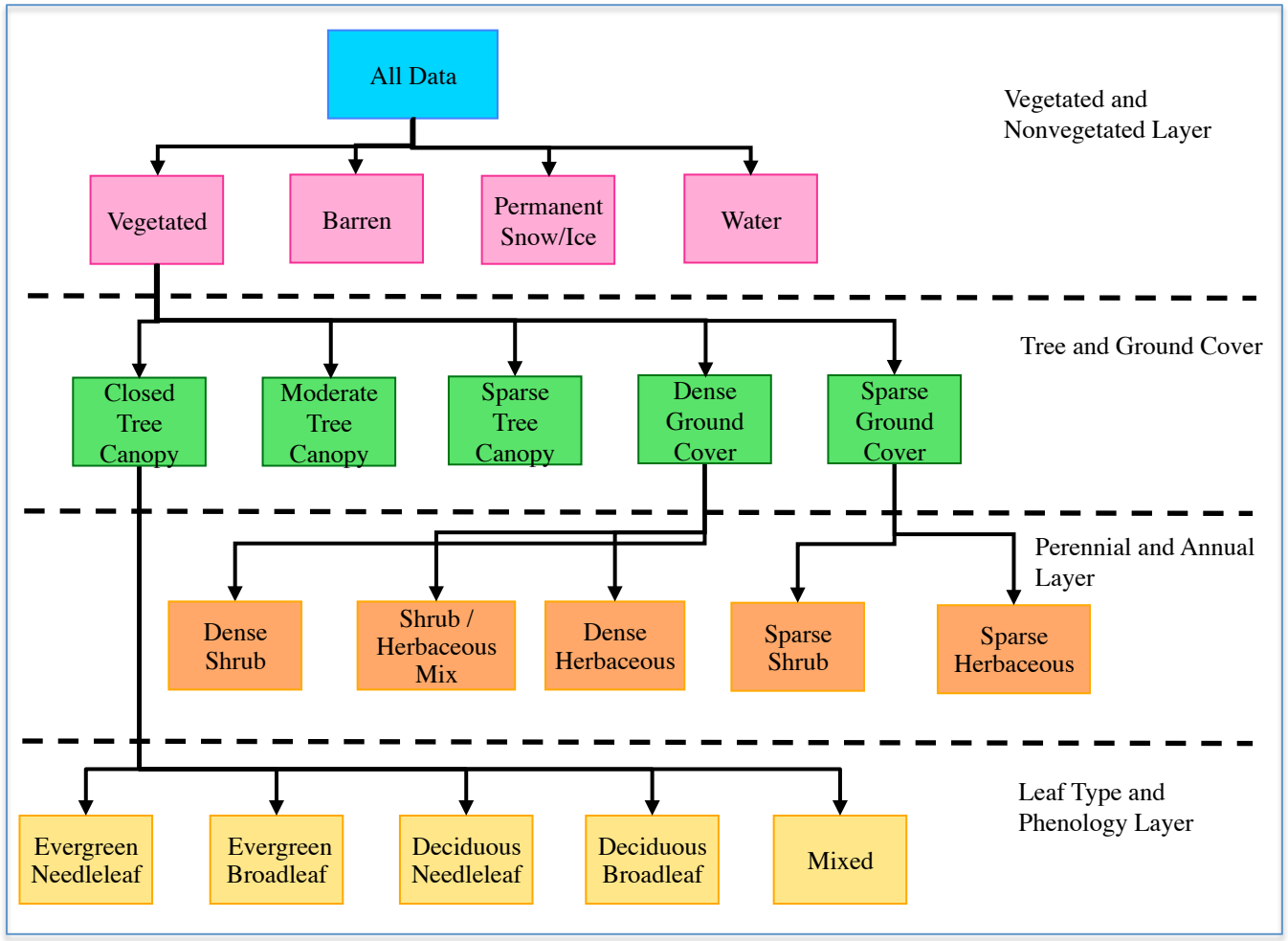
MCD12Q1 - Refinements

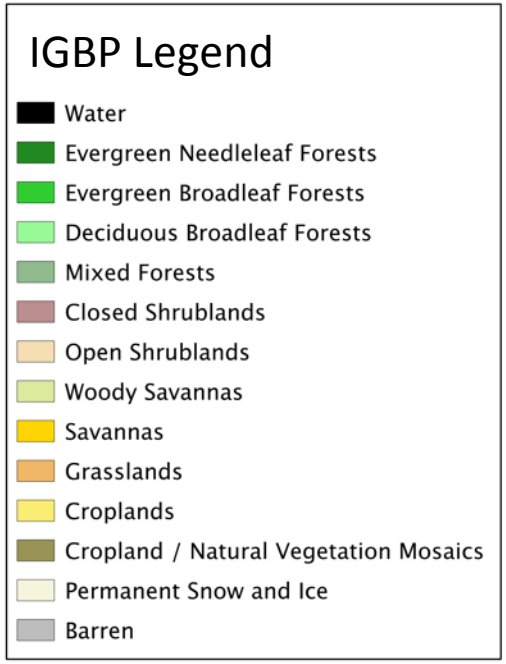
Training site database for supervised classification completely revised, augmented



