Multi-Date Compositing Techniques

Matthew Hansen[1]
Kyle Pittman[1]
Jiyul Chang[1]
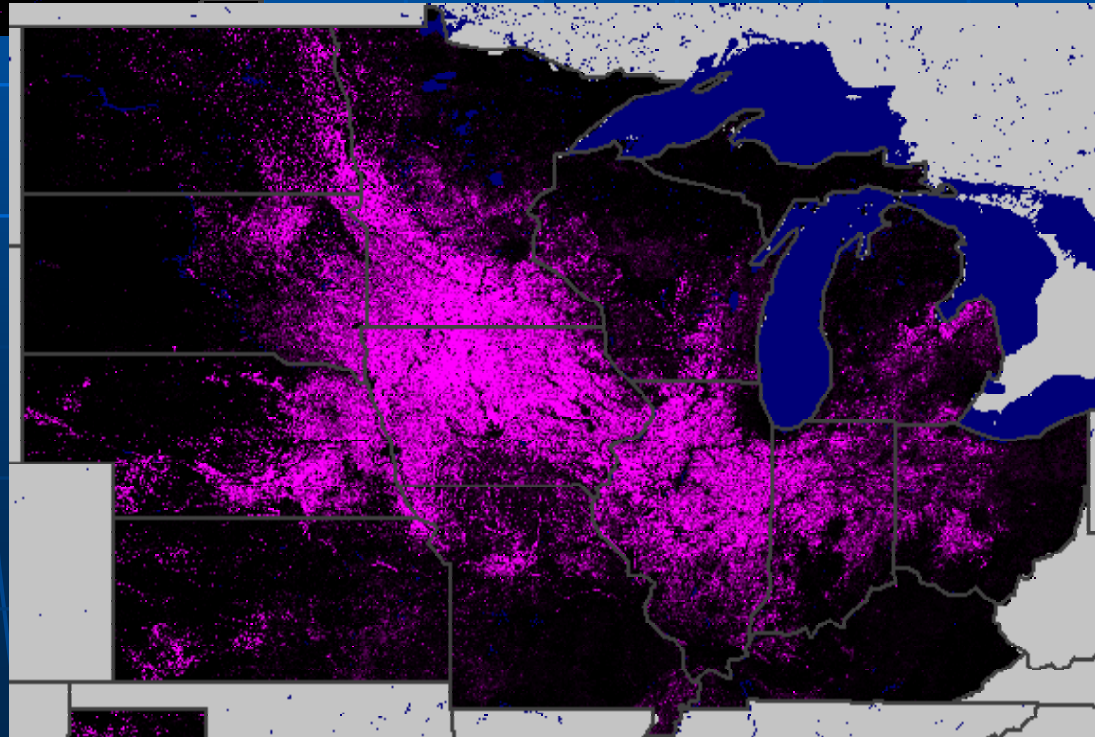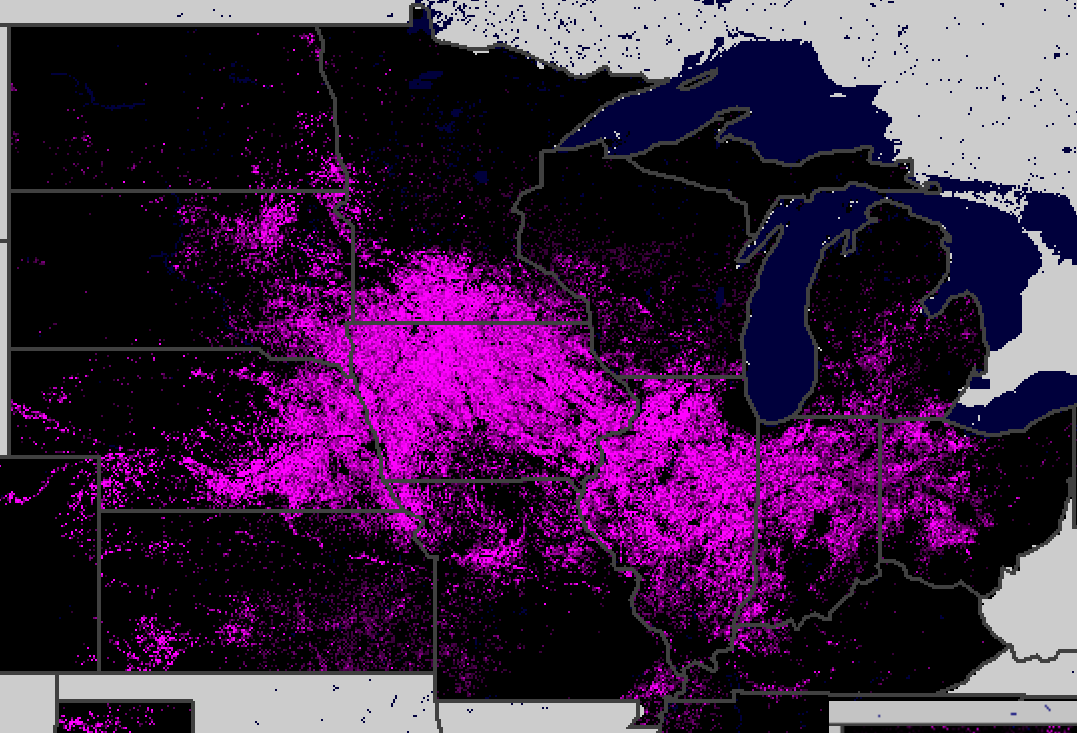Inbal Becker-Reshef[2]

[1]South Dakota State University
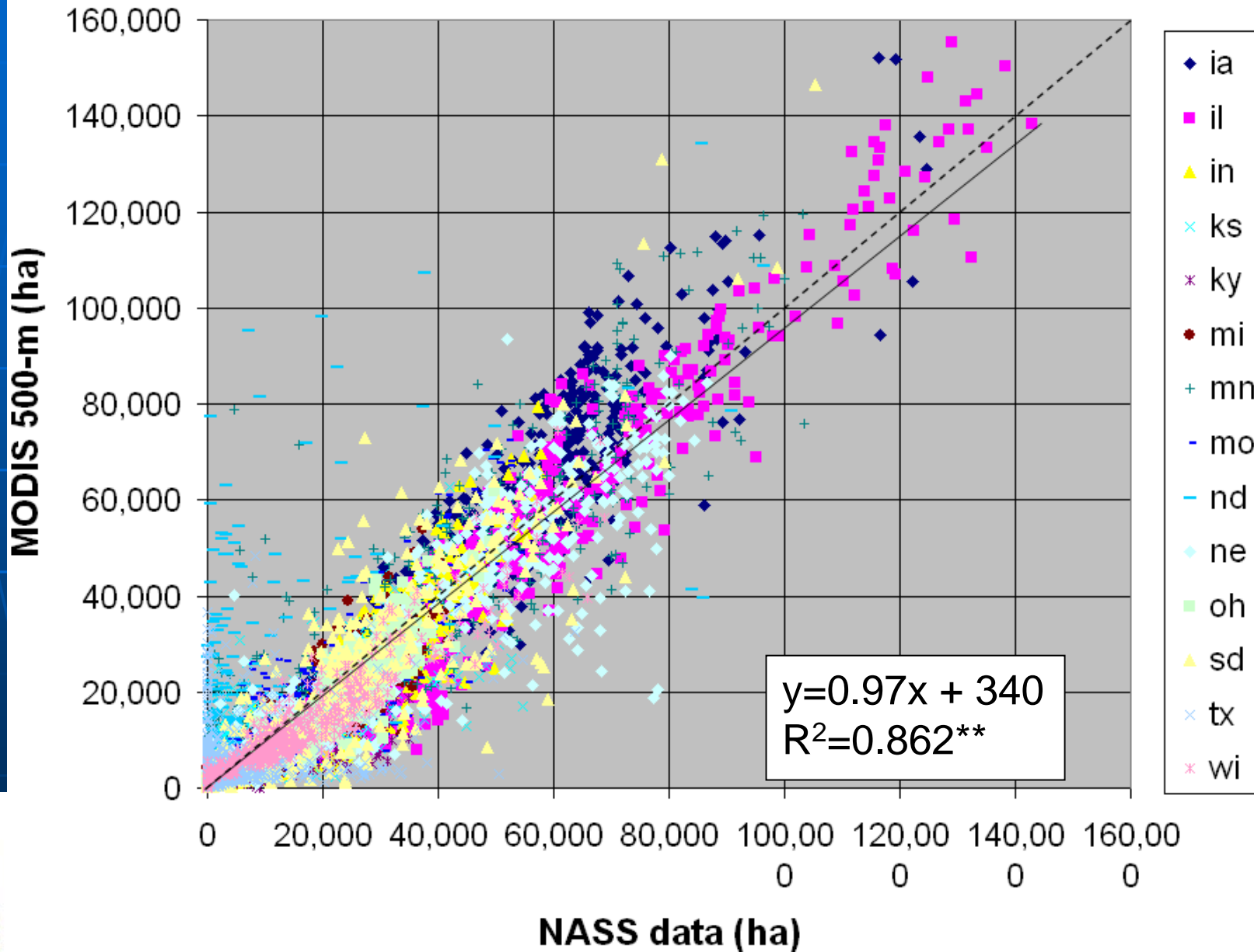[2]University of Maryland

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Previous MODIS-based crop mapping

Corn, 2002, multi-year model

Corn, 2002, single-year model

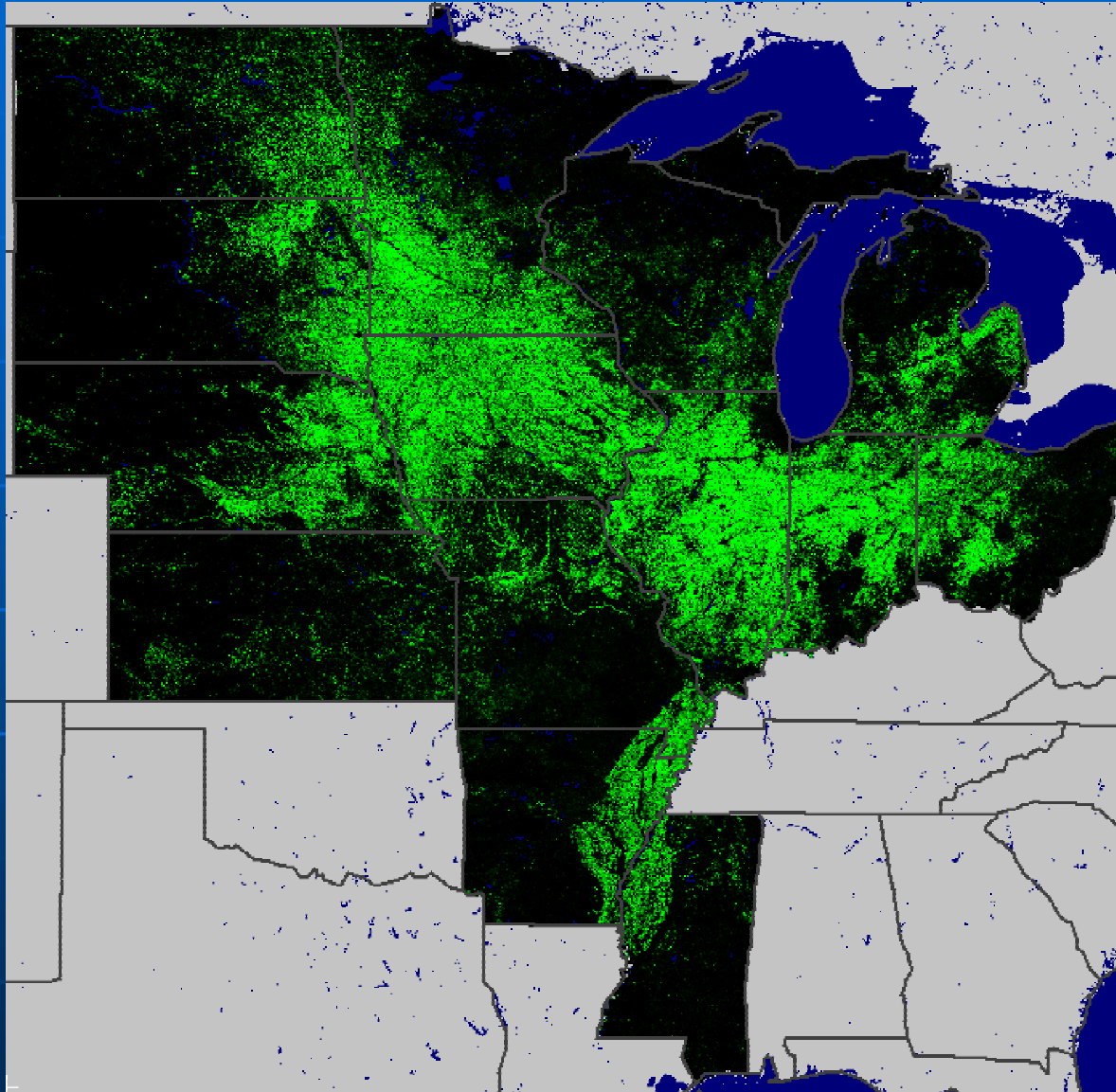Corn acreage (county level, 2000-2005)

$y=0.97x + 340$
$R^2=0.862**$

Corn acreage (state level, 2000-2005)

$y=0.99x + 13710$
$R^2=0.921**$
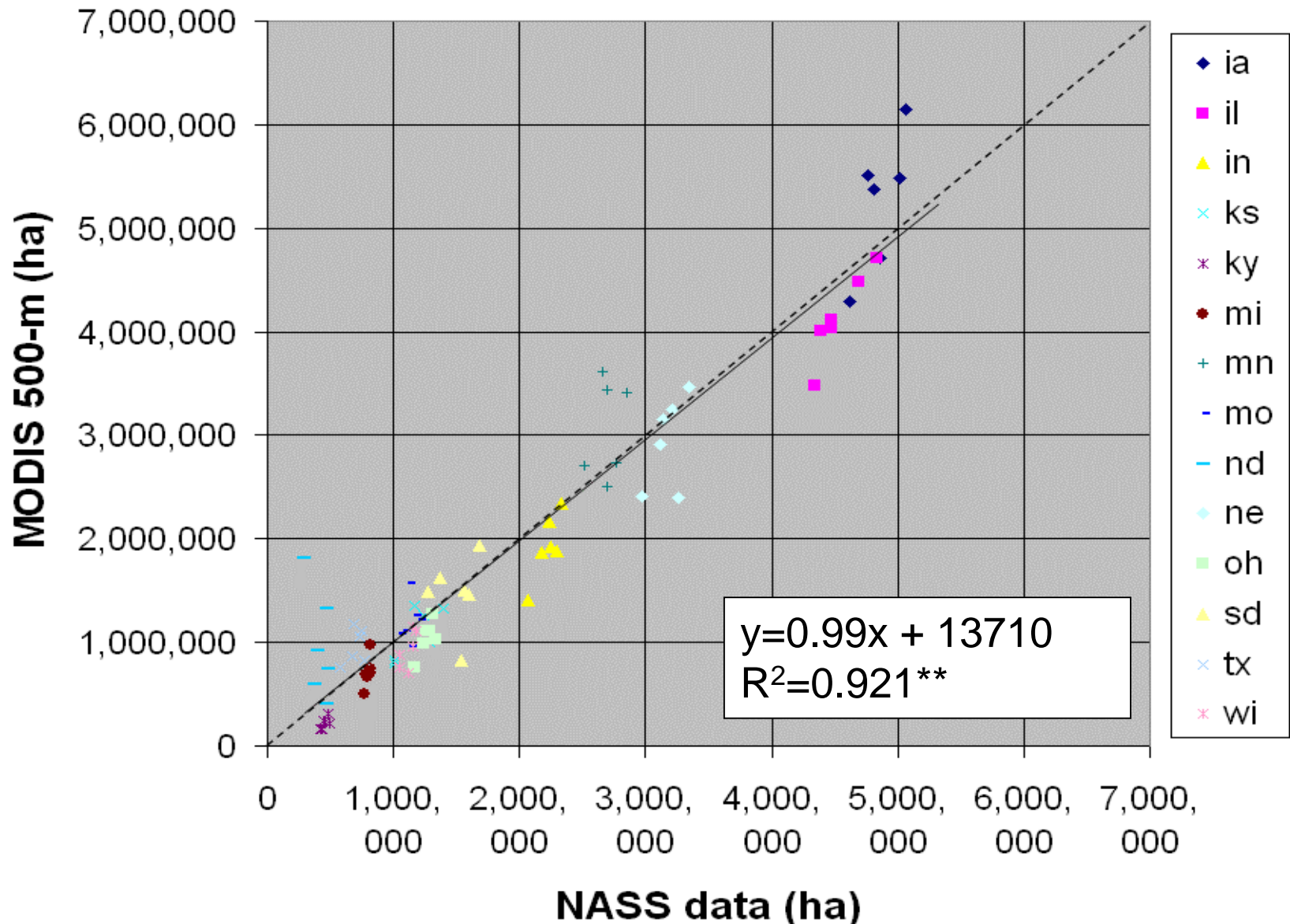
Soybean, 2002, single-year model
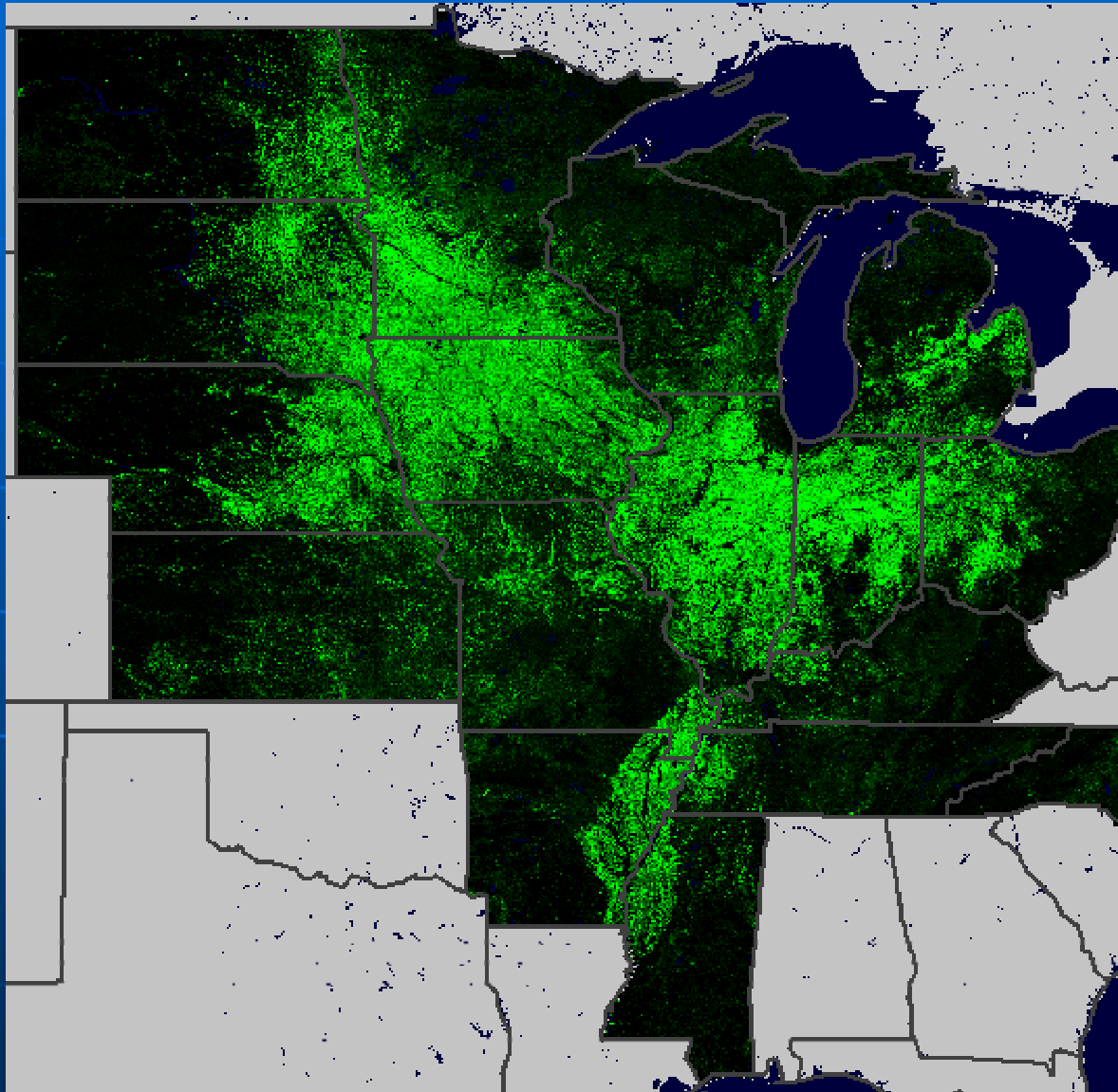
Soybean, 2002, multi-year model

