Research to Operational: A Paradigm Shift for the Cropland Data Layer Program

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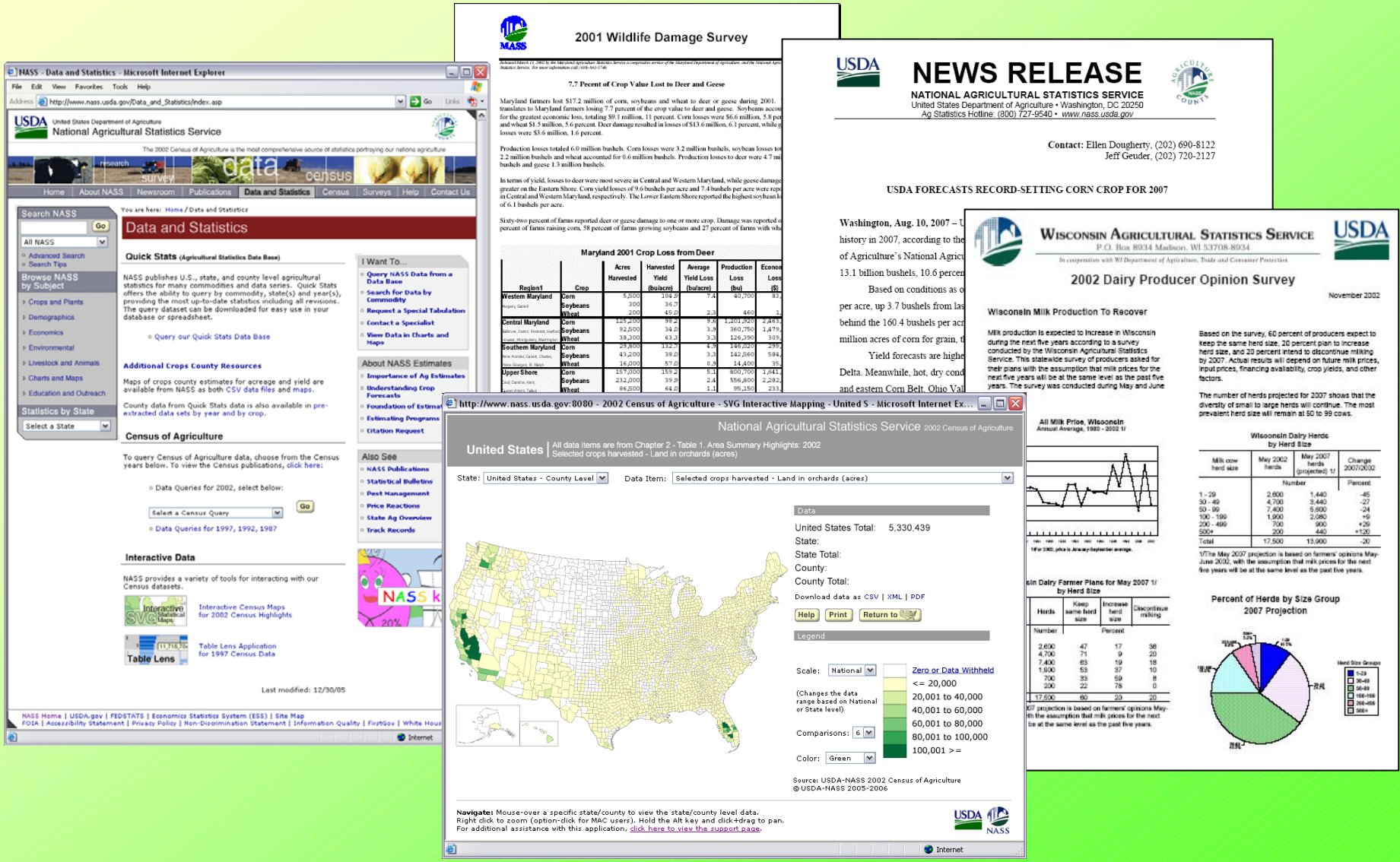
USDA/NASS

NASS Overview

Provider of timely, accurate, and useful statistics in service to U.S. agriculture

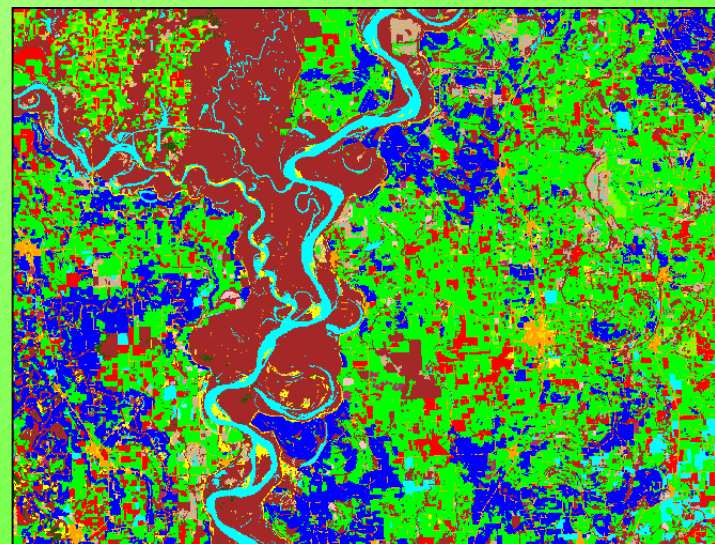


Agenda

- Acreage Program Updates
  - AWiFS & MODIS sensors
  - Ground truth: FSA/CLU + 578 & non-ag
  - Commercial software suite
- What’s next