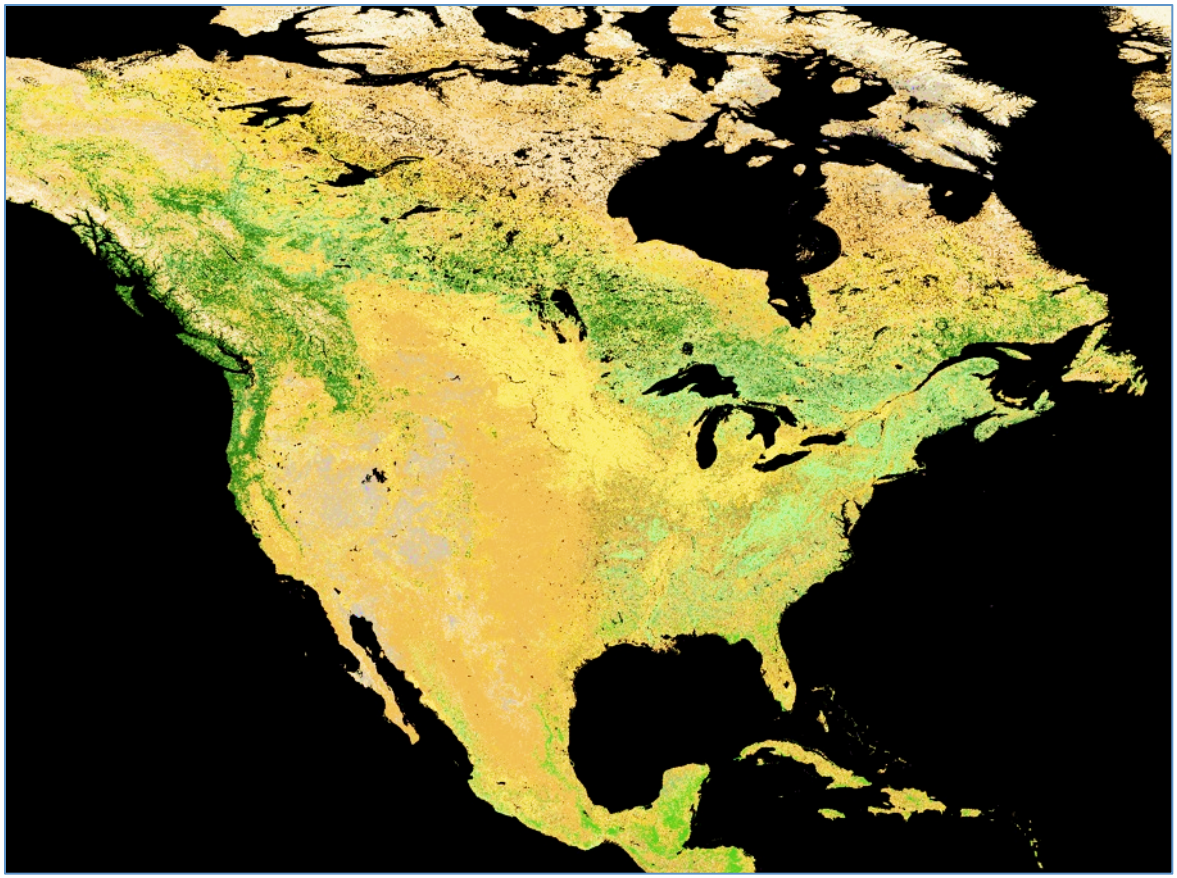
MCD12Q1 - Refinements

New LCCS Compliant Land Cover Layer





Preliminary C6 LCCS Product North America

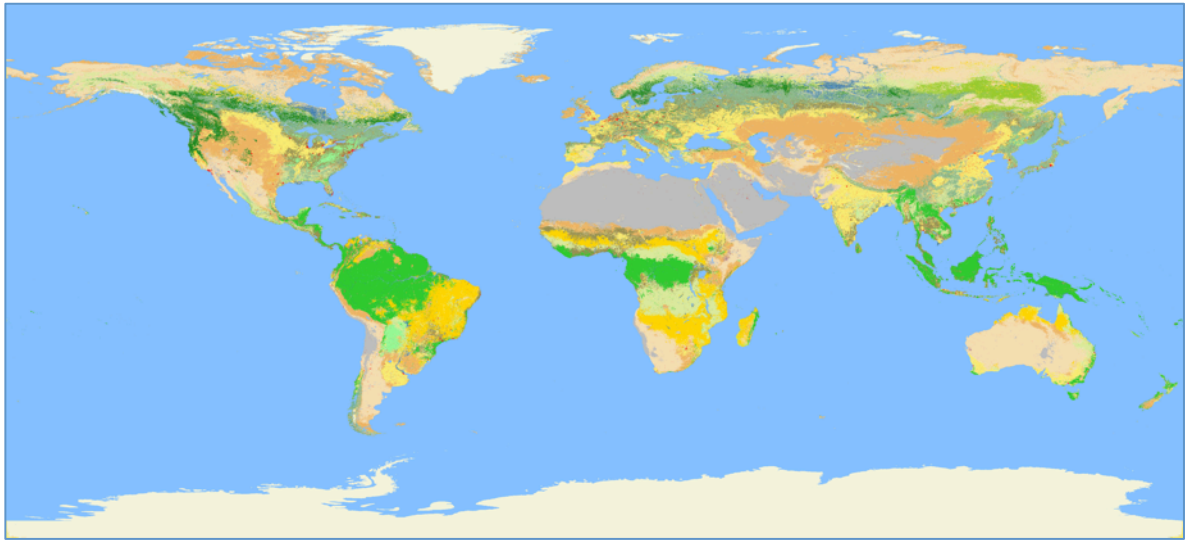


Legend

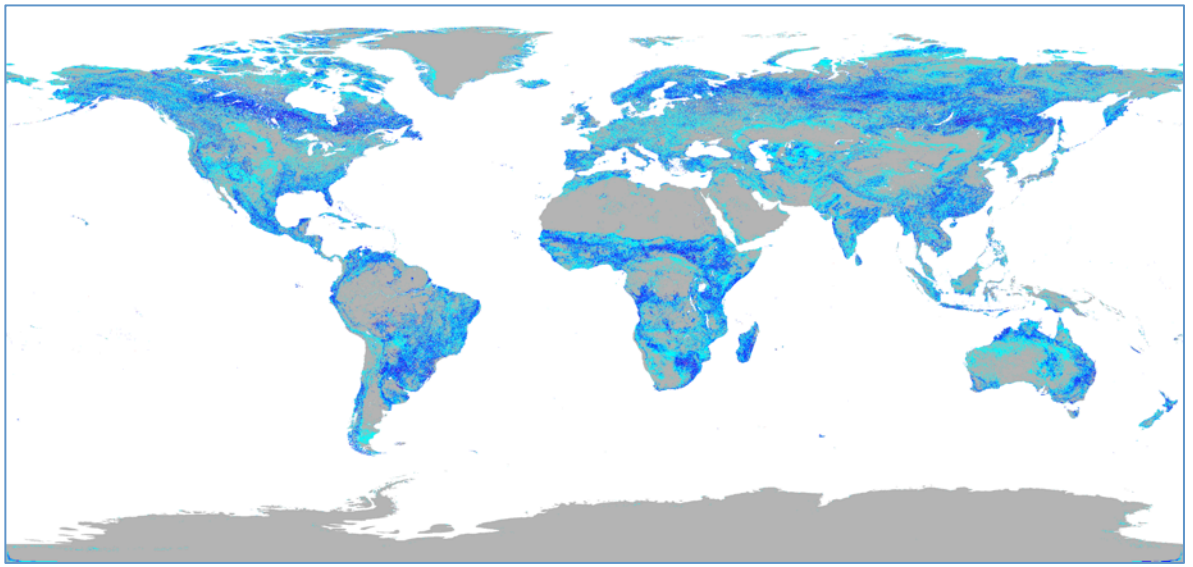
- Water
- Evergreen Needleleaf Forests
- Evergreen Broadleaf Forests
- Deciduous Broadleaf Forests
- Mixed Forests
- Closed Shrublands
- Open Shrublands
- Woody Savannas
- Savannas
- Grasslands
- Croplands
- Cropland / Natural Vegetation Mosaics
- Permanent Snow and Ice
- Barren

MCD12Q1 Refinements: Land Cover Change

Majority class from 11 years of MCD12Q1



Number of different class labels at each 500 m pixel



What is nature, magnitude of detectable change?

