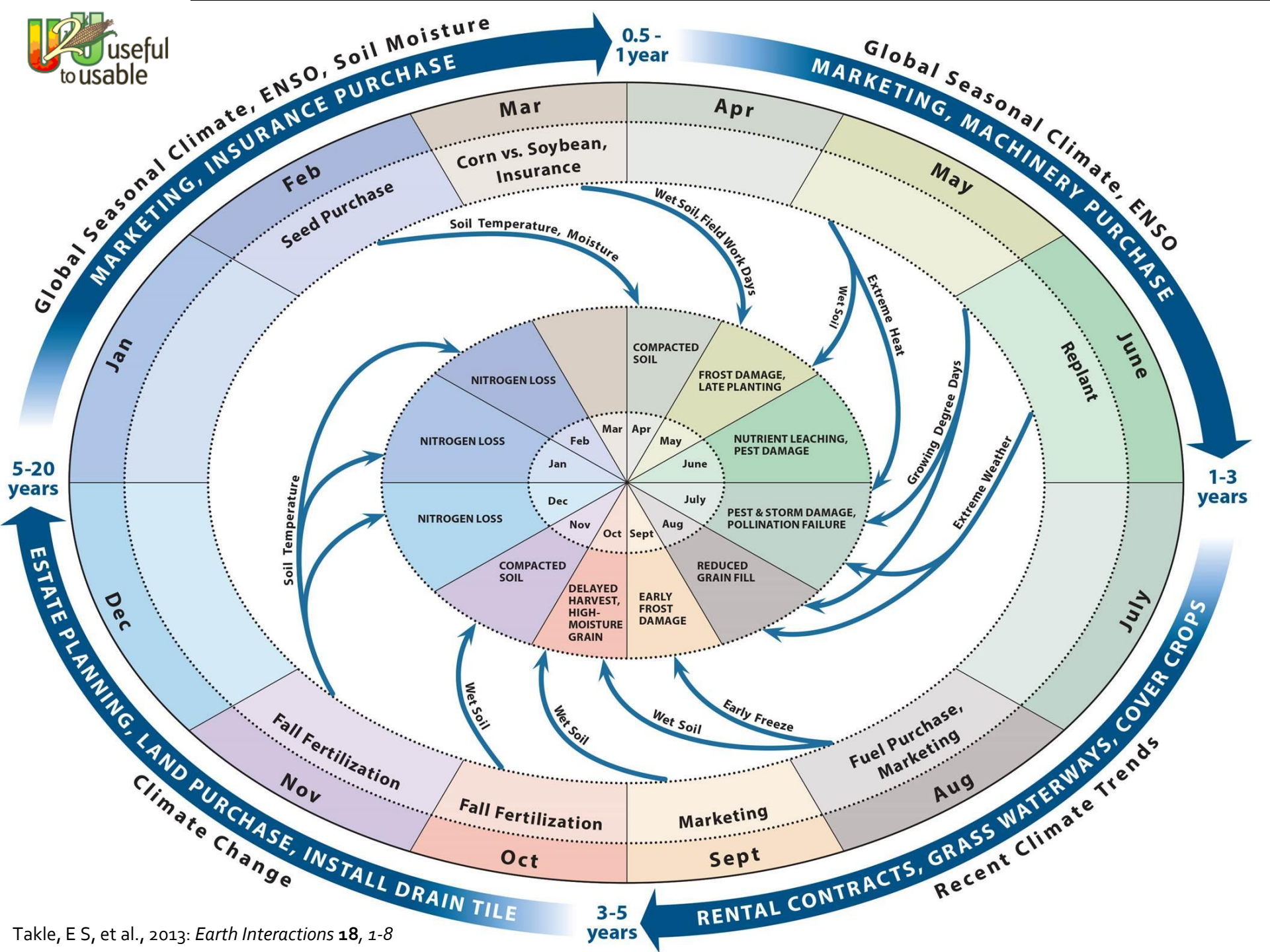
Pathway to Informed Decisions

Remote Sensing and Risk Management Tools

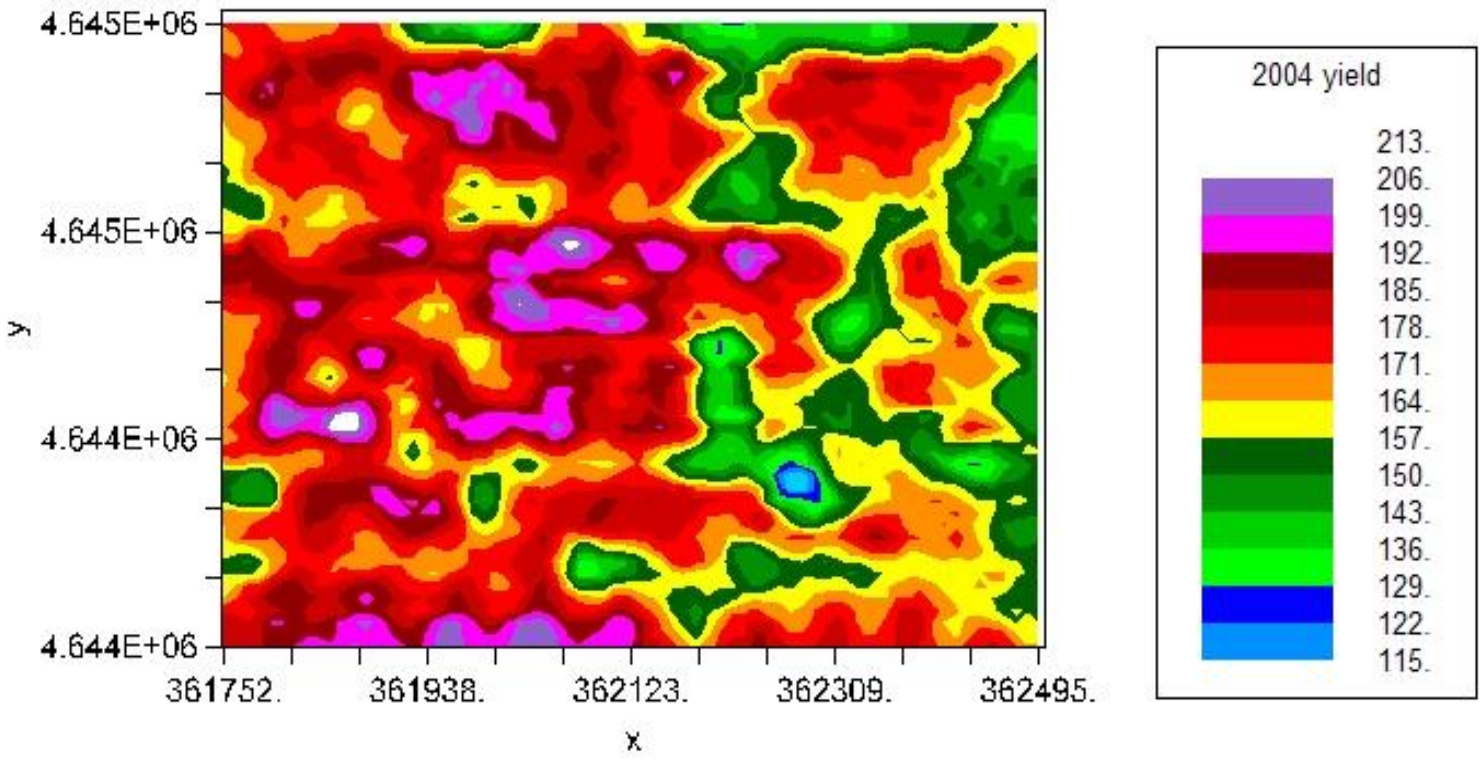
Contact Information

Jerry L. Hatfield
Laboratory Director
National Laboratory for Agriculture and the Environment
Director, Midwest Climate Hub
2110 University Blvd
Ames, Iowa 50011
515-294-5723
515-294-8125 (fax)
jerry.hatfield@ars.usda.gov

