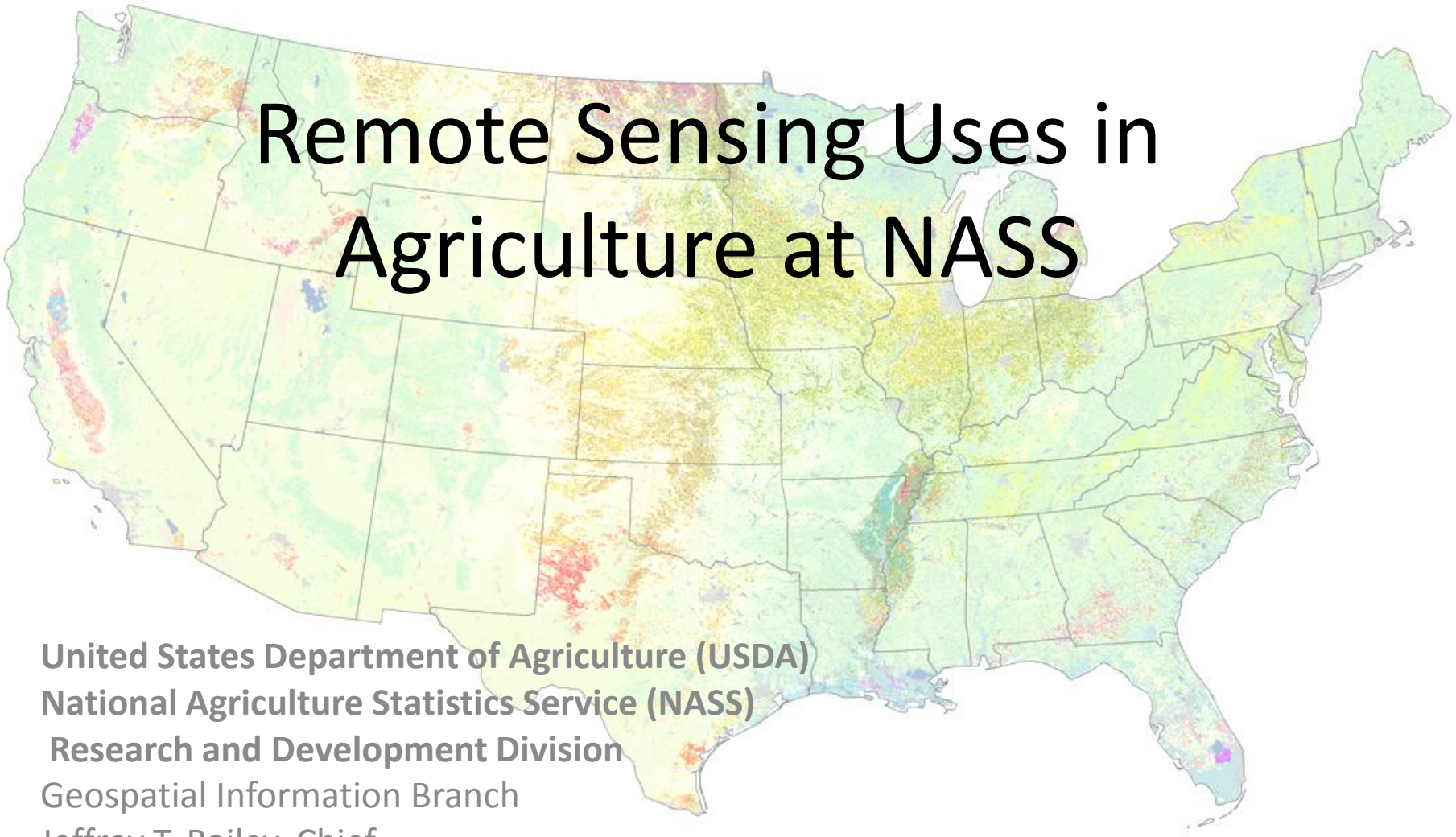
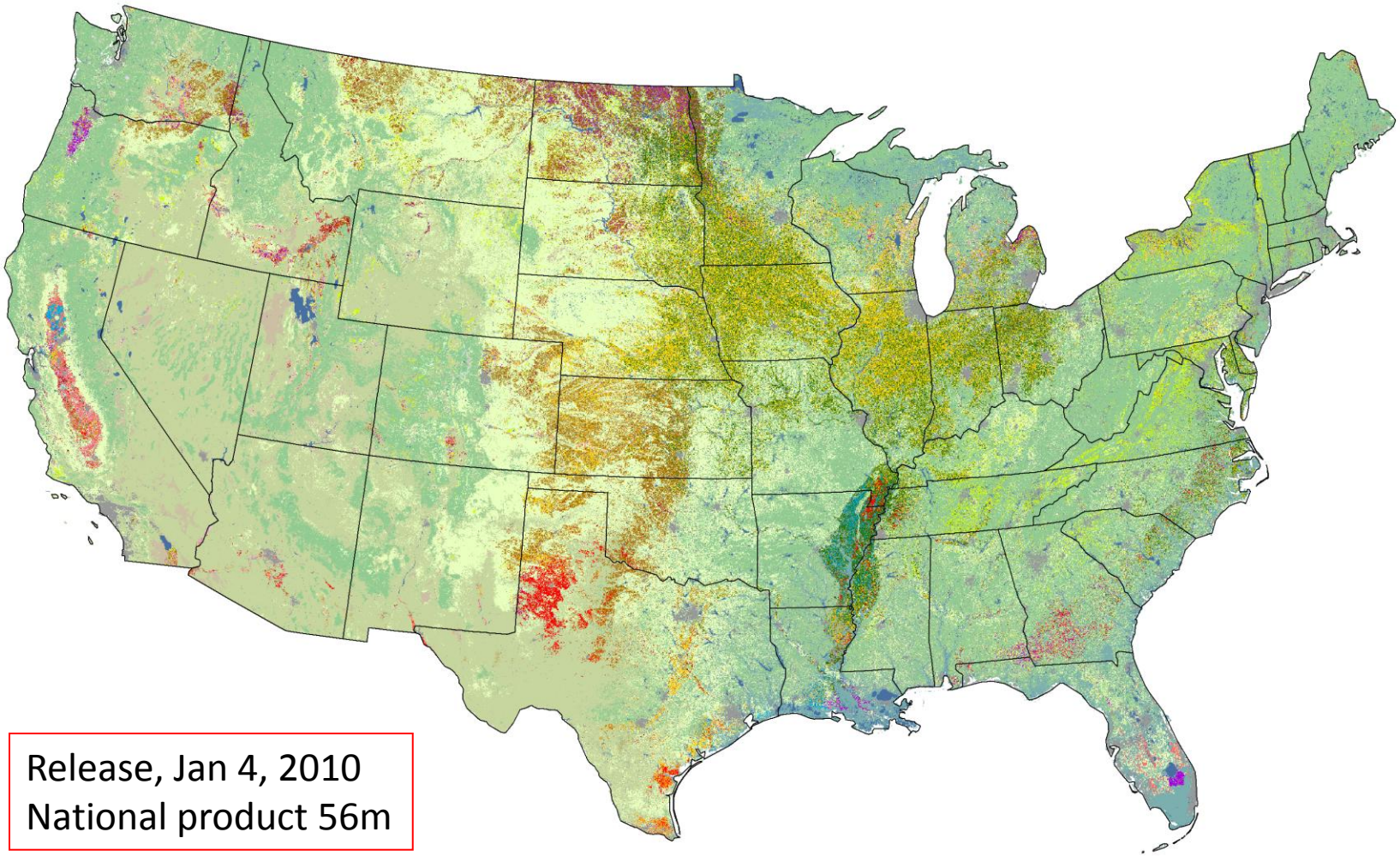


Remote Sensing Uses in Agriculture at NASS

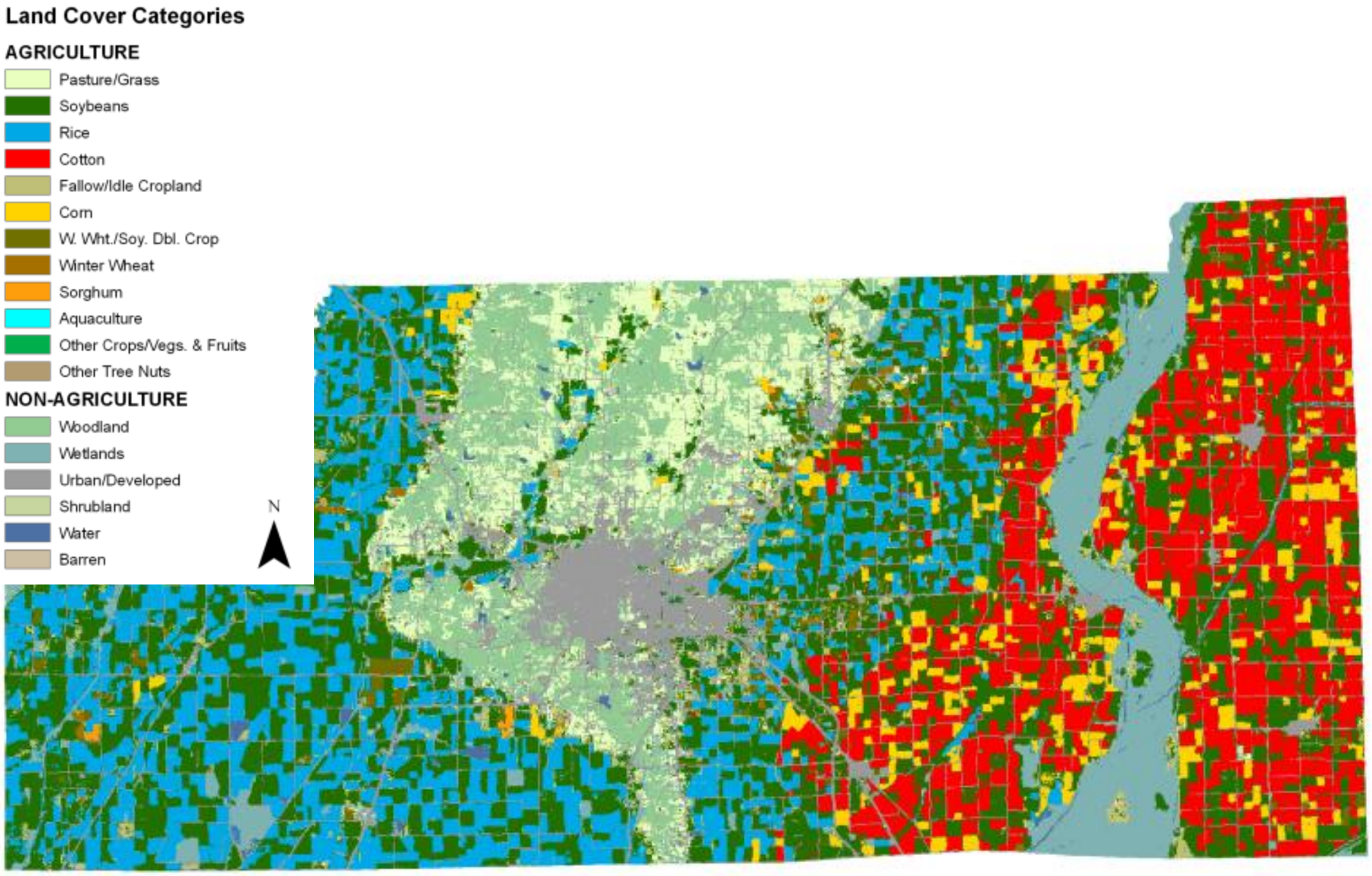
United States Department of Agriculture (USDA)
National Agriculture Statistics Service (NASS)
Research and Development Division
Geospatial Information Branch
Jeffrey T. Bailey, Chief
October 13, 2010