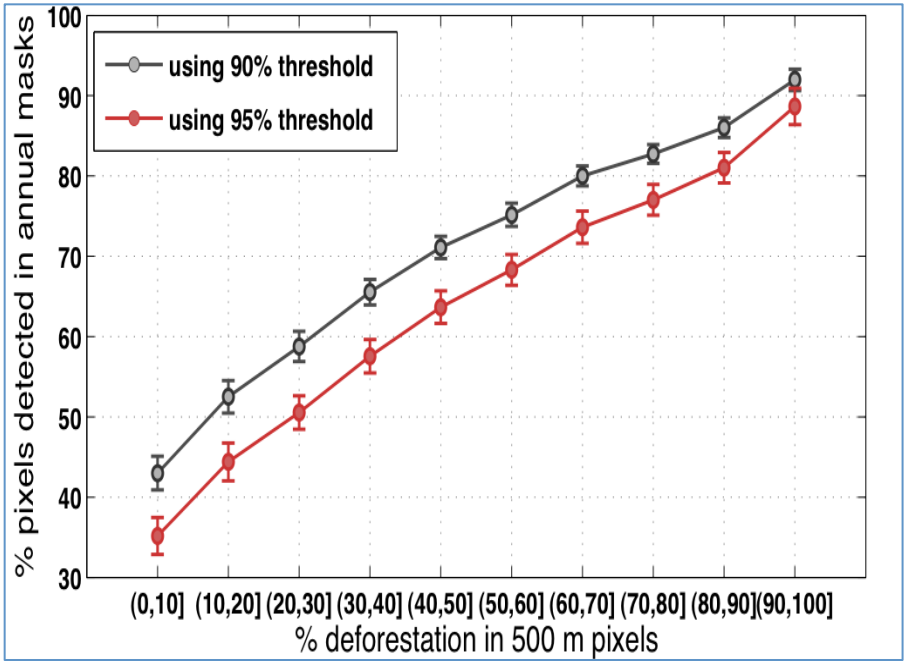
Signatures of LC Change in MODIS

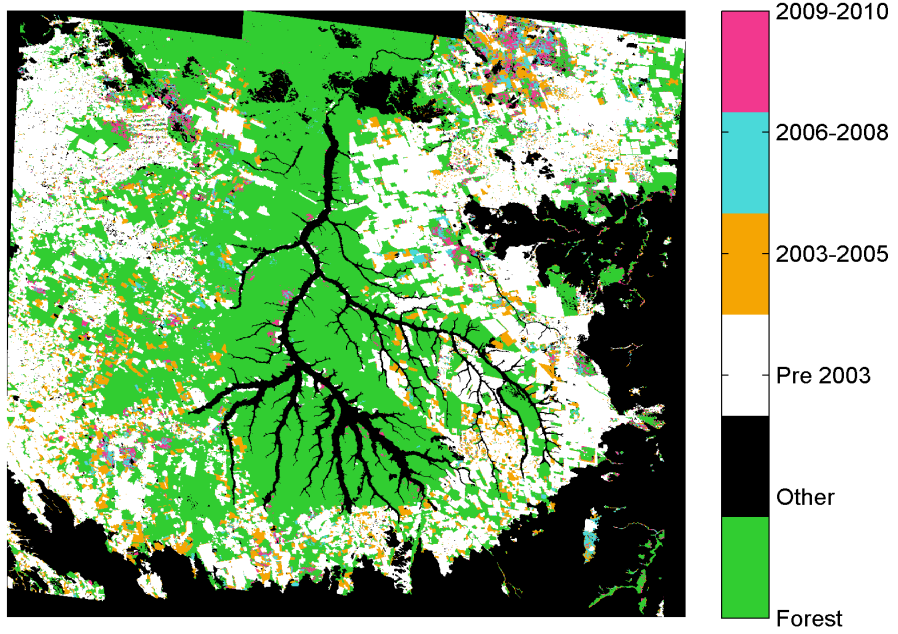
Land Cover Conversion:

- Pre-processing & feature extraction
- Statistical metrics of change that exploit both spatial and temporal information