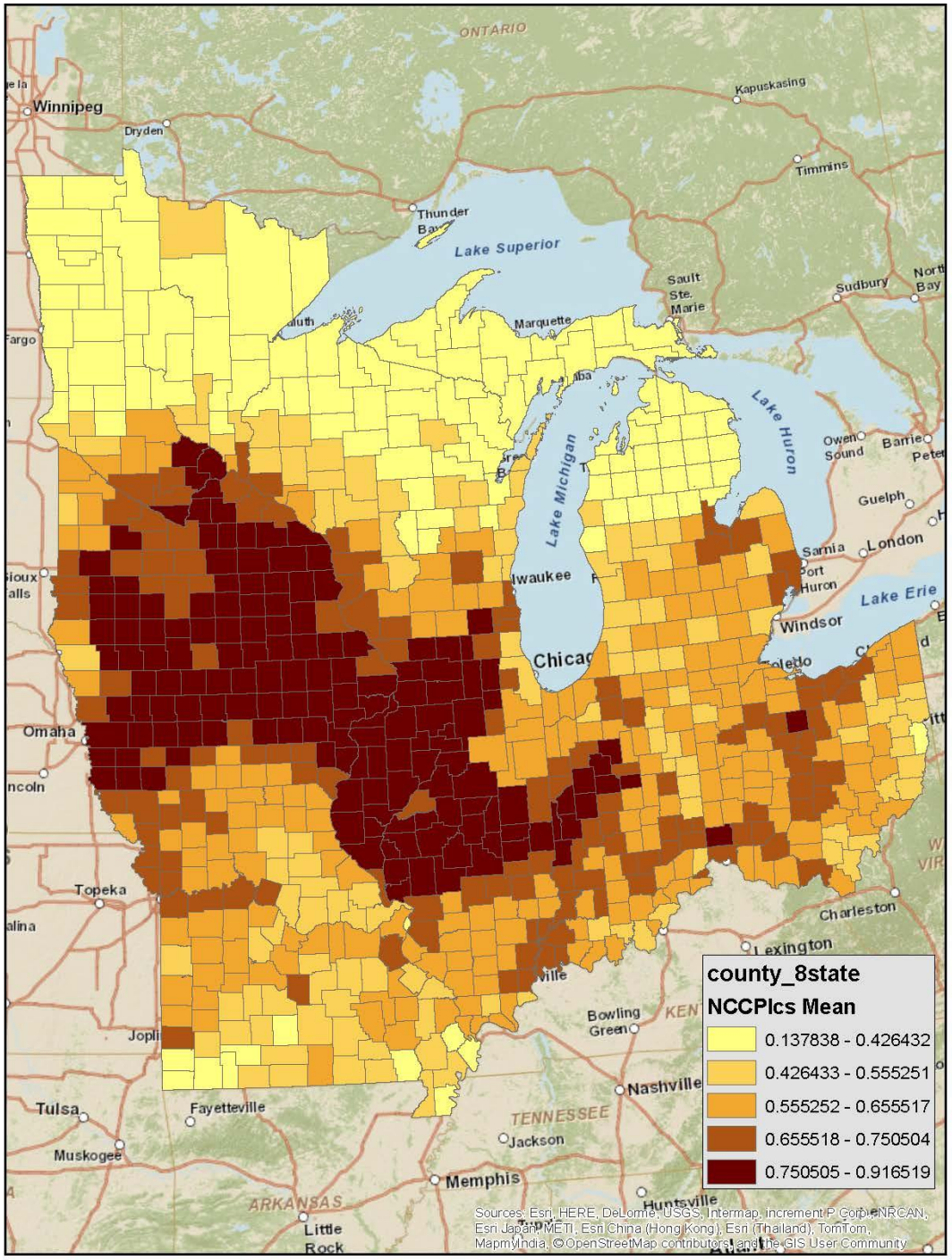


Takle, E S, et al., 2013: *Earth Interactions* **18**, *1-8*

Crop Yield Variation



NCCPI Across the Midwest



Climate Factors

- Inputs
  - Temperature
  - Precipitation
  - Solar radiation
  - Carbon dioxide

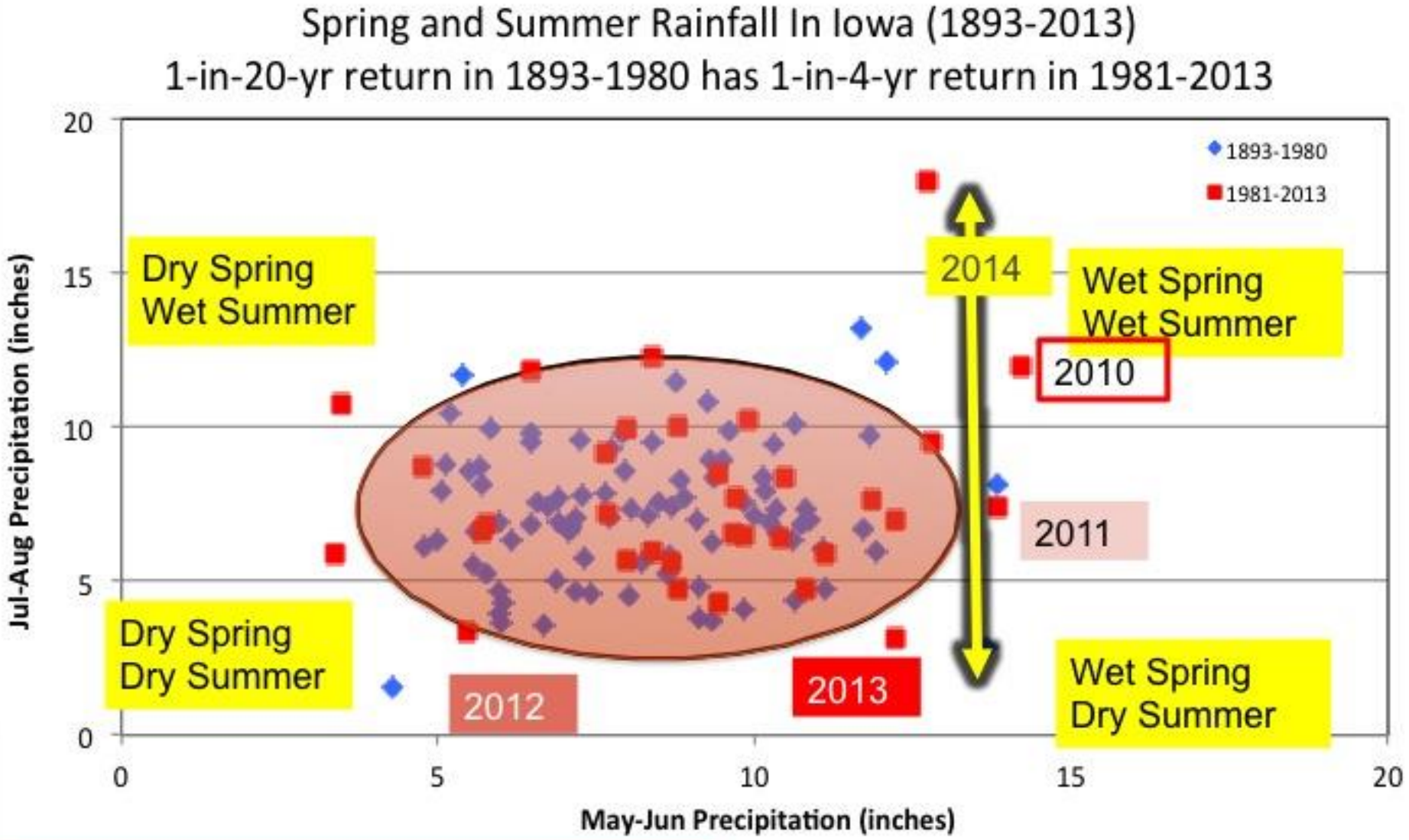
Direct
Growth
Phenology
Yield

Indirect
Insects
Diseases
Weeds

Soil is the underlying factor as a resource for nutrients and water

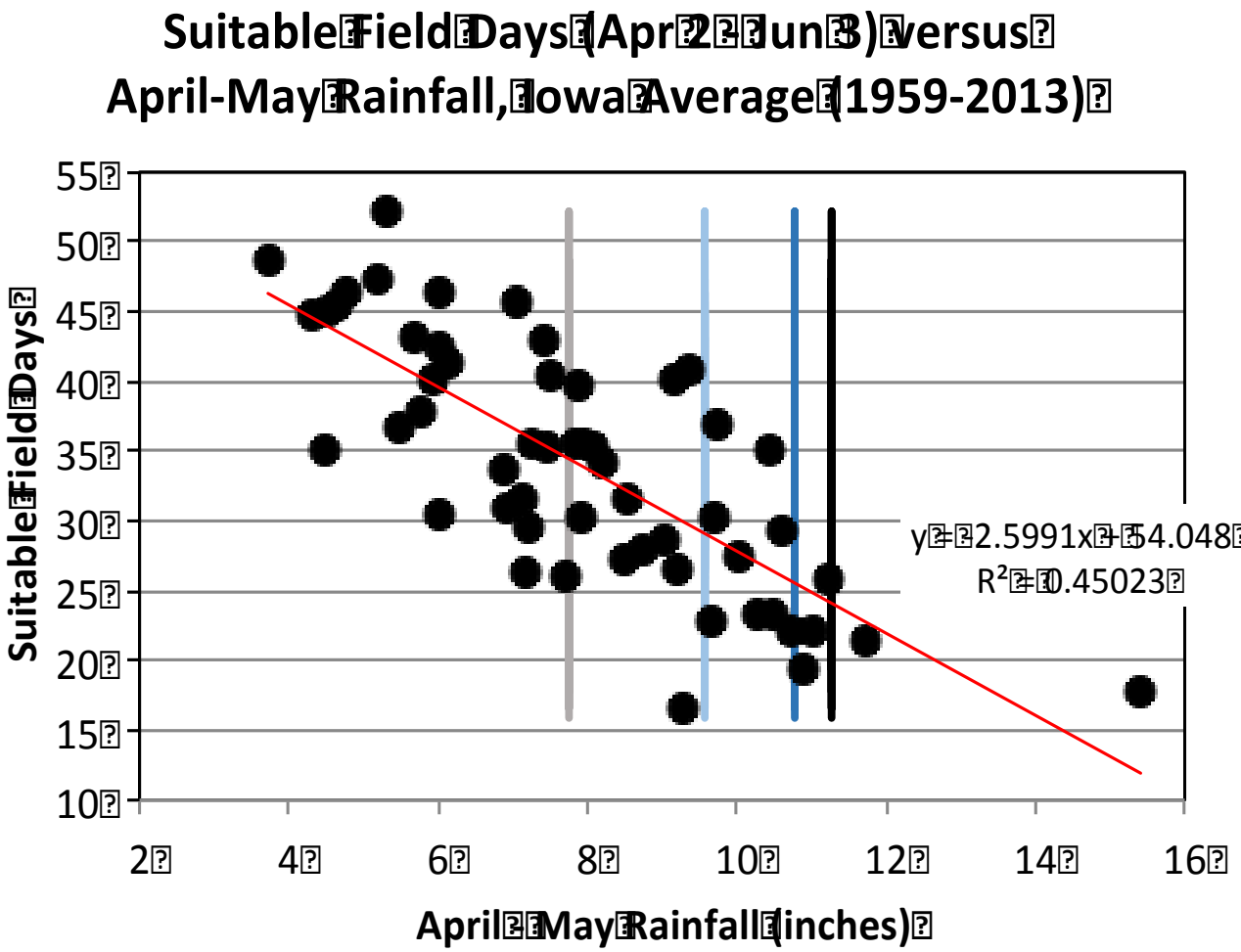
NLAE
National Laboratory for Agriculture and the Environment

Weather Trend: Unusual combinations of spring and summer rainfall are occurring more often