2009 Cropland Data Layers



Release, Jan 4, 2010
National product 56m

2009 Craighead County Arkansas

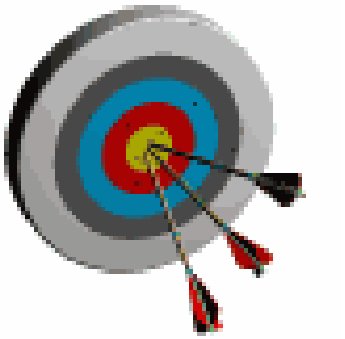


Cropland Data Layer (CDL) Objectives

- "Census by Satellite"
  Annually map the major program crops.

- Deliver remote sensing acreage estimates
  - In-season estimate for NASS Official Reports
  - Post season estimates for small area estimates

- Public domain crop specific crop classification
  - Hosted @ NRCS Geospatial Data Gateway or http://www.nass.usda.gov/research/Cropland/SARS1a.htm
  - Google "Cropland Data Layer"



Ground Truth – Land Cover

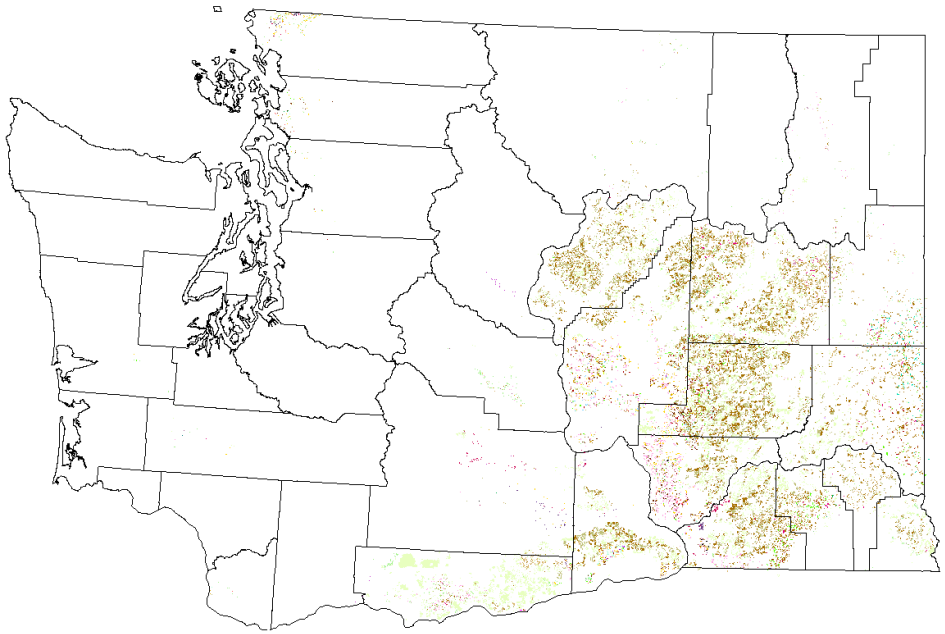
Agriculture Ground Truth

Provided by Farm Service Agency

- Identifies known fields and crops

Divide known fields into 2 sets

- ½ used for training software
- ½ used for validating results

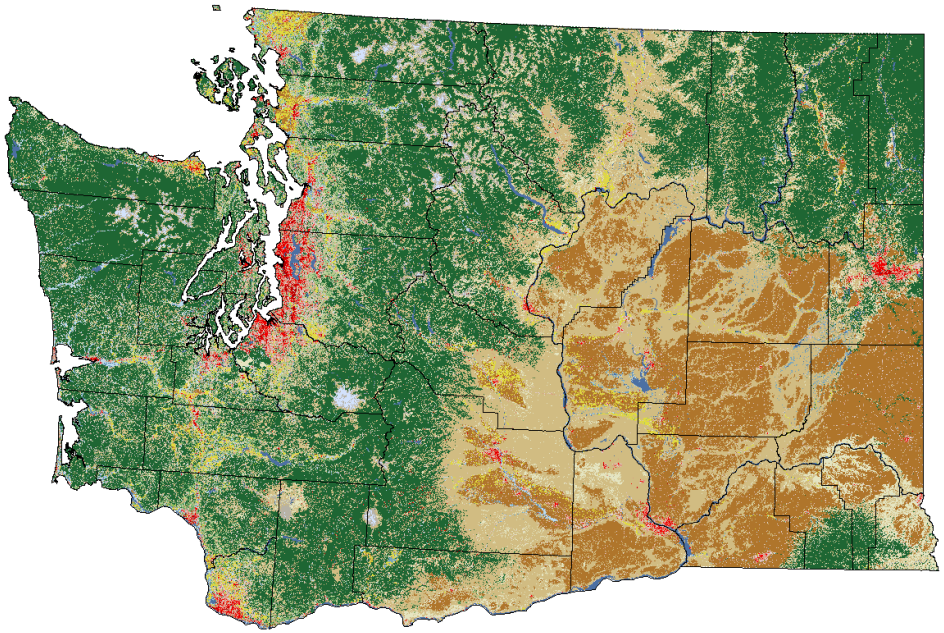


Non-Agriculture Ground Truth

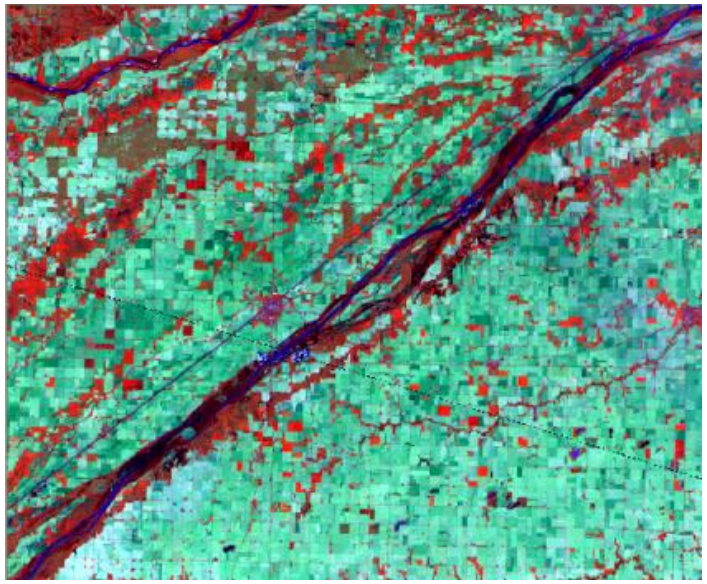
USGS National Land Cover Dataset

Identifies urban infrastructure and non-agriculture land cover

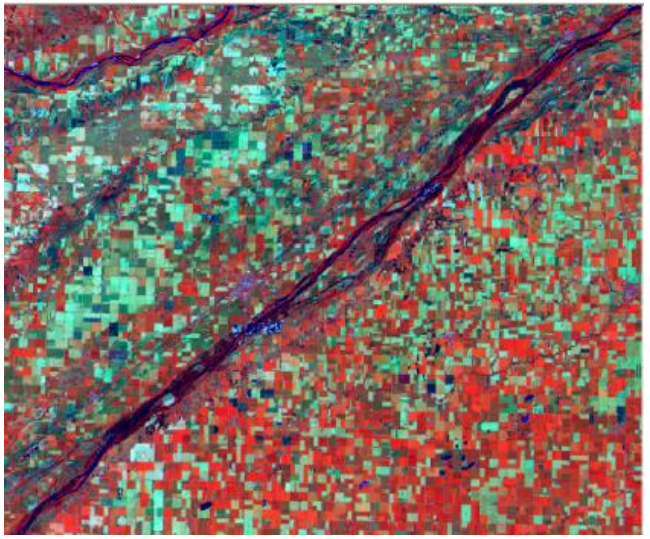
- Forest, grass, water, cities



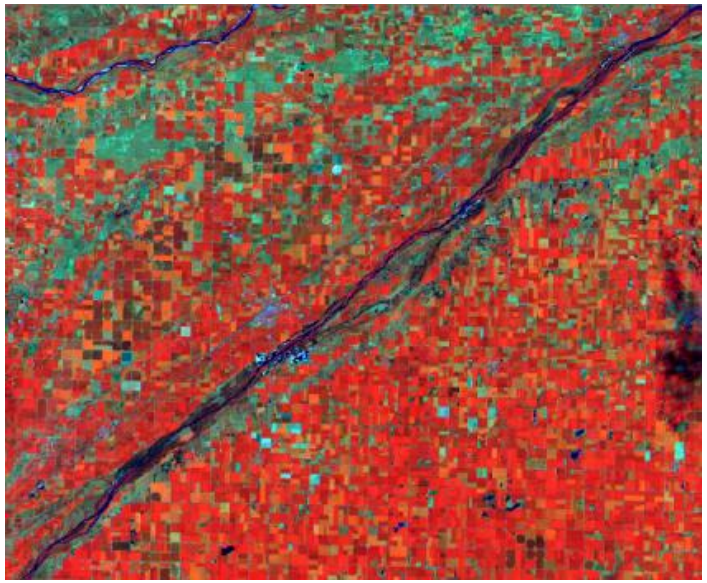
Satellite Images over time



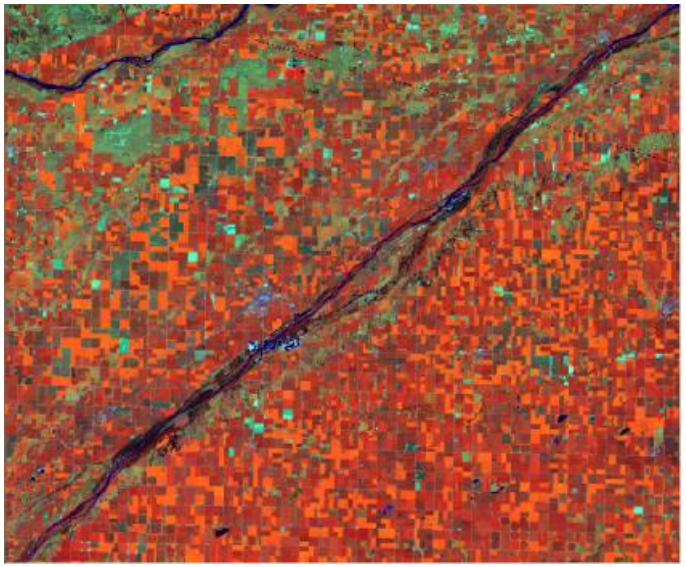
May 18



June 21



July 15

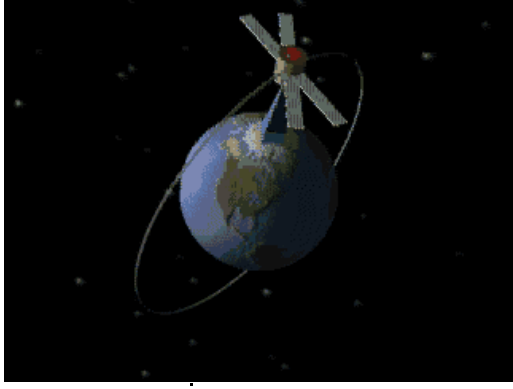


Aug 27

Sensor Specifications Compared

	TM	**AWiFS**
Altitude	705 km	817 km
Equatorial crossing time	9:45 ± 15 minutes	10:30 ± 5 minutes
Temporal Resolution	16 days	5 days
Spatial Resolution	30 x 30 m (reflective) 120 x 120 m (thermal)	56 x 56 m