Soybean acreage (county level, 2000 - 2005)

y=0.97x + 340
R^2=0.862**
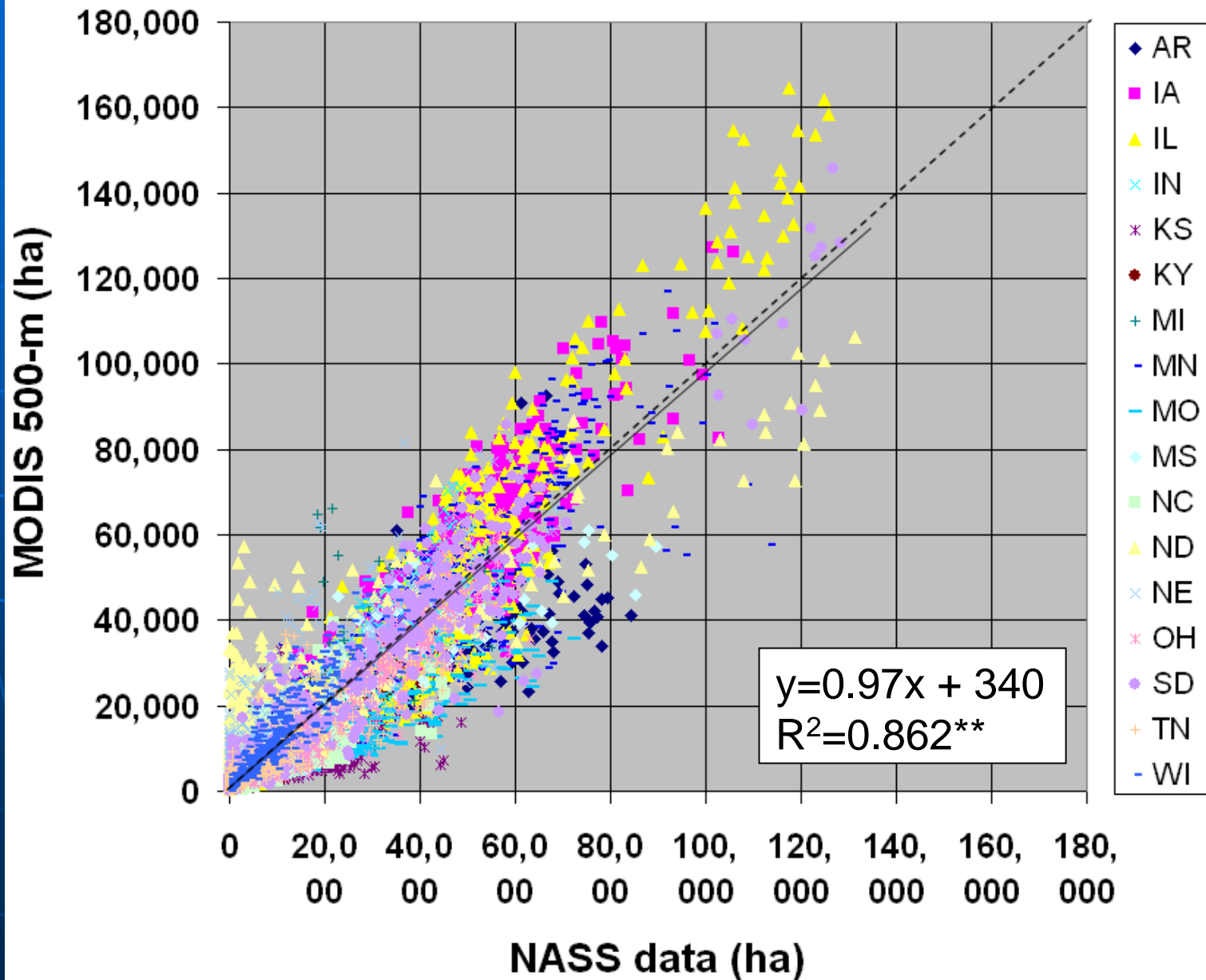
Soybean acreage (state level, 2000 - 2005)

y=0.99x + 13710
R²=0.921**
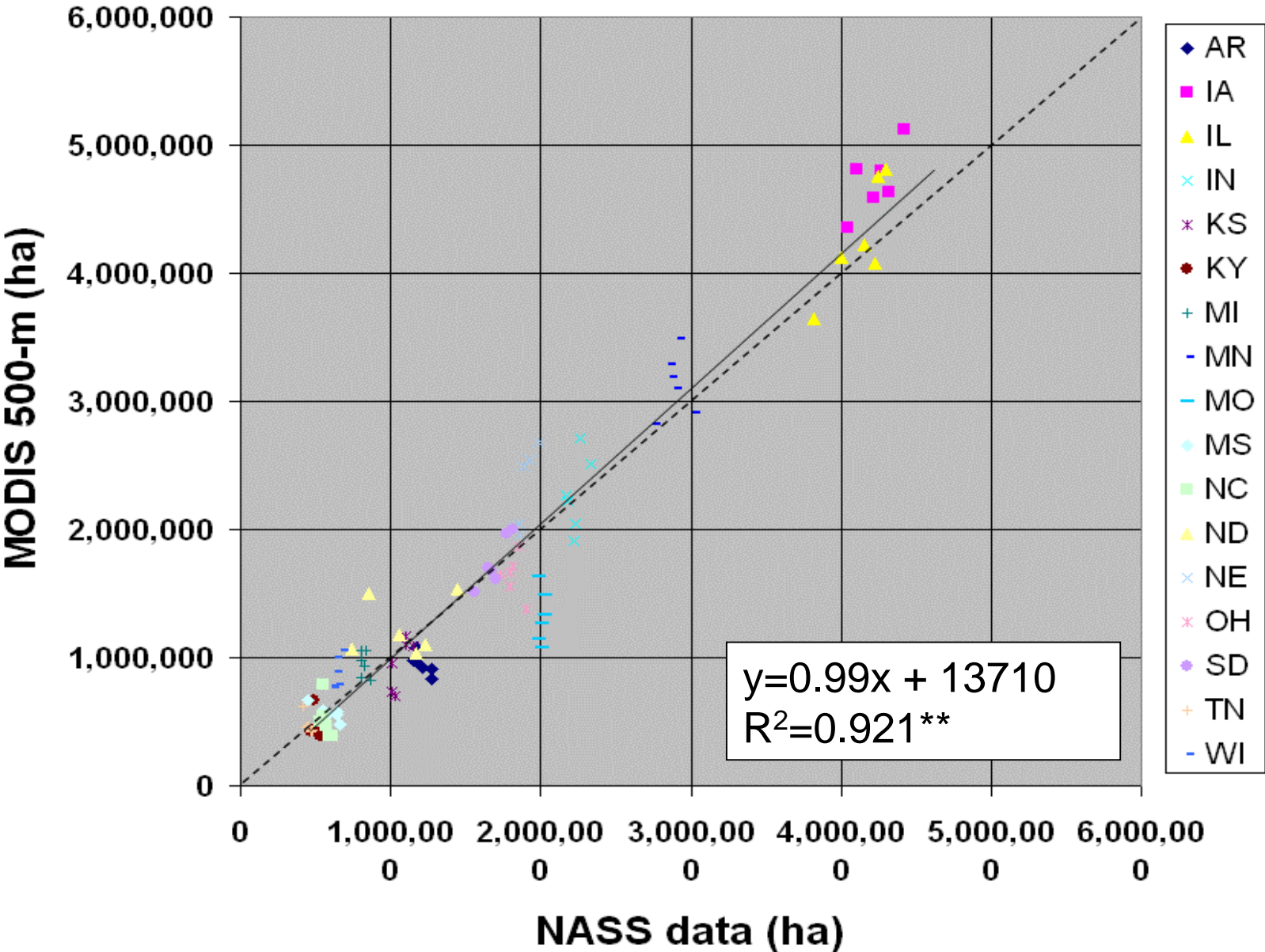
Per pixel mid-resolution compositing

- Normalization - using MODIS products
- Cloud/shadow screening – hard-wired algorithm
  - Not yet implemented on AWiFS
  - Using Landsat, we rely heavily on thermal
- Anisotropy adjustment
  - Improves classification accuracy with Landsat, expect similar results with AWiFS
- Per pixel quality assessment
  - Do not think per scene, but per pixel, taking all available imagery
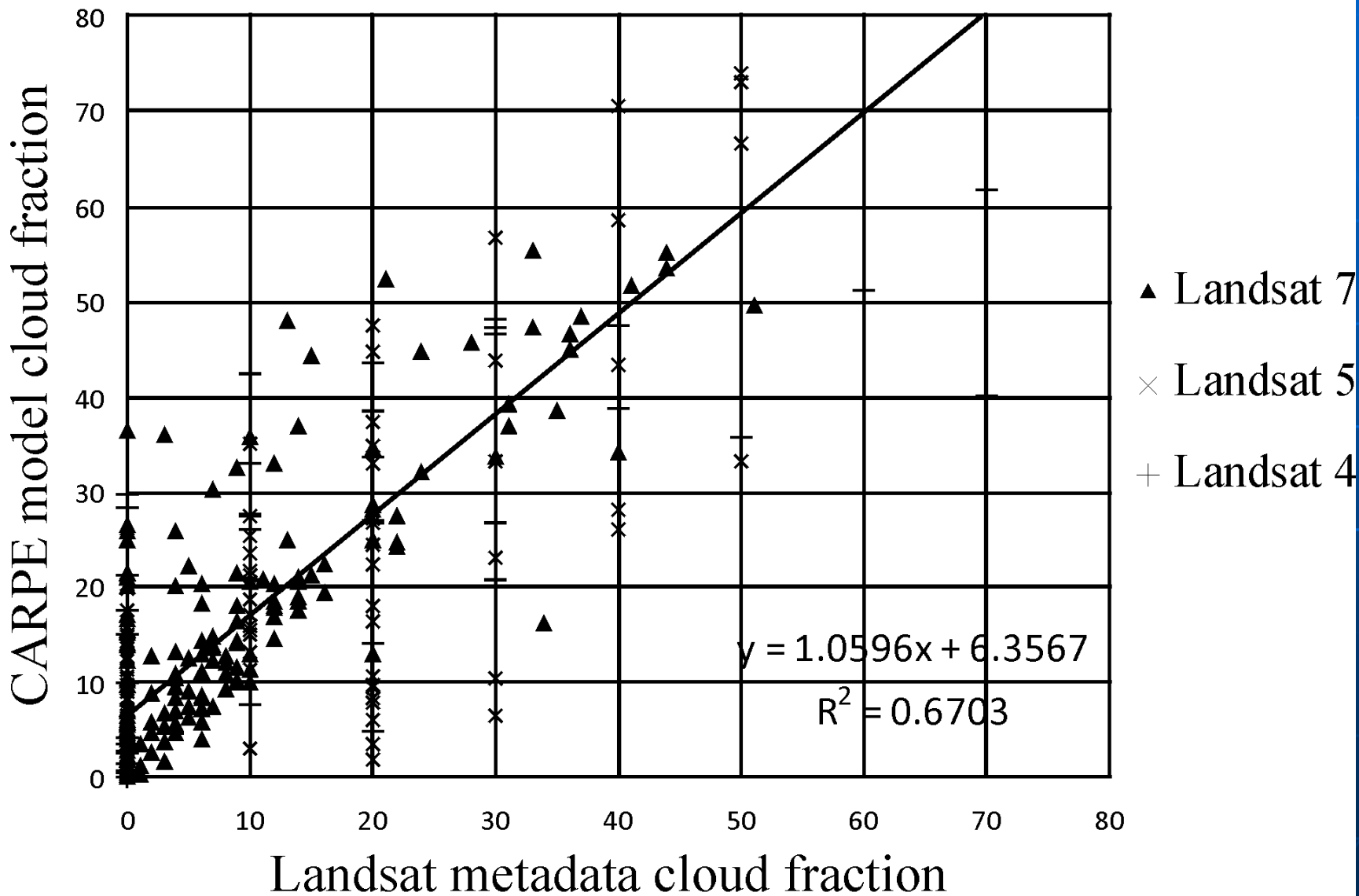
- Compositing procedure
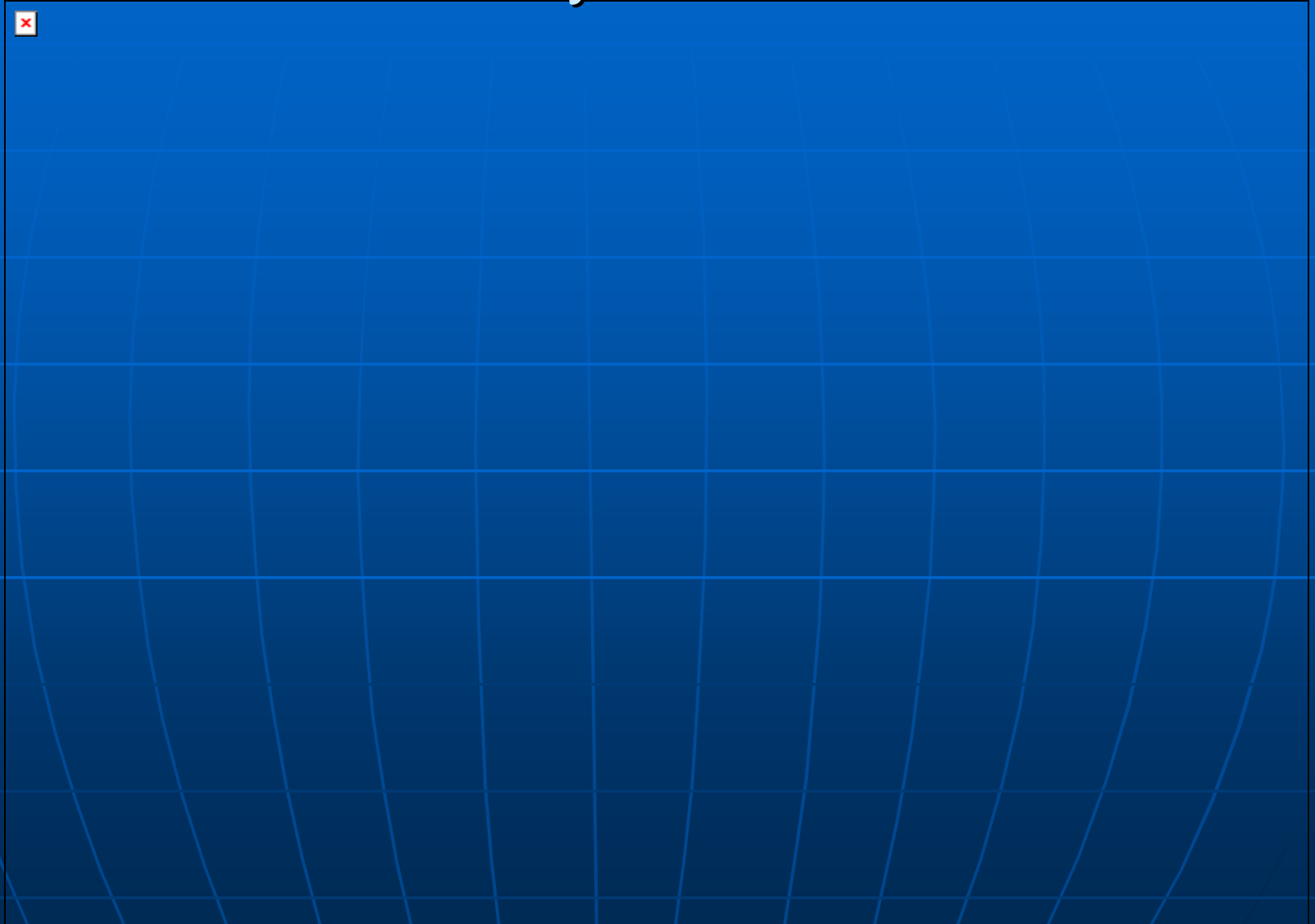
Congo Basin

2000 Geocover – single best image

Three best images

Example of per pixel cloud algorithm per path/row compared to ACCA for Landsat

Use MODIS to find targets – forest/soybean/corn



AWiFS unadjusted   Anisotropy   Adjusted image output

Testing AWiFS to date

- Imagery over the Midwest corn/soybean belt
  - 58 AWiFS scenes covering 28 July 07 -- 12 Aug 07
  - Normalized using MODIS-derived global treecover product
  - Composited using Maximum NDVI
- No systematic acquisition
- Rescaled data
- Significant geolocation issues with some images
- No thermal band for cloud screening
- However, possibility for mass-processing clearly evident

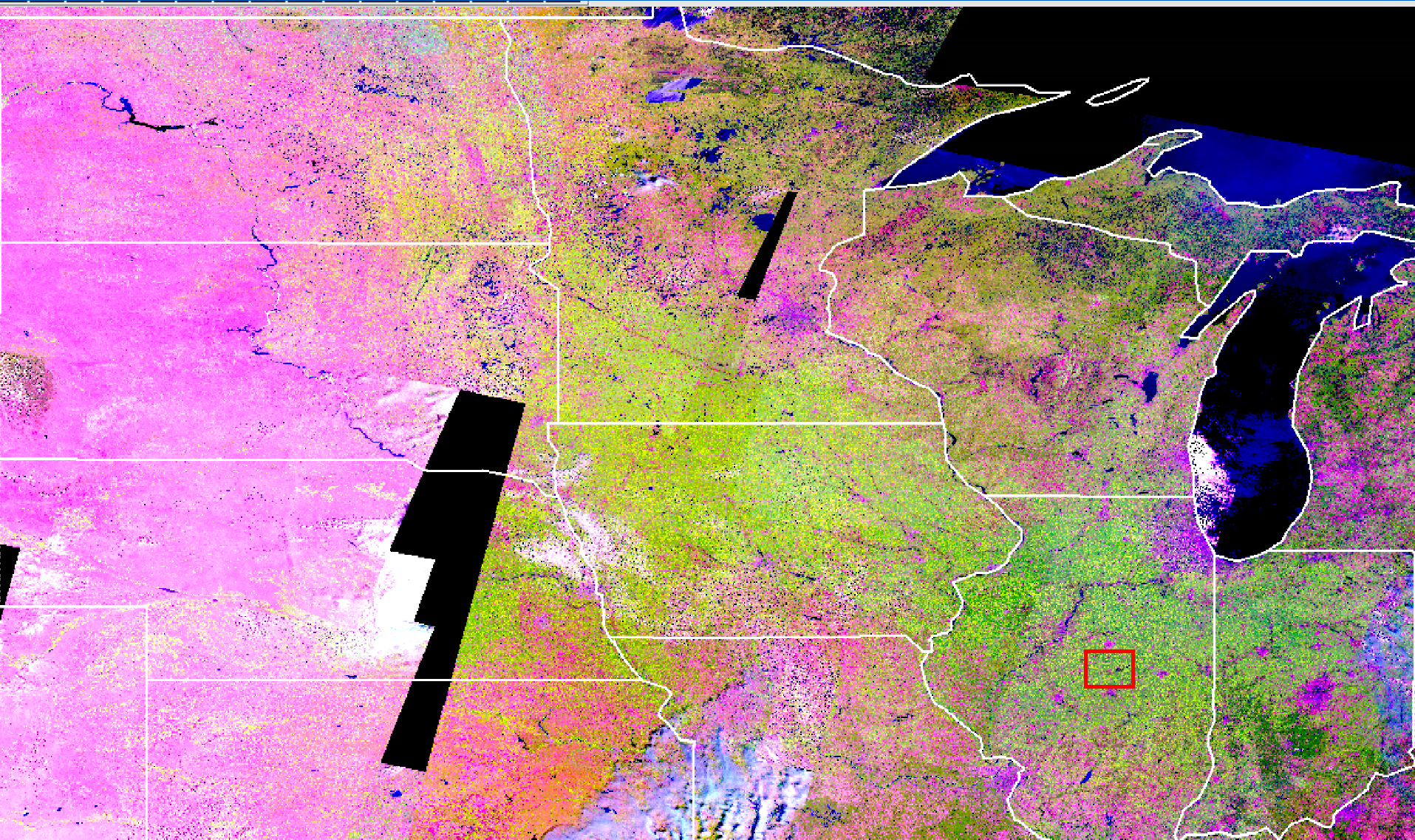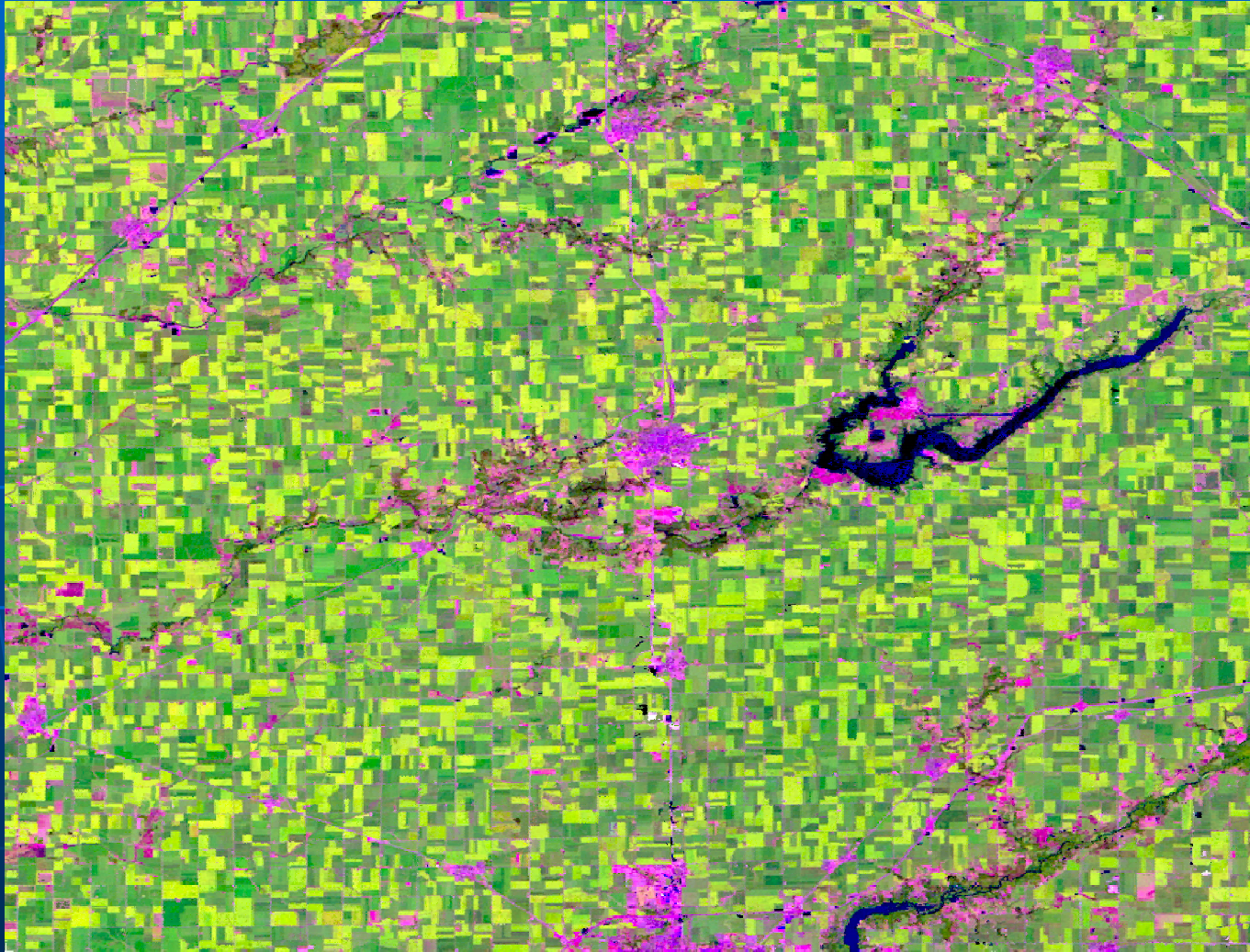SDSU