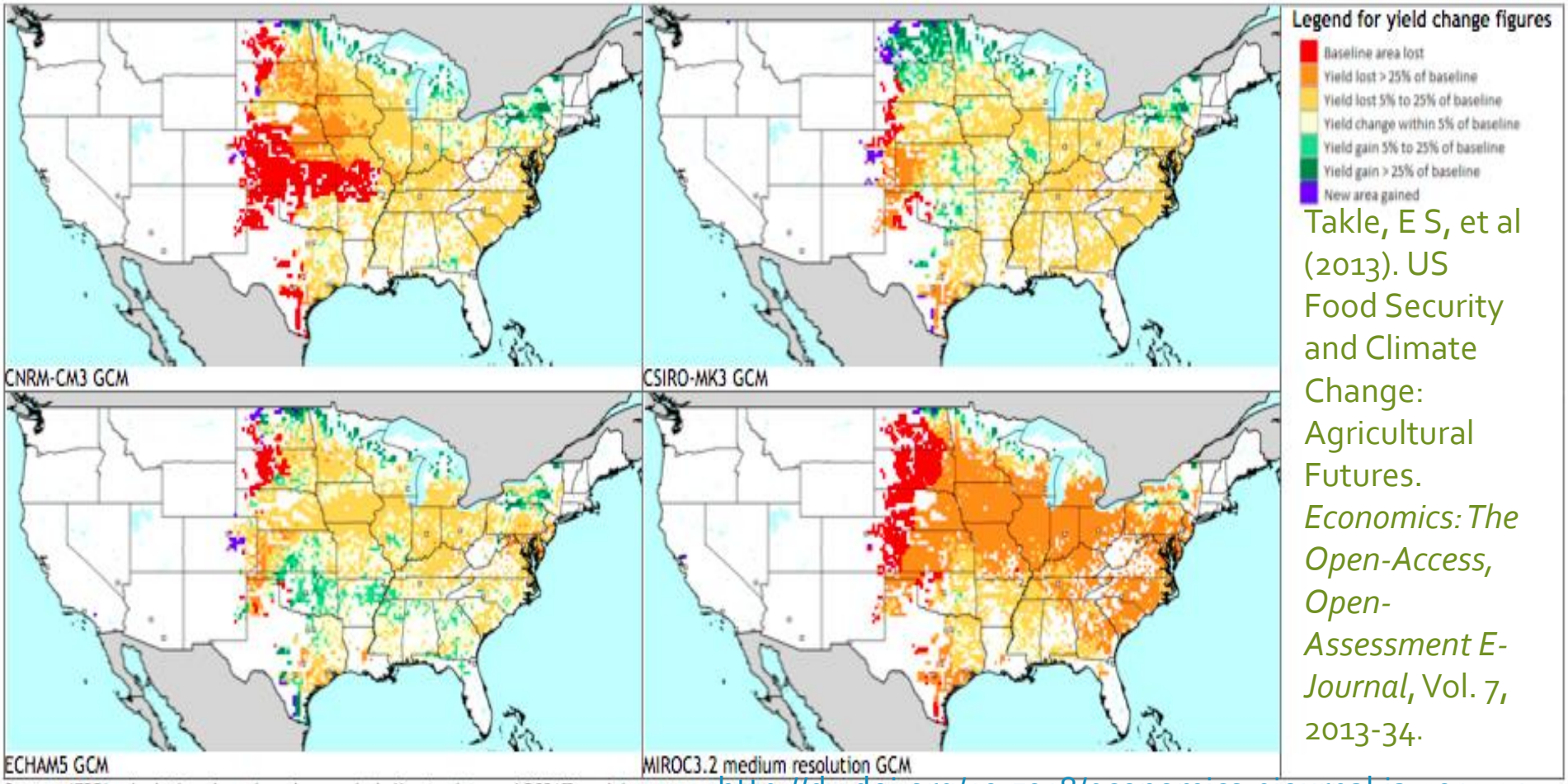


Data Source: State of Iowa Climatologist

Every 1" Increase of April-May Rainfall Reduces Suitable Field Days by 2.6 days



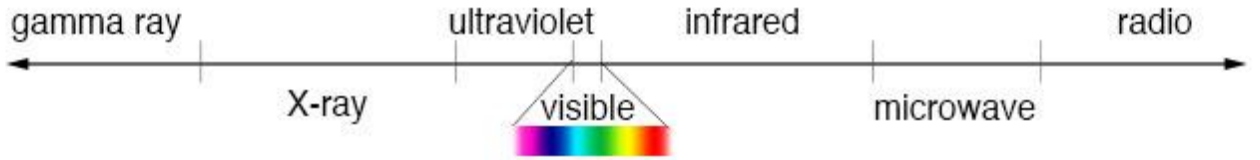
Maize yields are projected to decline across the corn belt and growing regions lost in the Great Plains

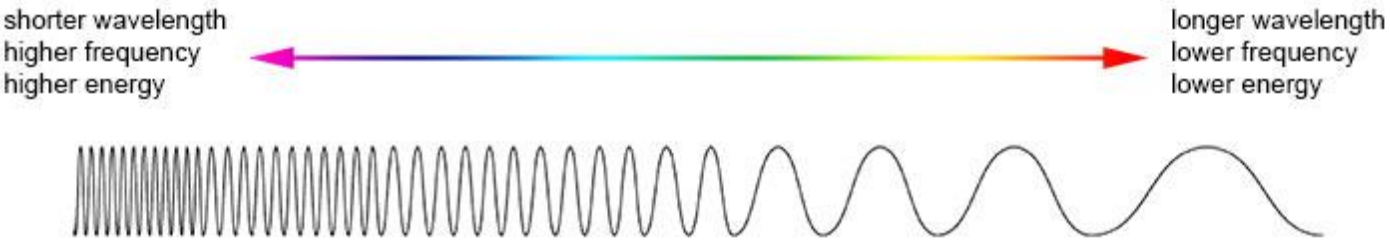


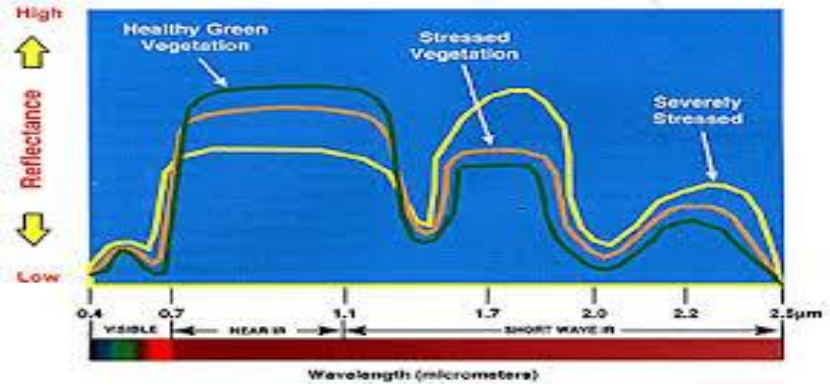
Takle, E S, et al (2013). US Food Security and Climate Change: Agricultural Futures. *Economics: The Open-Access, Open-Assessment E-Journal*, Vol. 7, 2013-34.

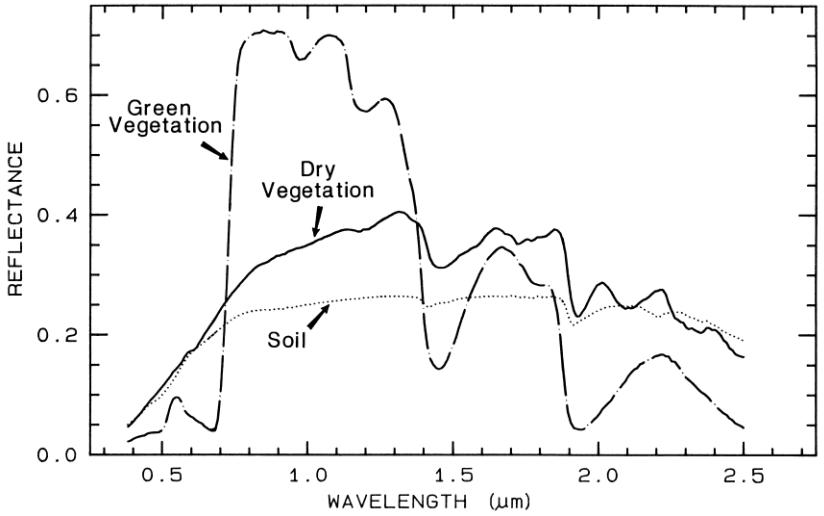
http://dx.doi.org/10.5018/economics-ejournal.ja.2013-34

Electromagnetic Spectrum









Vegetative Indices

NDVI = (NIR-red)/(NIR+red)