$$D^2_{yr1,yr2} = (X_{yr1} - X_{yr2})'(X_{yr1} - X_{yr2})$$

$$D^2_{yr} = (X_{yr} - \overline{X})'\Sigma^{-1}(X_{yr} - \overline{X})$$



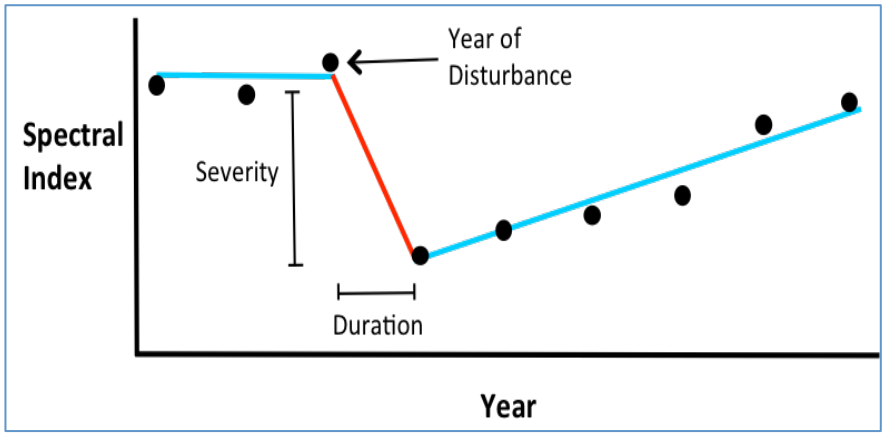


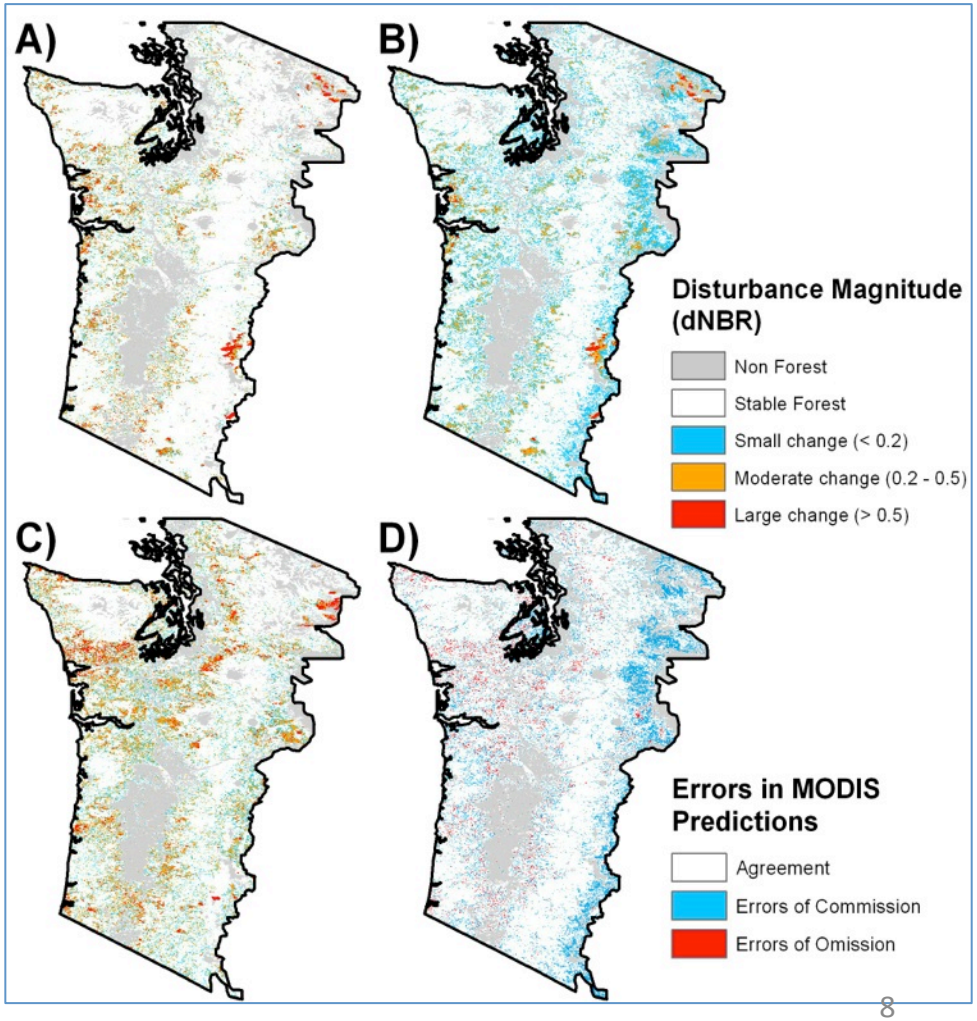
Huang et al., in prep

Signatures of LC Change in MODIS

Disturbance

- How does area of land cover change affect detection of change?
- How does land cover history (disturbance) affect detection of change?
- How does noise in data affect detection of change?



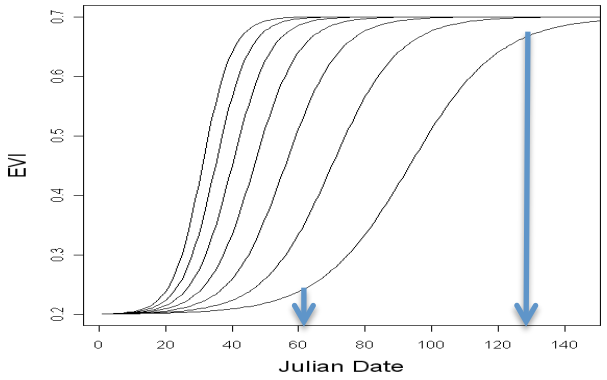


Sulla-Menashe et al, in revision RSE

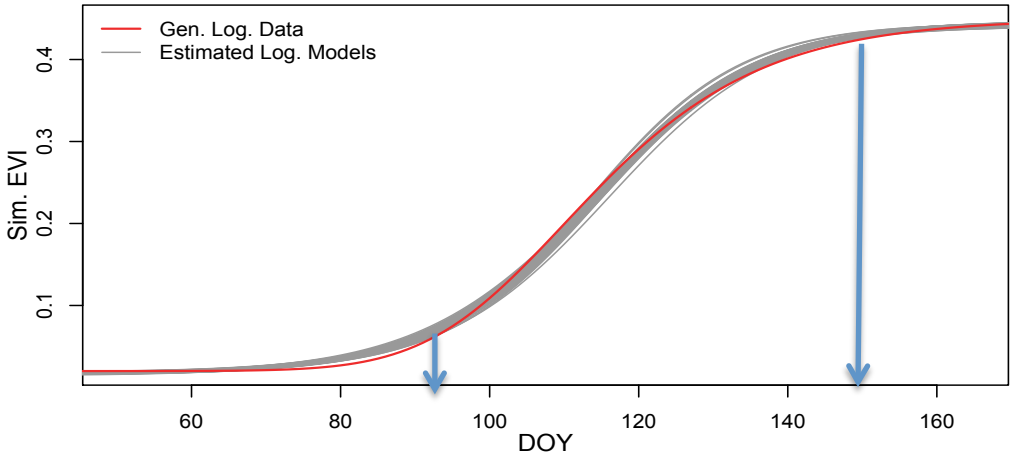
MCD12Q1 Summary

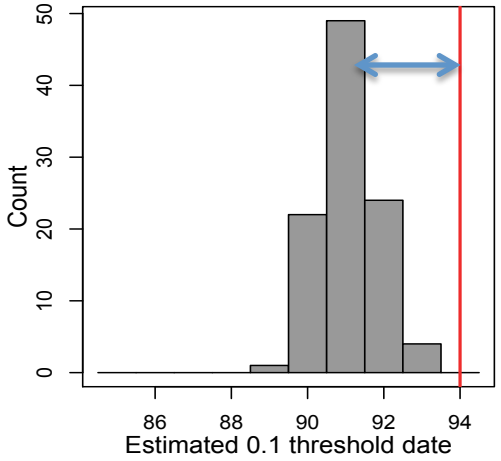
- Improved training site database
  - Provides improved basis for mapping
- New LCCS-based classification
  - Better framework for LC mapping
- Land cover time series
  - Explicit incorporation of change
  - Explicit definition of nature, magnitude of changes

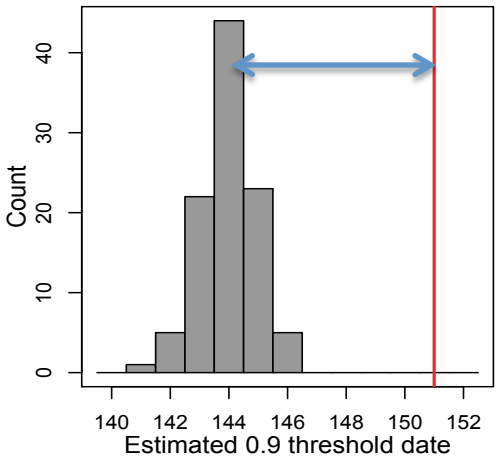
MCD12Q2 - Refinements



Bias reduction for asymmetric phenology using generalized logistic function.