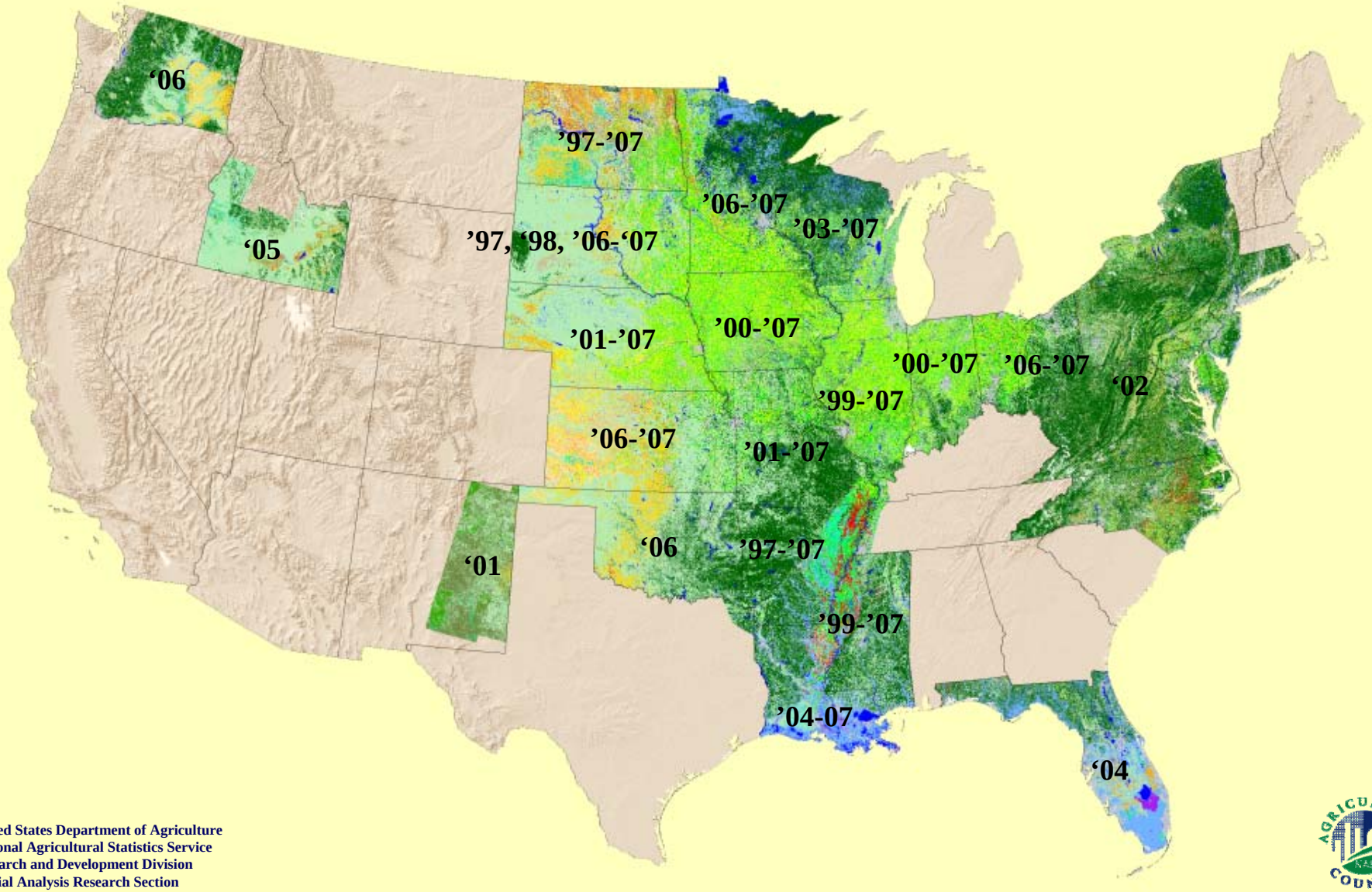
Remote Sensing Program Objectives

- "Census by Satellite"
  - Without area duplication
  - Cover major producing corn and soybean regions
  - Indications reflect actual location of the crops
    - Not address on record
- Provide timely, accurate, useful independent indications
  - Measurable error
  - Unbiased/independent estimator
  - County & state level
- Deliver indications 75 days earlier
  - For October Agricultural Statistics Board
  - Versus end-of-year December estimates