SAVI = (NIR-red)/(NIR+red+.05)*1.5

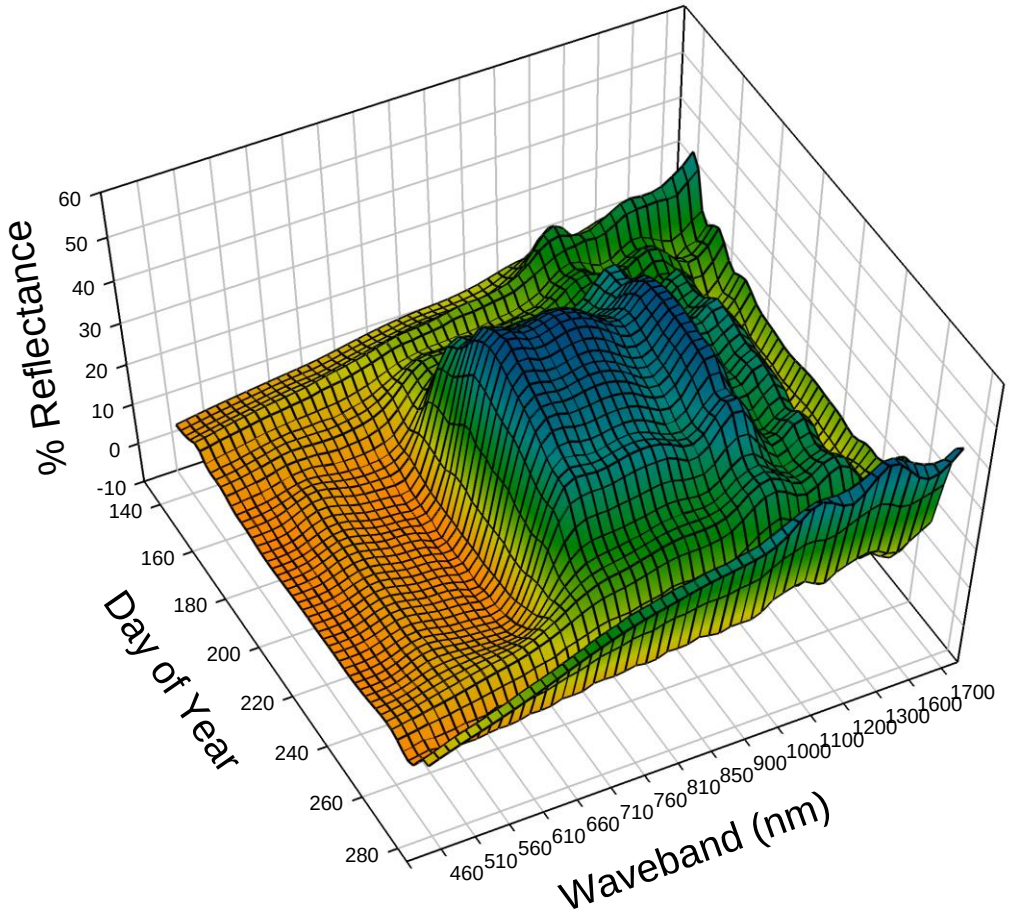
PSRI = (red-green)/NIR

Ratio = red/NIR

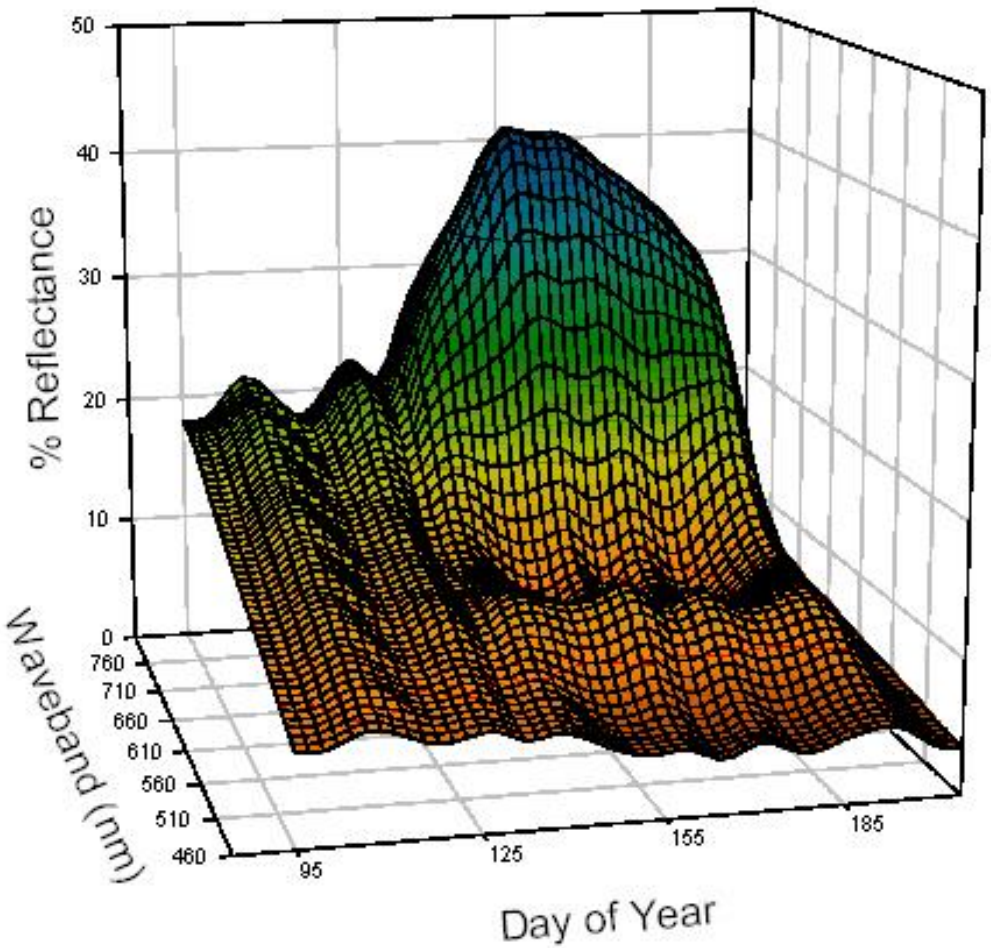
Often use 30+ different vegetative indices to estimate canopy parameters

Seasonal Reflectance Data

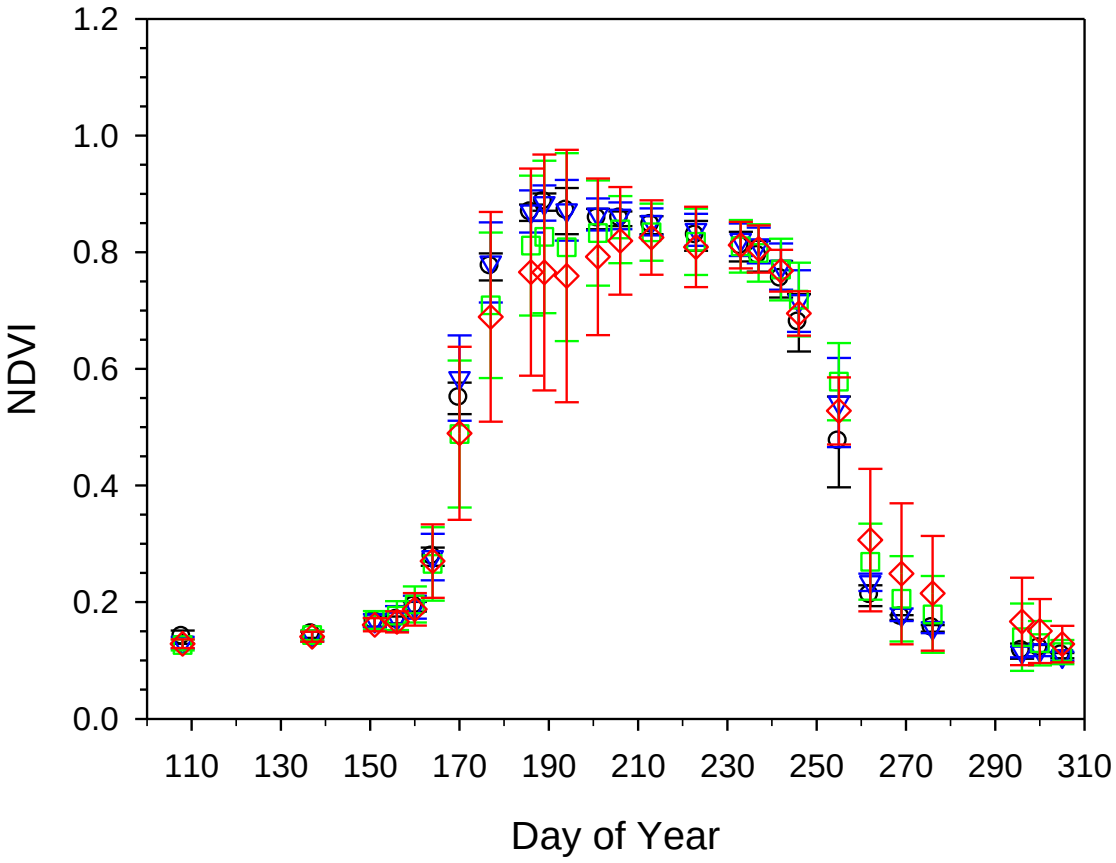
Corn 2010



Canola

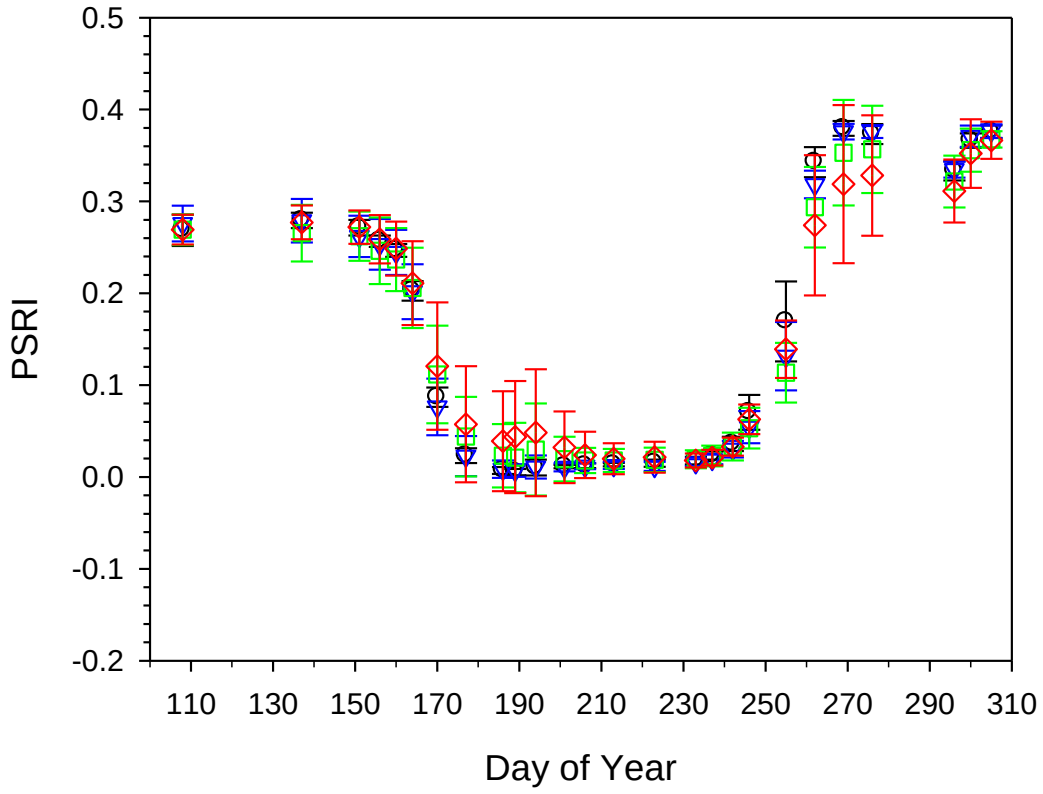

50
40
30
20
10
0
% Reflectance
760
710
660
610
560
510
460
Wavebands (nm)
95
125
155
185
Day of Year