MODIS Forest Mask
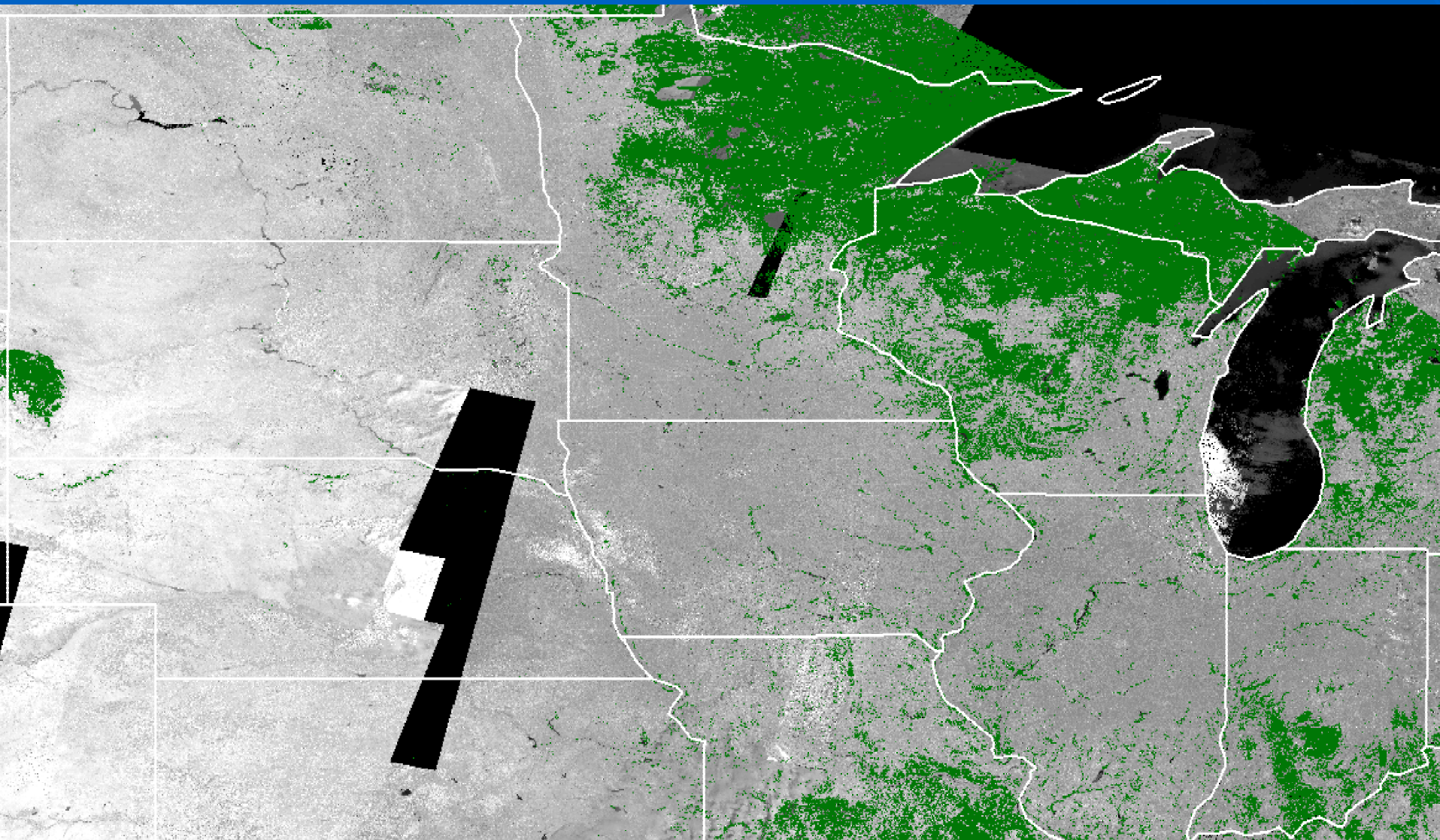
AWiFS Composite
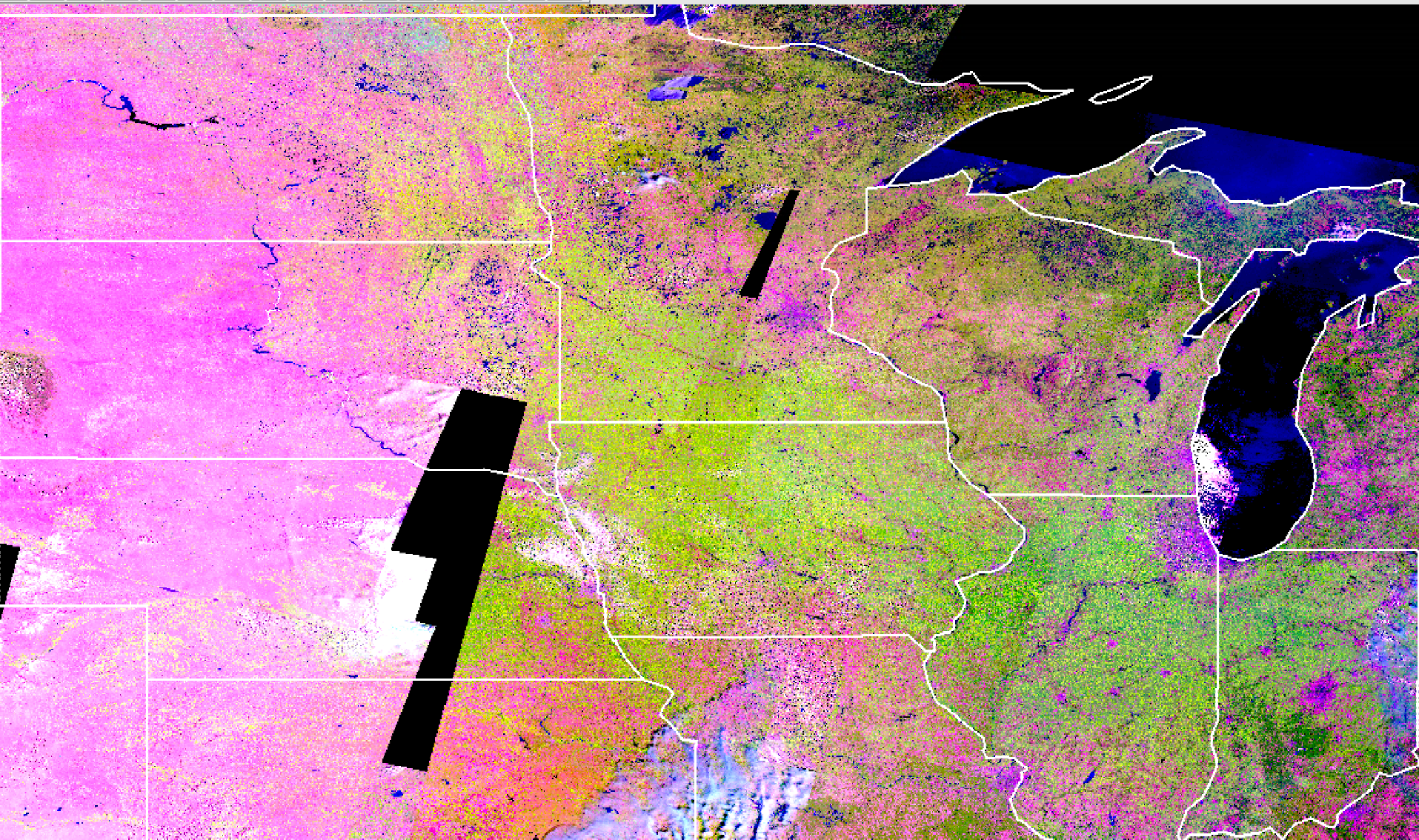
Red: AWiFS band 5, Green: AWiFS band 4, Blue: AWiFS band 3
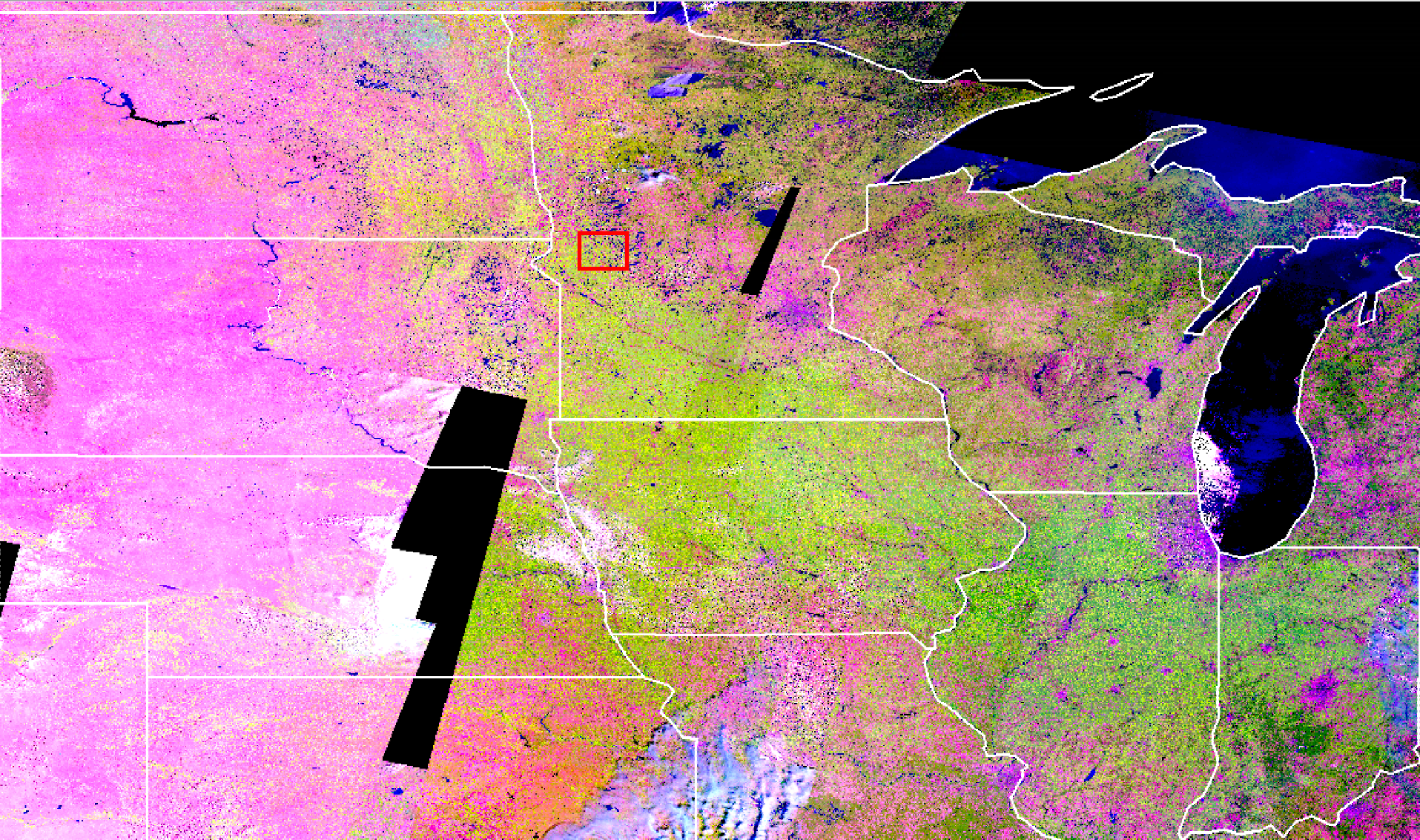
AWiFS Composite

Red: AWiFS band 5, Green: AWiFS band 4, Blue: AWiFS band 3
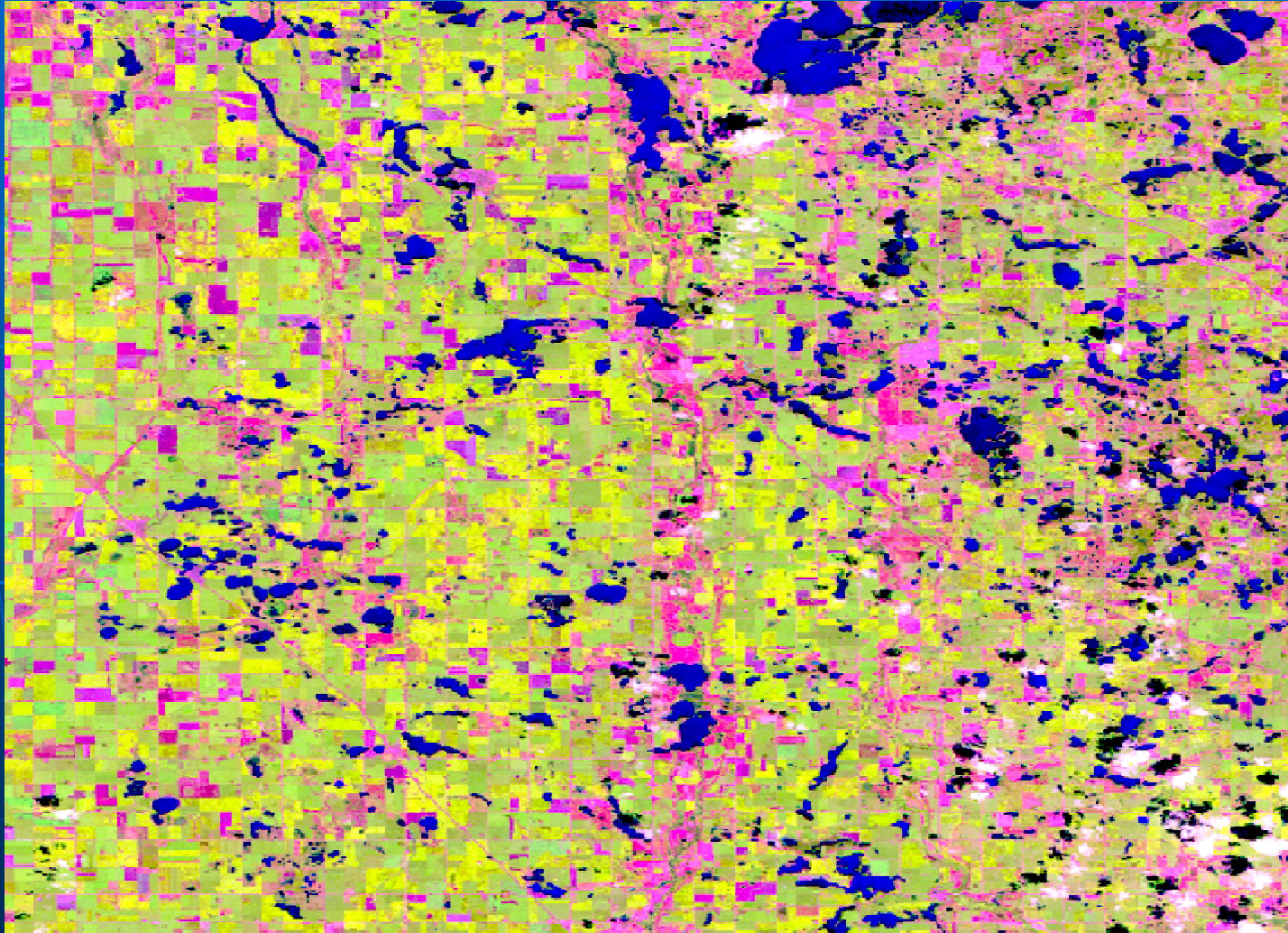
Central Illinois Zoom
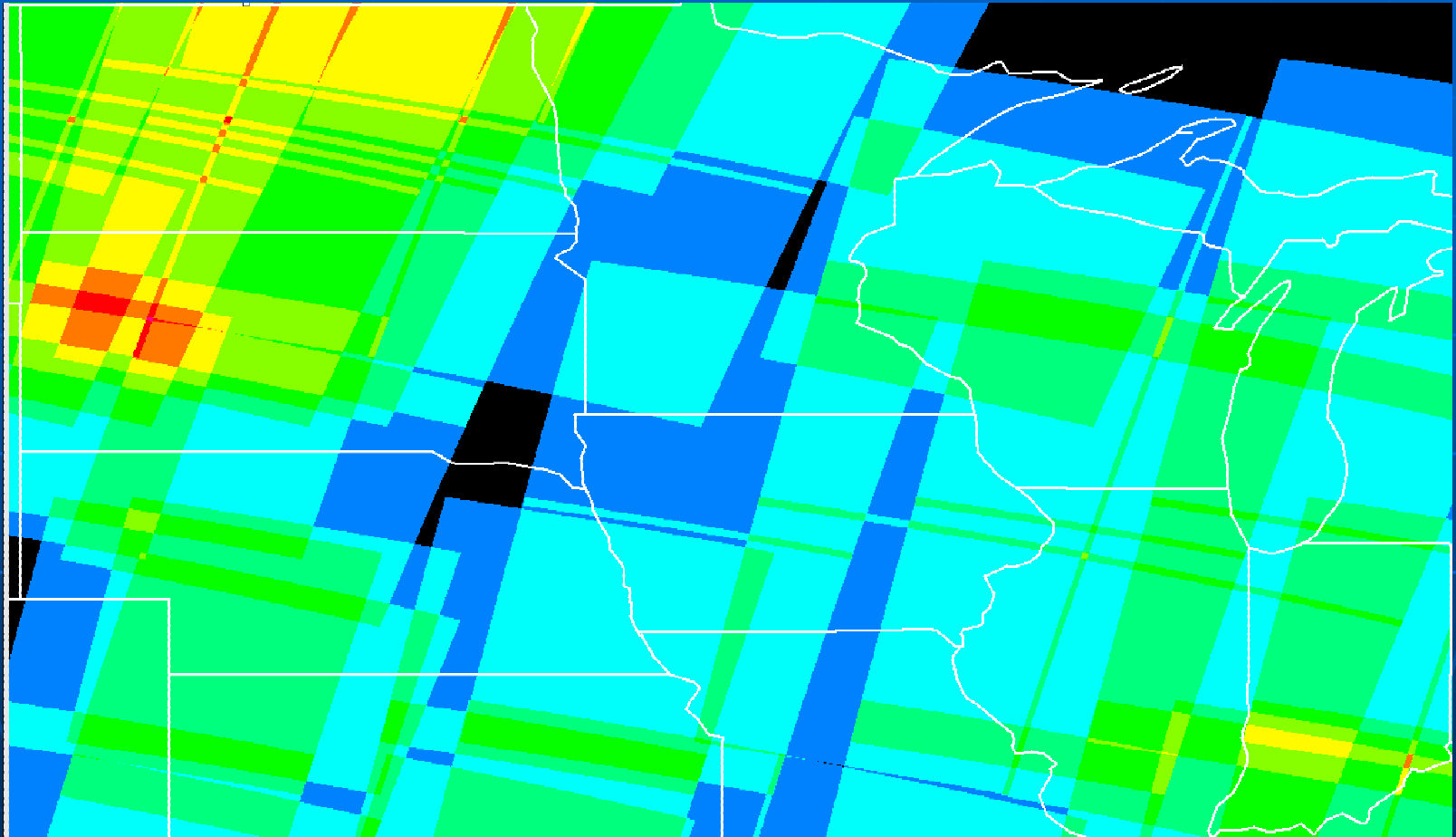