Radiometric Resolution	8 bit (256)	10 bit (1024)
Spectral Resolution	6 (B, G, R, NIR, SWIR, MIR) + Thermal IR	4 (G, R, NIR,SWIR)
Swath wide	185 km	737 km
Scene size	184 x 152 km	370 x 370 km

Data Partnerships



Foreign Agricultural Service

- Resourcesat-1 AWiFS

Linking U.S. Agriculture FAS to the World

Farm Service Agency

- Agricultural “ground truth”

USDA Farm Service Agency

US Geological Survey

- National Land Cover Dataset

MRLC Consortium

US Geological Survey/ NASA

- Landsat TM 5

USGS science for a changing world NASA

Software Suite

Ground Truth Preparation
- ESRI ArcMap

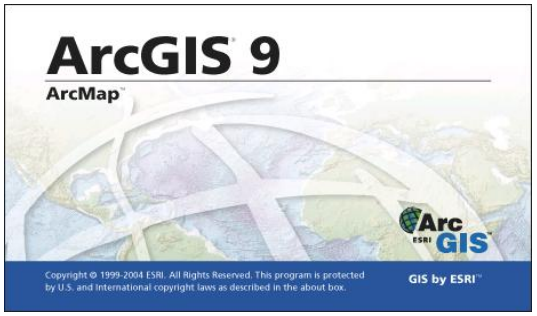
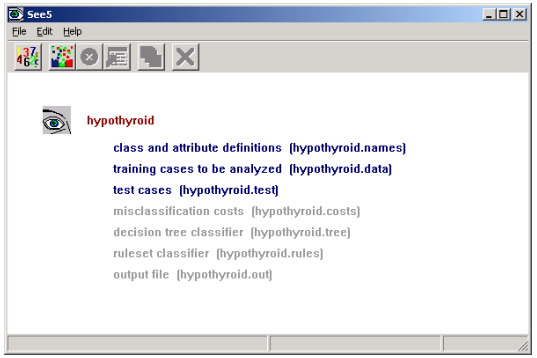


Image Preparation
- Leica Geosystems ERDAS Imagine 9.1

Image Classification
- See 5

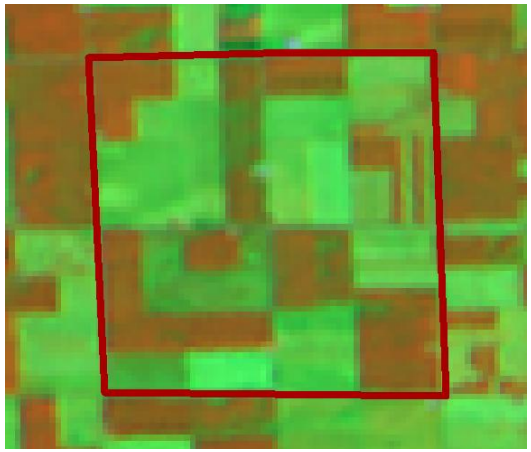


Acreage Estimates
- SAS/IML Workshop

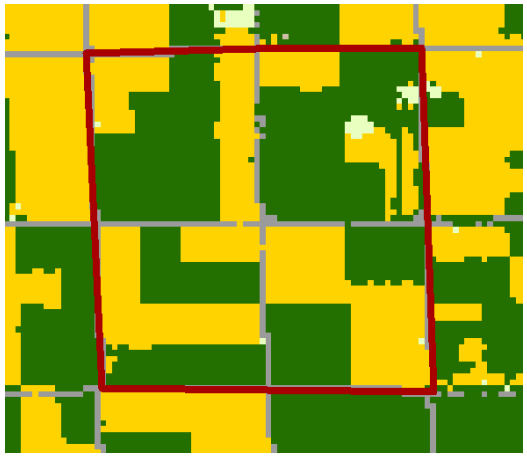
Regression-based Acreage Estimator

Acreage not just about counting pixels

The Goal: Identify areas with defined acreage totals to compare CDL pixel counts
Current Solution: June Agriculture Survey Segments



Vs.



June Ag Segment

Farmers within segment report 220 acres of corn

Crop Land Data Layer

Pixel Counting estimates 180 acres of corn

Regression-based Acreage Estimator

Acreage not just about counting pixels

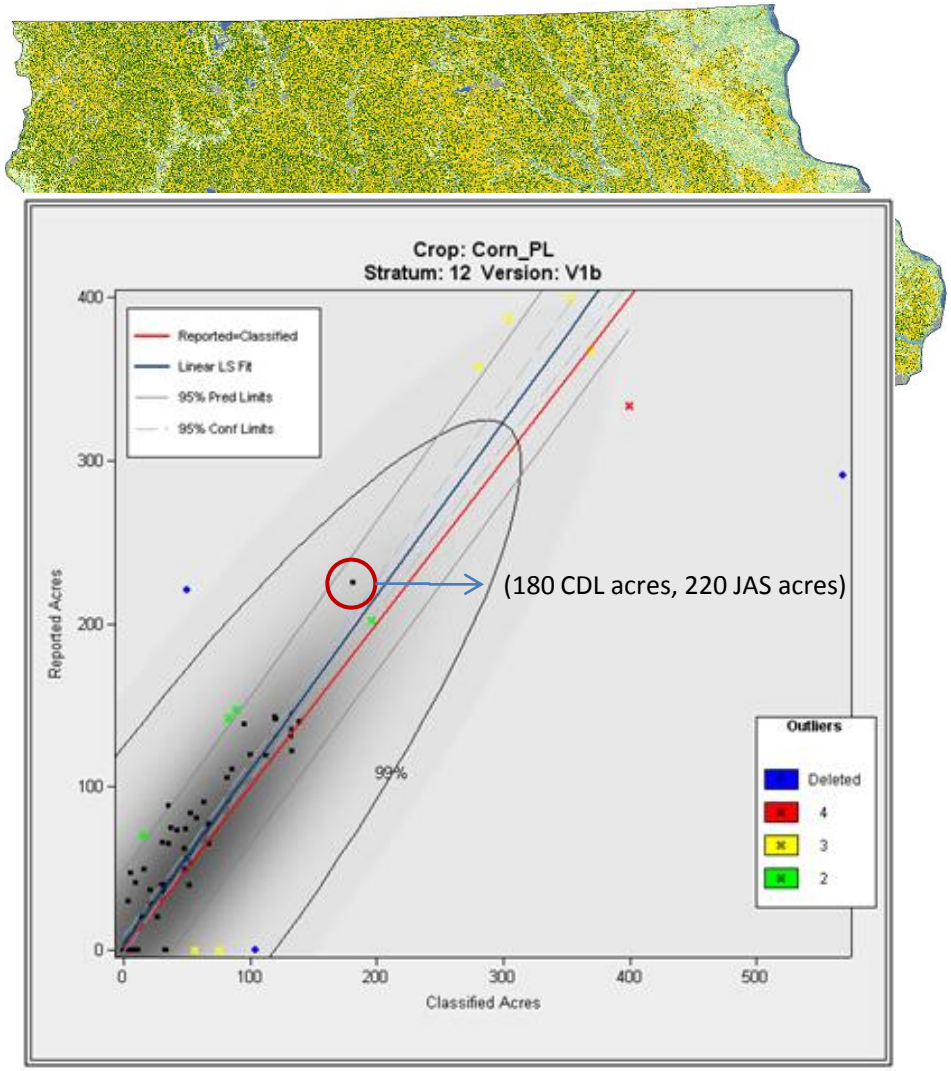
Simple Linear Regression

Regression used to relate categorized pixel counts to the ground reference data

- **(X) – Cropland Data Layer (CDL) classified acres**
- **(Y) – June Agricultural Survey (JAS) reported acres**