Seasonal Patterns of NDVI - Corn



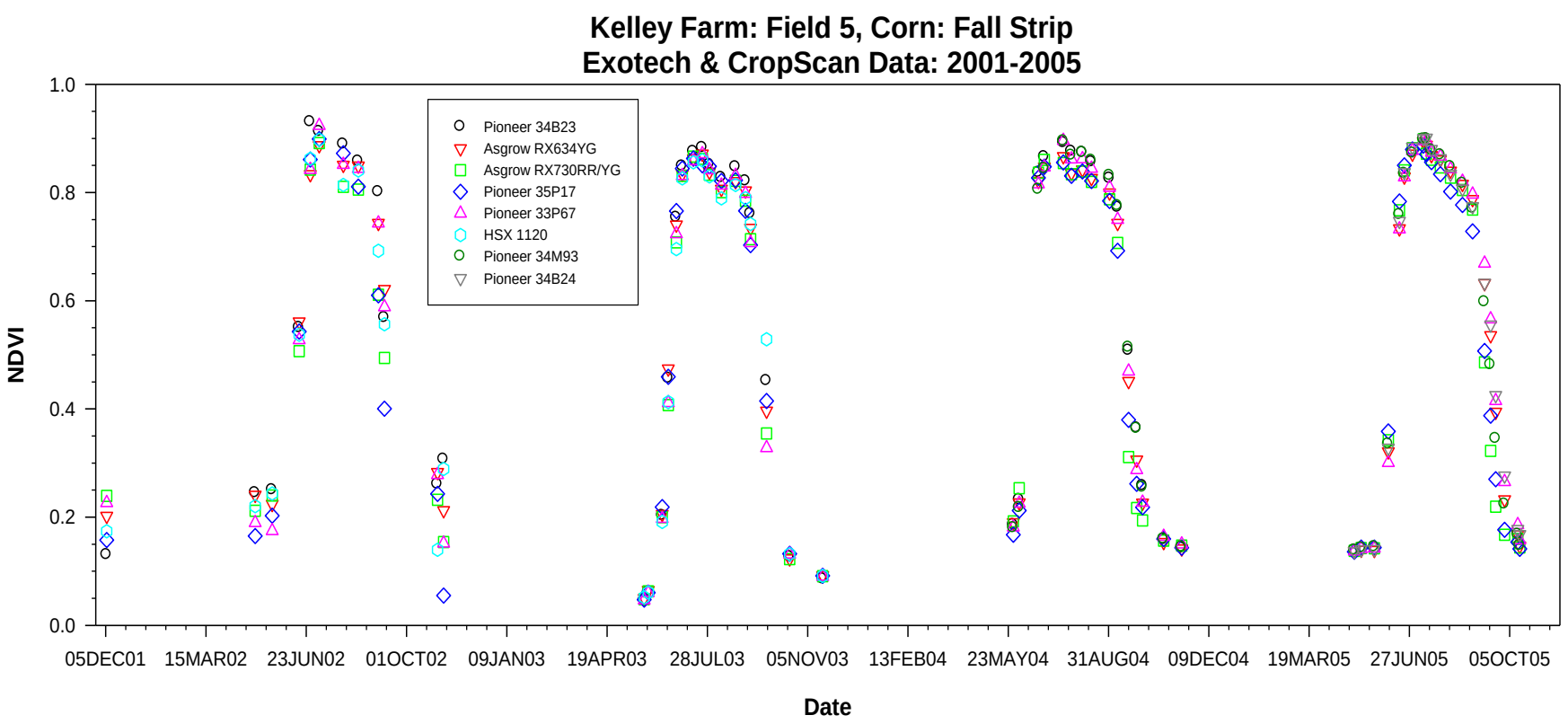
Fall strip with 135 kg ha^{-1} (○),
Fall strip with 135 kg ha^{-1} with N-serve (Δ),
Spring strip with 135 kg ha^{-1} (□),
Spring strip with 191 kg ha^{-1} (◊).

Seasonal Patterns of PSRI - Corn

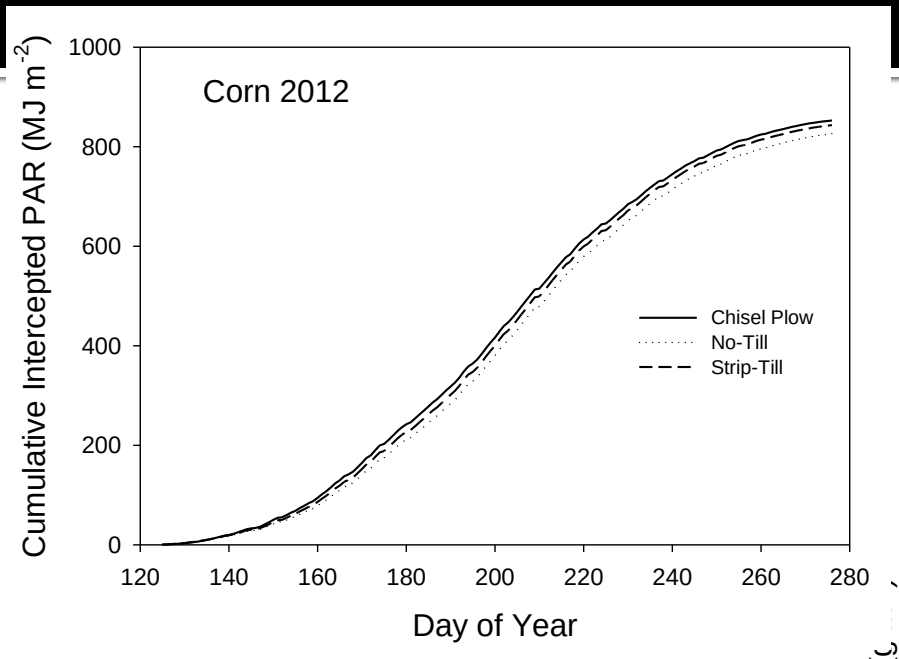


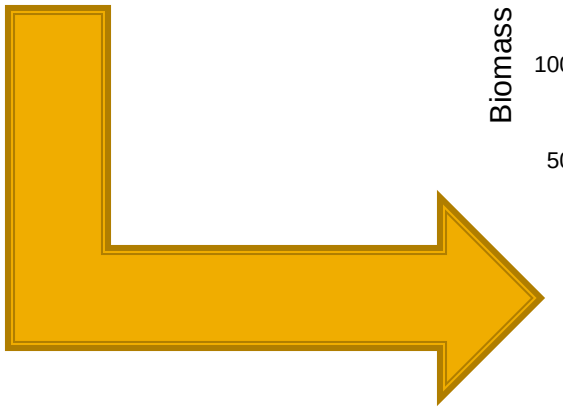
Fall strip with 135 kg ha^{-1} (○),
Fall strip with 135 kg ha^{-1} with N-serve (Δ),
Spring strip with 135 kg ha^{-1} (□),
Spring strip with 191 kg ha^{-1} (◊).