Corn= green, Soybeans=yellow

AWiFS Composite
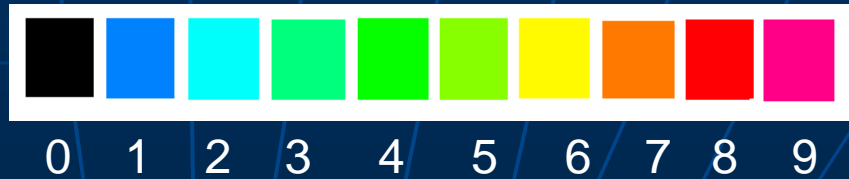
Western Minnesota Zoom

Corn= green, Soybeans=yellow

Available AWiFS Imagery

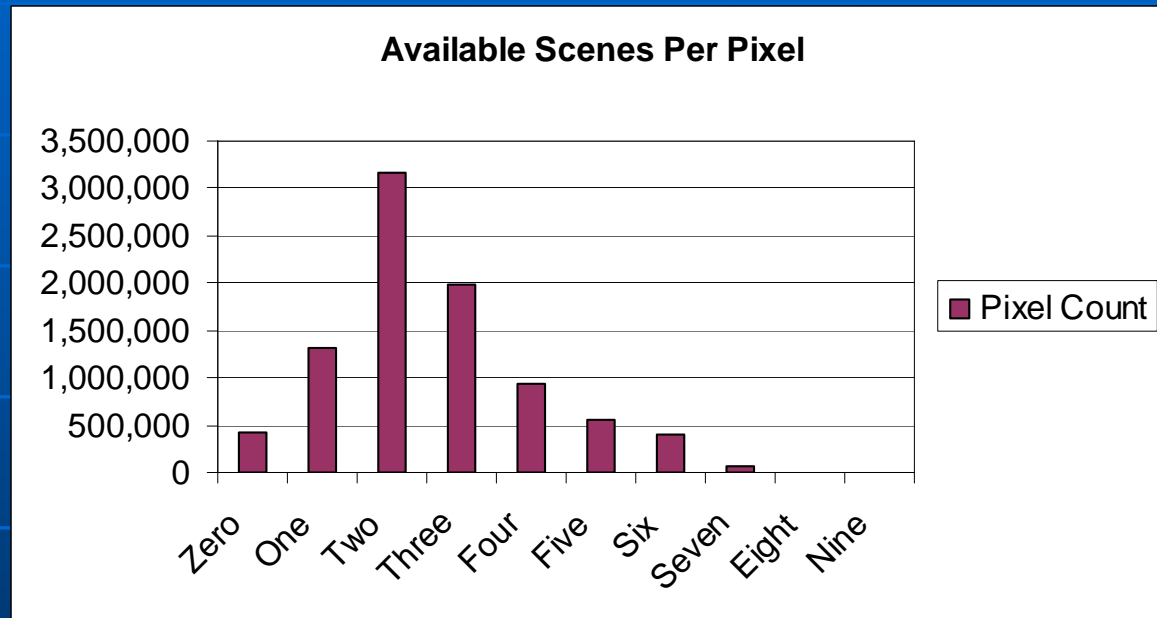**Available Scenes per pixel**

0 1 2 3 4 5 6 7 8 9

Available AWiFS Imagery

	Pixel Count	Percent
Zero	415,213	4.71%
One	1,304,830	14.81%
Two	3,158,789	35.85%
Three	1,983,396	22.51%
Four	929,718	10.55%
Five	552,746	6.27%
Six	391,222	4.44%
Seven	65,135	0.74%
Eight	10,319	0.12%
Nine	120	0.00%

Available Scenes Per Pixel
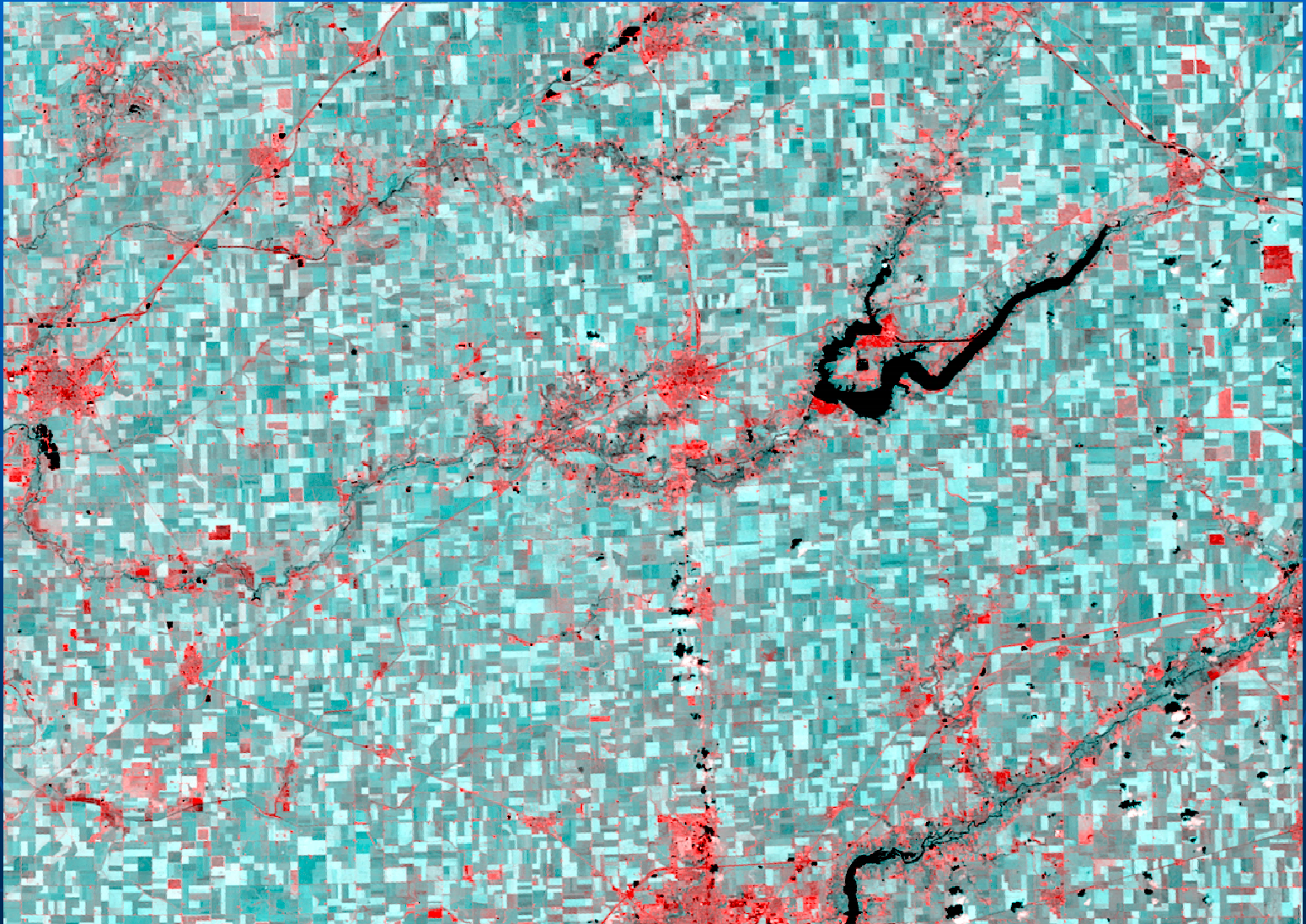

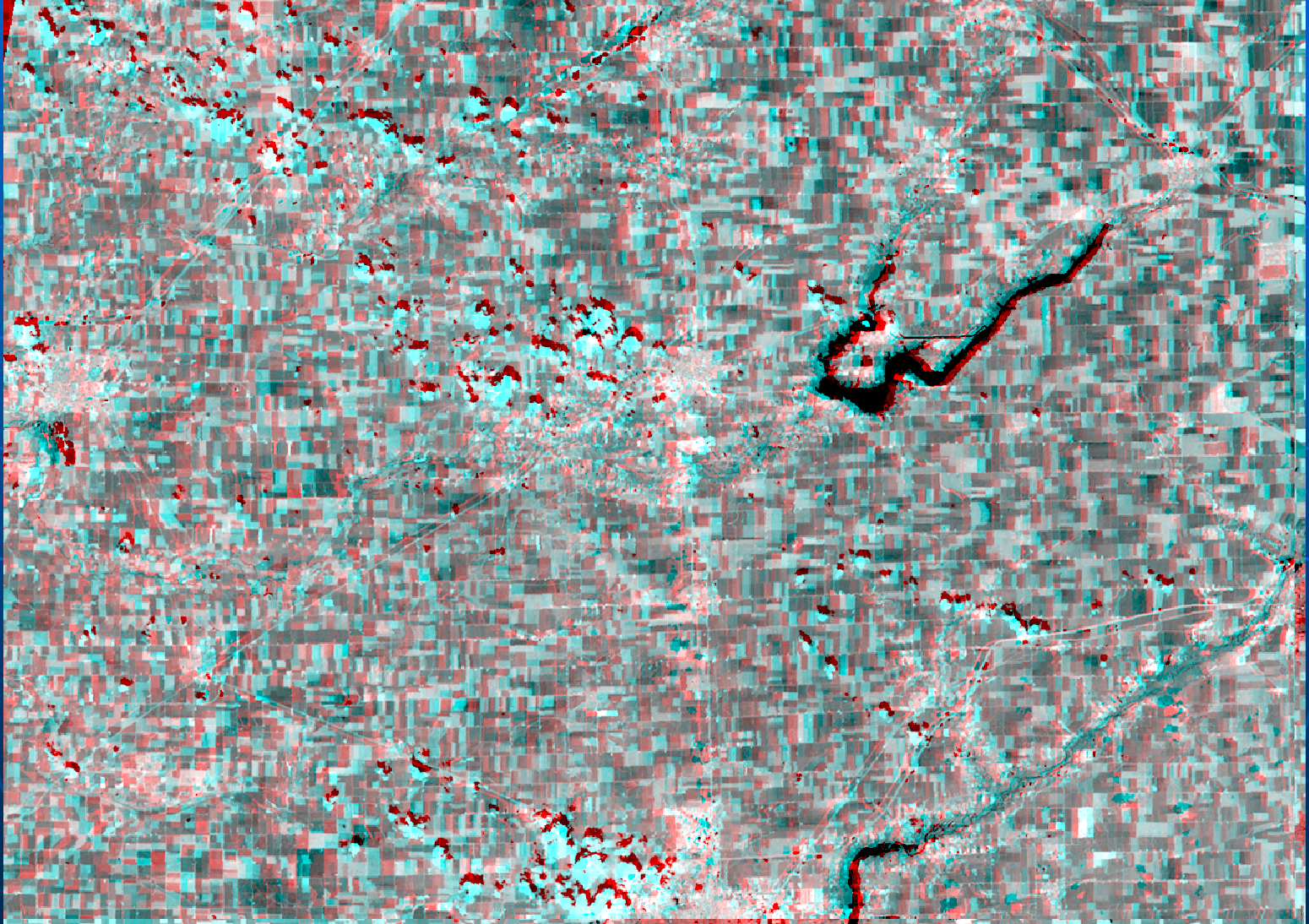55% of pixels have 2 or fewer scenes available

Cloud contamination and georeferencing issues further reduce availability

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Geolocation Problems

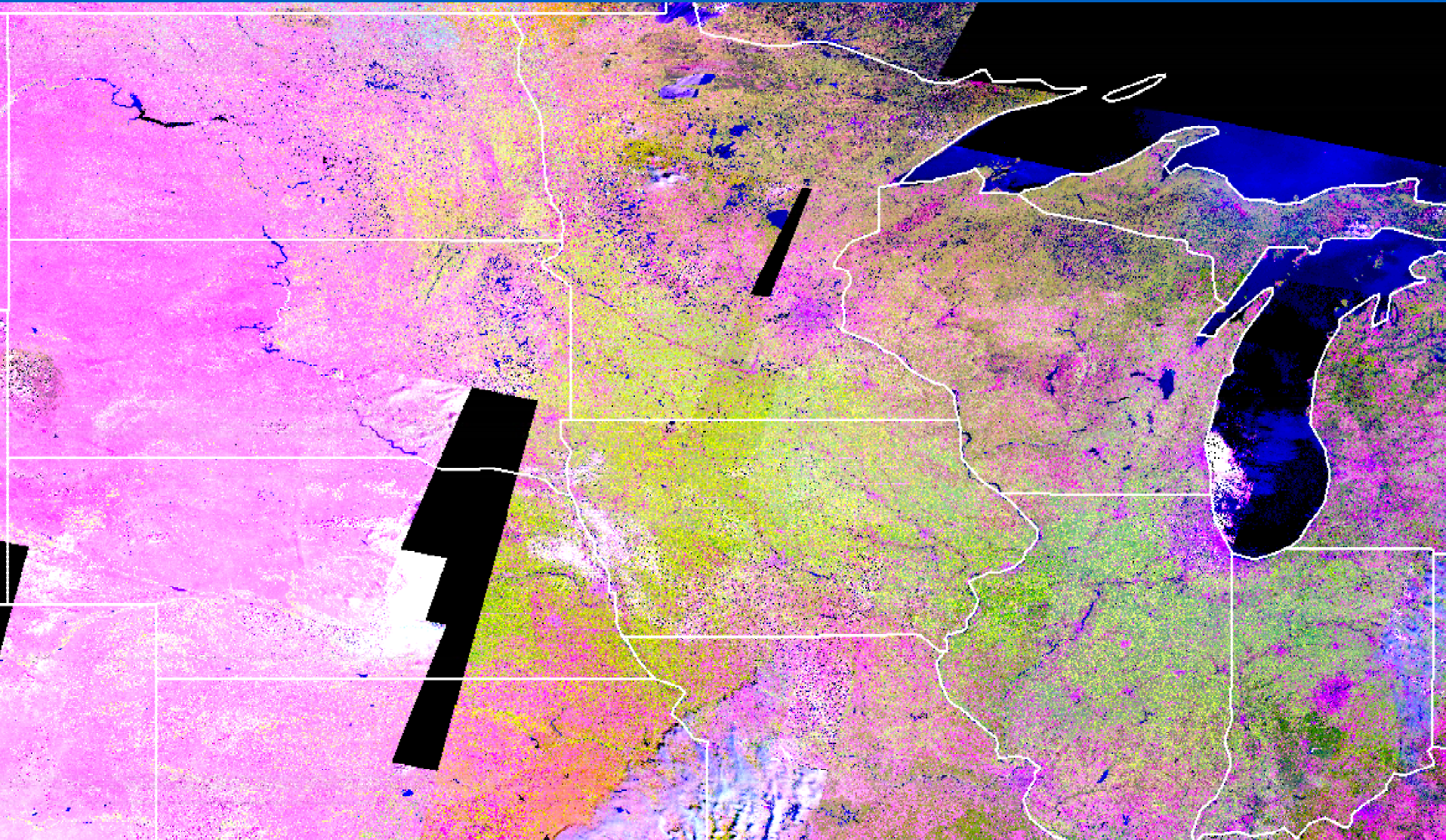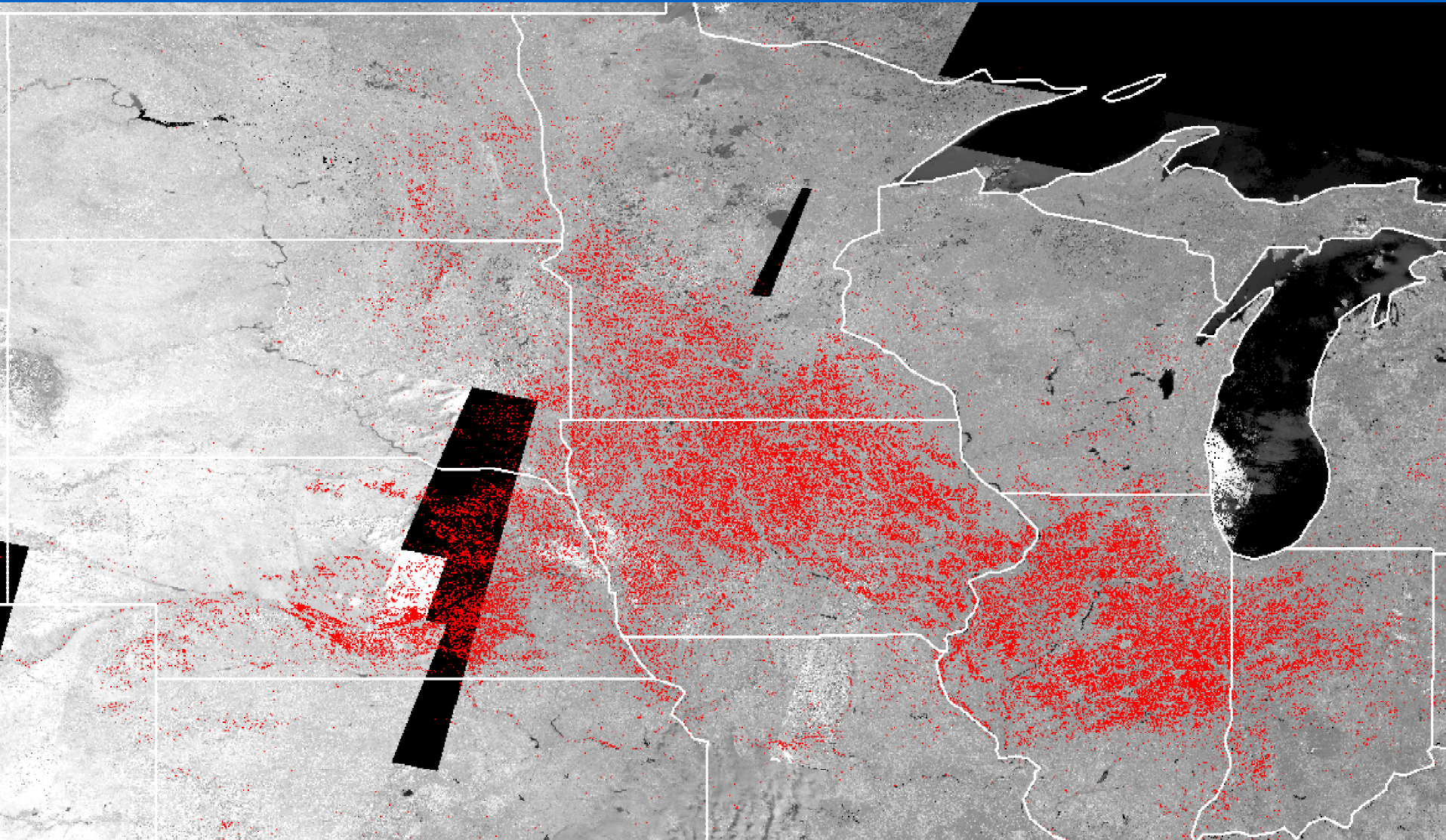# Geolocation Problems

250-m MODIS

- Inputs are 12 16-day composites, covering 6 Mar 07 – 13 Sept 07
  - 7 MODIS land bands plus NDVI and GNDVI

- Apply individual corn and soybean models based on year 2000 and 2002 MODIS data and NASS CDL's