Outlier segment detection - removal from regression analysis

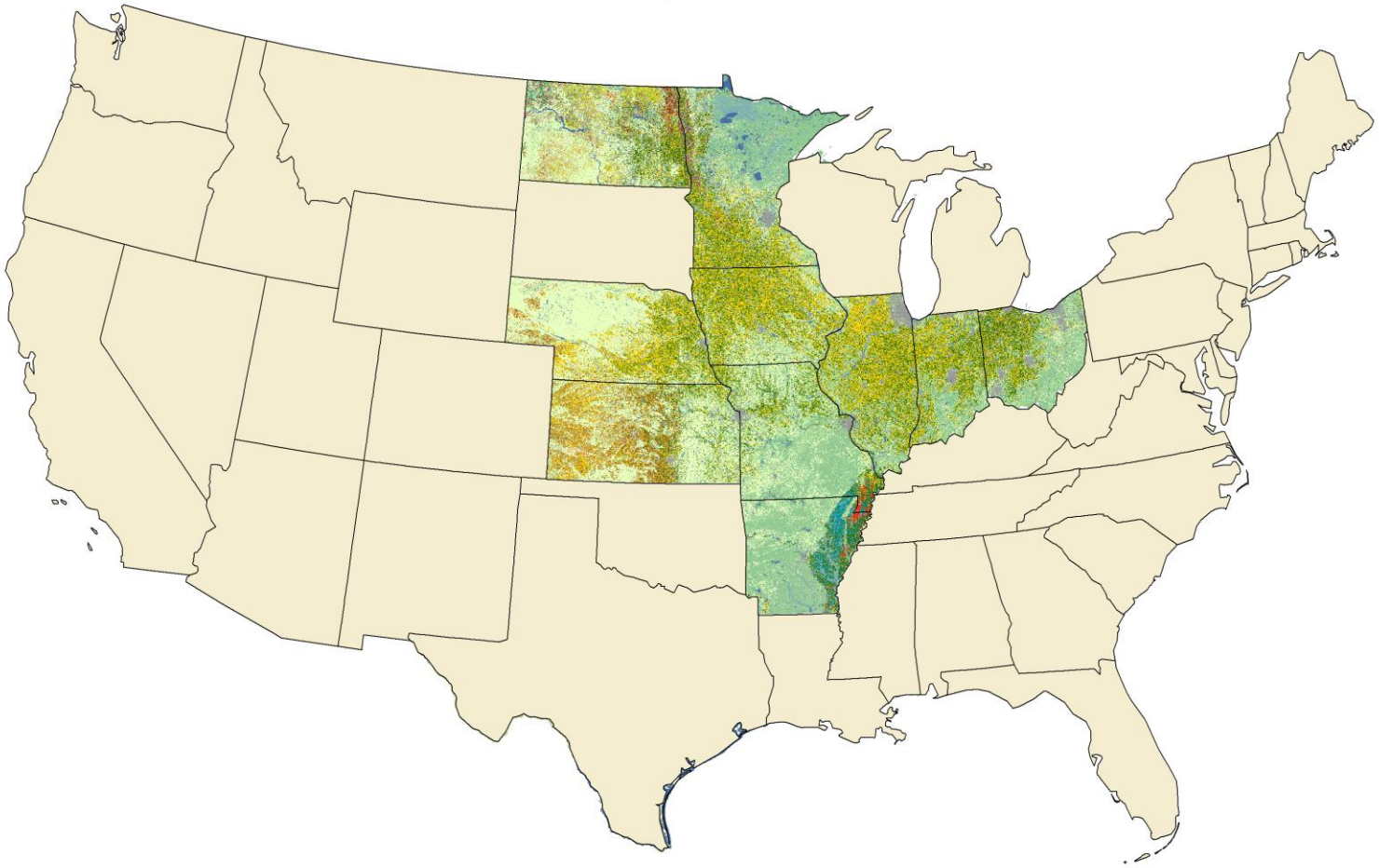
Using regression results in estimates reduces error rates over using JAS alone



Number of CDL & Acreage Indications

Item	Year			
	2007	2008	2009	2010
Total CDL's	21	35	48	48
In Season State Level Estimates	15	19	26	28
Post Season County Level Estimates	15	19	36	36
Crops	9	14	15	16

NASS Remote Sensing Yield
2010 Program States



Future Remote Sensing Efforts

- Expansion & Improvements of Existing Efforts
  - Cropland Data Layers and Acreage Estimation
  - Yield Estimation for state and county levels
- New Research & Development Areas
- Delivery of Products via interactive web portal

New Research Areas

- ***Crop Progress*** **– Provide quantitative assessments by stage of crop for each specific crop.**

- ***Crop Conditions*** **– Quantitatively assess the amount of a specific crop in very poor, poor, fair, good, and excellent condition.**

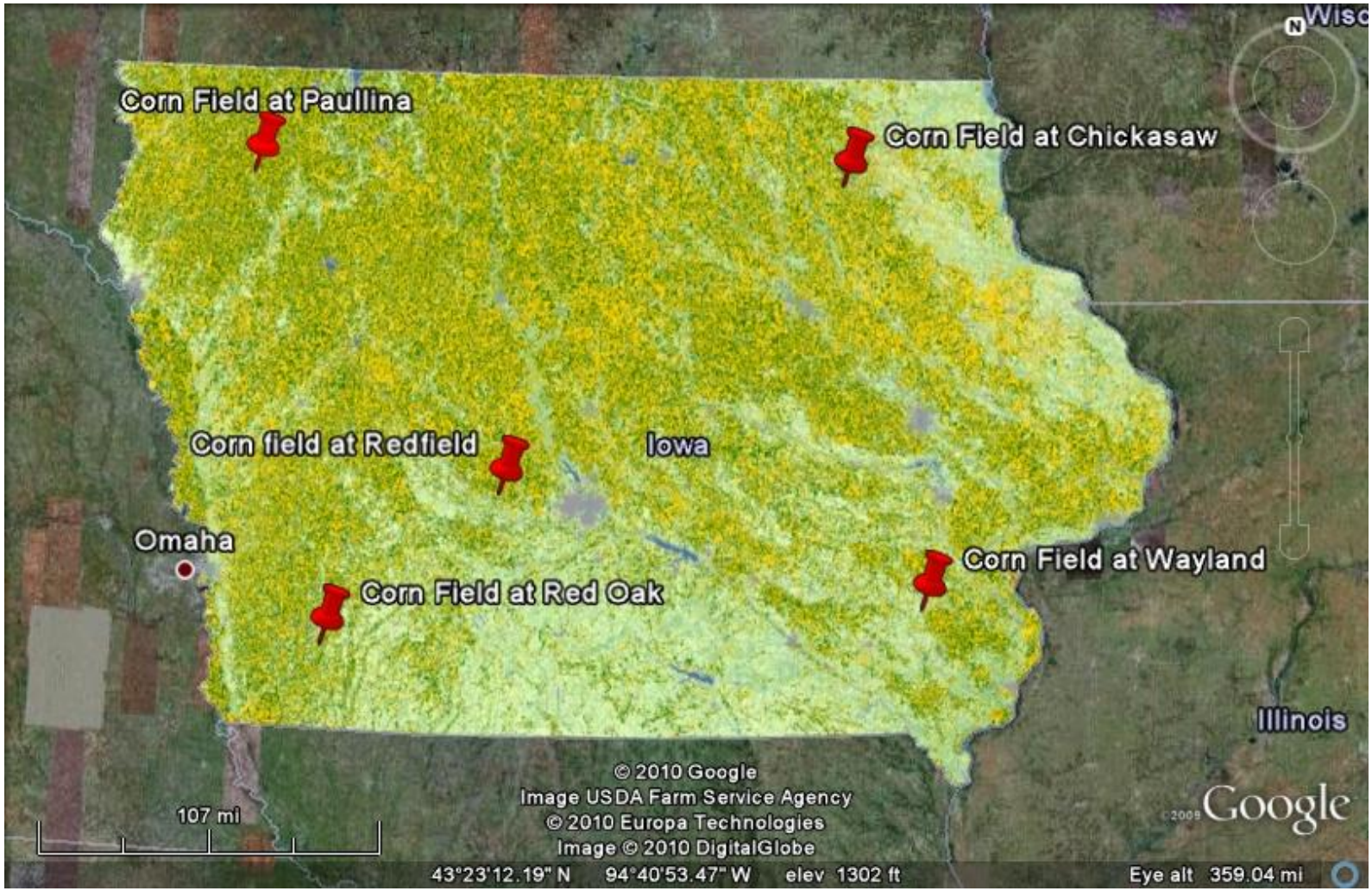
- ***Soil Moisture*** **- Monitoring and assessing Topsoil (surface to 6" depth) and Subsoil (>6"-- 3-4') moisture in categories similar to the following - Very short, Short, Adequate, Surplus.**

- ***Natural Disaster Monitoring & Assessment*** **- timely monitoring & assessing significant events affecting crop area, conditions and yield**

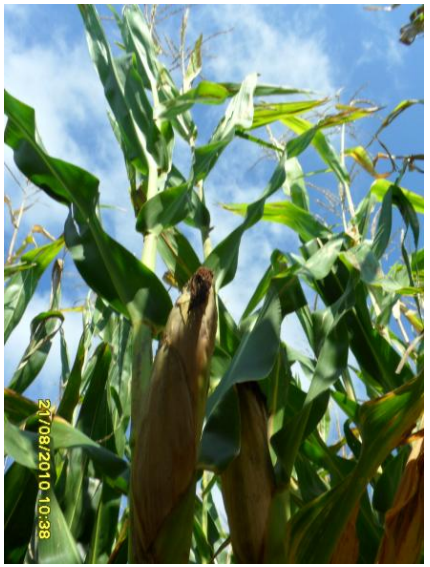
A National Crop Progress System Based on NASA Earth Science Results

- NASS and GMU awarded 1.1 million competitive funds in April 2009.
- Currently researching “Greeness” measures. Enhancements to Normalized Difference Vegetative Indexes (NDVI)
- Establishing Ground Truth Data Collection Procedures