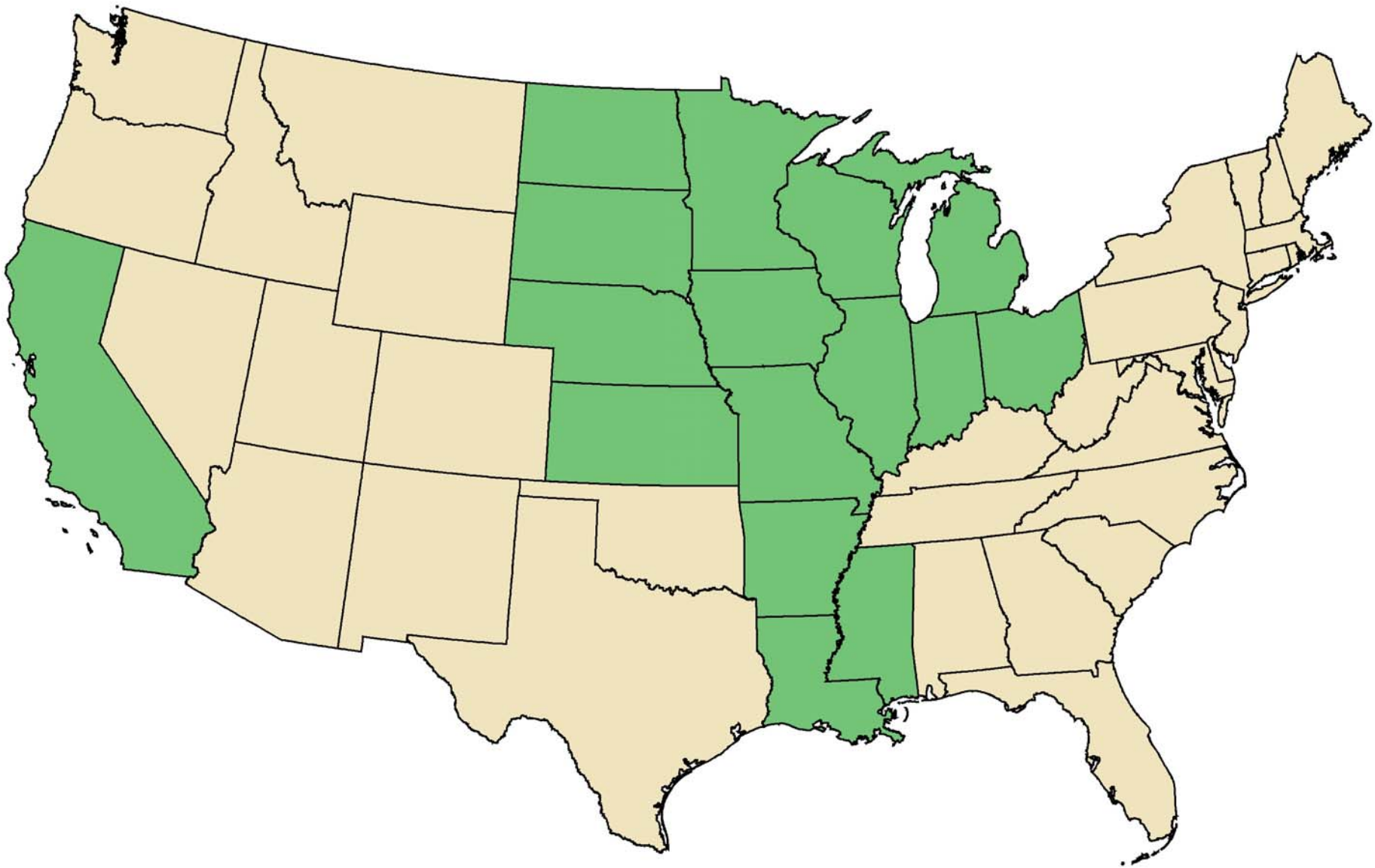
Cropland Data Layers

1997 - 2007

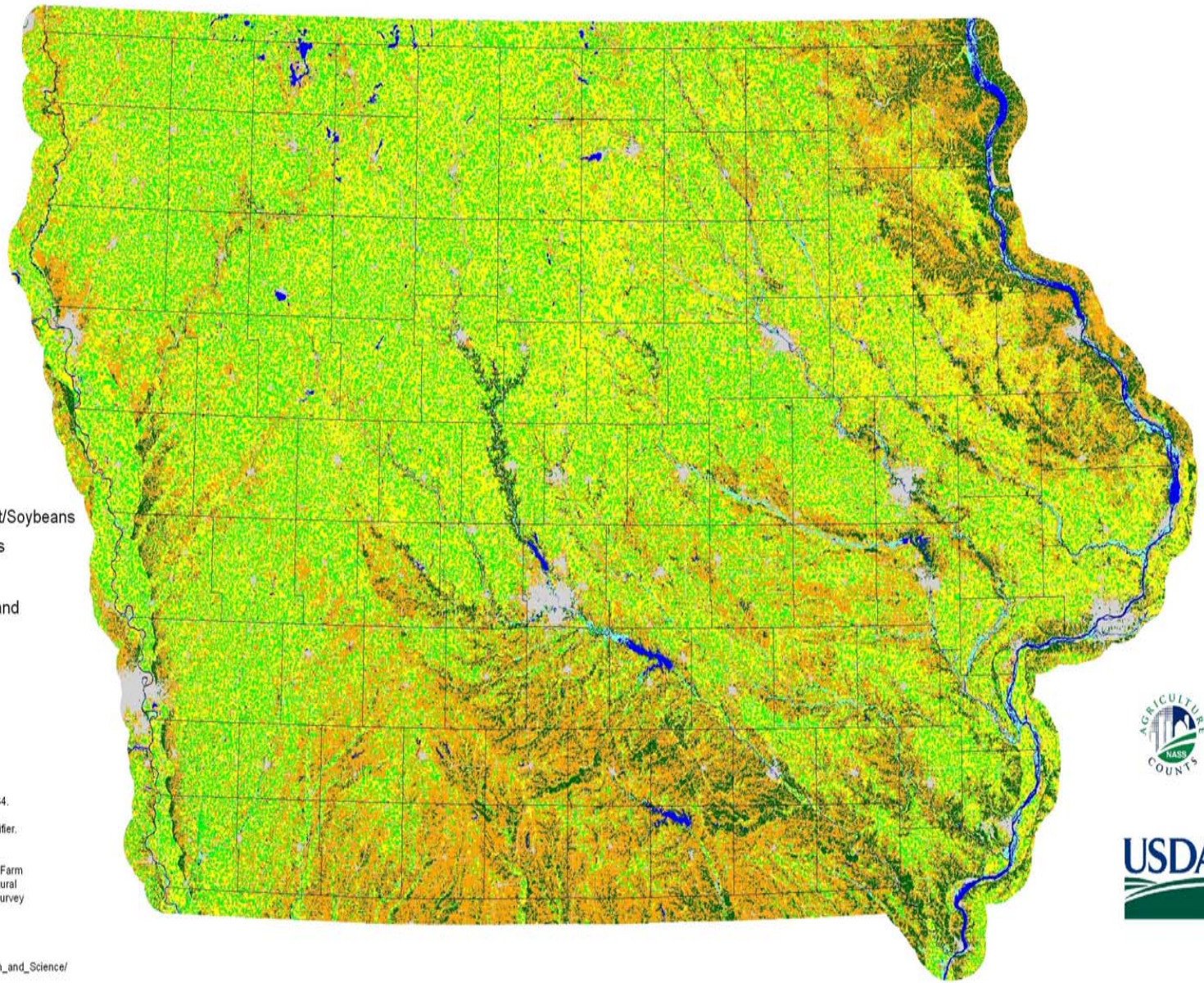


United States Department of Agriculture
National Agricultural Statistics Service
Research and Development Division
Spatial Analysis Research Section

2007 Cropland Data Layer Coverage



2007 Iowa Cropland Data Layer



Categories

- Corn
- Soybeans
- Winter Wheat
- Double-Cropped, Winter Wheat/Soybeans
- Alfalfa, Hay, Other Small Grains
- All Other Crops
- Pasture, Grassland, Idle Cropland
- Woods
- Wetlands
- Urban
- Water

Data Source: Resourcesat-1 AWiFS satellite imagery.