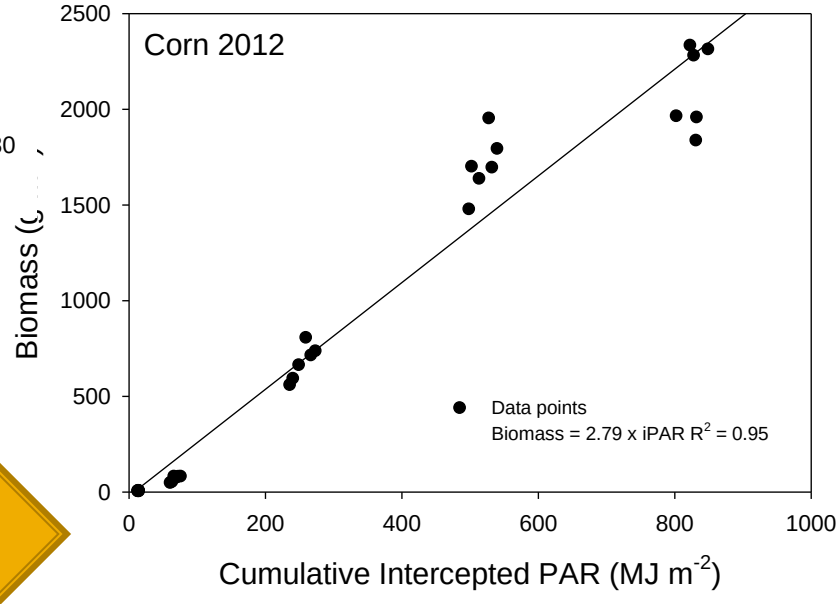
Patterns Across Years – Corn



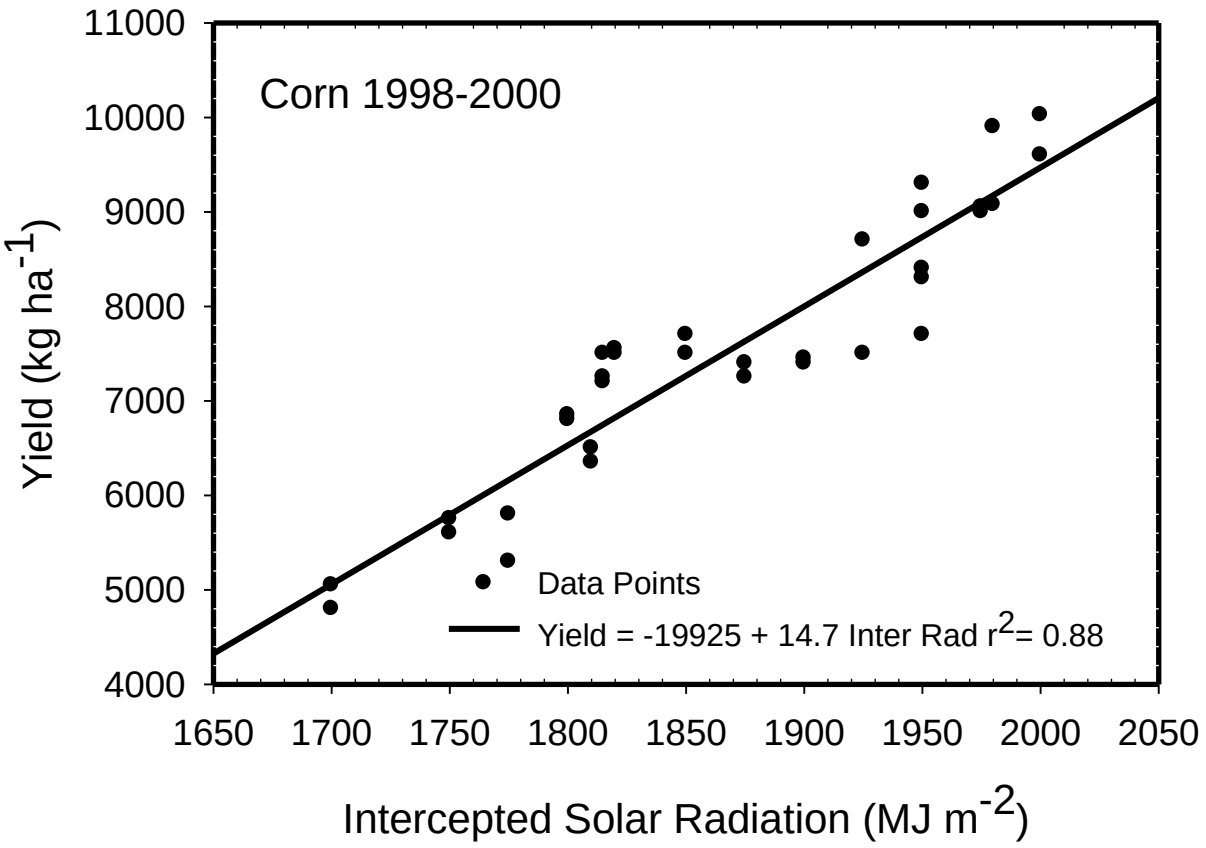
Applications of NDVI



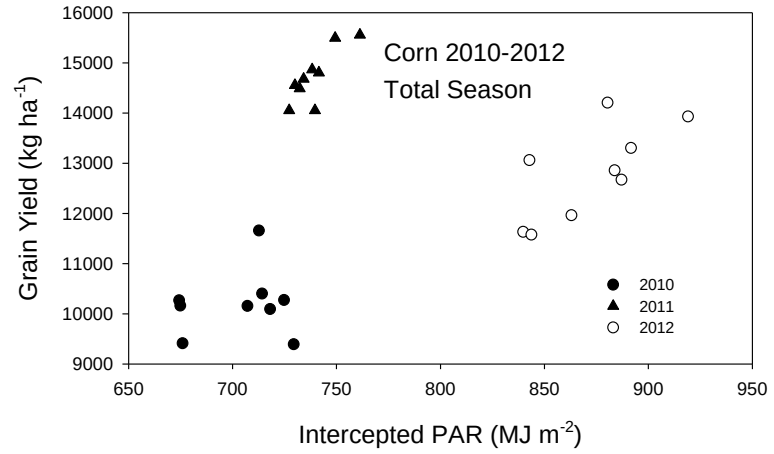


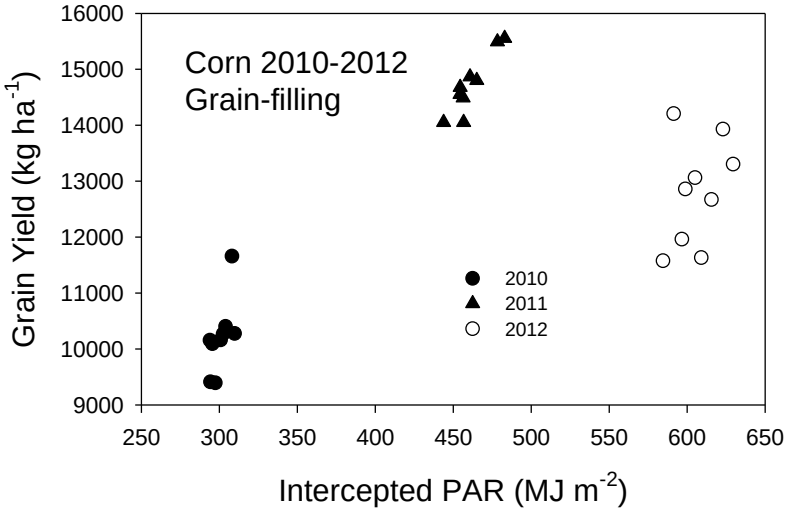


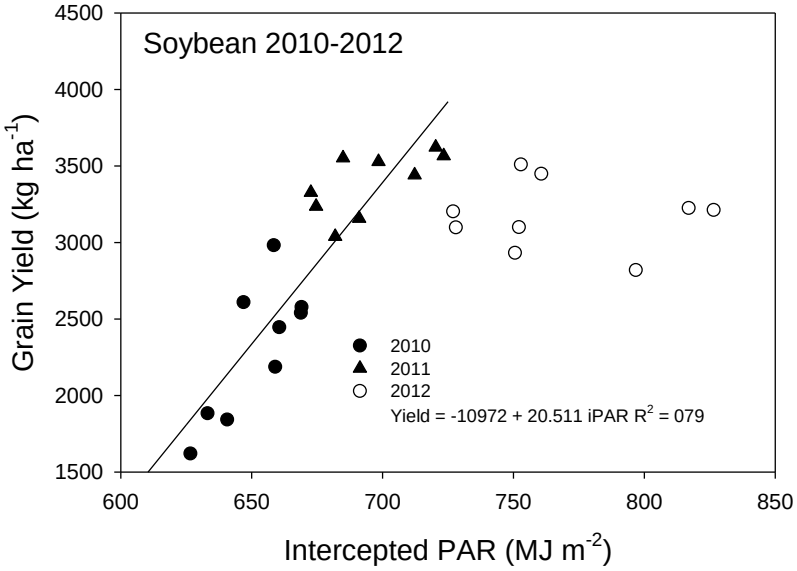
Light Use efficiency



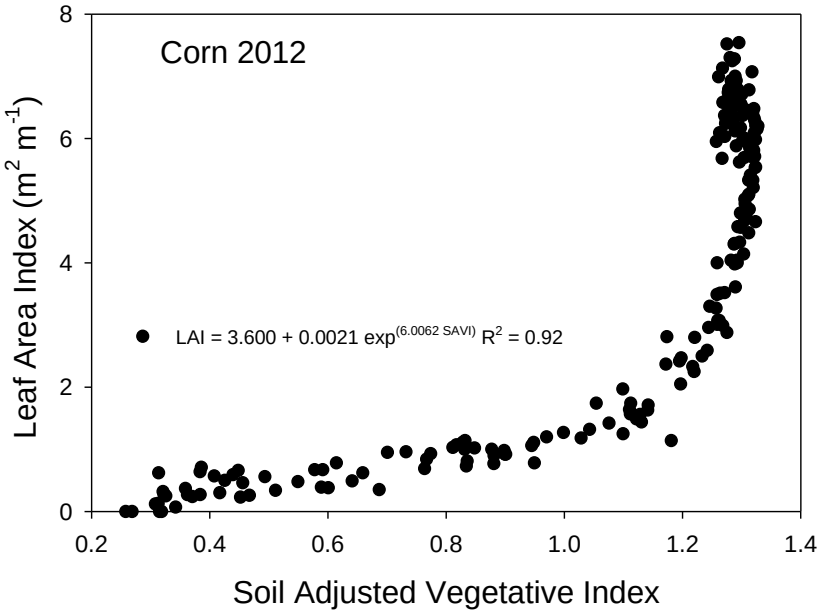
Radiation Use Efficiency