Ground Truth Data Collection: Observation Sites



Corn Progress Observation Results

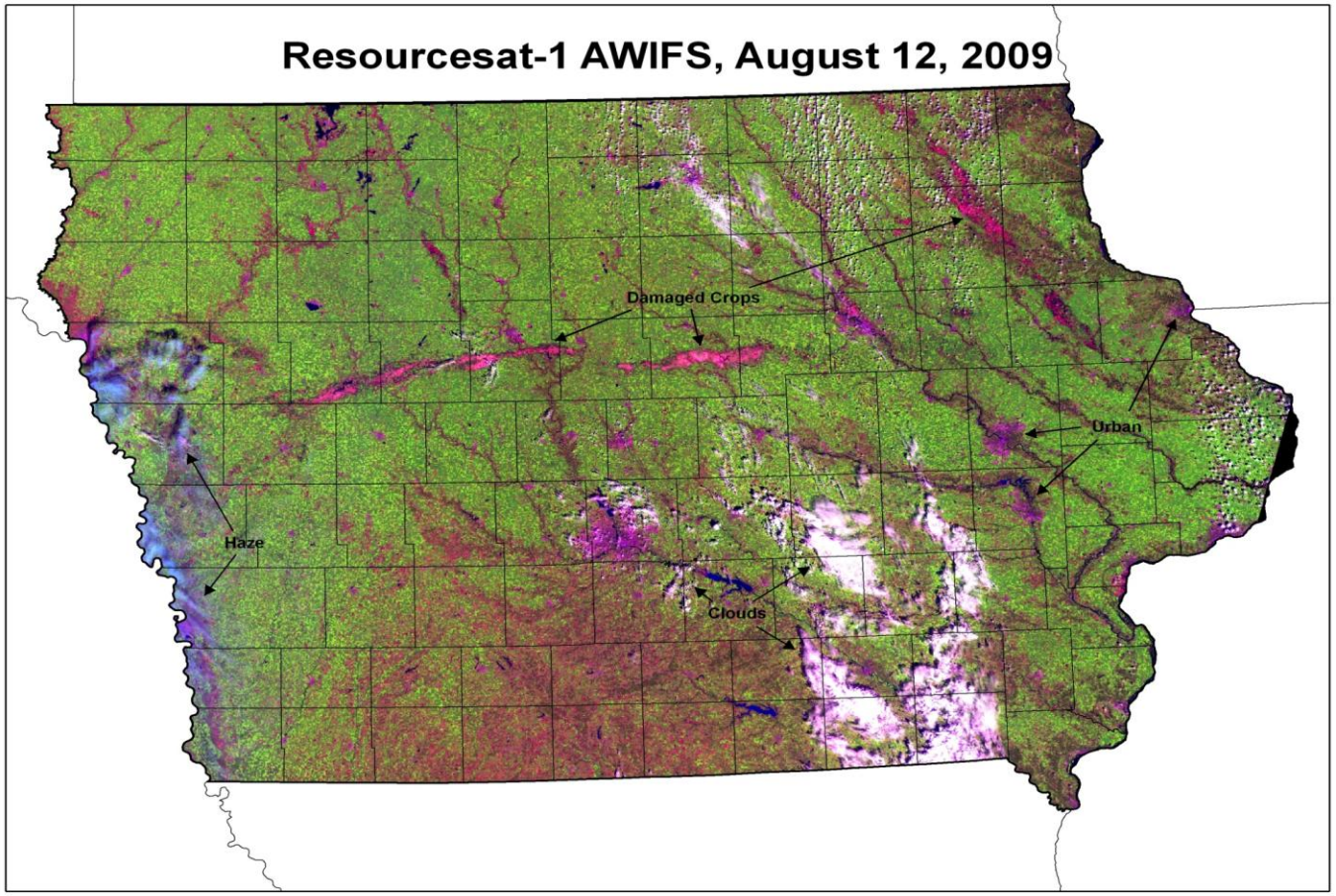


Corn Field Observation Data

Date	Height	V-Stage	R-Stage
5/06		V2	
5/14	4.75	V2	
5/20	6.75	V3	
5/27	15.25	V3	
6/03	28	V4	
6/11	48	V5	
6/19	63	v6	
6/26	85	v8	

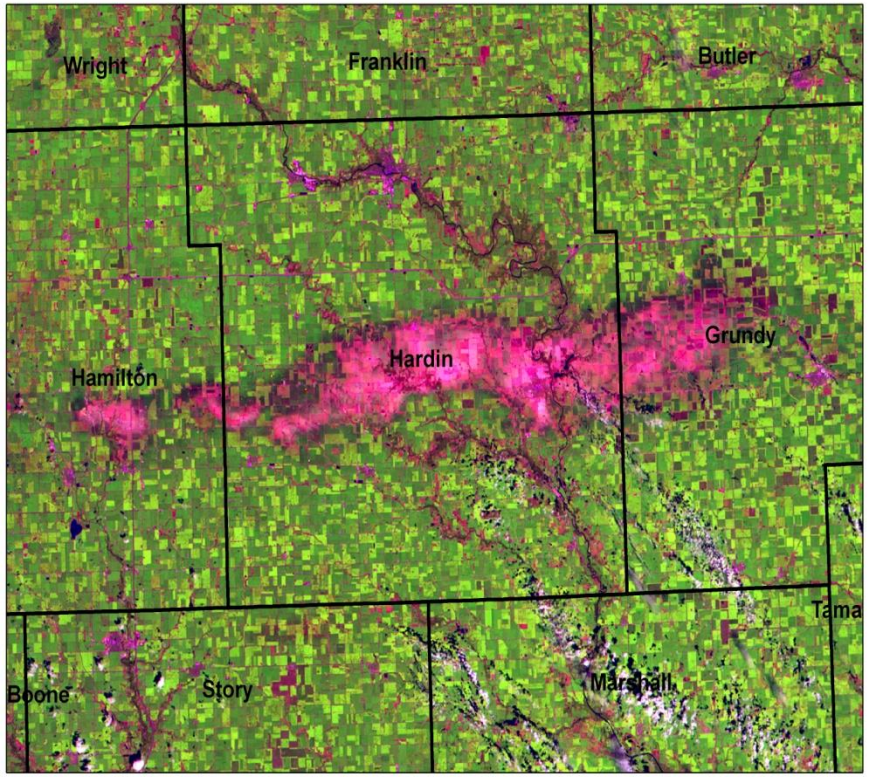
Date	Height	V-Stage	R-Stage
7/02	92	V10	
7/10	112	V15	missing
7/16	120?	Missing	missing
7/24	114	Missing	R3
7/31	114	VT	R3
8/07	114	VT	R3
8/13	114	VT	R4
8/21	114	VT	R5