- Result is percent crop type per pixel
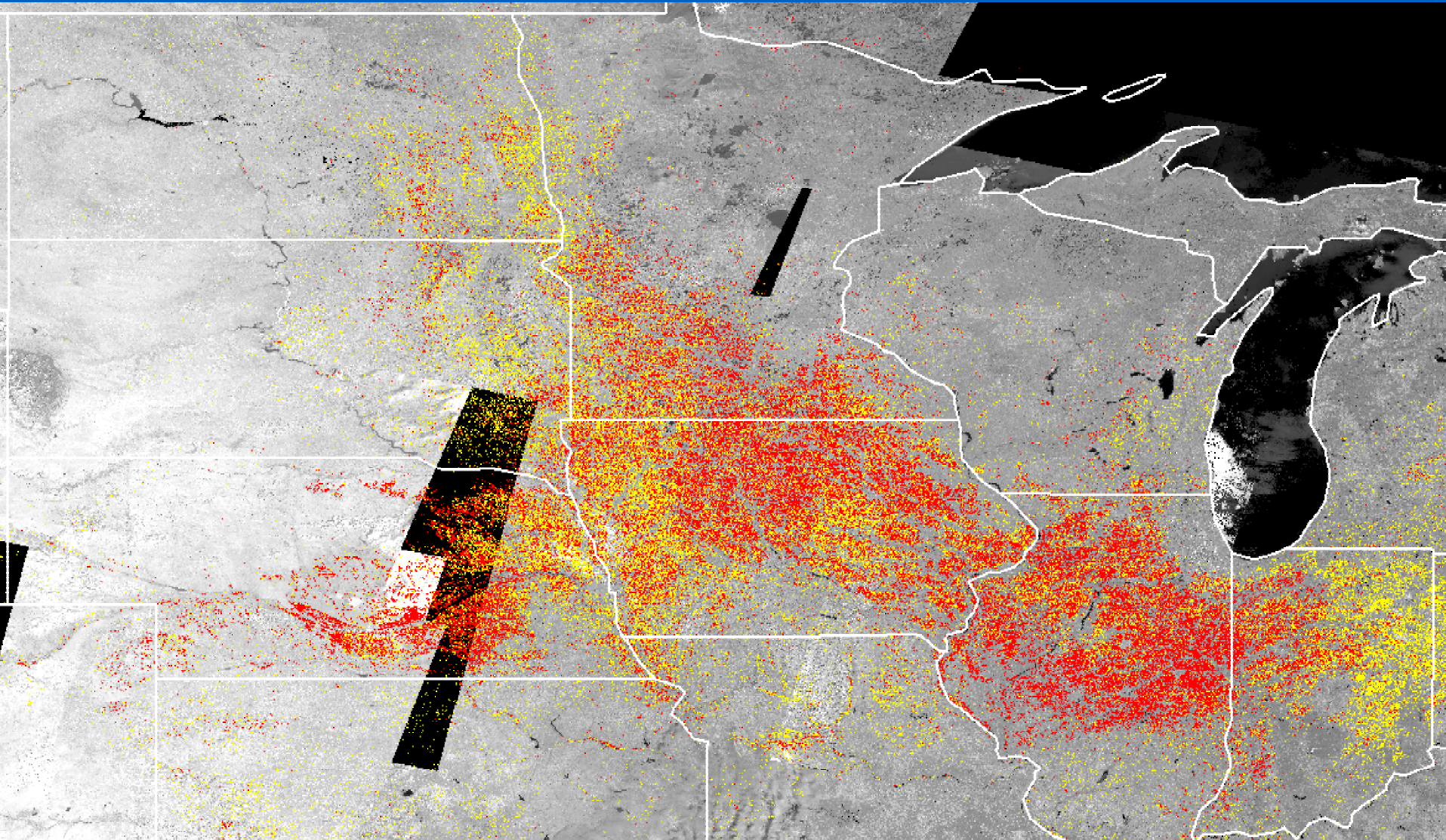
- Threshold to high corn and high soybean areas
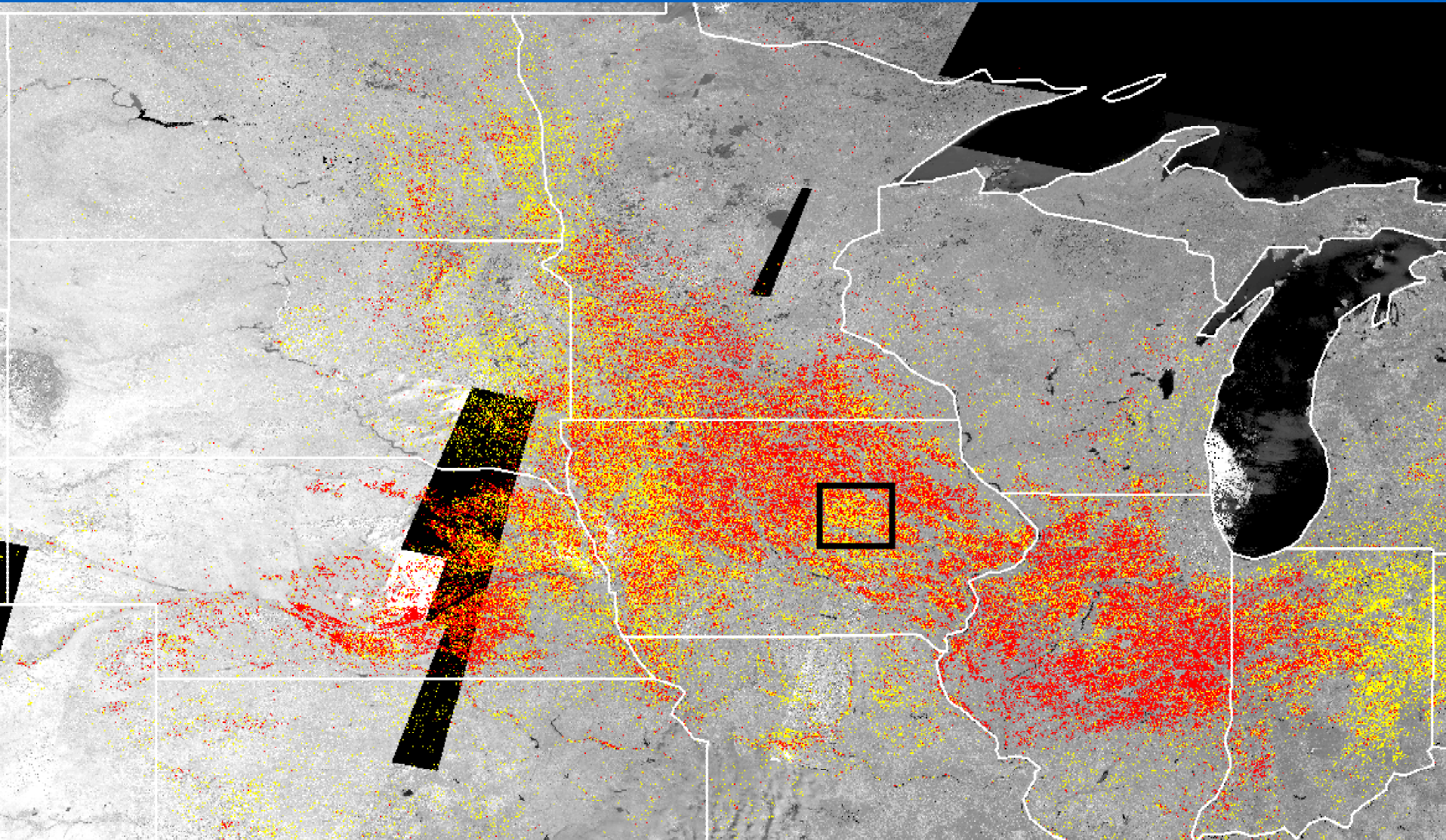
AWiFS Composite