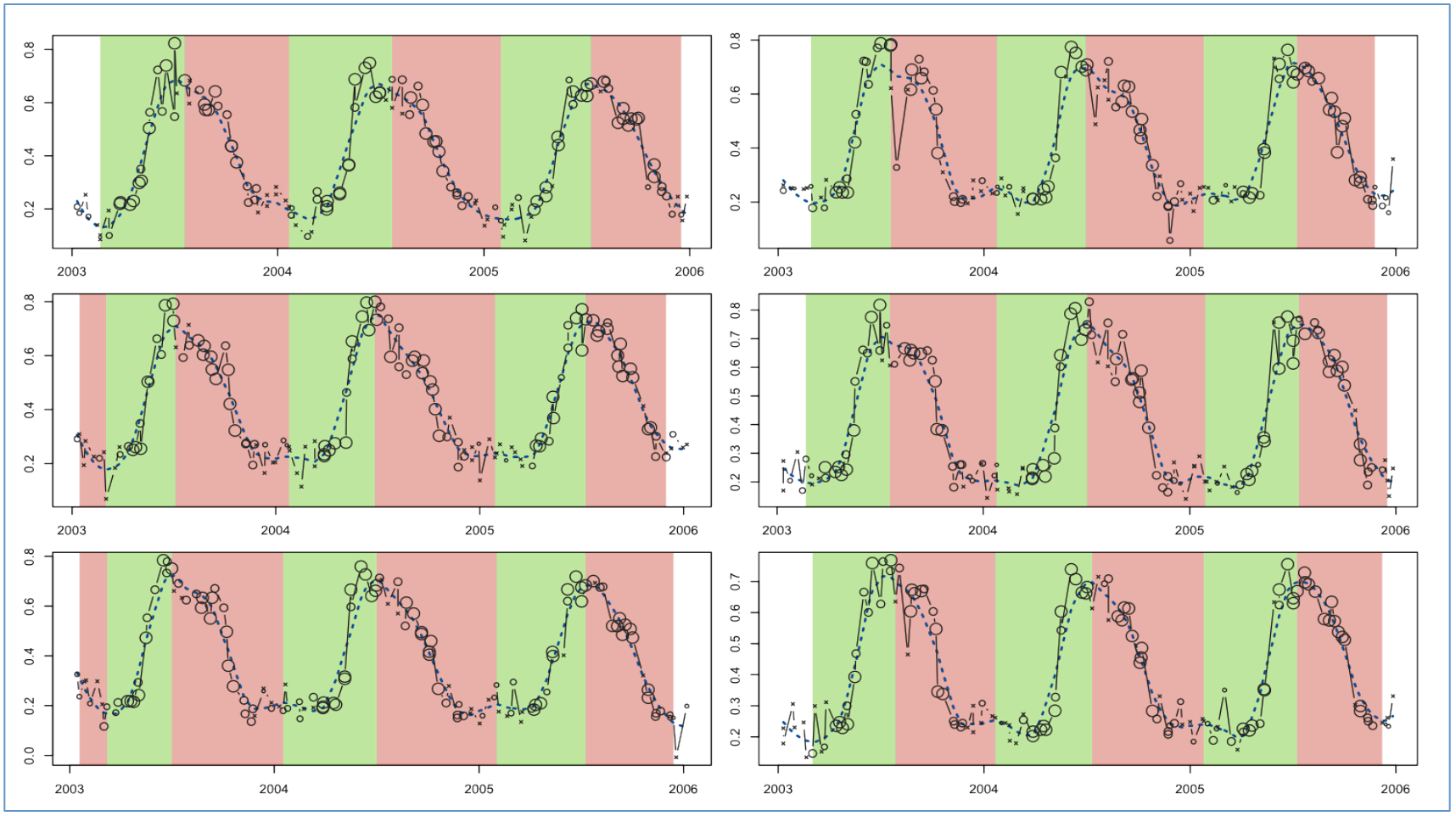






MCD12Q2 - Refinements

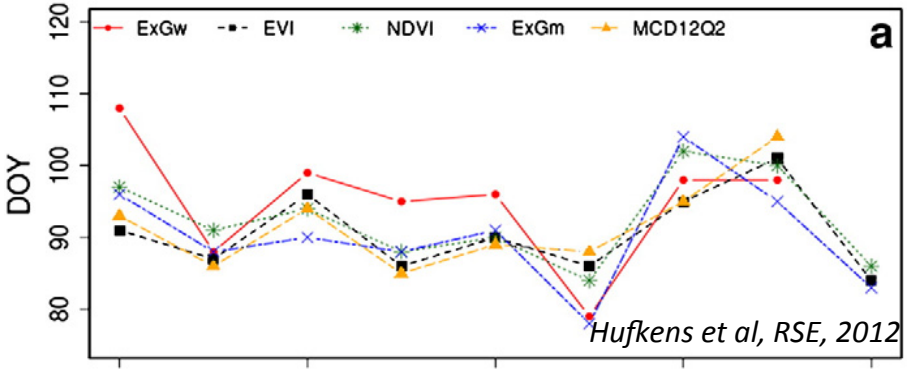
Smoothing & gap filling (snow, noise, missing data) via local regression



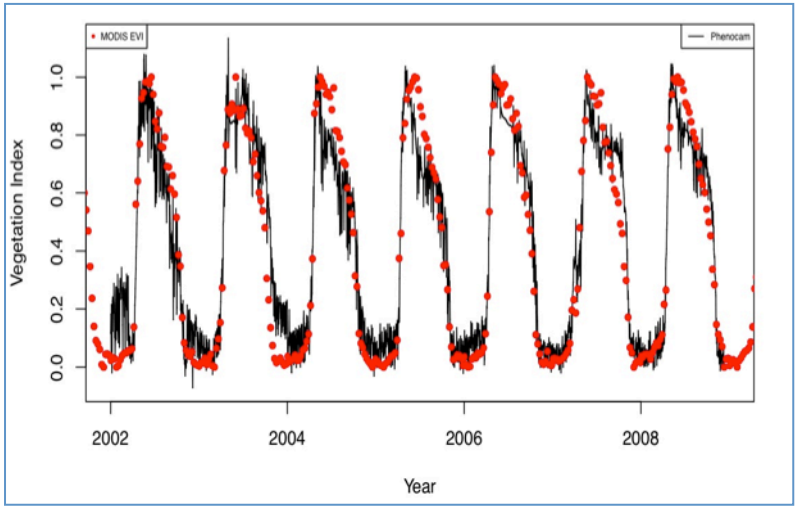
MCD12Q2 - Assessment

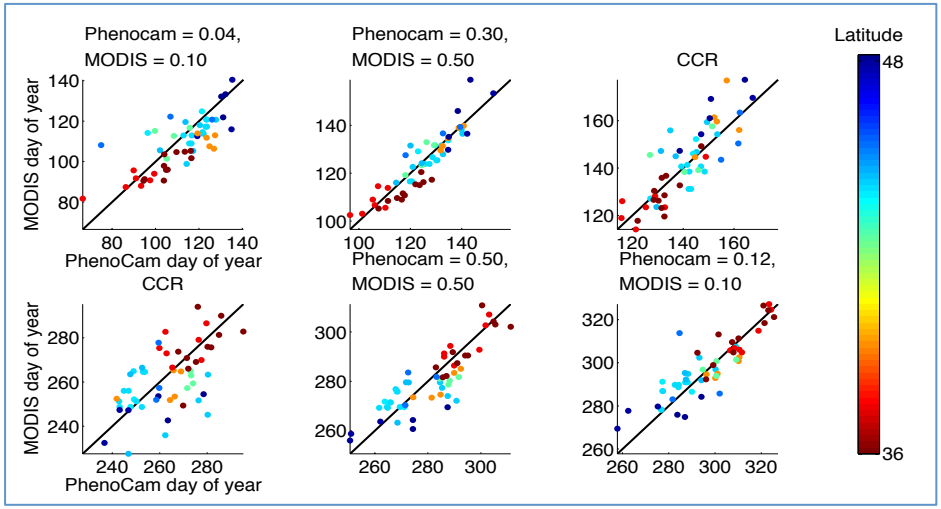
Comparison with Webcam data

- G_{cc} time series from "Phenocams"
- Using identical curvature change point methods to identify transitions
- Across sites and across years