Natural Disaster Assessments – Visual Reference

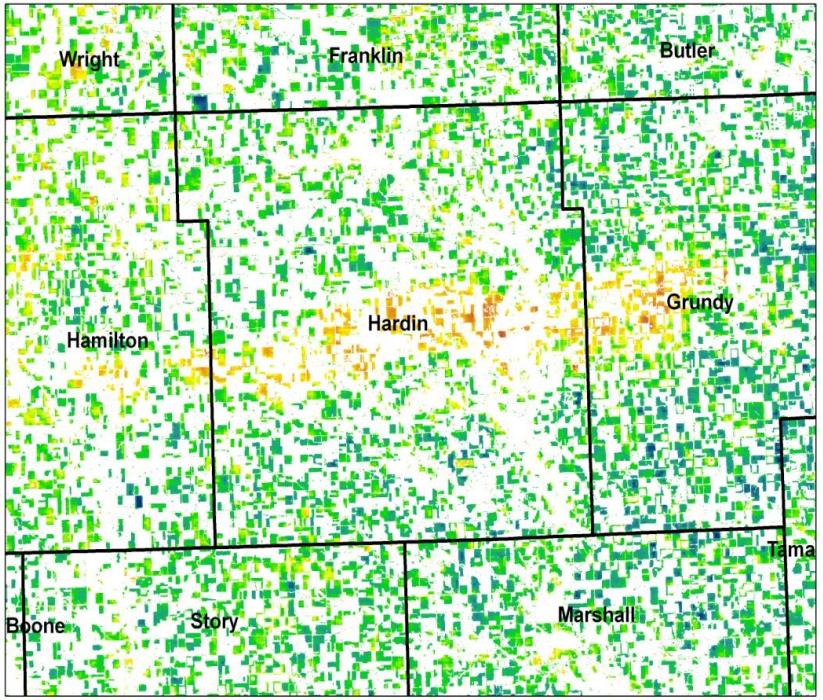


Natural Disaster Assessments - Prototype Crop Yield Map

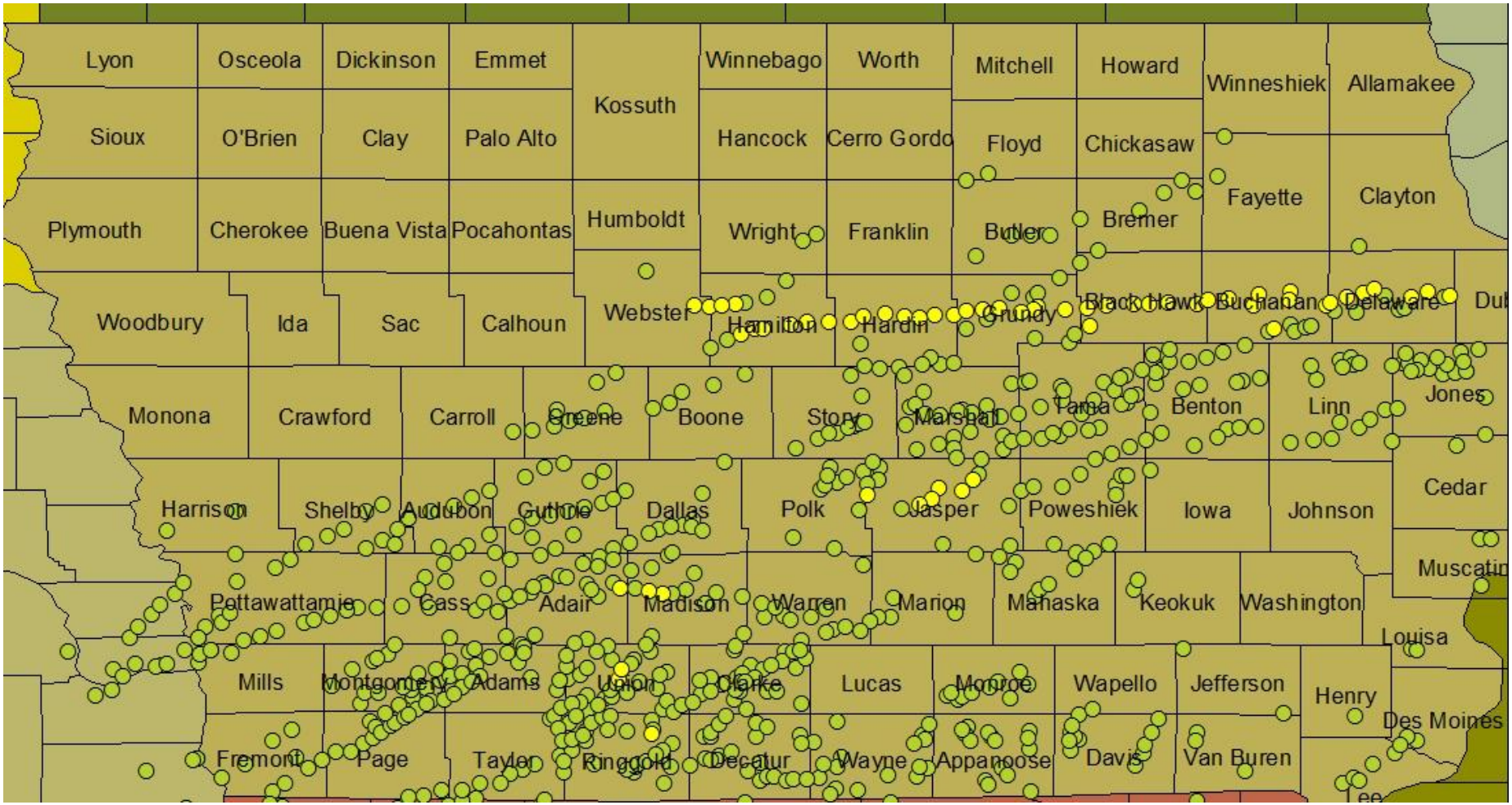
Raw AWiFS



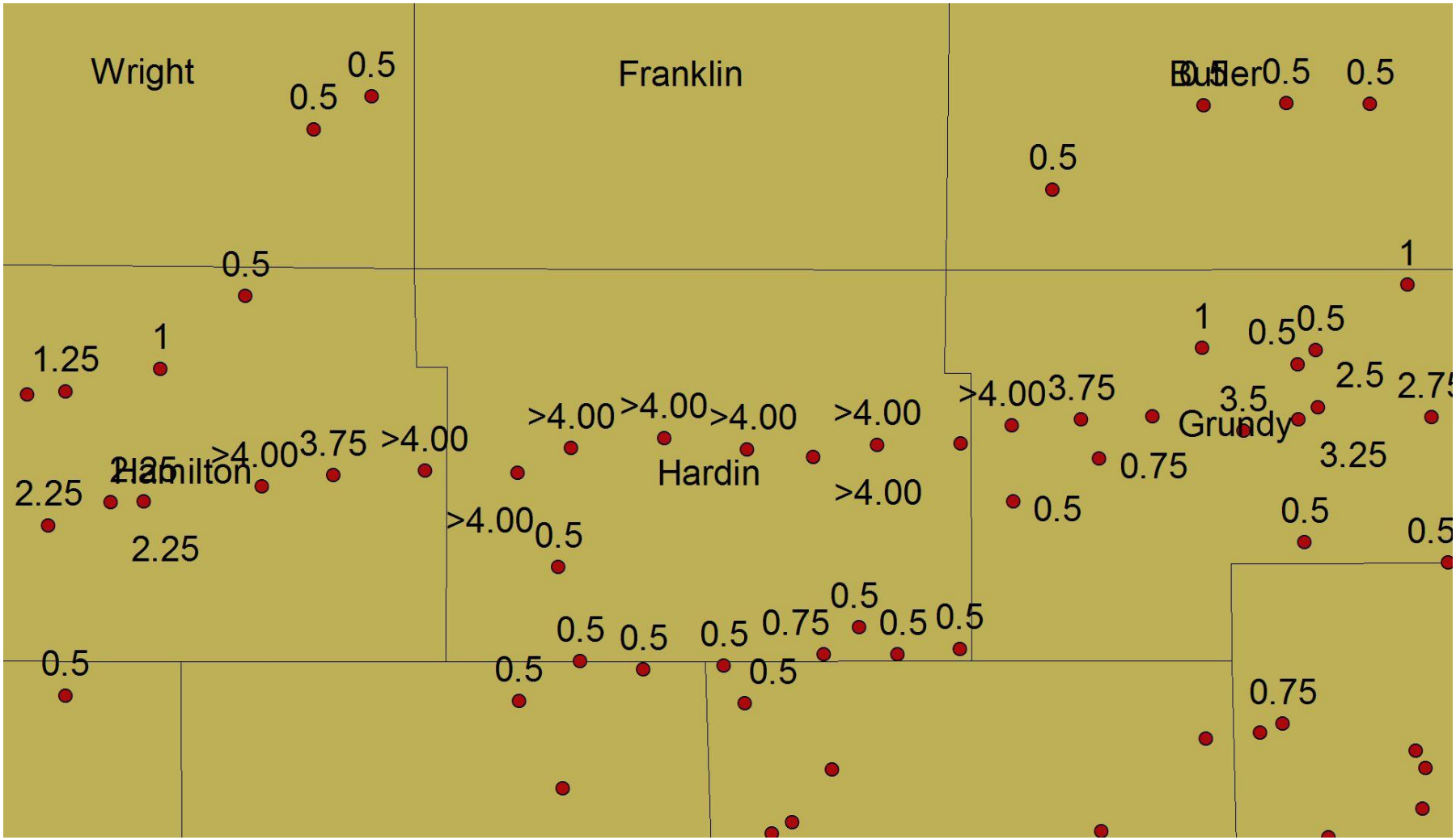
Yield Impact



Hail Event 8/9/09



Hail Diameter Inches



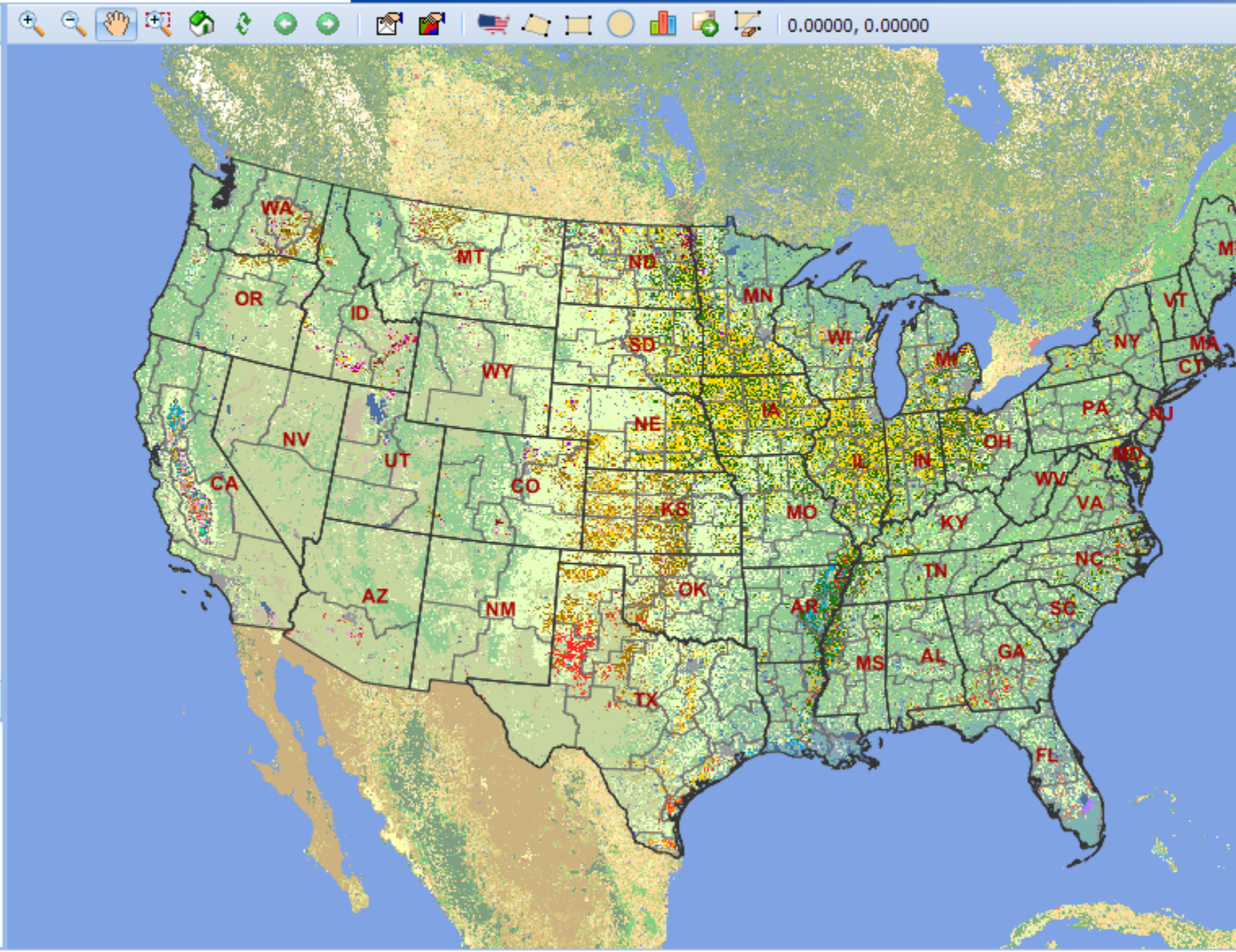
USDA United States Department of Agriculture
National Agricultural Statistics Service