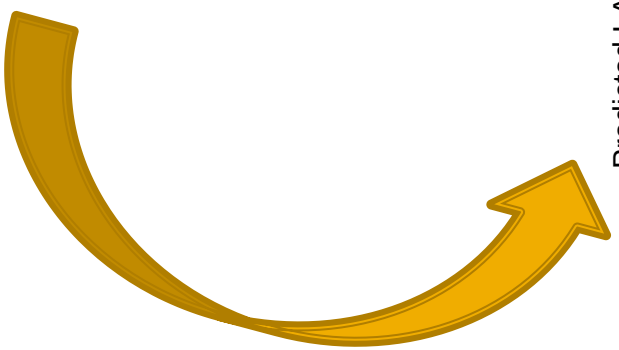


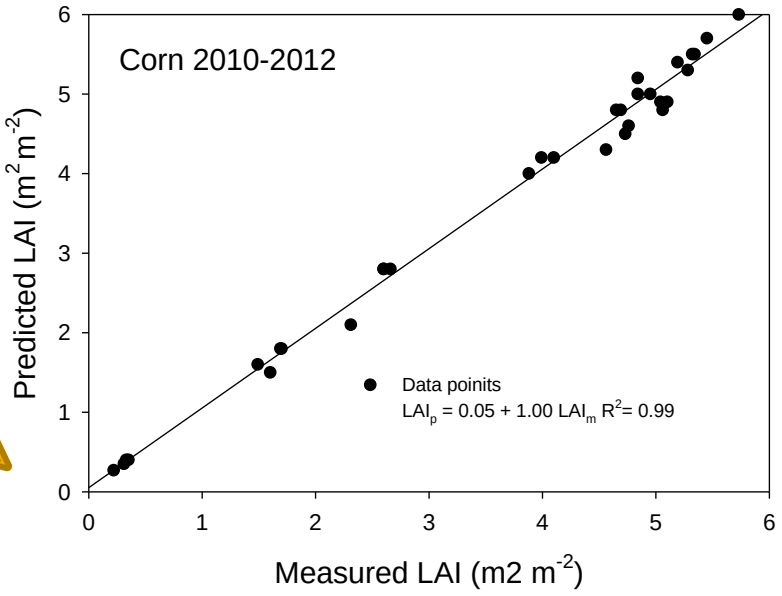




Leaf Area Estimation

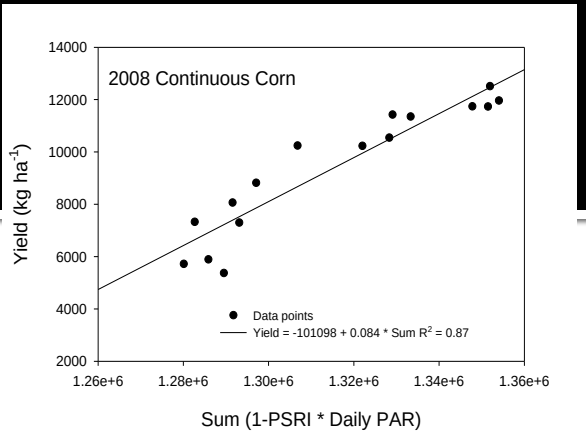


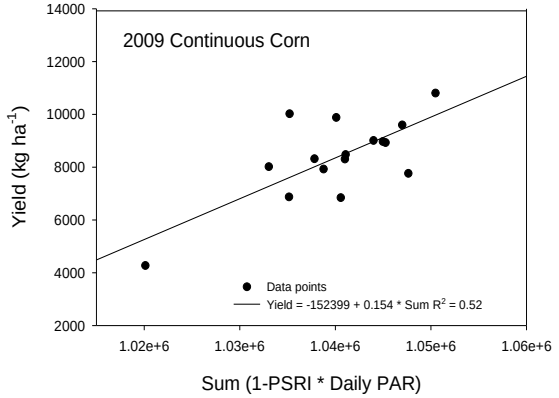


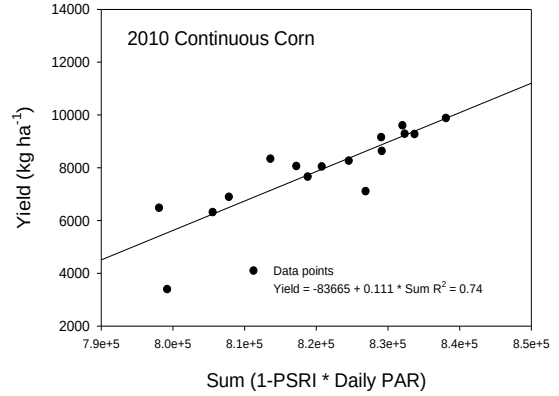


Senescence Index

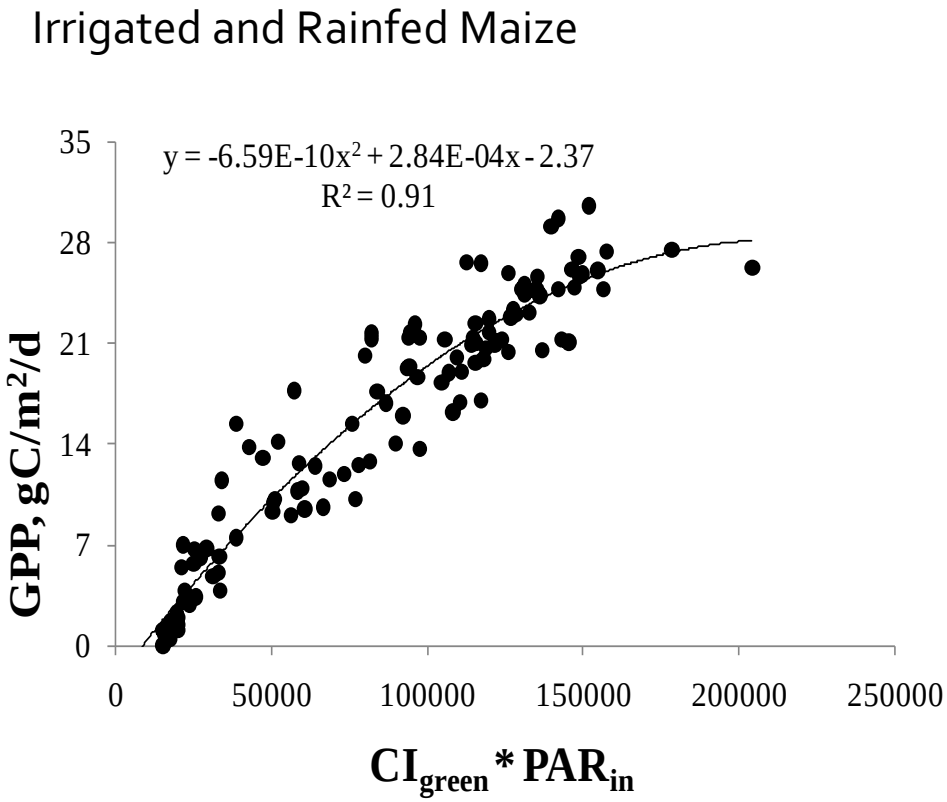
The longer we can maintain green leaf area during the grain-filling period the higher the yield