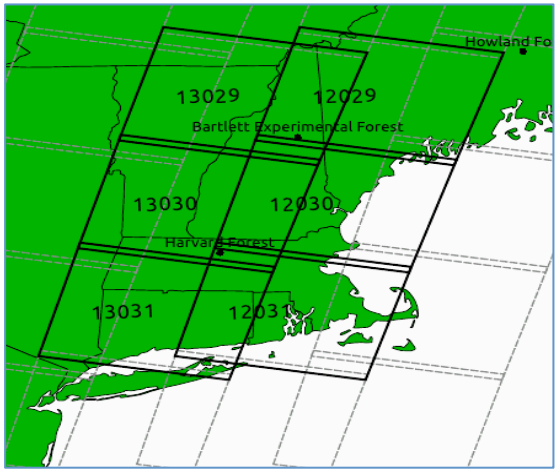
Hufkens et al, RSE, 2012

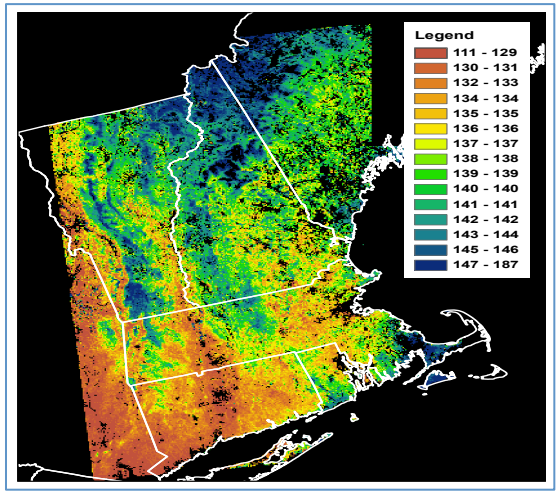


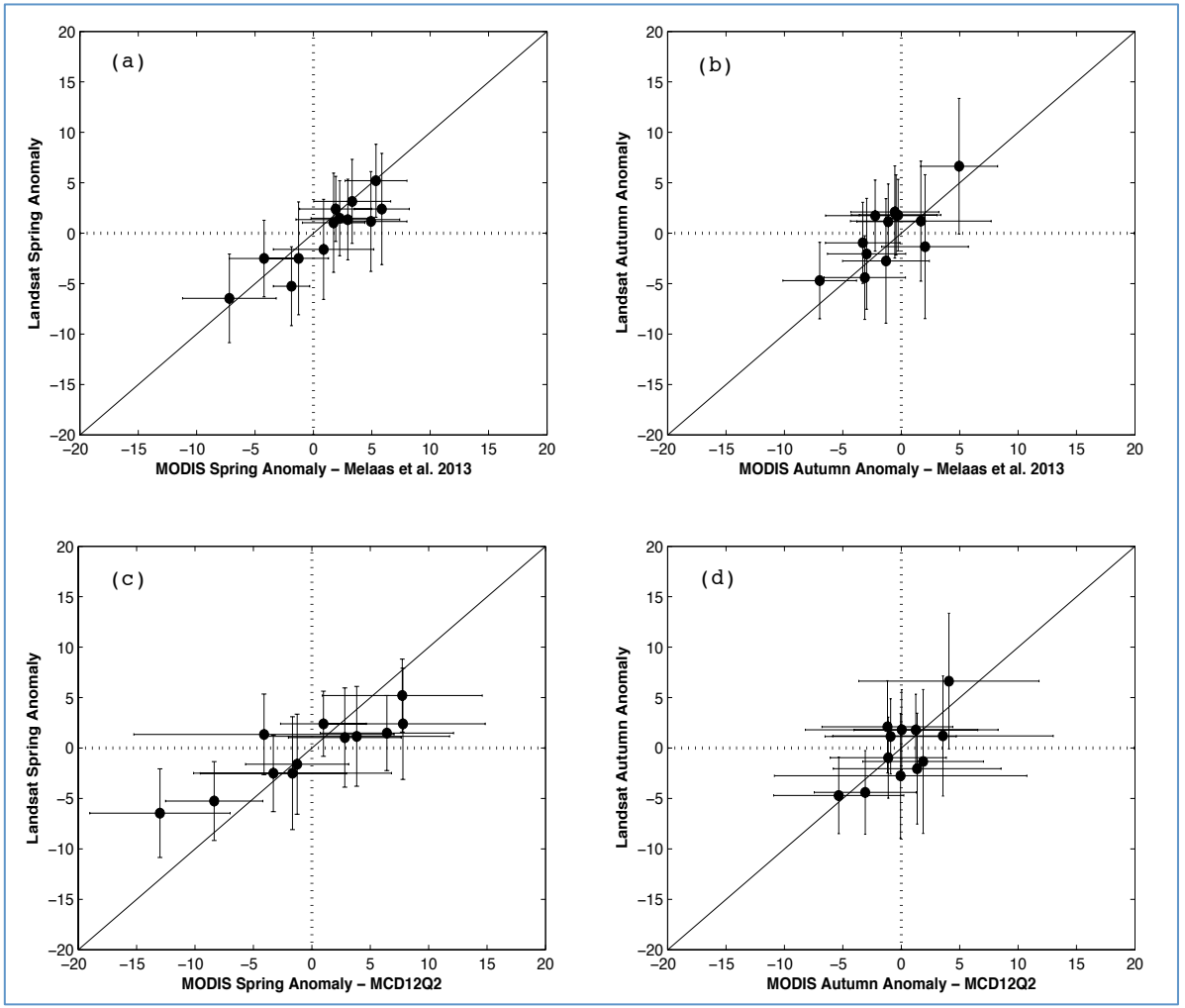


Klosterman et al, in prep

MCD12Q2 - Assessment

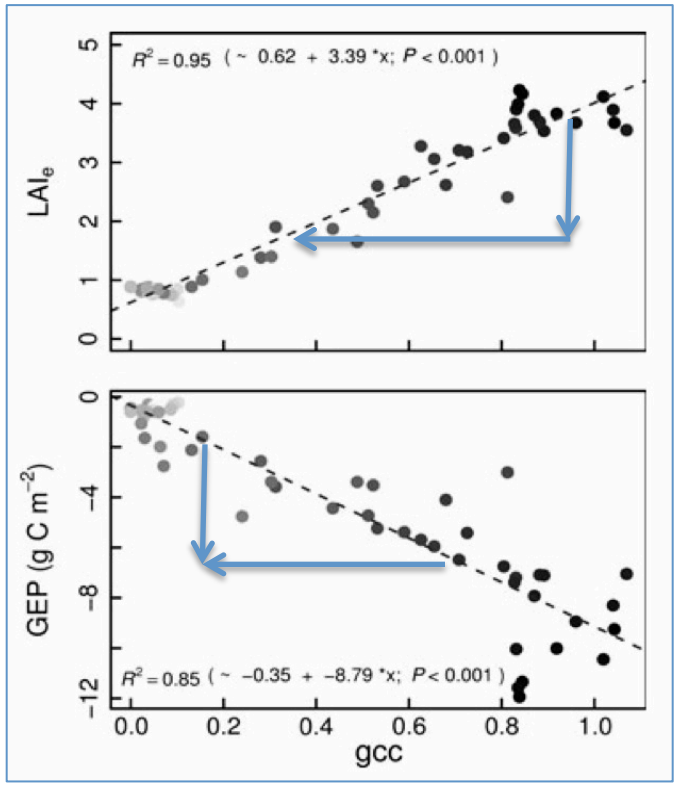


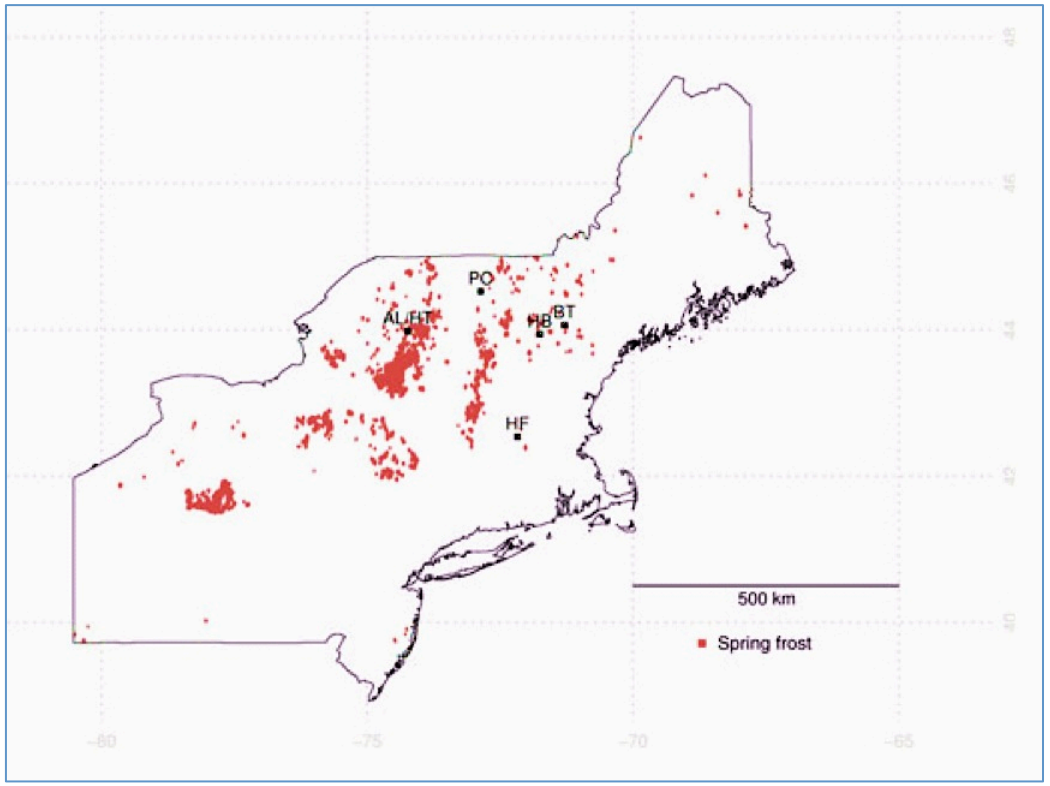