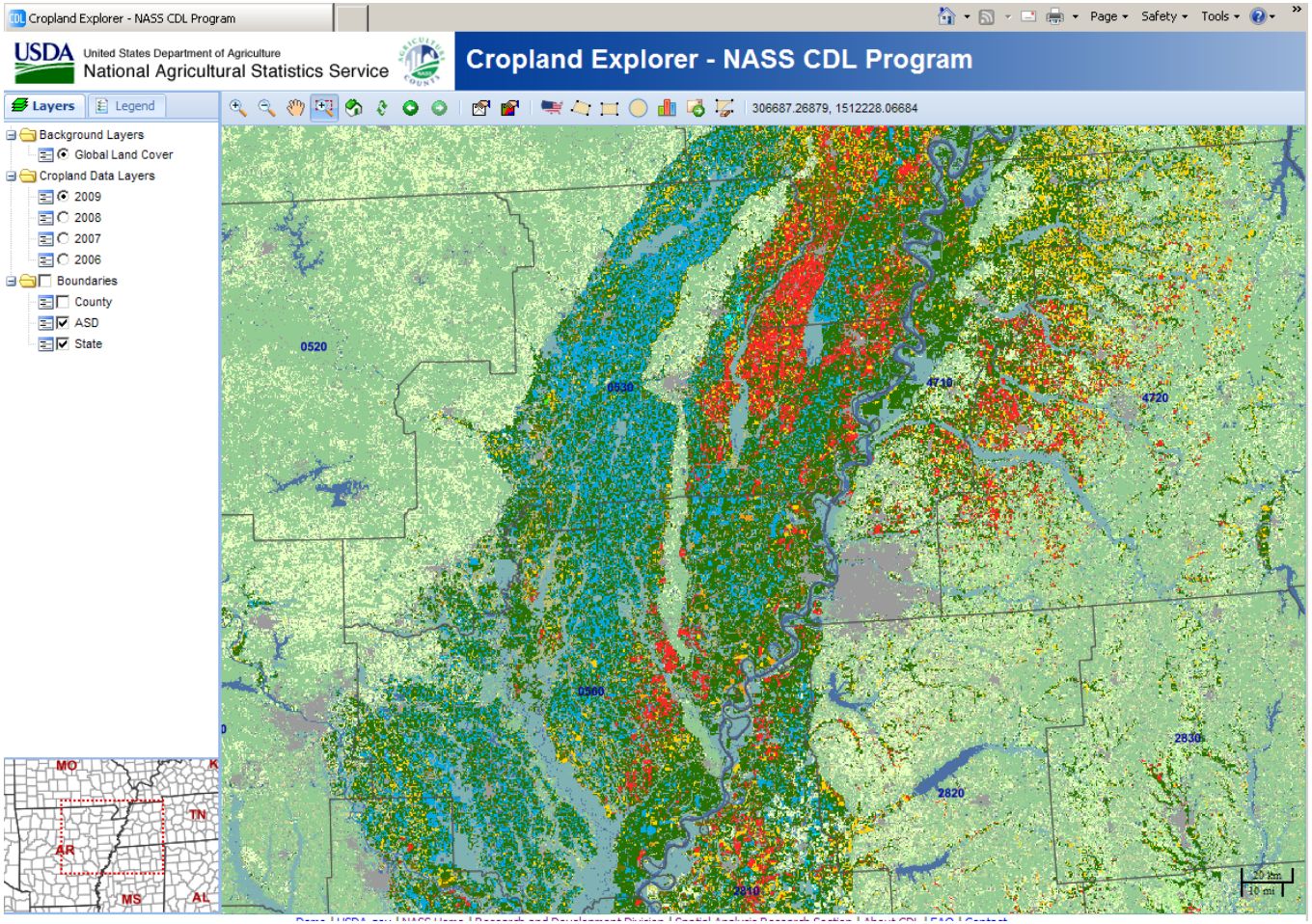
Cropland Explorer - NASS CDL Program

Map Layers

- Background Layers
  - Global Land Cover
- Cropland Data Layers
  - 2009
  - 2008
  - 2007
  - 2006
- Boundaries
  - County
  - ASD
  - State

Legend




Cropland Explorer - NASS CDL Program
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Safety
Tools
USDA
United States Department of Agriculture
National Agricultural Statistics Service
Cropland Explorer - NASS CDL Program
Layers
Legend
306687.26879, 1512228.06684
Background Layers
Global Land Cover
Cropland Data Layers
2009
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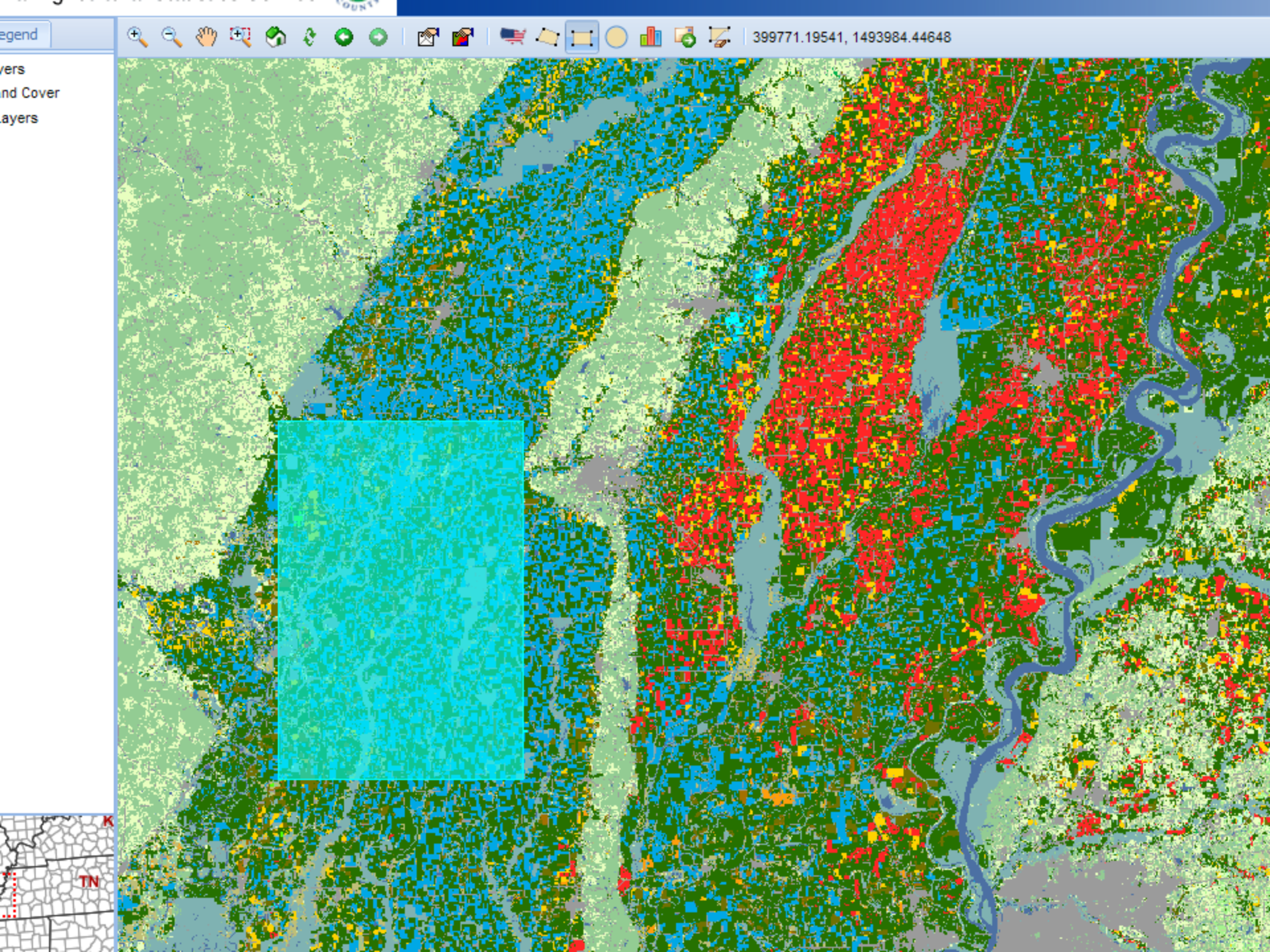
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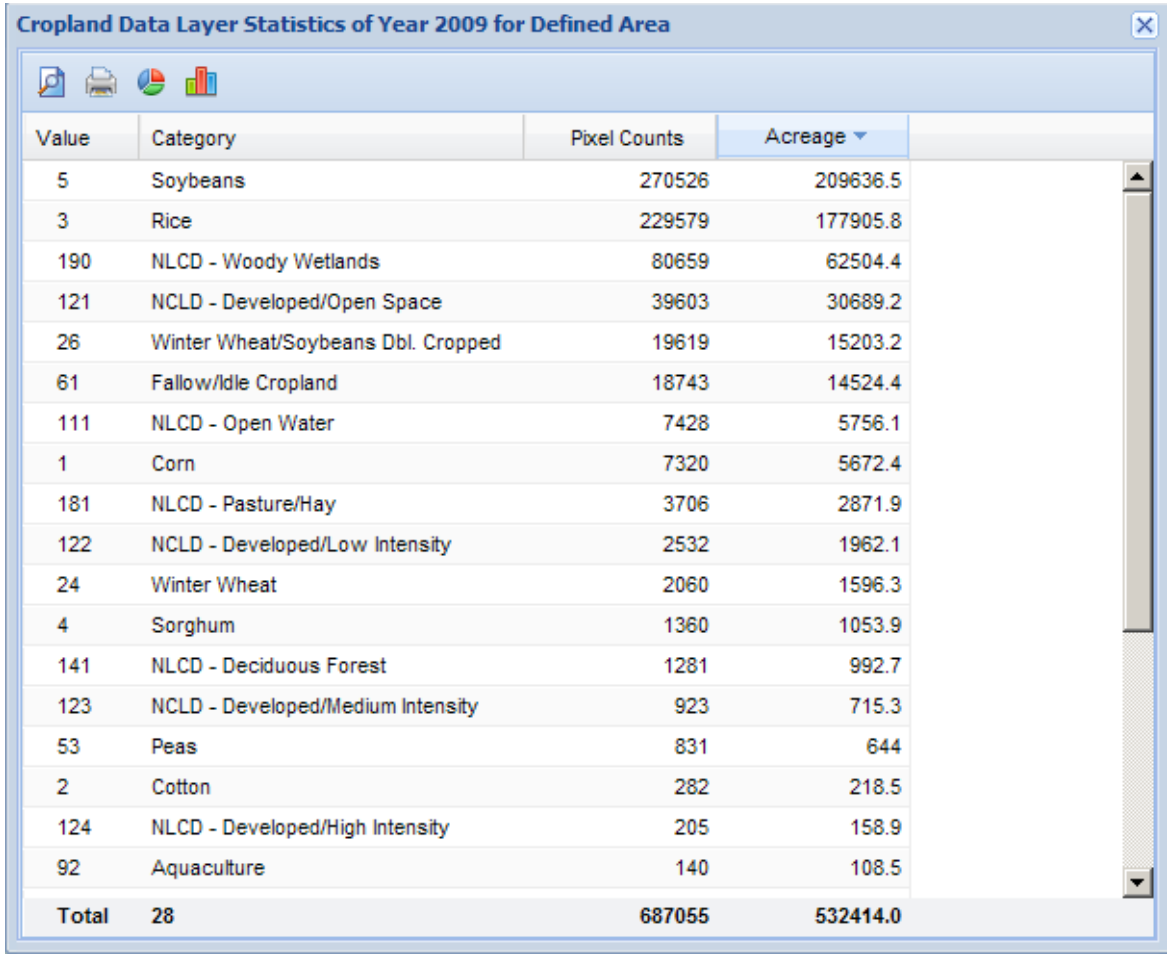
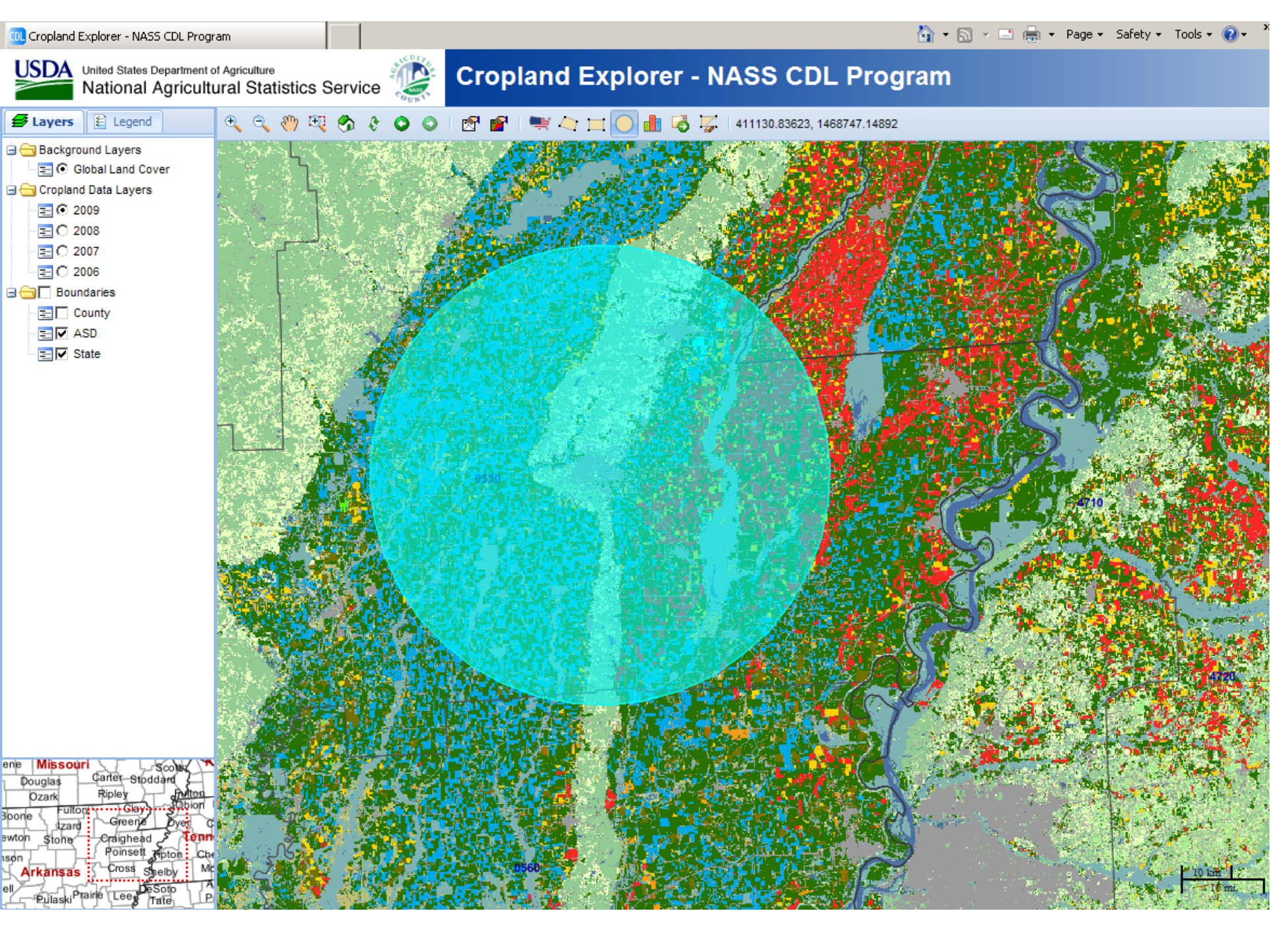