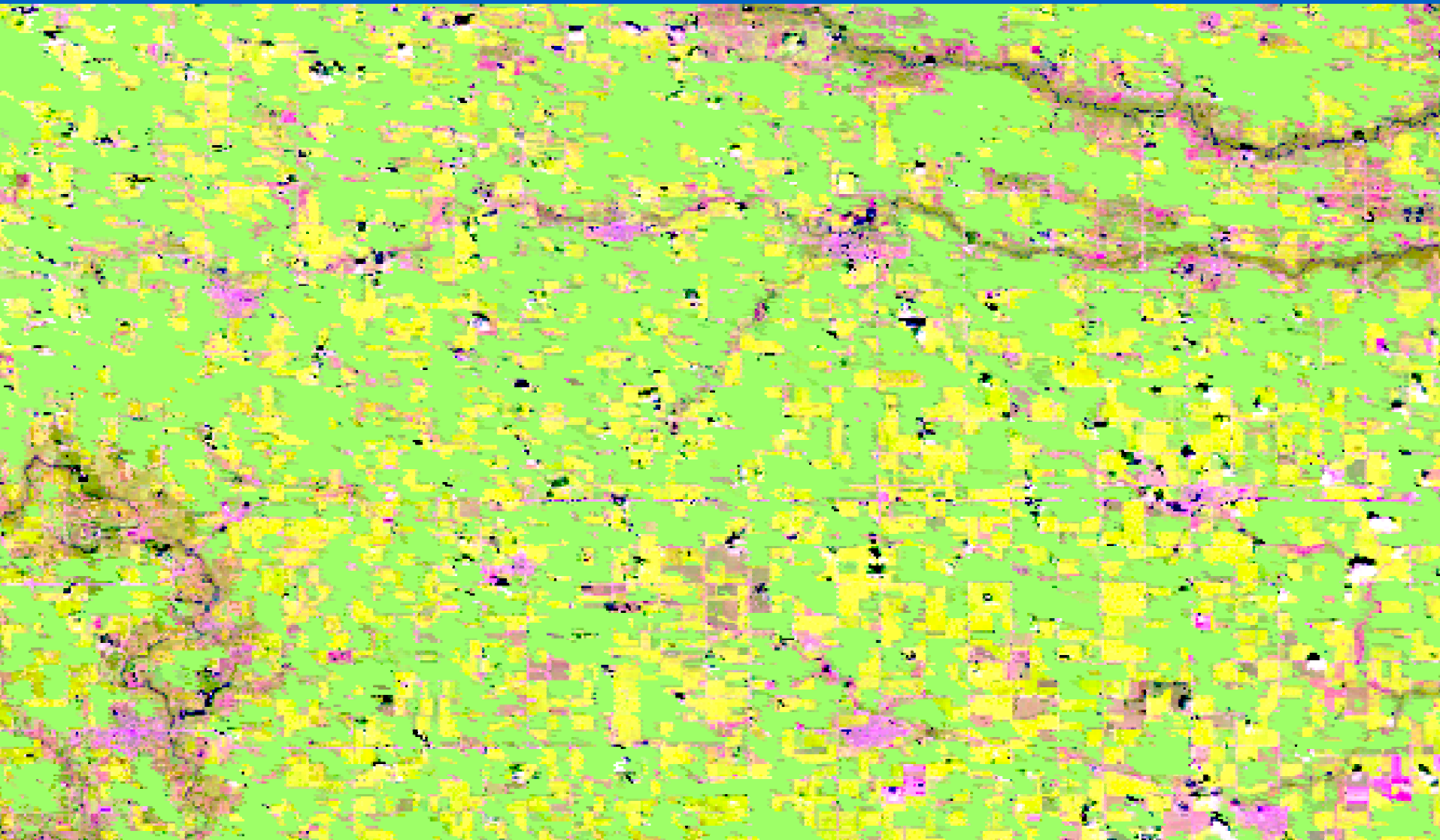# MODIS Corn

MODIS Corn & Soybeans

MODIS Corn & Soybeans

Iowa-- AWiFS

Corn= green   Soybean= yellow

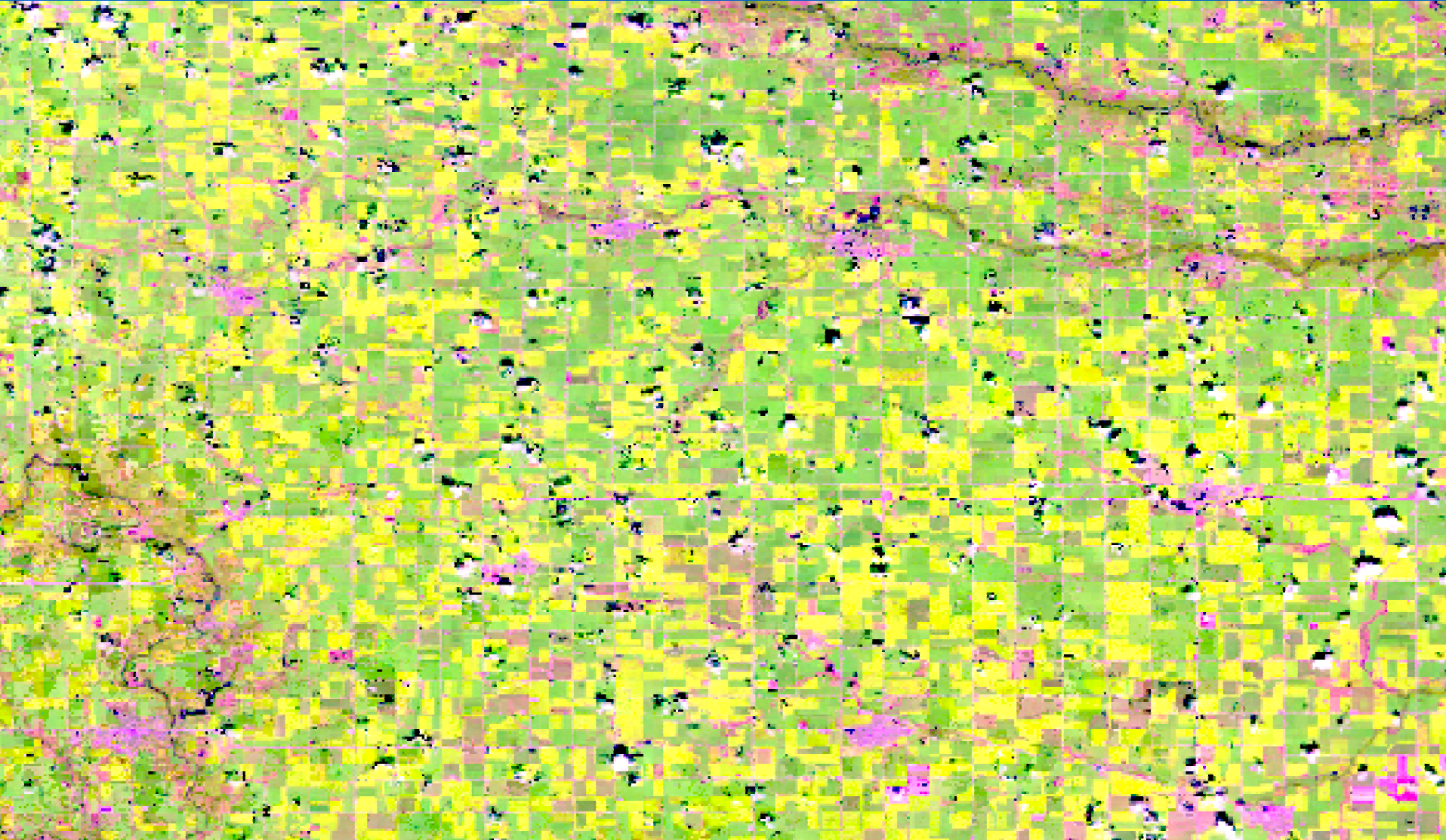# Iowa– MODIS Corn

Corn= green   Soybean= yellow

Iowa-- AWiFS

Corn= green   Soybean= yellow

Iowa– MODIS Soybean
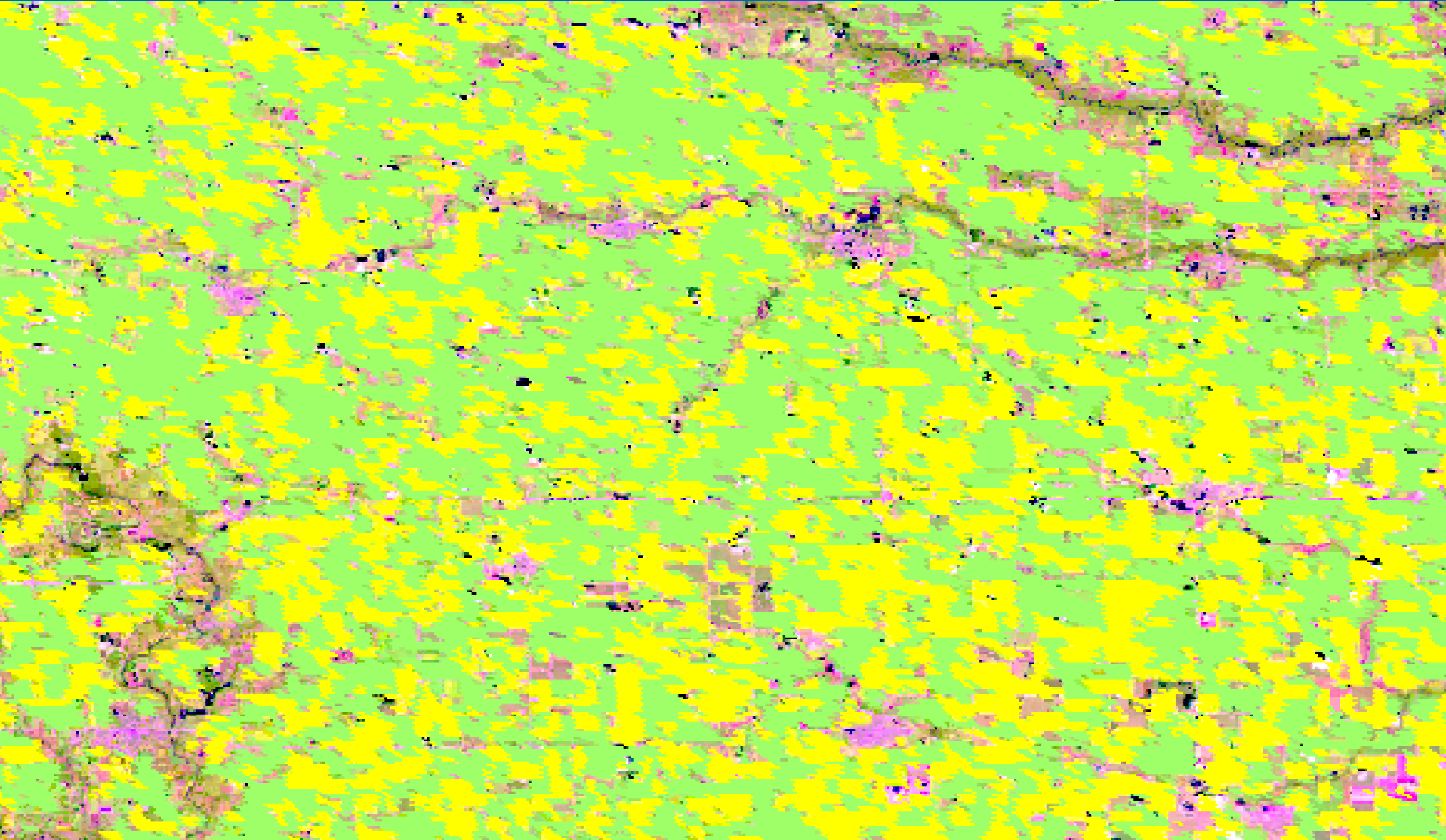

Corn= green   Soybean= yellow

Iowa-- AWiFS
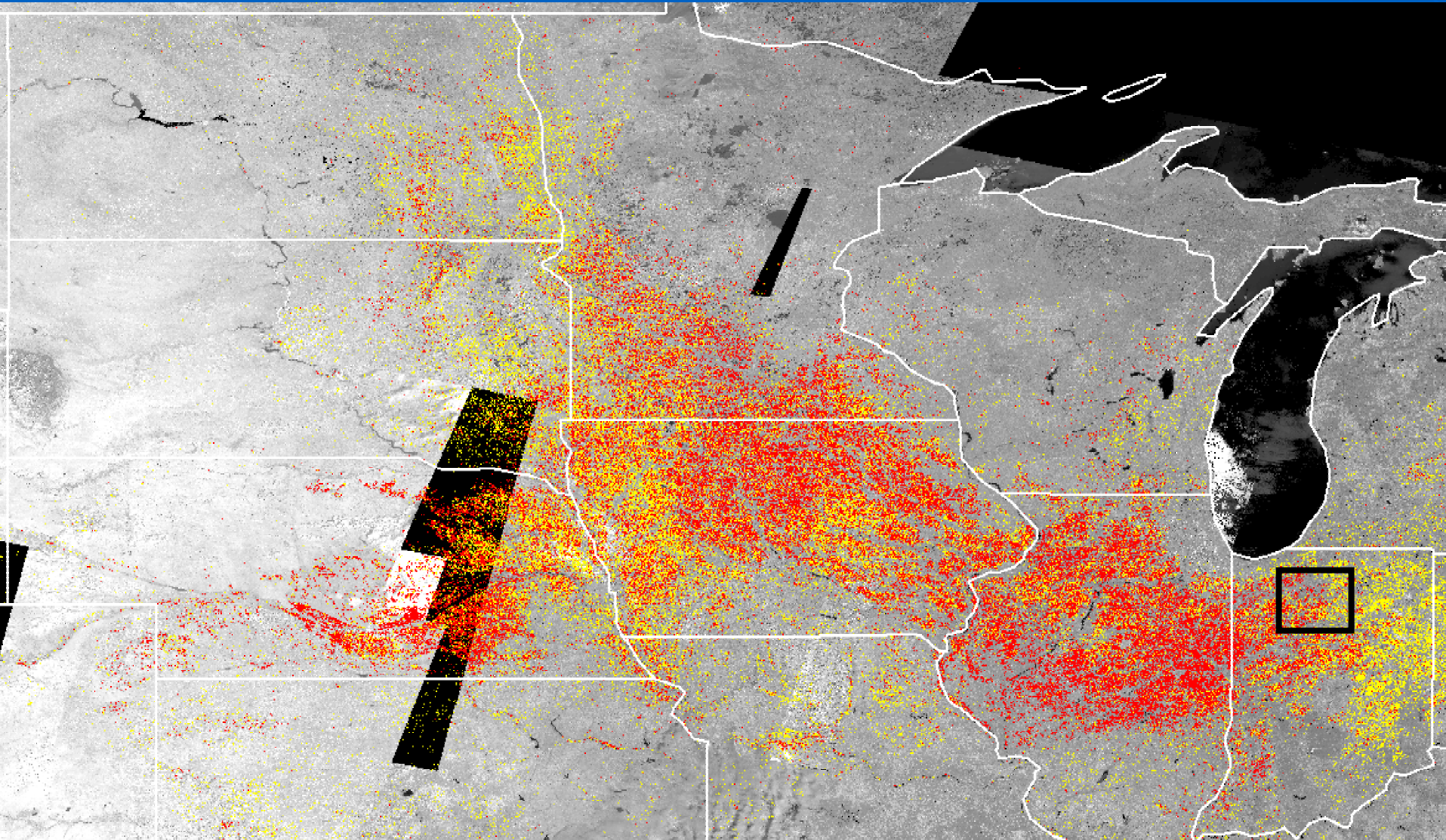
Corn= green   Soybean= yellow
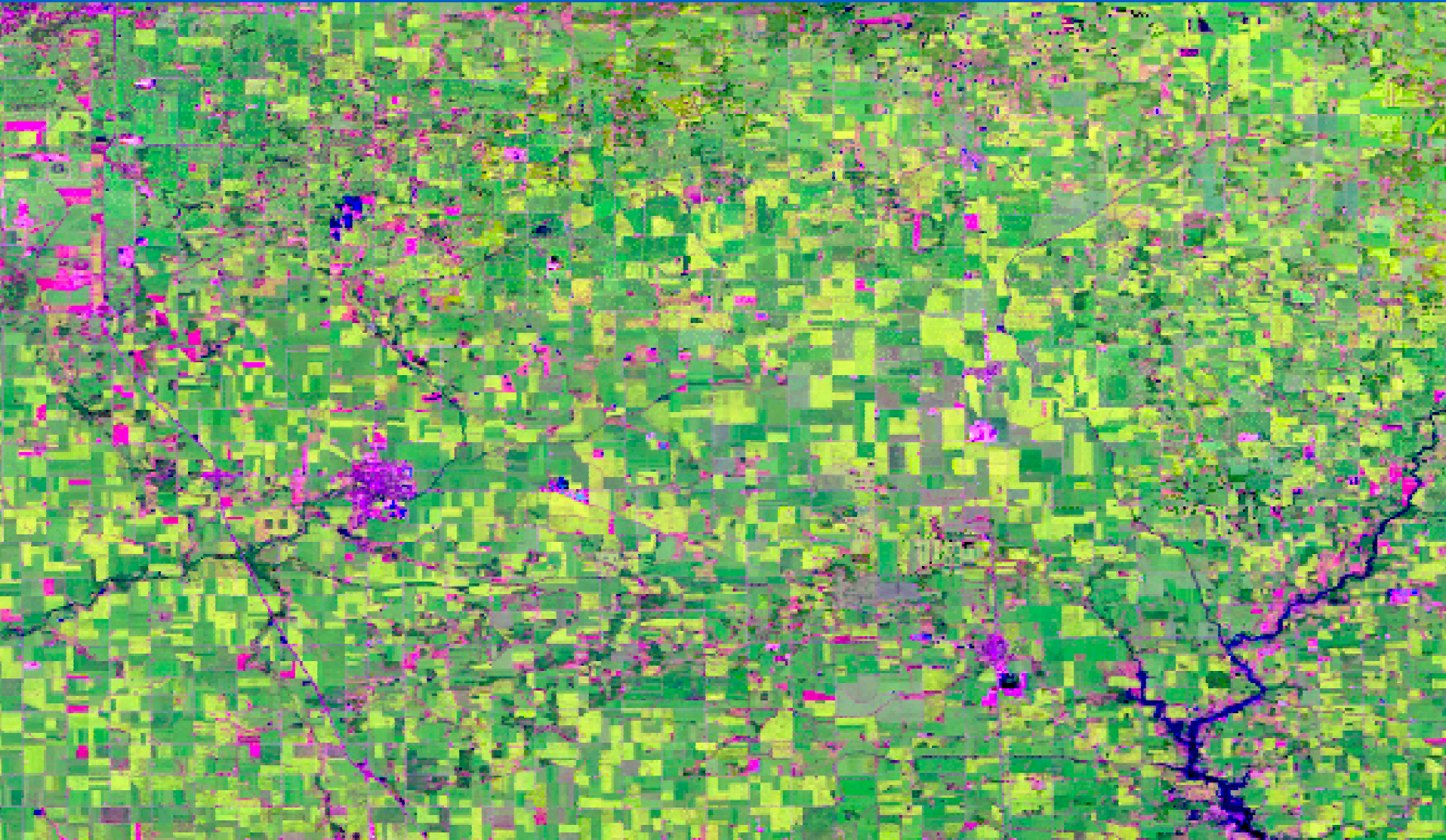
Iowa– MODIS Corn & Soybean