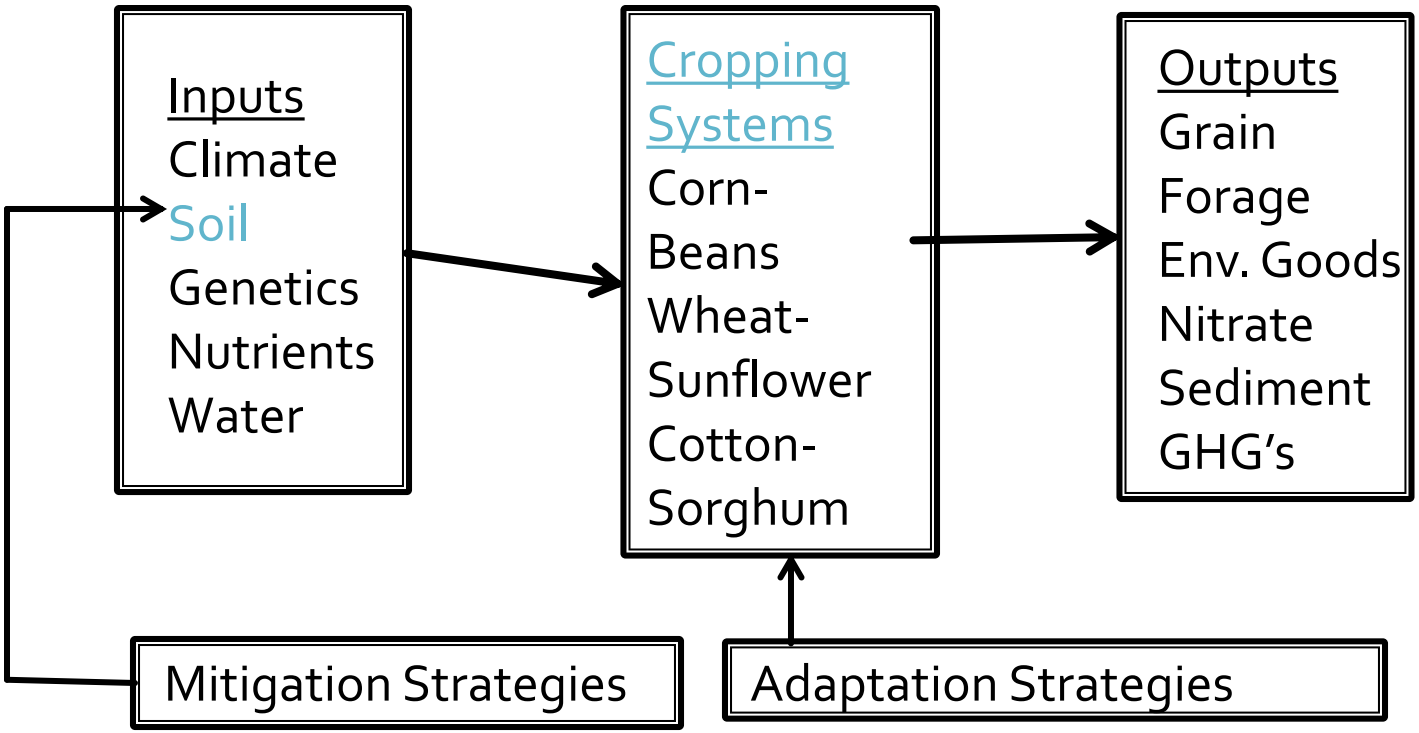




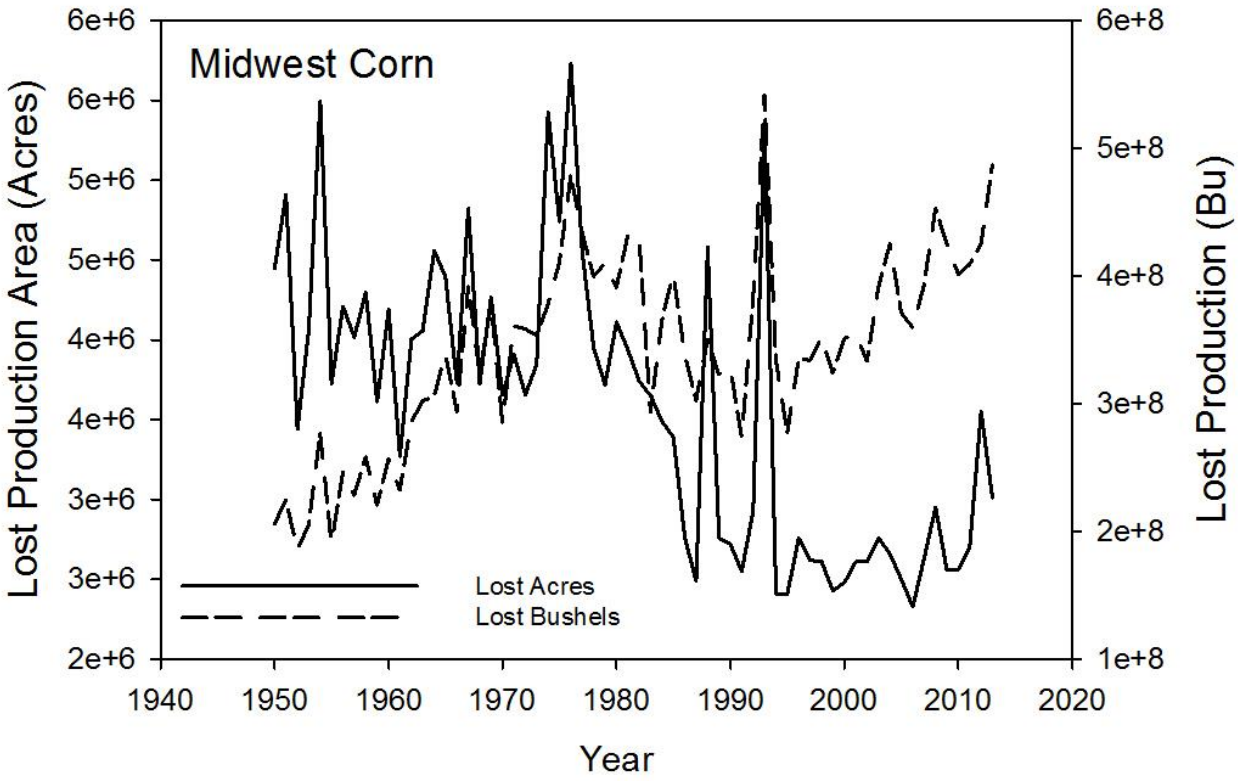
GPP vs CI (Corn)



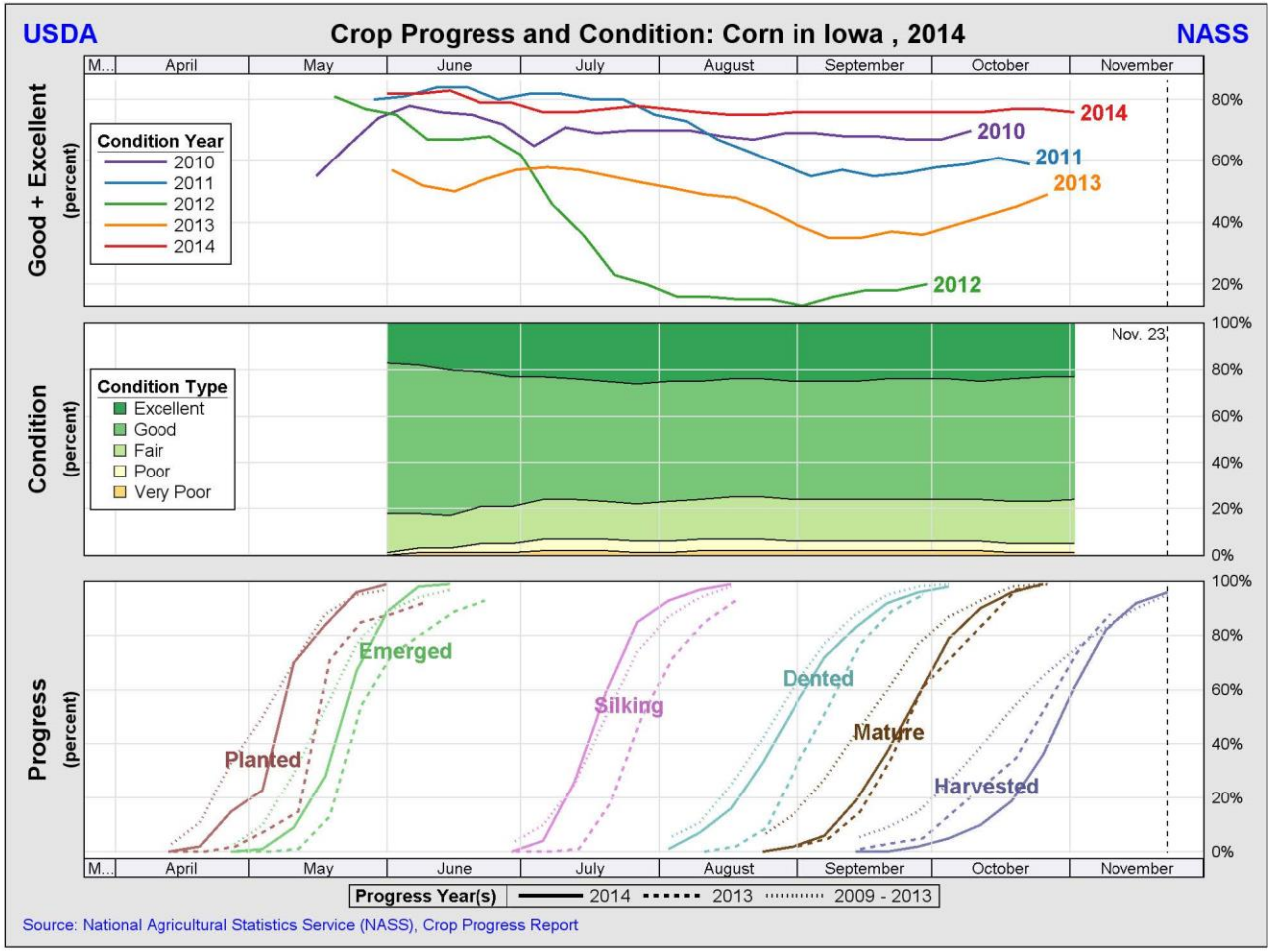
Framework For Agronomic Systems



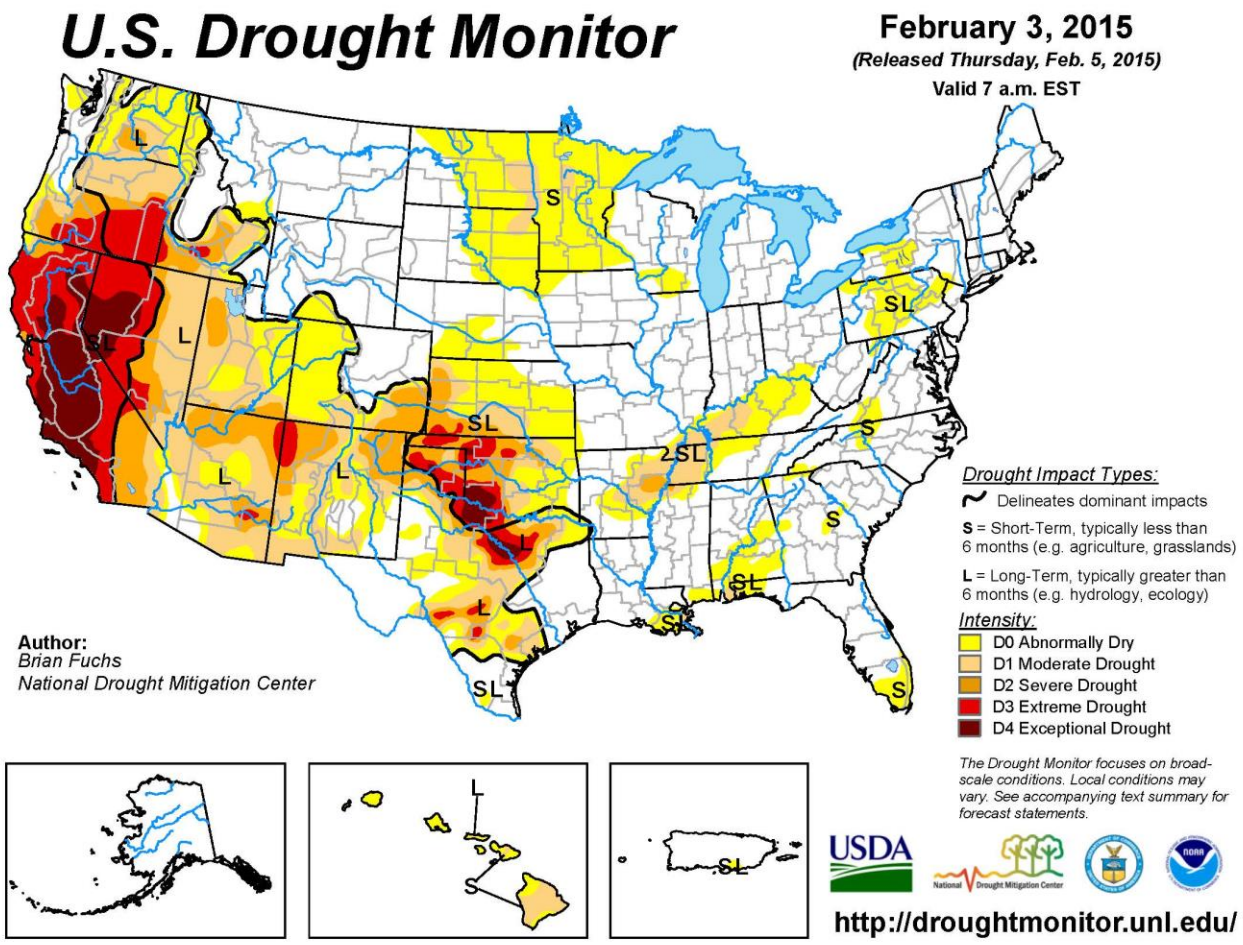
Corn: Lost Area and Production



Crop Progress-Iowa



Drought Progression



NDVI Global

May 9-24

July 12 -27

Utility of Remote Sensing

- View of spatial and temporal dynamics within and among growing seasons
- Detection of canopy parameters beyond crop yield and placed in a context of plant growth dynamics
- Evaluate the change in response relative to weather variation