Value	Category	Pixel Counts	Acreage
5	Soybeans	270526	209636.5
3	Rice	229579	177905.8
190	NLCD - Woody Wetlands	80659	62504.4
121	NCLD - Developed/Open Space	39603	30689.2
26	Winter Wheat/Soybeans Dbl. Cropped	19619	15203.2
61	Fallow/Idle Cropland	18743	14524.4
111	NLCD - Open Water	7428	5756.1
1	Corn	7320	5672.4
181	NLCD - Pasture/Hay	3706	2871.9
122	NCLD - Developed/Low Intensity	2532	1962.1
24	Winter Wheat	2060	1596.3
4	Sorghum	1360	1053.9
141	NLCD - Deciduous Forest	1281	992.7
123	NCLD - Developed/Medium Intensity	923	715.3
53	Peas	831	644
2	Cotton	282	218.5
124	NLCD - Developed/High Intensity	205	158.9
92	Aquaculture	140	108.5
Total	**28**	**687055**	**532414.0**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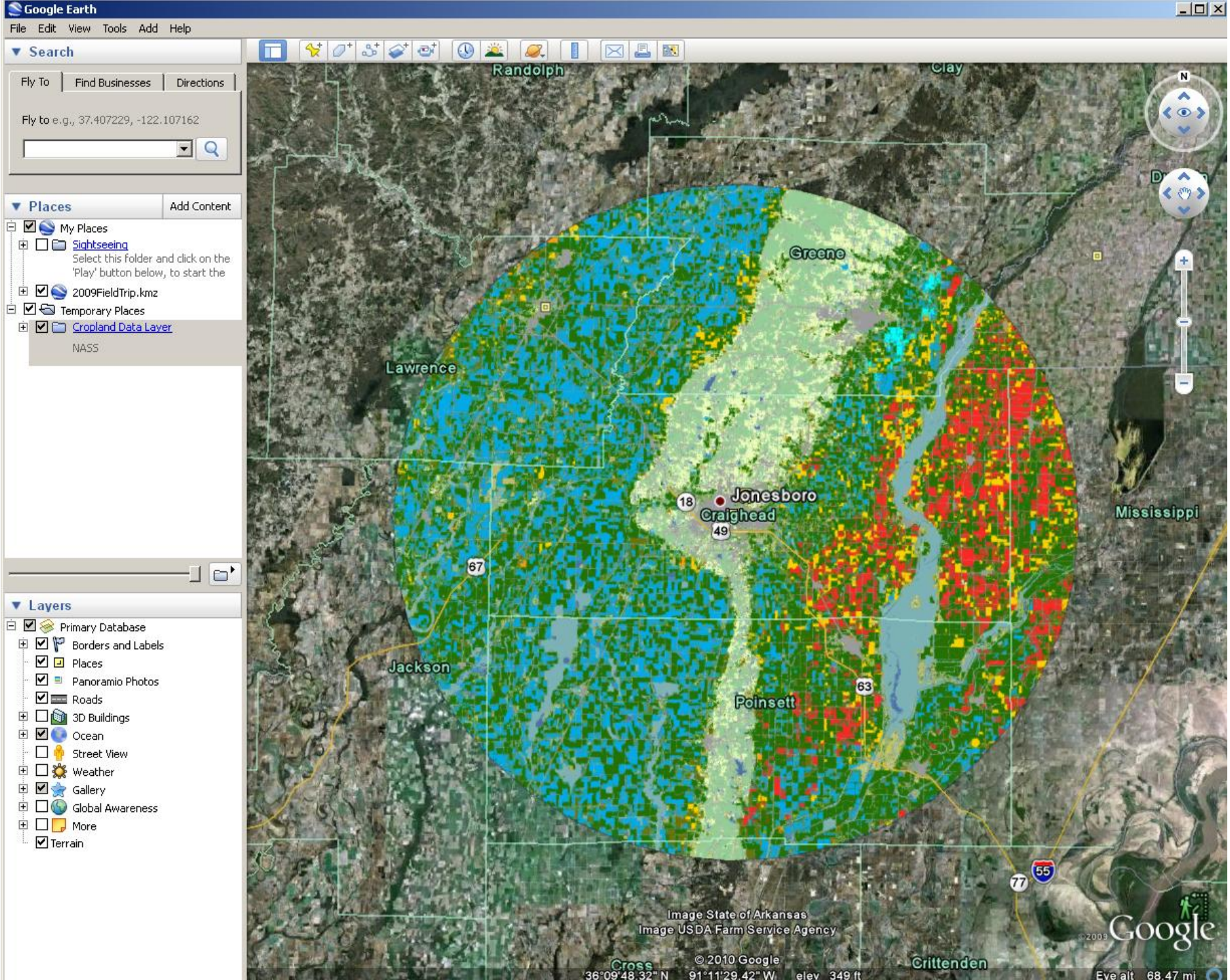
Background Layers
Global Land Cover
Cropland Data Layers
2009
2008
2007
2006
Boundaries
County
ASD
State
0530
4710
4720
0560
10 km
10 mi.
Missouri
Arkansas
Douglas
Ozark
Carter
Ripley
Stoddard
Fulton
Obion
Izard
Greene
Dyer
Stone
Craighead
Poinsett
Lipton
Cross
Shelby
DeSoto
Tate
Pulaski
Prairie
Lee


Google Earth
File Edit View Tools Add Help
Search
Fly To
Find Businesses
Directions
Fly to e.g., 37.407229, -122.107162
Places
Add Content
My Places
Sightseeing
Select this folder and click on the 'Play' button below, to start the
2009FieldTrip.kmz
Temporary Places
Cropland Data Layer
NASS
Layers
Primary Database
Borders and Labels
Places
Panoramio Photos
Roads
3D Buildings
Ocean
Street View
Weather
Gallery
Global Awareness
More
Terrain
Randolph
Clay
Greene
Lawrence
Jonesboro
Craighead
Mississippi
Jackson
Poinsett
Cross
Crittenden
18
49
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55
Image State of Arkansas
Image USDA Farm Service Agency
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