Corn= green   Soybean= yellow

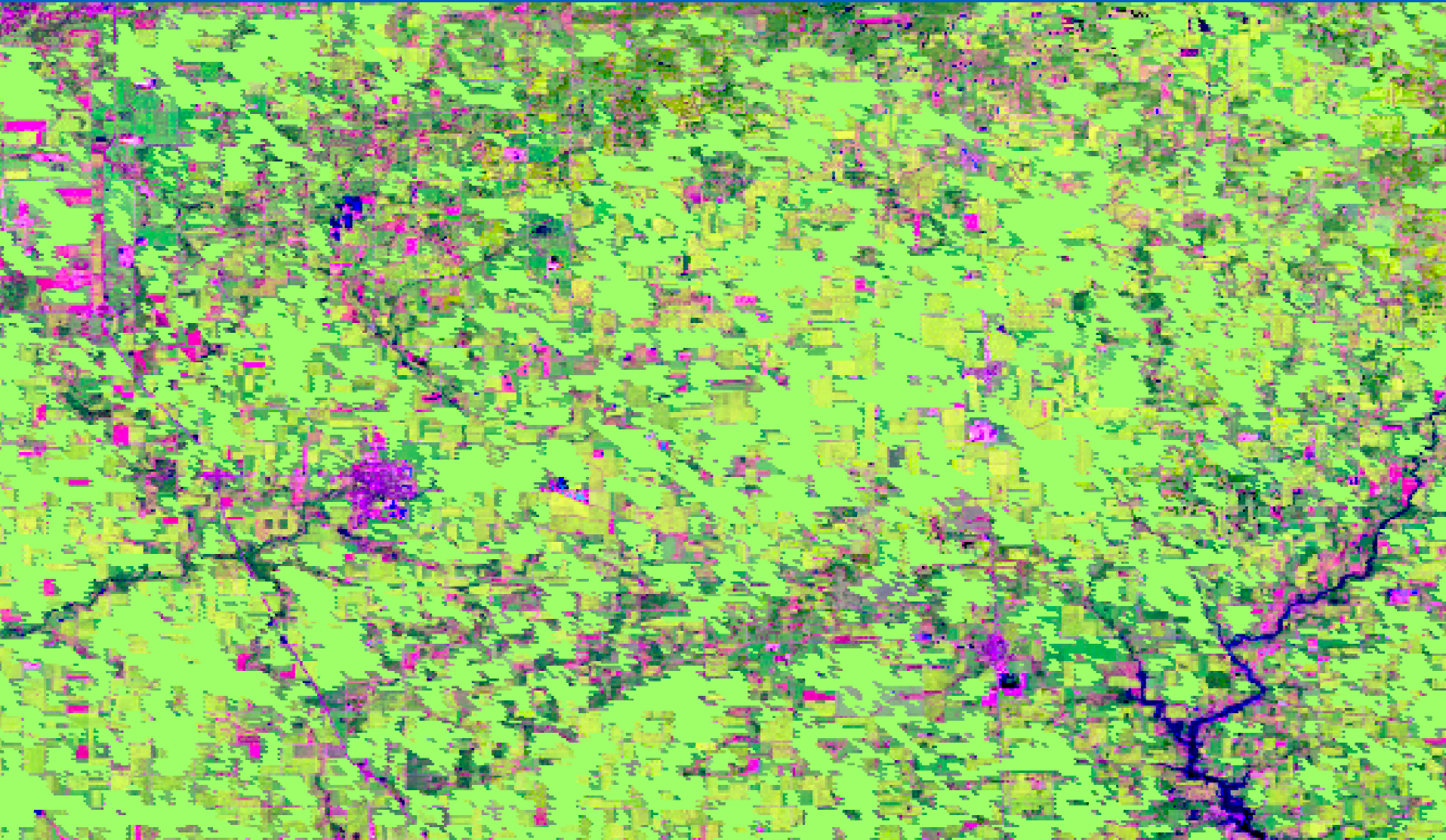MODIS Corn & Soybeans

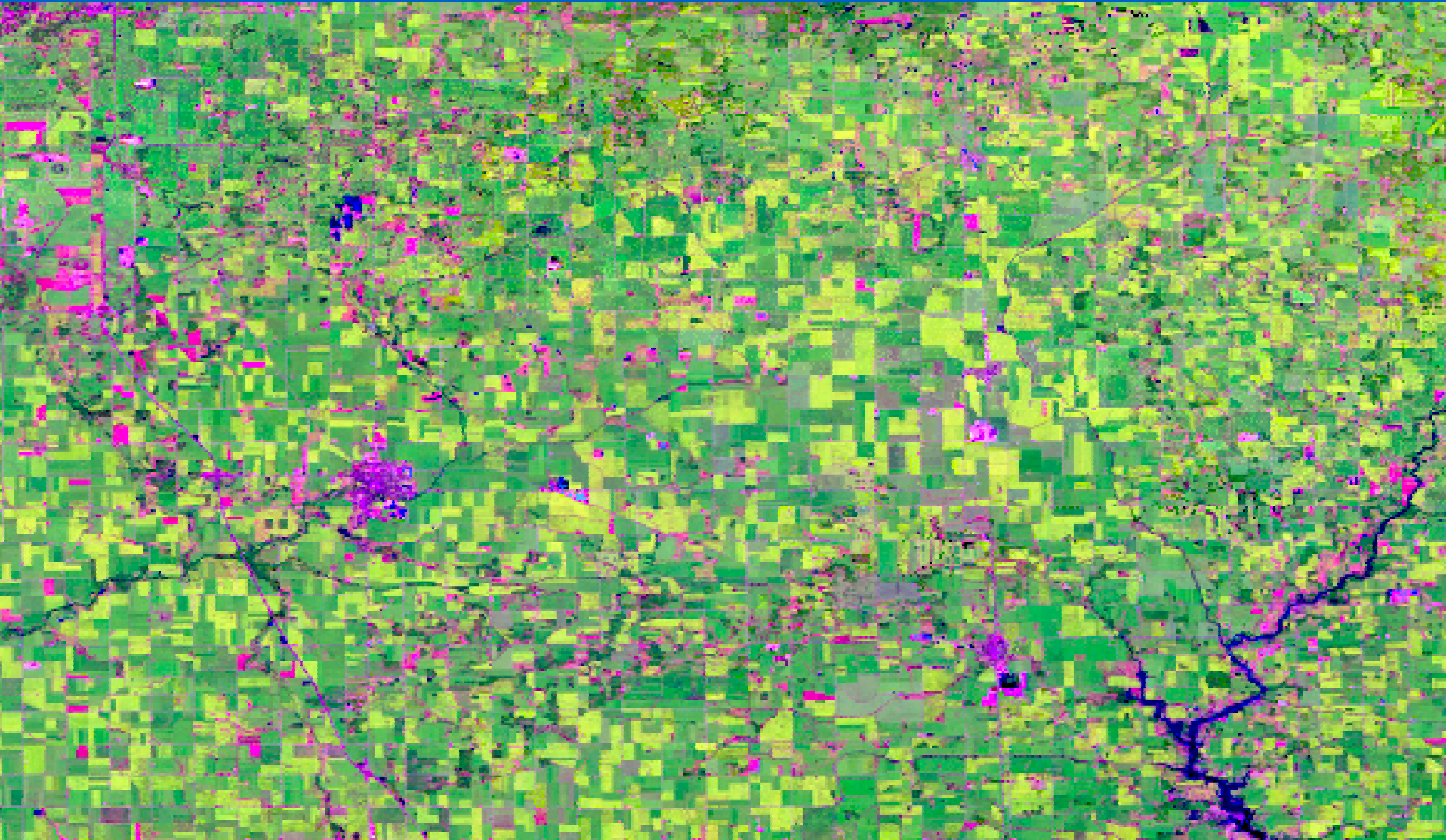# Indiana-- AWiFS

Corn= green   Soybean= yellow

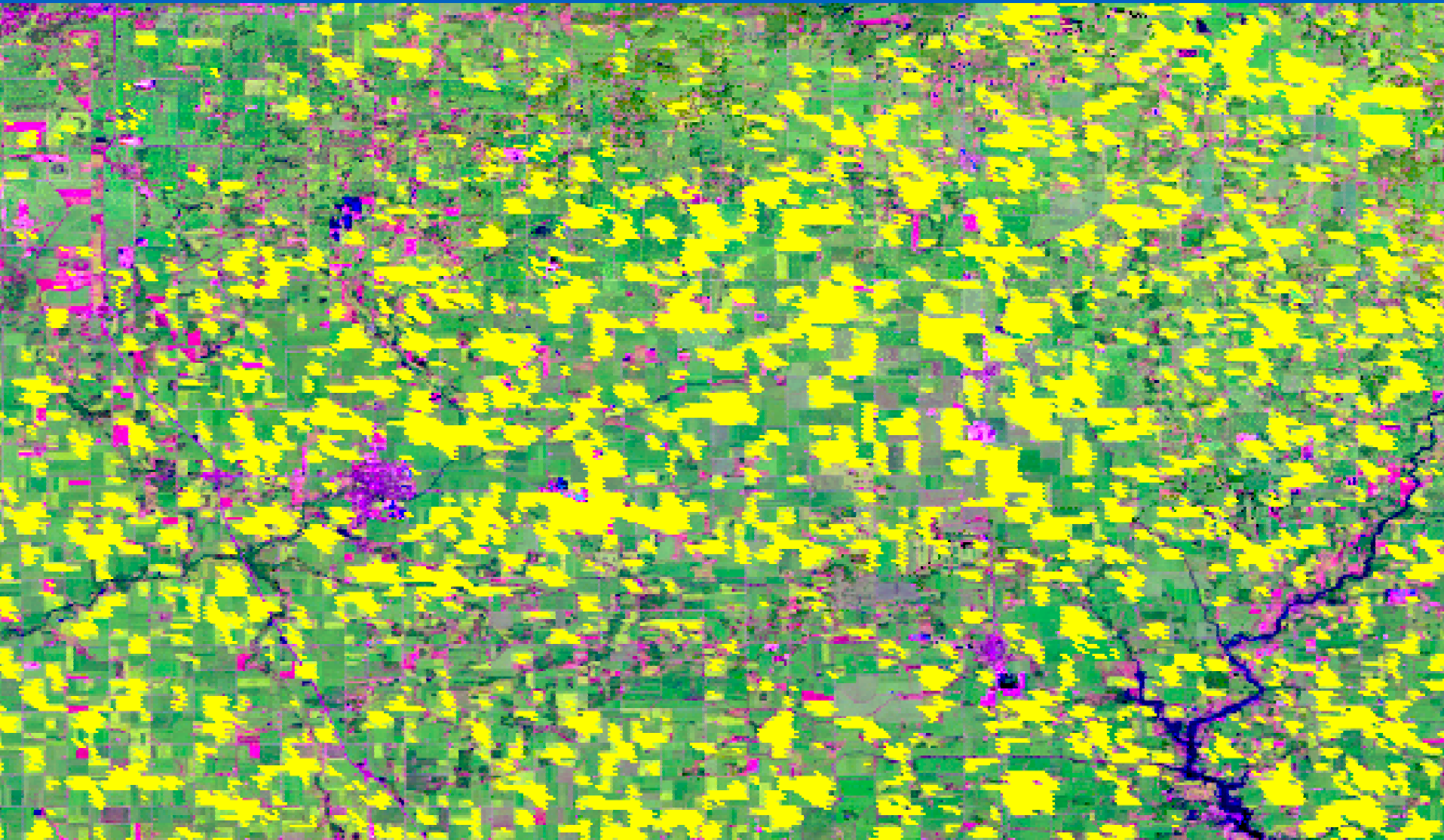# Indiana– MODIS Corn

Corn= green   Soybean= yellow

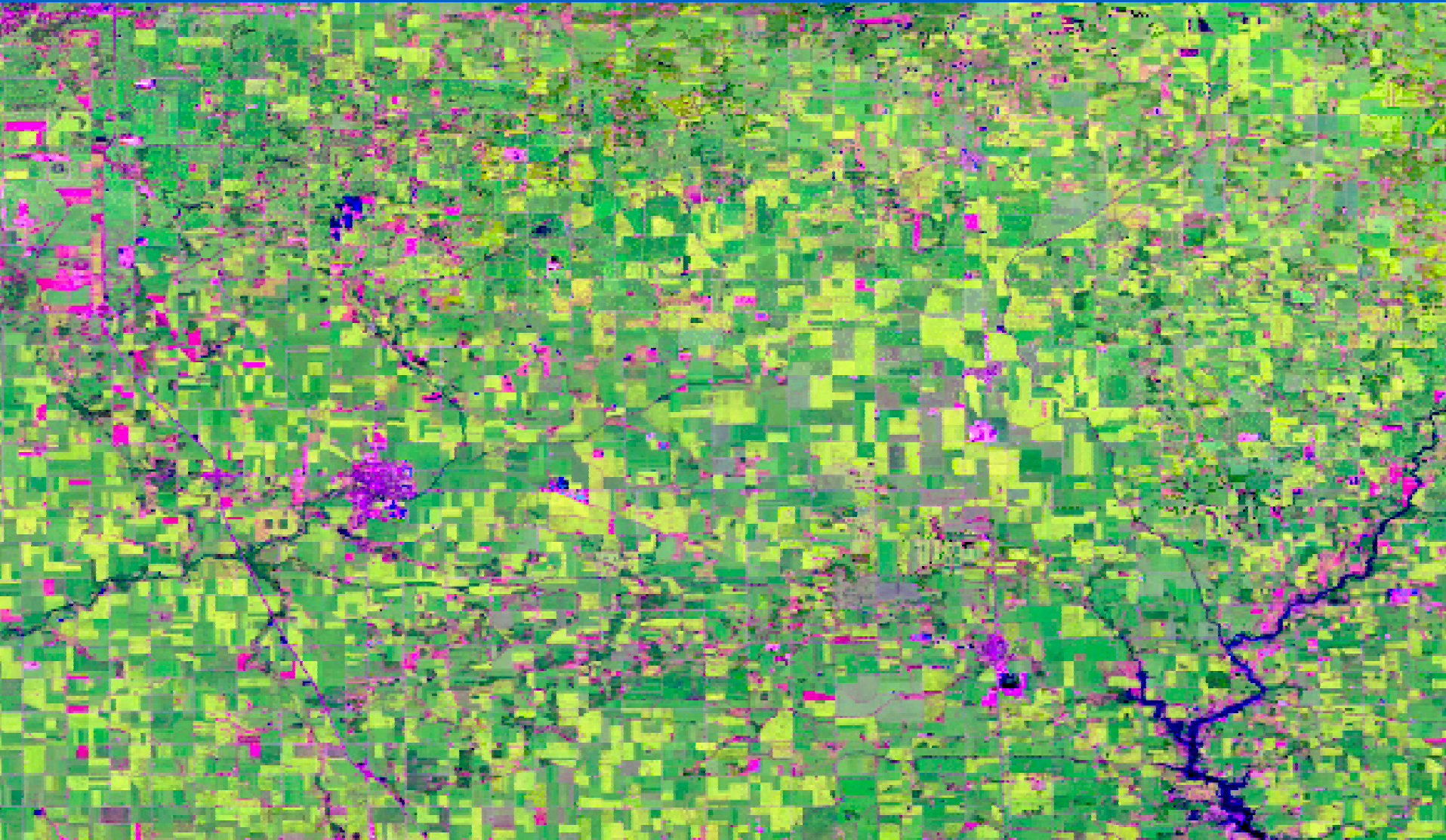# Indiana-- AWiFS

Corn= green   Soybean= yellow

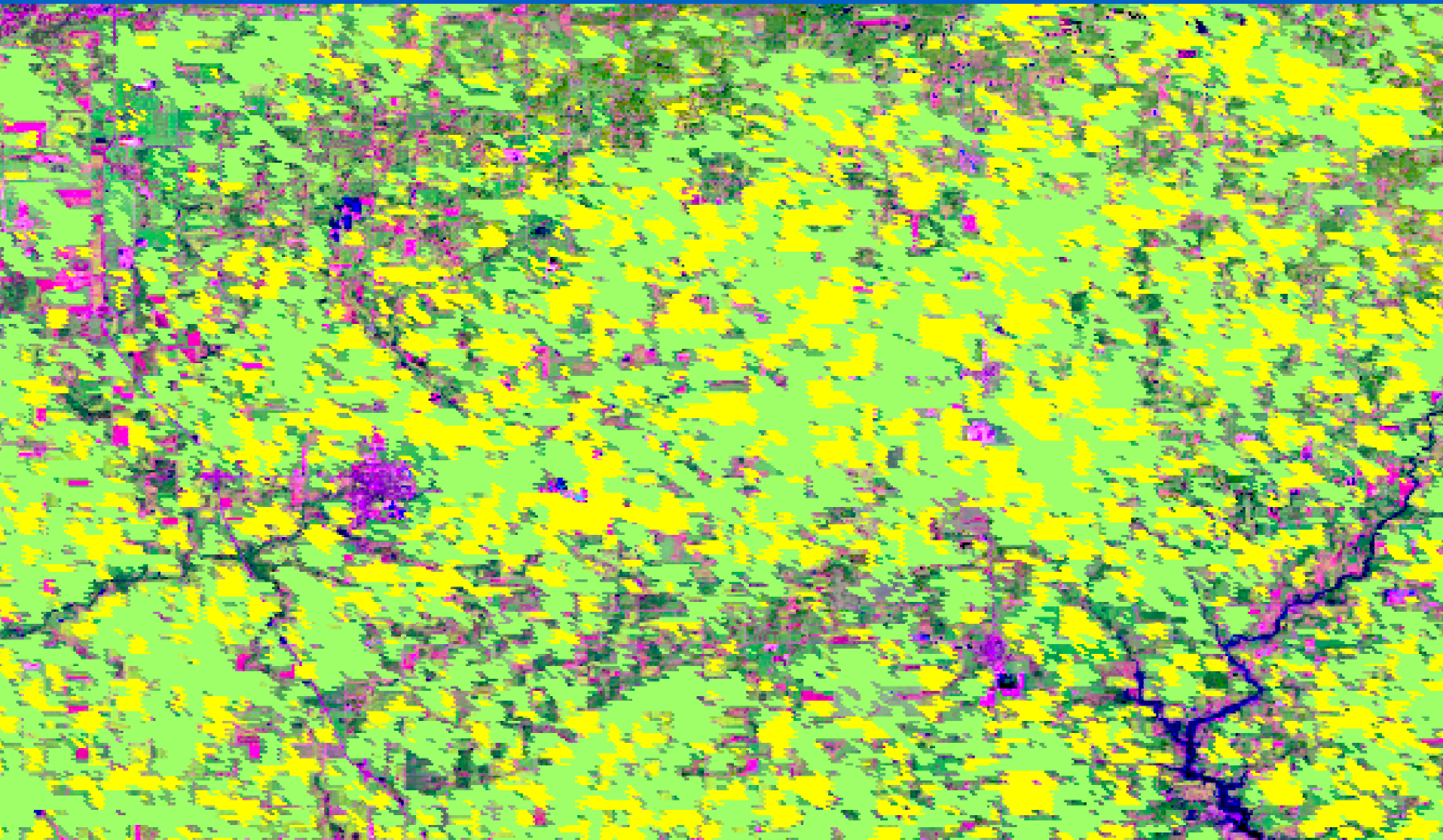# Indiana– MODIS Soybean

Corn= green   Soybean= yellow

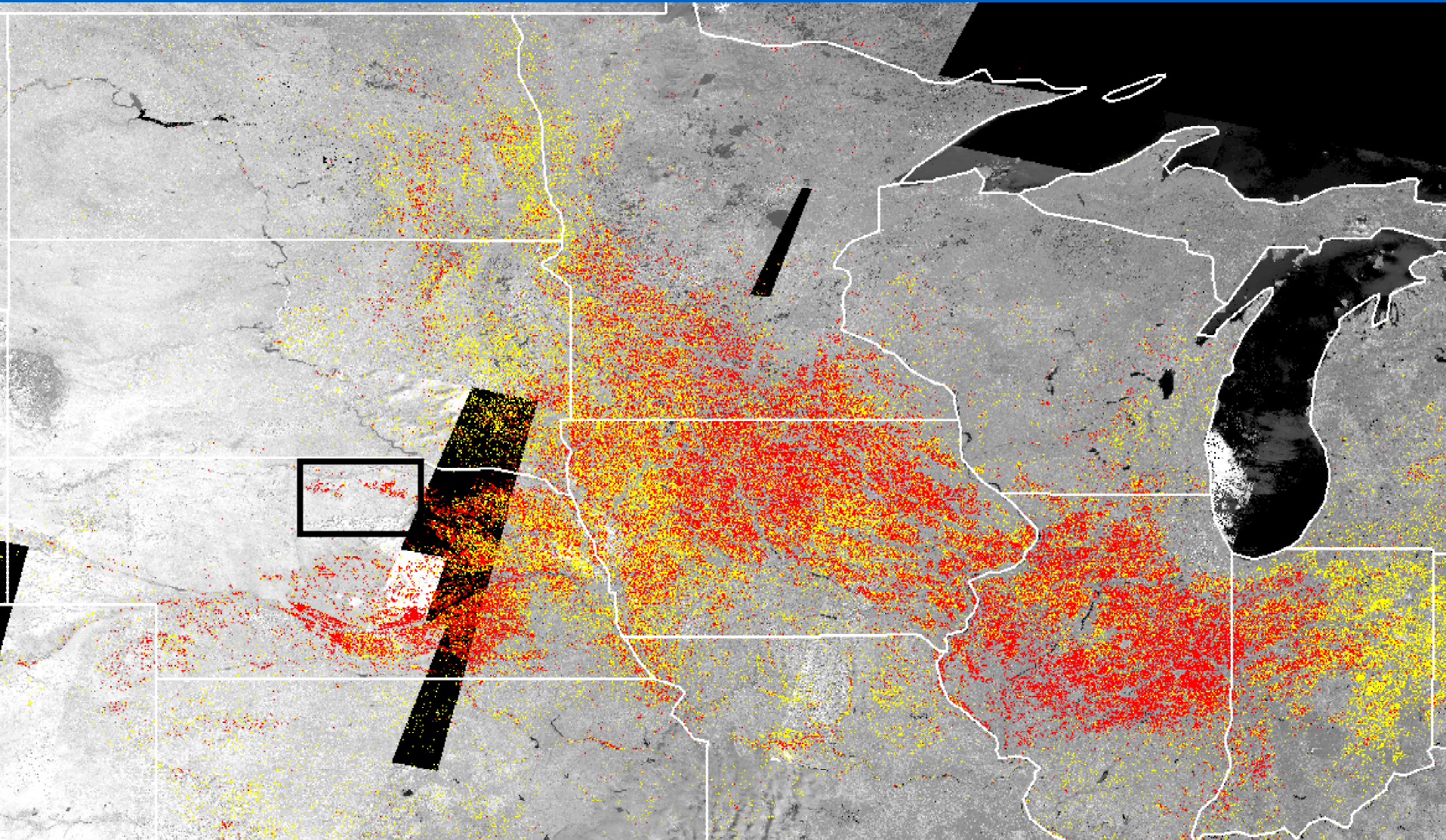# Indiana-- AWiFS

Corn= green   Soybean= yellow

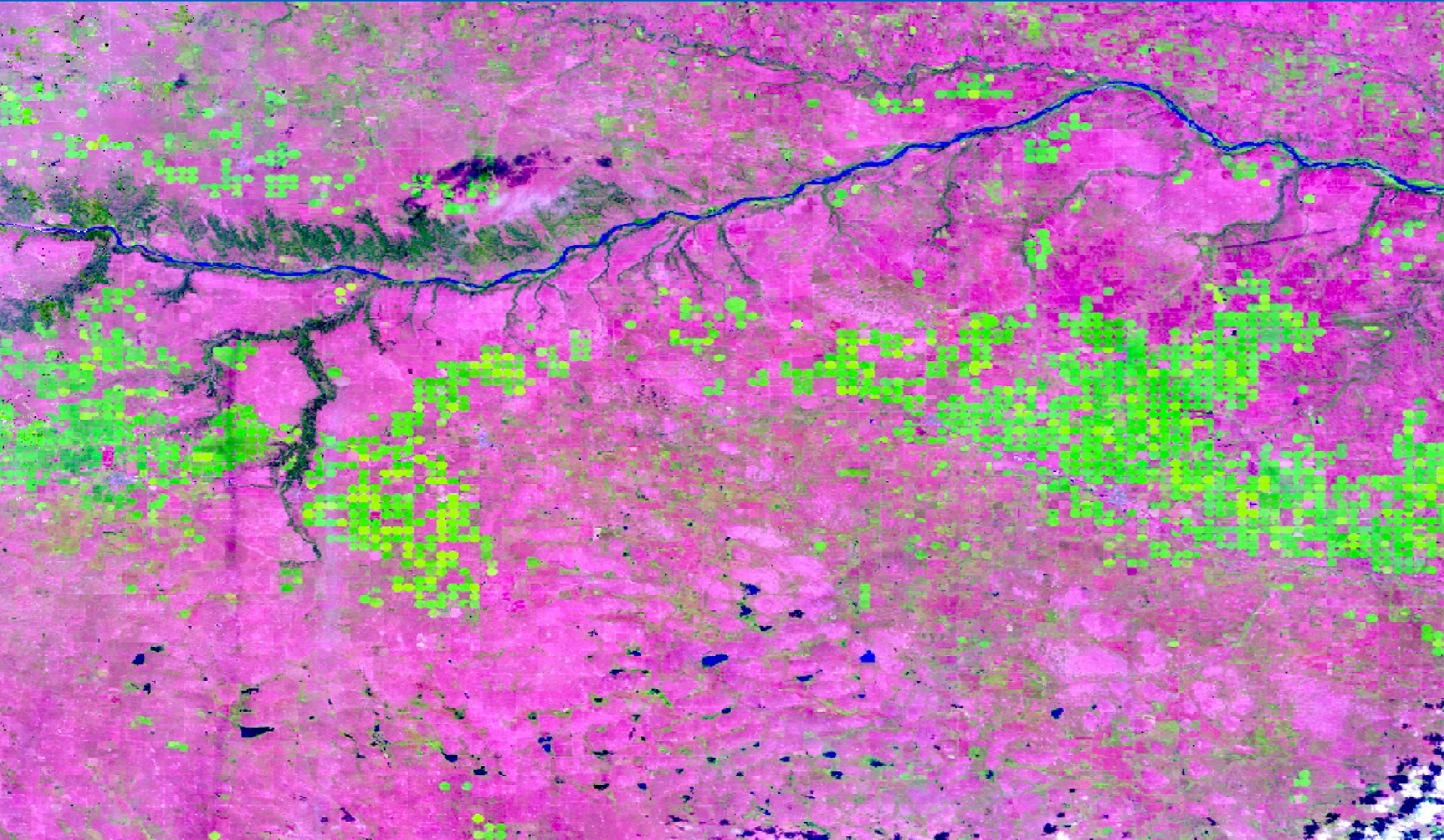# Indiana– MODIS Corn & Soybean

Corn= green   Soybean= yellow

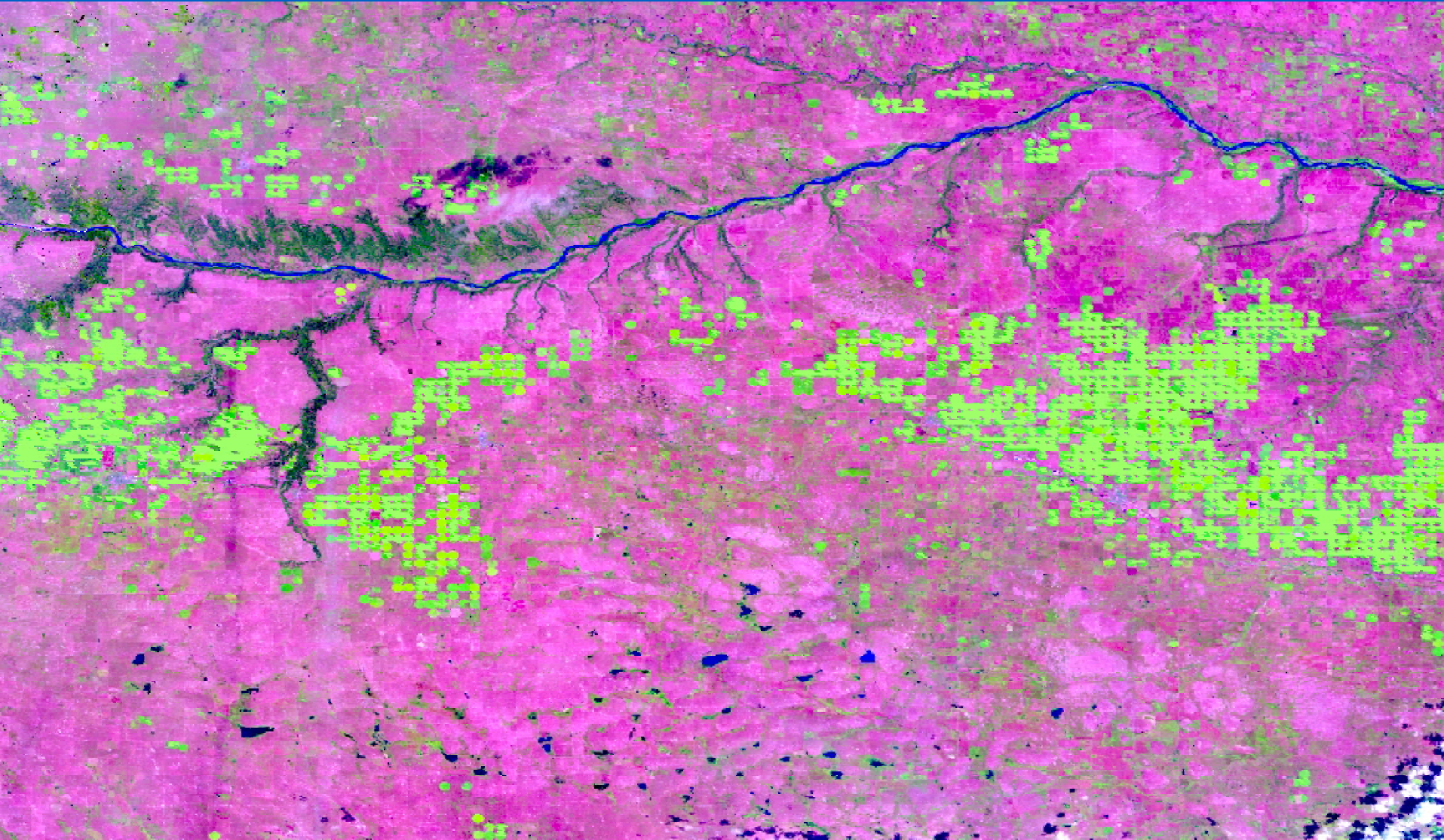MODIS Corn & Soybeans

Nebraska-- AWiFS

Corn= green   Soybean= yellow

Nebraska– MODIS Corn

Corn= green   Soybean= yellow
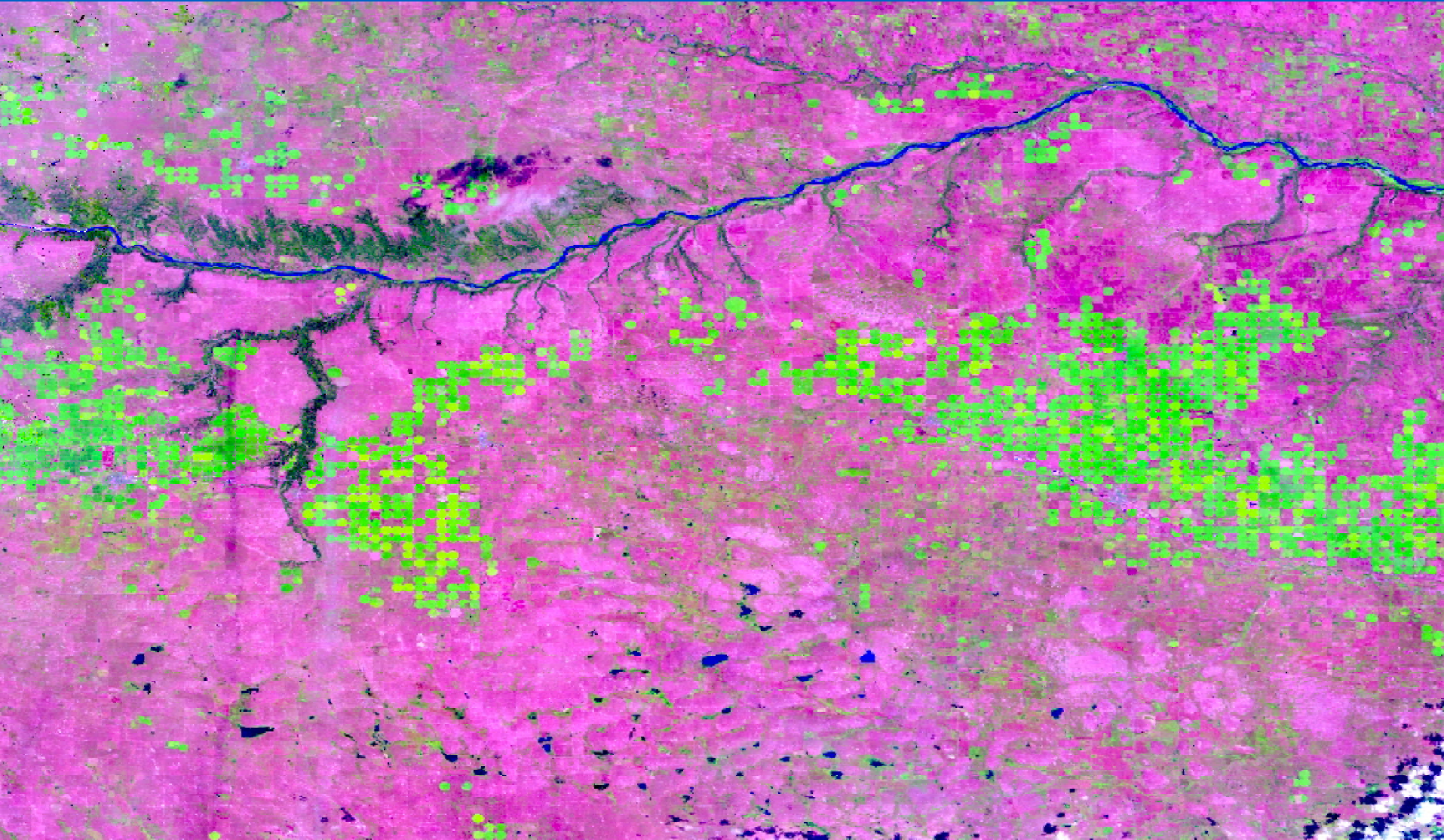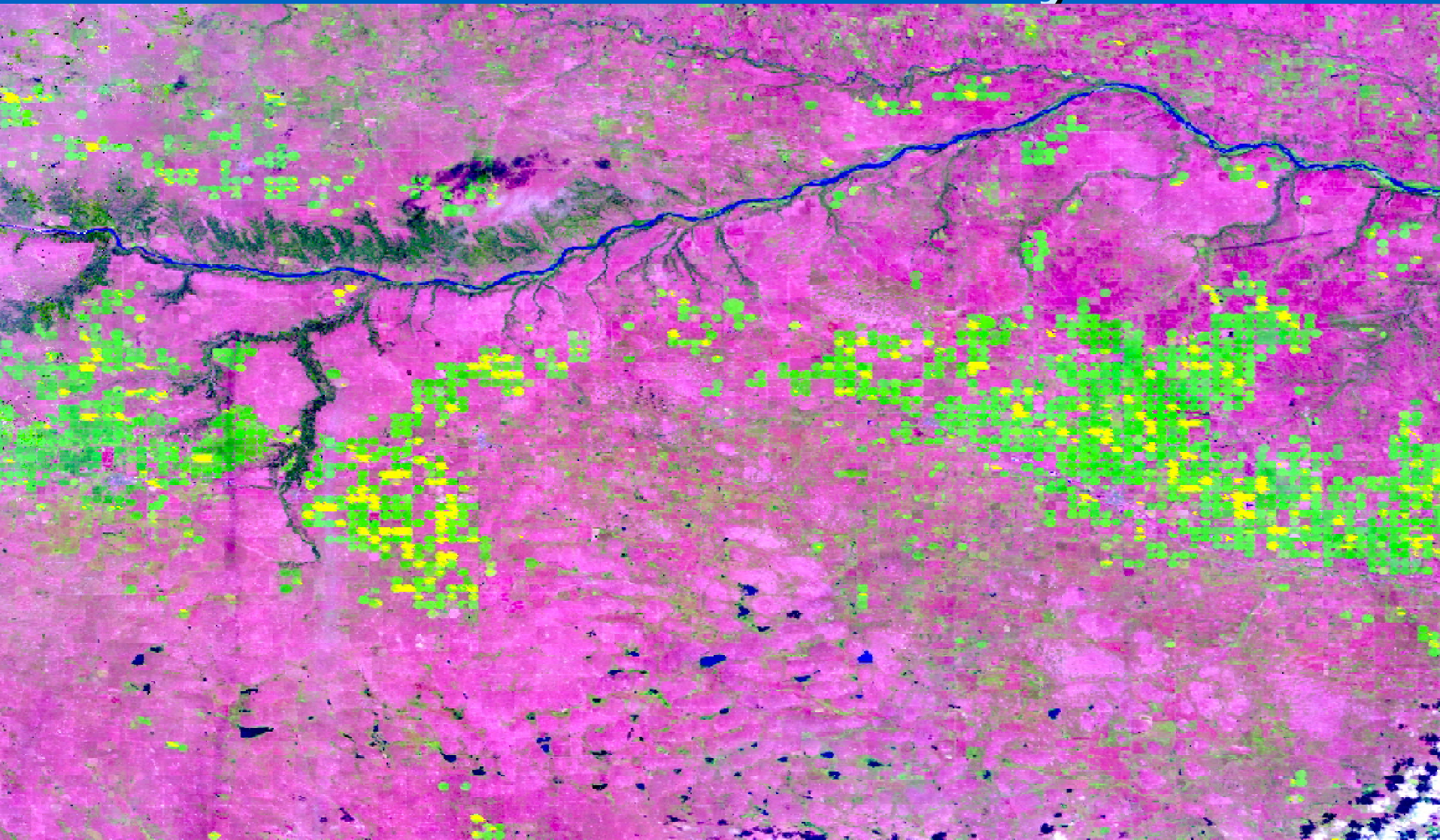
Nebraska-- AWiFS
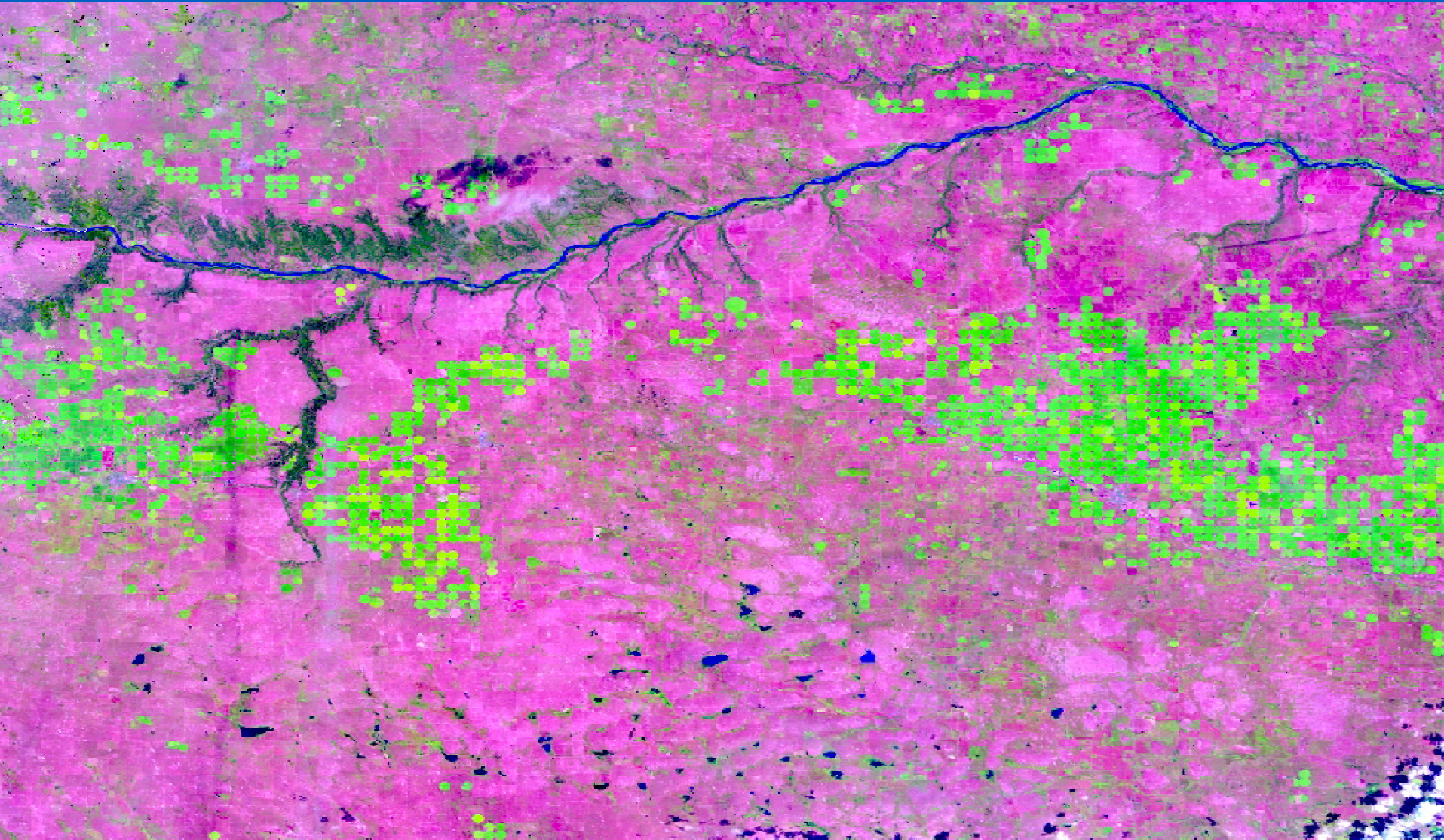