Projection: UTM zone 15, spheroid WGS84, datum WGS84.

Image Processing: Rulequest's See5.0 decsion-tree classifier. Minimum mapping unit of 20 acres.

Ground Truth: Agricultural training and validation from the Farm Service Agency Common Land Unit Program. Non-Agricultural training and validation from the United States Geological Survey National Land Cover Dataset 2001.

Map Production: ArcGIS 9.2.

Additional Information: http://www.nass.usda.gov/Research_and_Science/

AGRICULTURE COUNTS NASS

USDA

Cropland Data Layer Components

- AWiFS sensor

IRS Resourcesat-1 AWiFS Imagery

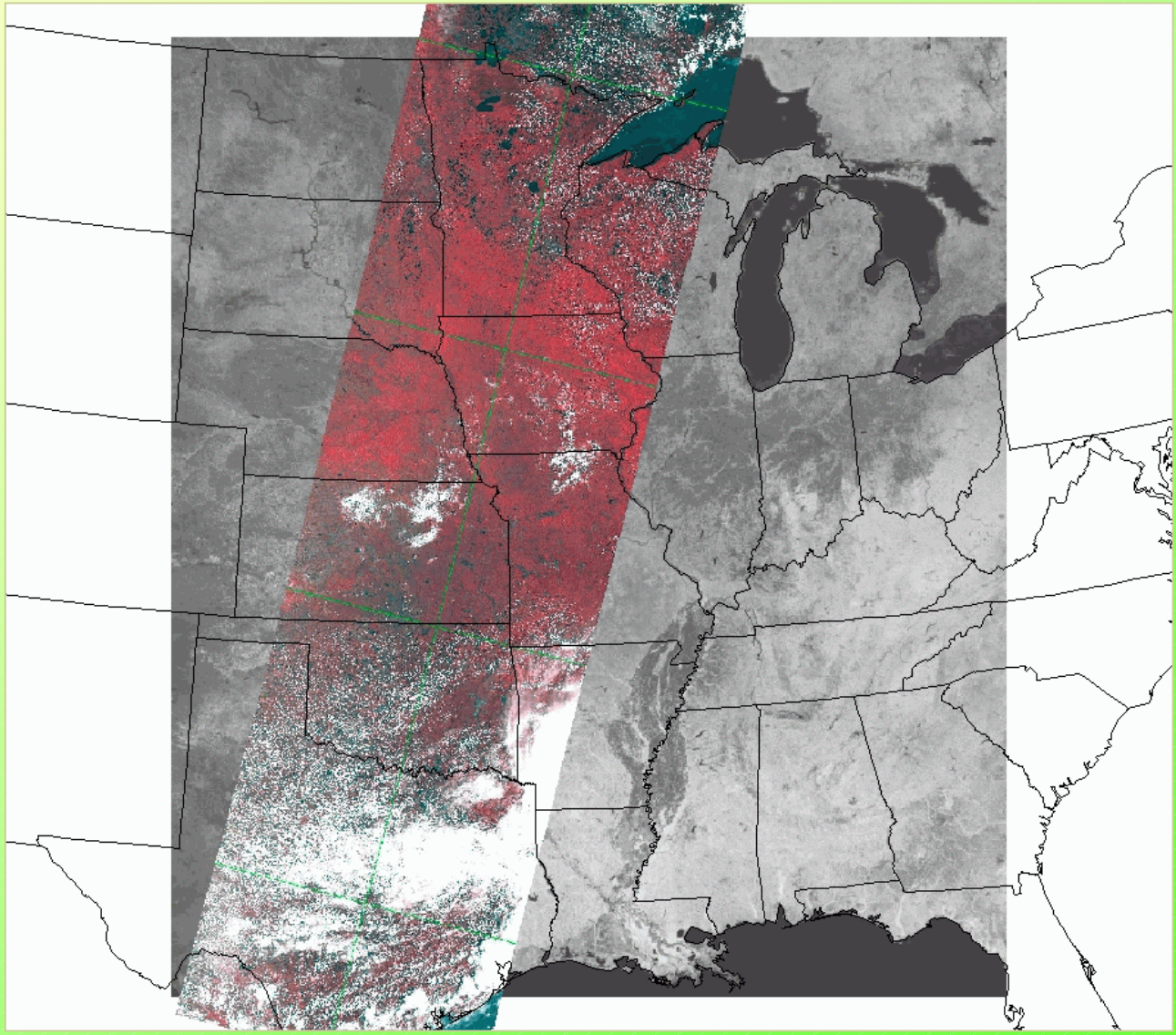
Eliminate clouds

5-day revisit

Key spectral bands

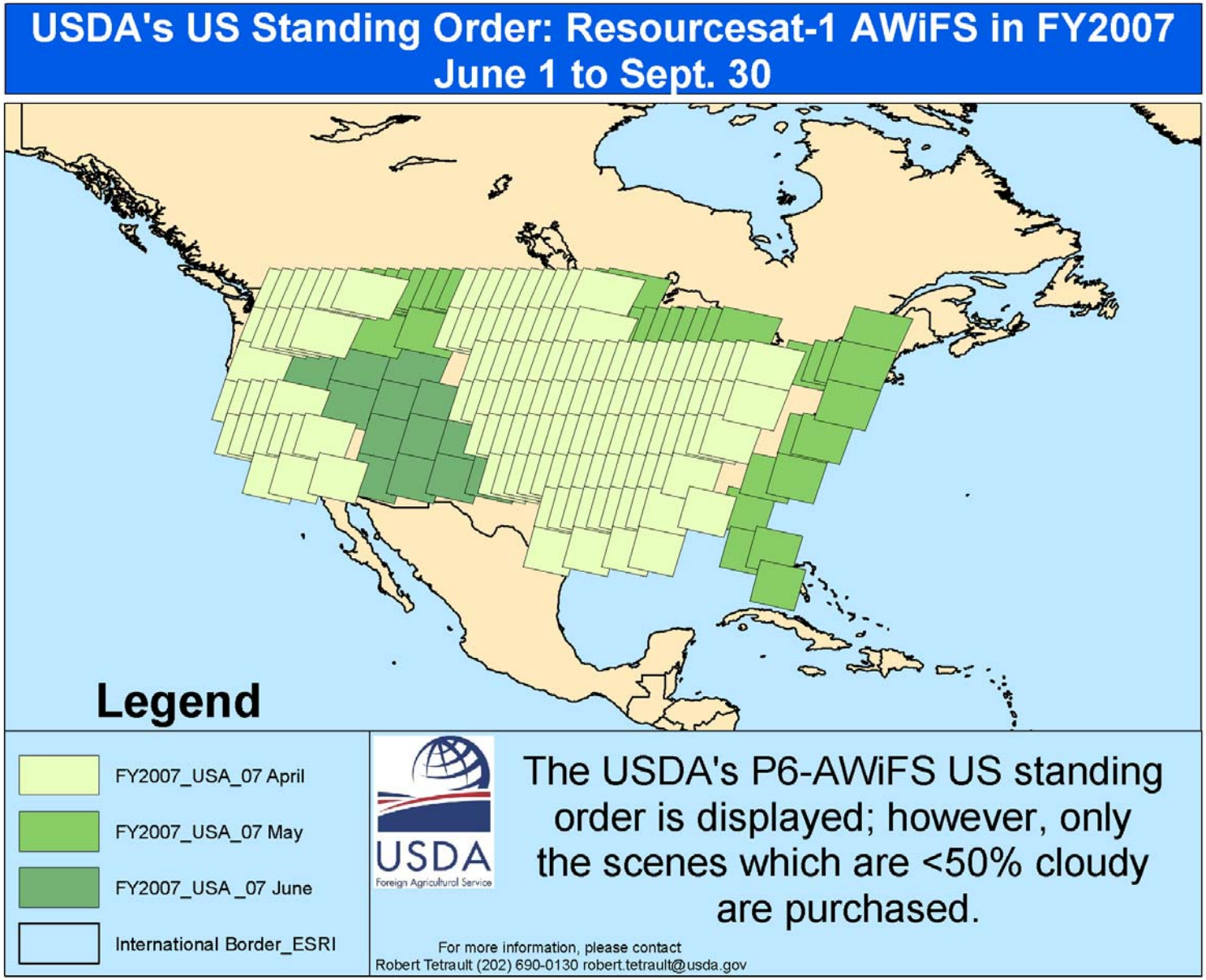
Large area coverage

Resolution adequate



6 July 2007

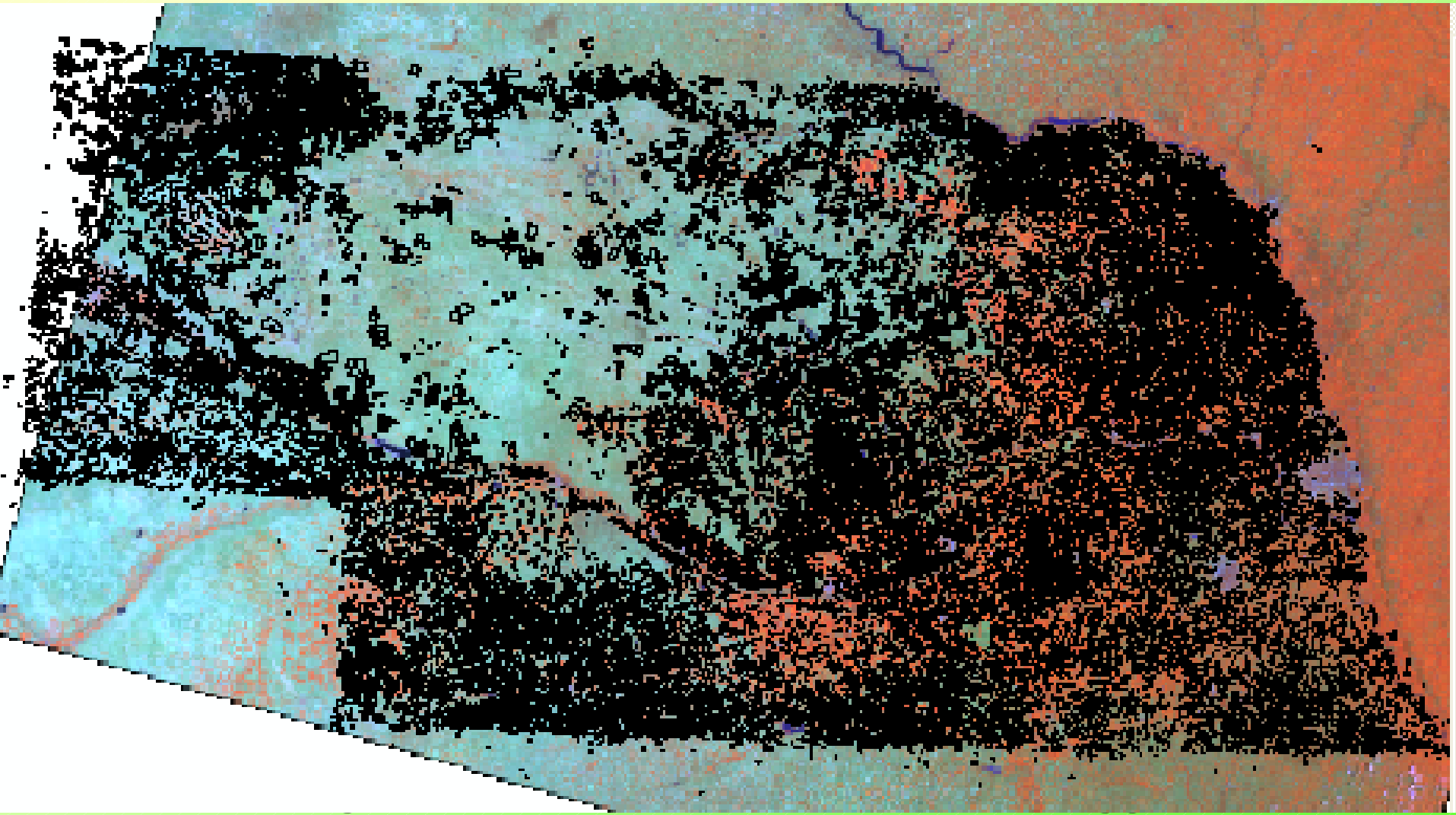
Foreign Ag Service Cooperation



Cropland Data Layer Components

- AWiFS sensor
- Common Land Unit/578 Admin Data
  - USDA/Farm Service Agency
    - Training/testing datasets
  - Ancillary training datasets
    - MODIS, NLCD, NED, CDL