Start of Spring from MODIS vs Landsat

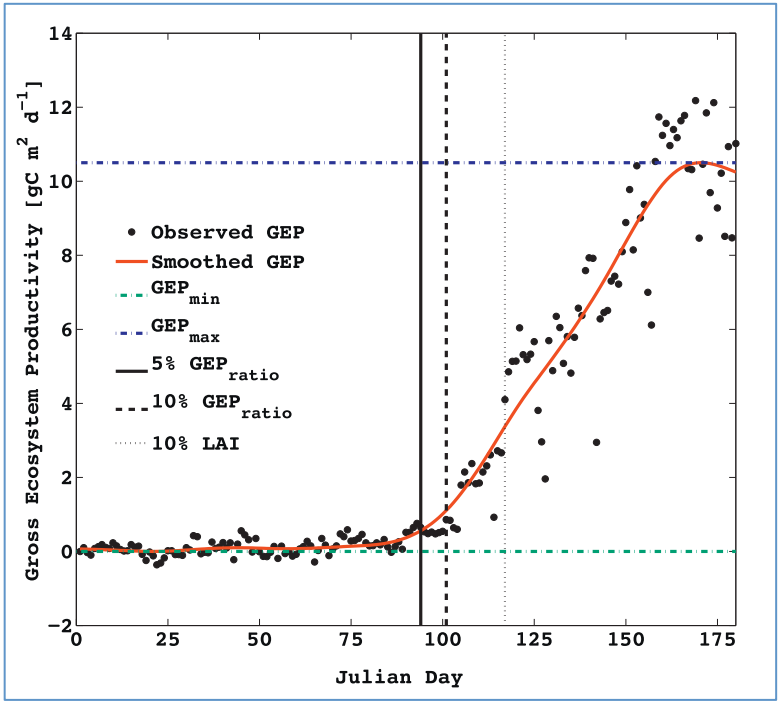
MCD12Q2 – New Science Results

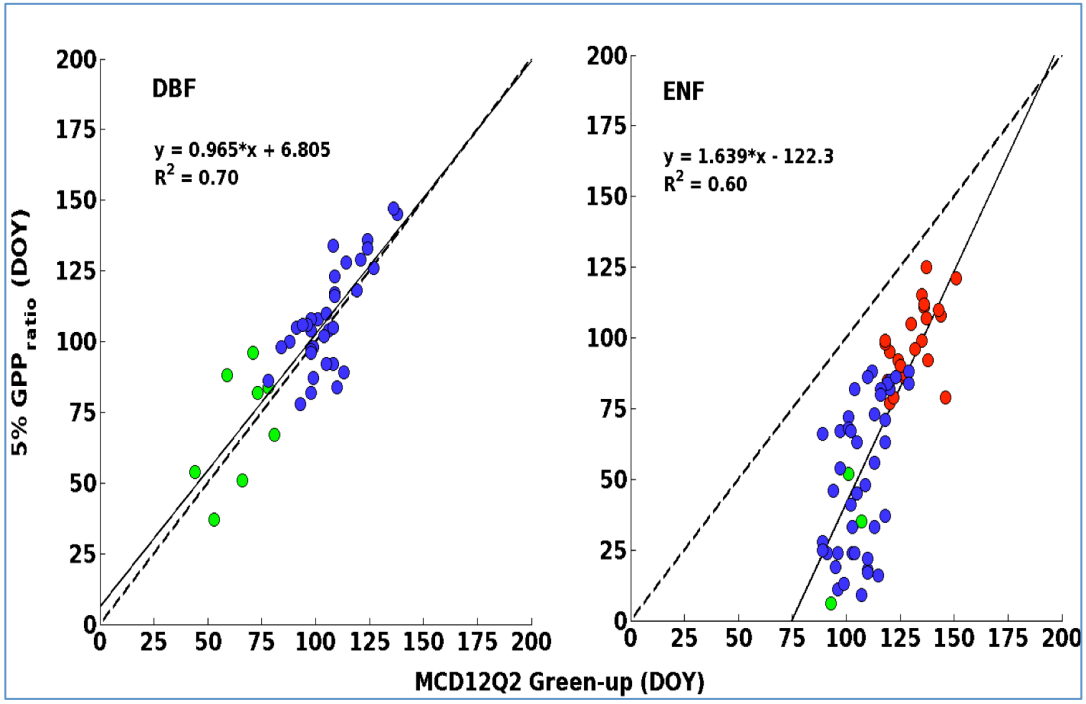




Carbon cost associated with early spring and late spring frosts based on MODIS and flux data (Hufkens et al., GCB, 2012)