Corn= green   Soybean= yellow

Nebraska– MODIS Soybean

Corn= green   Soybean= yellow

Nebraska-- AWiFS

Corn= green   Soybean= yellow

Nebraska– MODIS Corn & Soybean
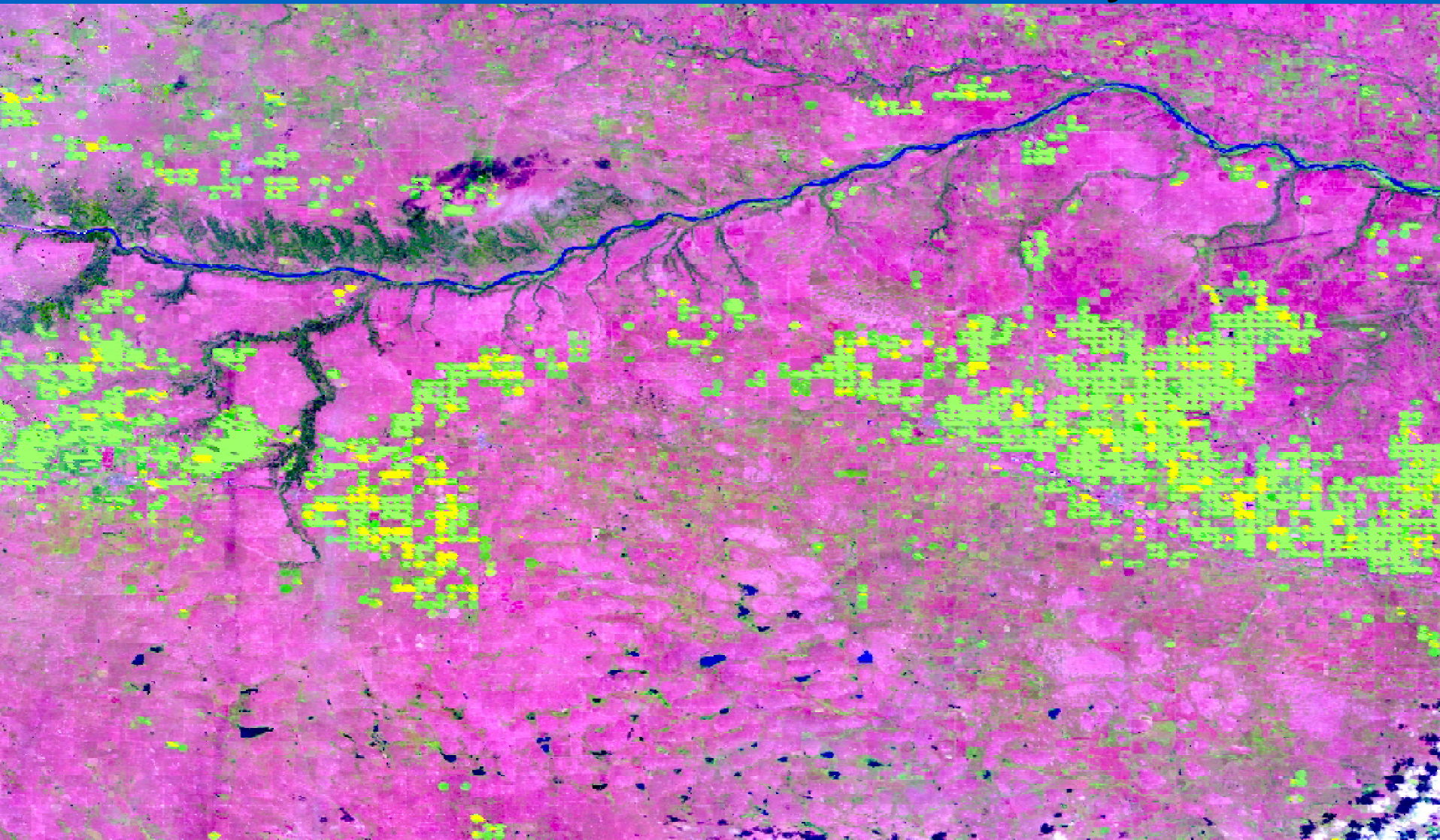
Corn= green   Soybean= yellow

Class Separability

AWiFS Spectral Plot

Median normalized AWiFS DN values for all pixels falling under MODIS corn, soybean or forest masks

Class Separability

Scatterplot showing separability of corn (red), soybeans (green) and all other cover types (blue) using AWiFS bands 4 and 5 across the entire region

Color intensity indicates point density
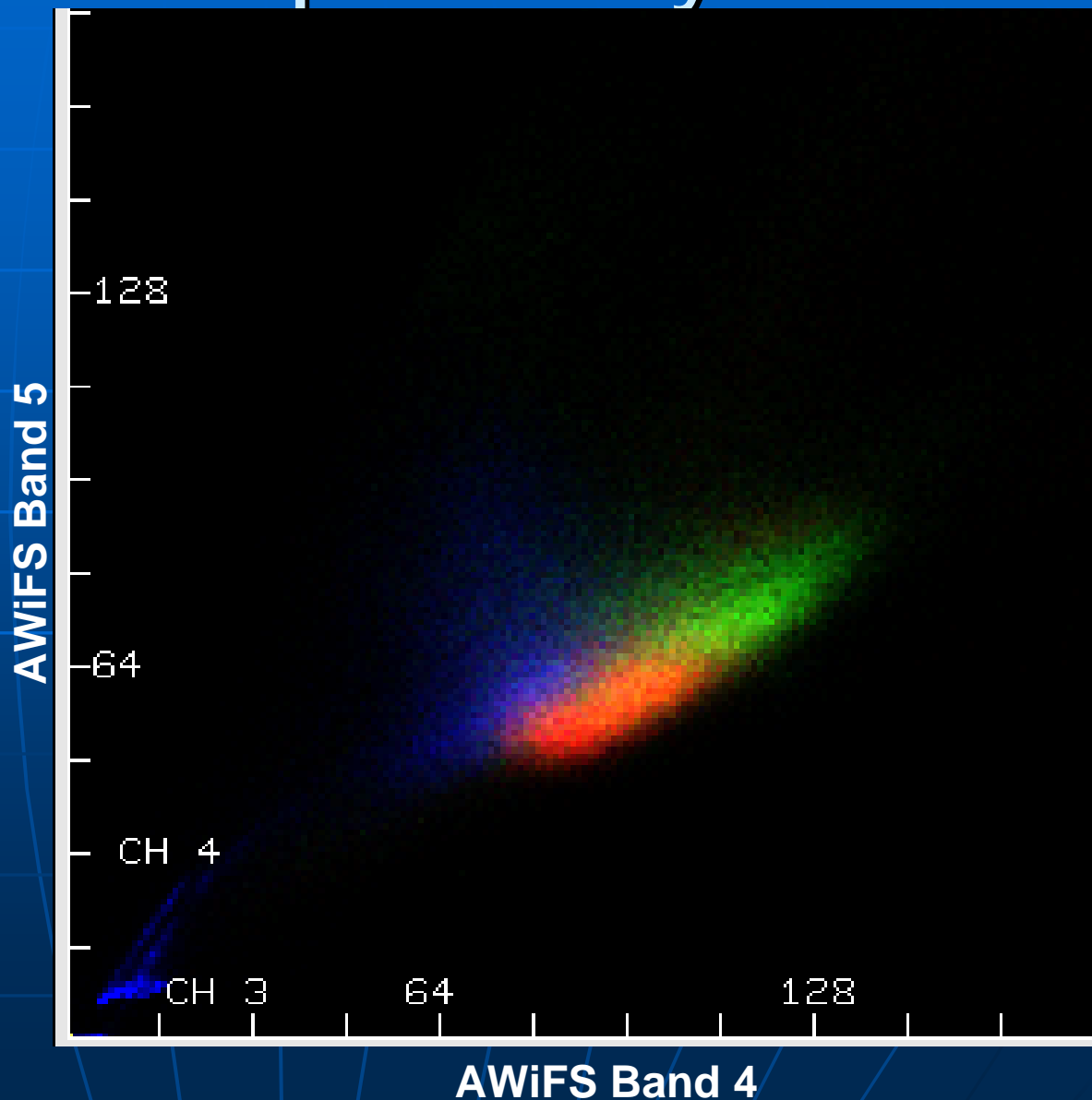
Class Separability

Scatterplot showing separability of corn (red), soybeans (green) and all other cover types (blue) using AWiFS bands 4 and 5 across the entire region
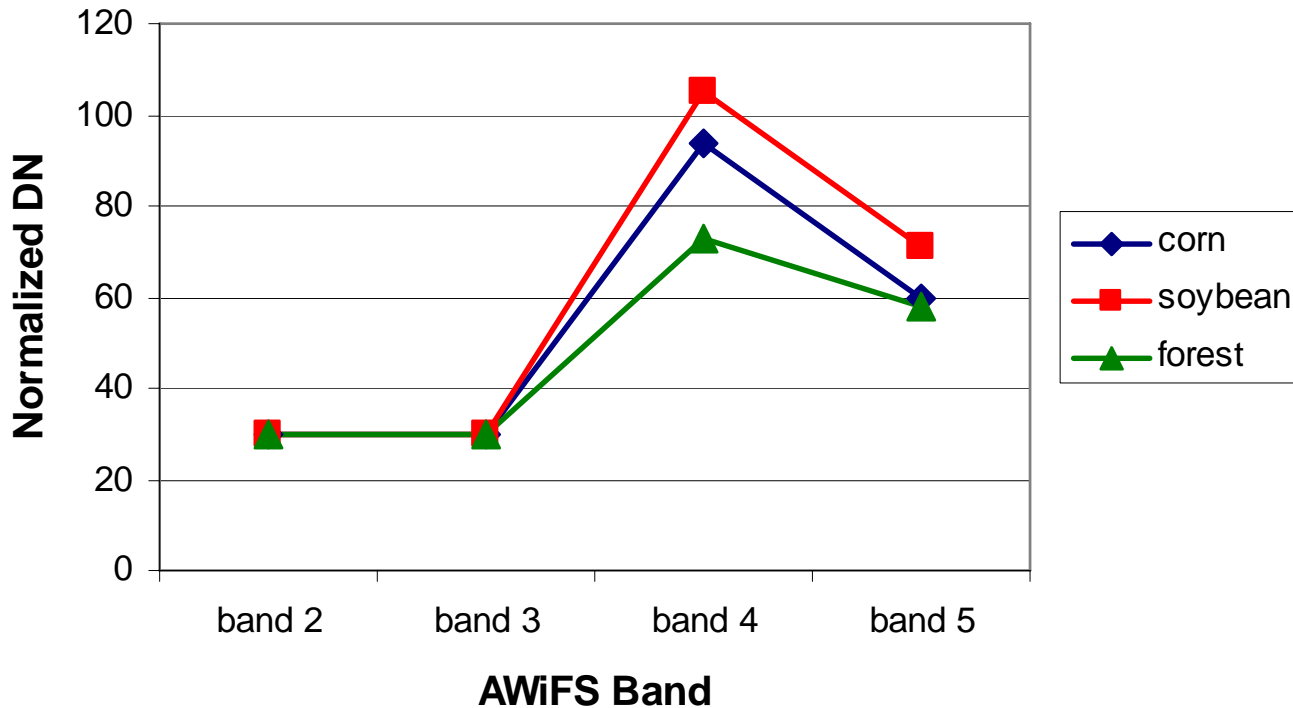
Color intensity indicates point density

Conclusions

- Previous work using Landsat in the Congo demonstrates the potential for using MODIS products to normalize higher-resolution data across large areas
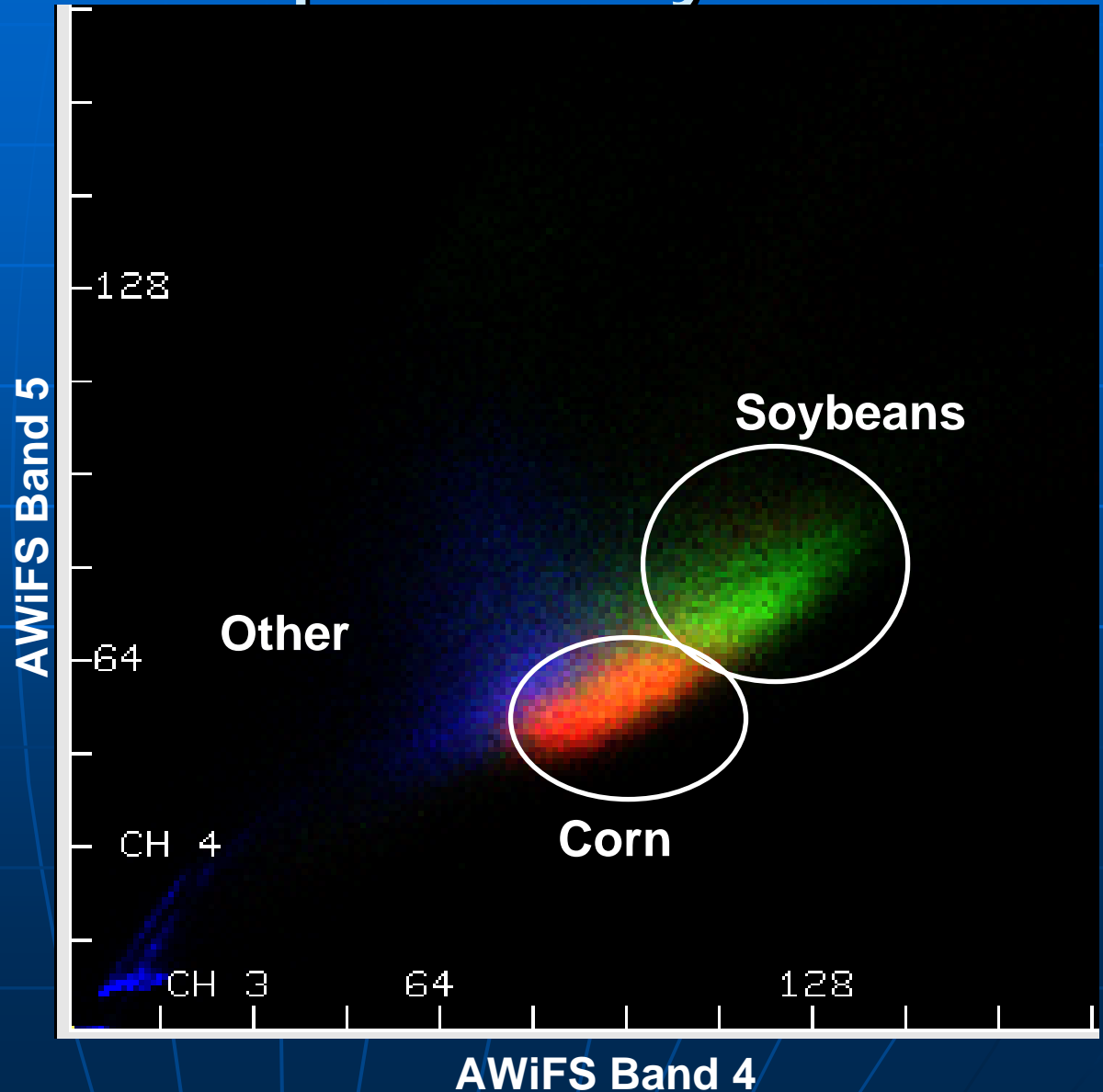
- These same techniques can now be applied to AWiFS data for the purposes of crop mapping

- Preliminary MODIS 250m crop type results show the ability to spectrally discriminate corn and soybeans at regional scale using AWiFS

Next Steps

- Finalize 250m MODIS crop type maps

- Use these products to complete a standard AWiFS normalization and compositing processing chain

- Use MODIS products as training to build crop type models based on regional AWiFS composites
  - Result of this would be standardized large area crop maps at AWiFS resolution

- Expand both MODIS and AWiFS processing to cover other crops (ex: wheat) and regions

Thank you!

Questions?