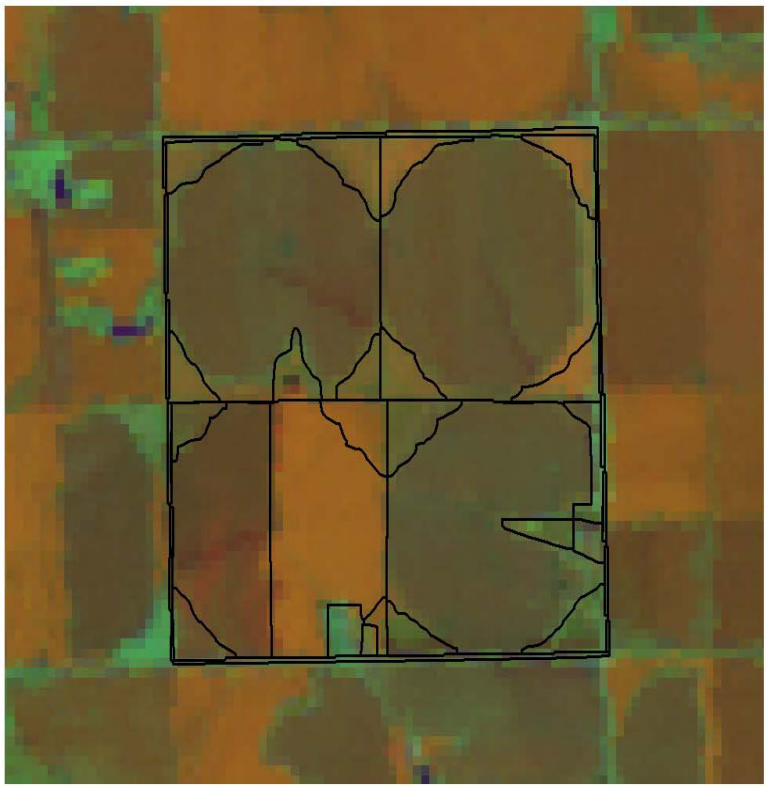
Ground Truth - Agriculture



NASS June Agricultural Survey (JAS) data still
used for acreage estimation

Definitional Issues

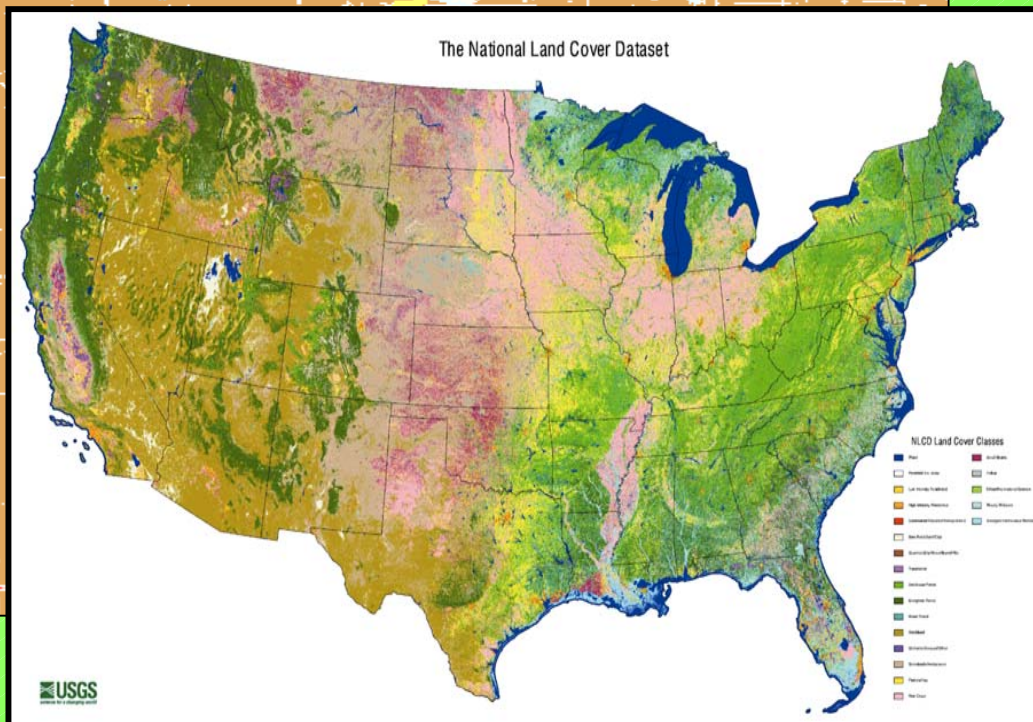
NASS Segment Boundaries



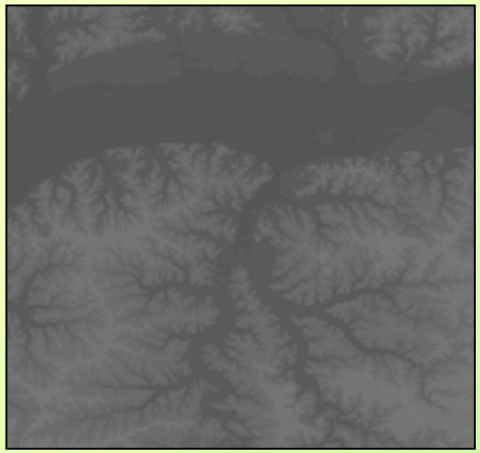
FSA Boundaries

Ground Truth – Non Agricultural

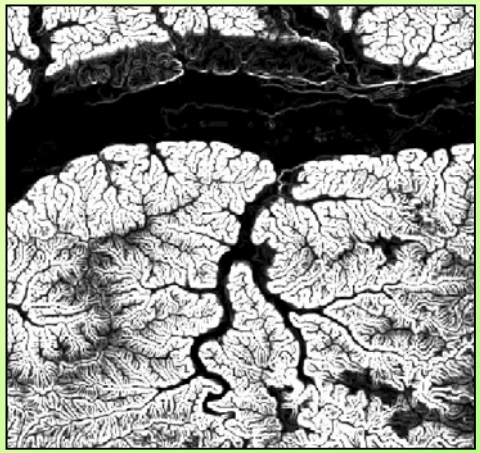
- Proportional sampling
- Use categorized 2001 National Land Cover Dataset from USGS