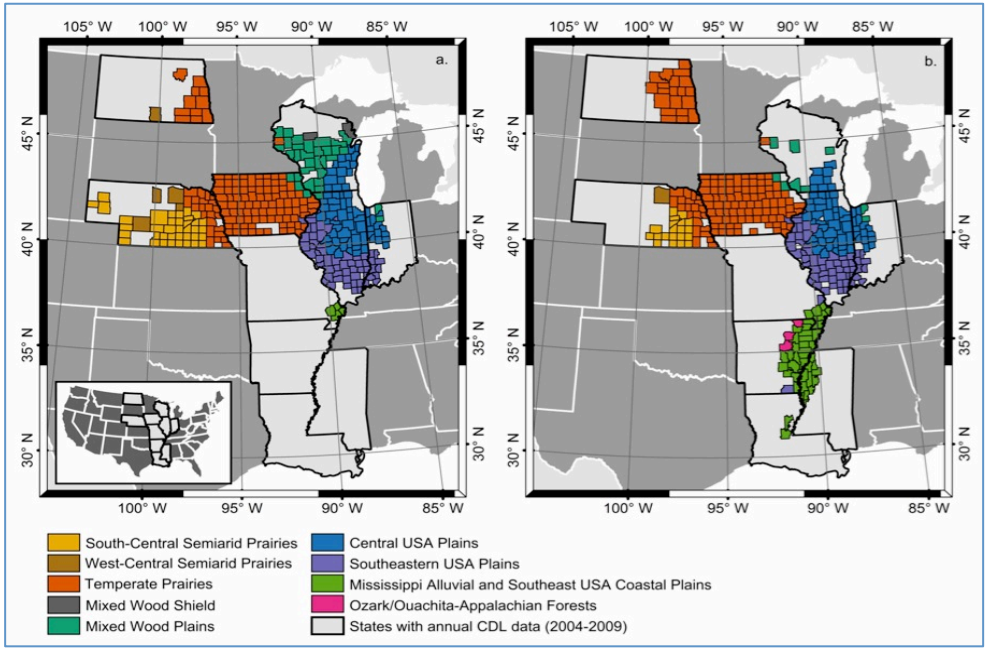
MCD12Q2 – New Science Results

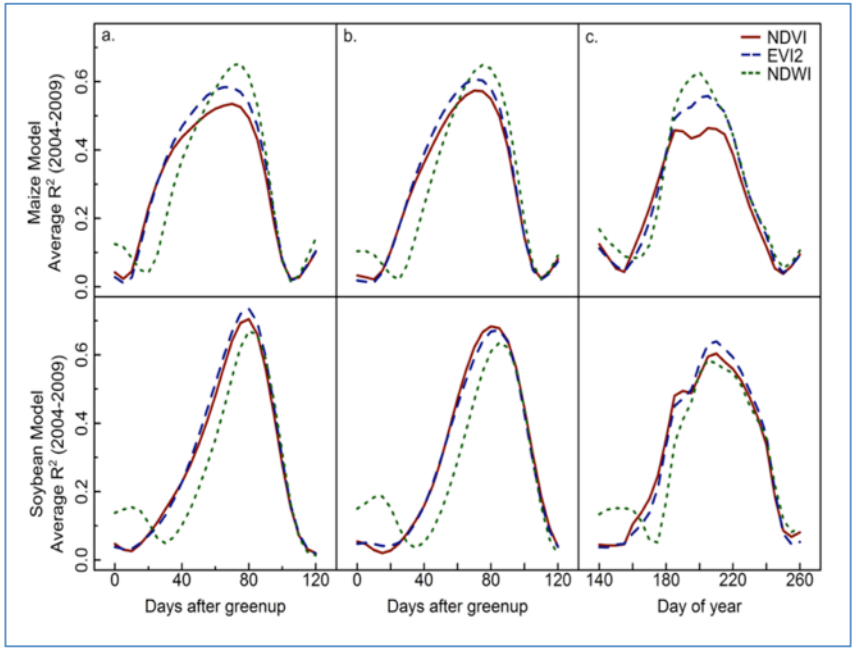


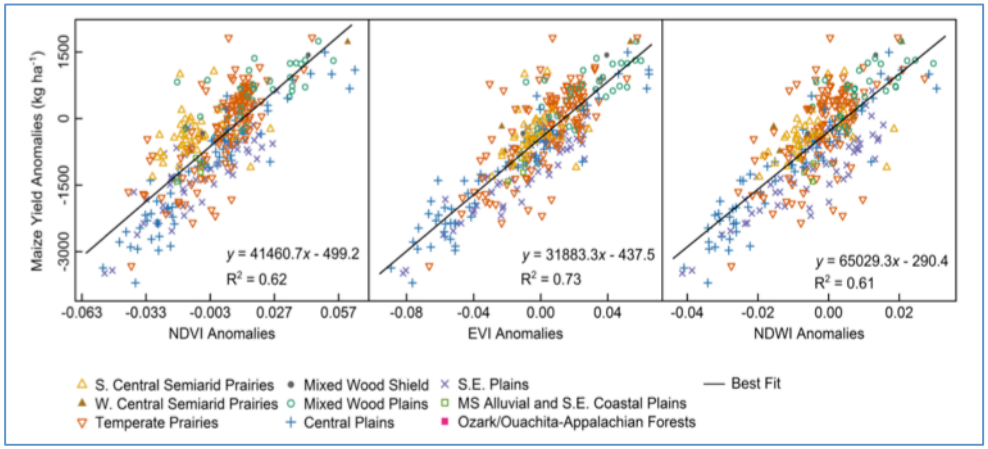


Comparison of Photosynthetic Start of Spring from Eddy Covariance vs MCD12Q2 (Melaas et al., AFM, 2013)

MCD12Q2 – New Science Results







Significant information in phenology related to crop yields. Upper left shows study region composed of major corn (left) and soybean (right) production counties in US. Upper right shows correlation between "phenologically-adjusted" vegetation indices and yield. Lower left plots yield 2005 anomalies versus predicted anomalies from MODIS.

Bolton and Friedl, AFM (2013)

MCD12Q2 - Summary

- Revised functional model for phenology
  - Reduces bias in product
- Improved treatment for noise, missing data
  - Reduces noise in product
- Extensive assessment and validation
  - Feeding back into algorithm revisions

Questions?