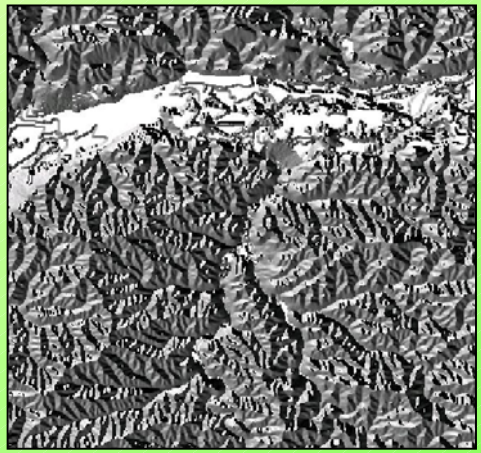
Ancillary Data – USGS Products



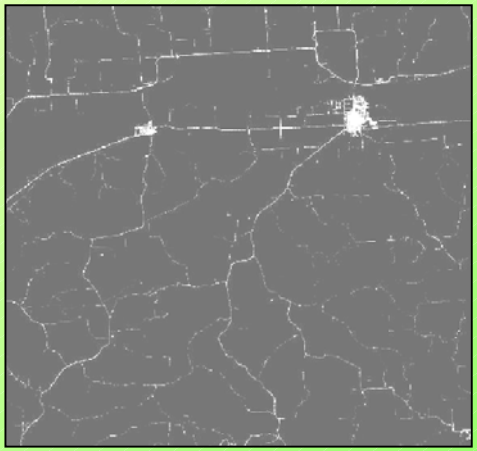
Elevation



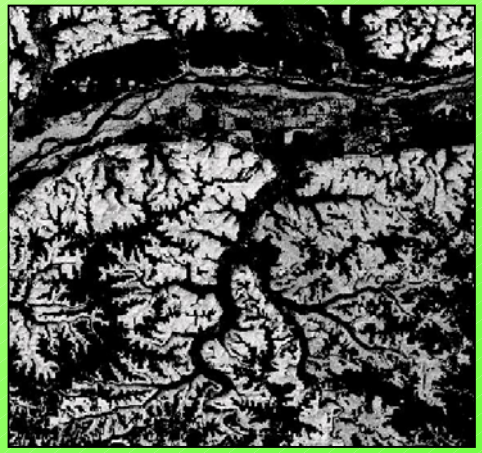
Slope



Aspect

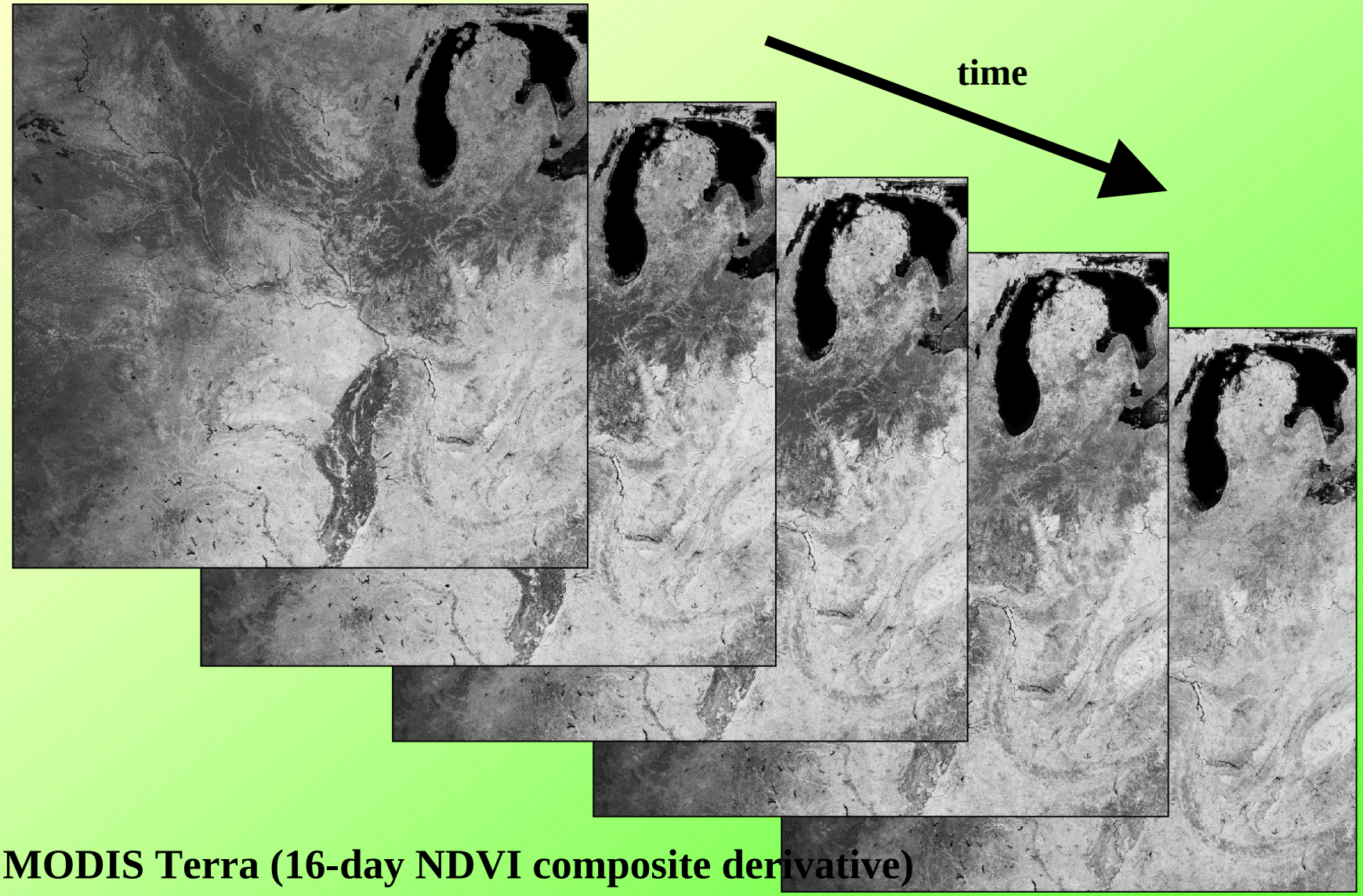


Impervious



Canopy

MODIS NDVI Imagery



NASA MODIS Terra (16-day NDVI composite derivative)

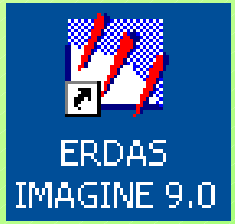
- **Time series of current growing season**
- **Fall scenes from previous year**

Cropland Data Layer Components

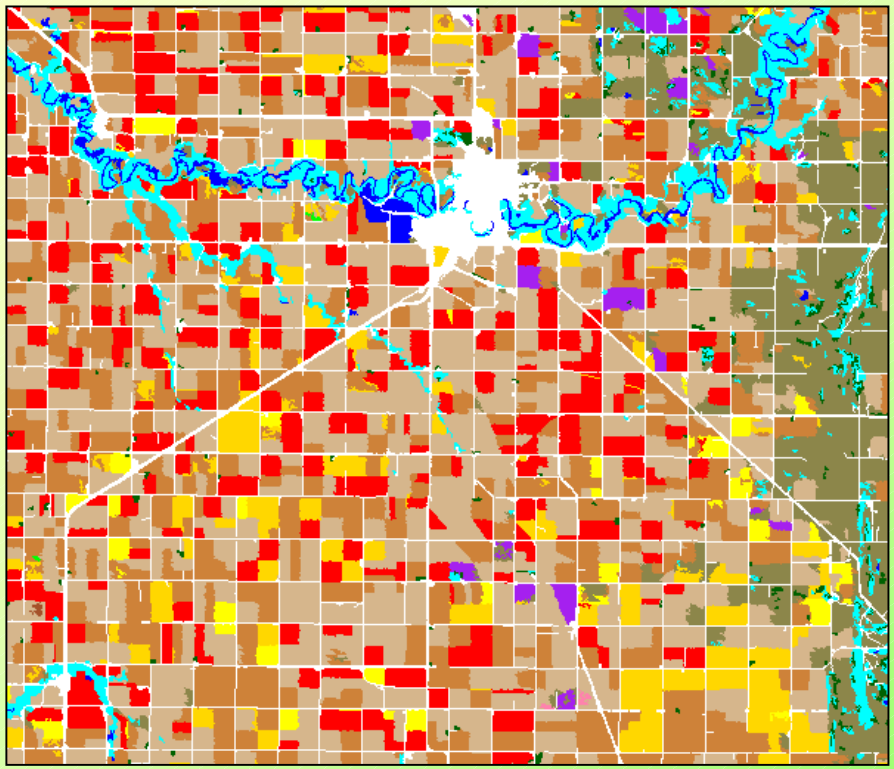
- AWiFS sensor
- Common Land Unit/578 Admin Data
  - USDA/Farm Service Agency
- Commercial software suite

Commercial Software Suite

- Imagery Preparation
  - Leica Geosystems ERDAS Imagine
- Image classification
  - Decision tree software
    - See5.0 www.rulequest.com
- Ground Truth Preparation
  - ESRI ArcGIS
- Acreage Estimation
  - SAS/IML workshop



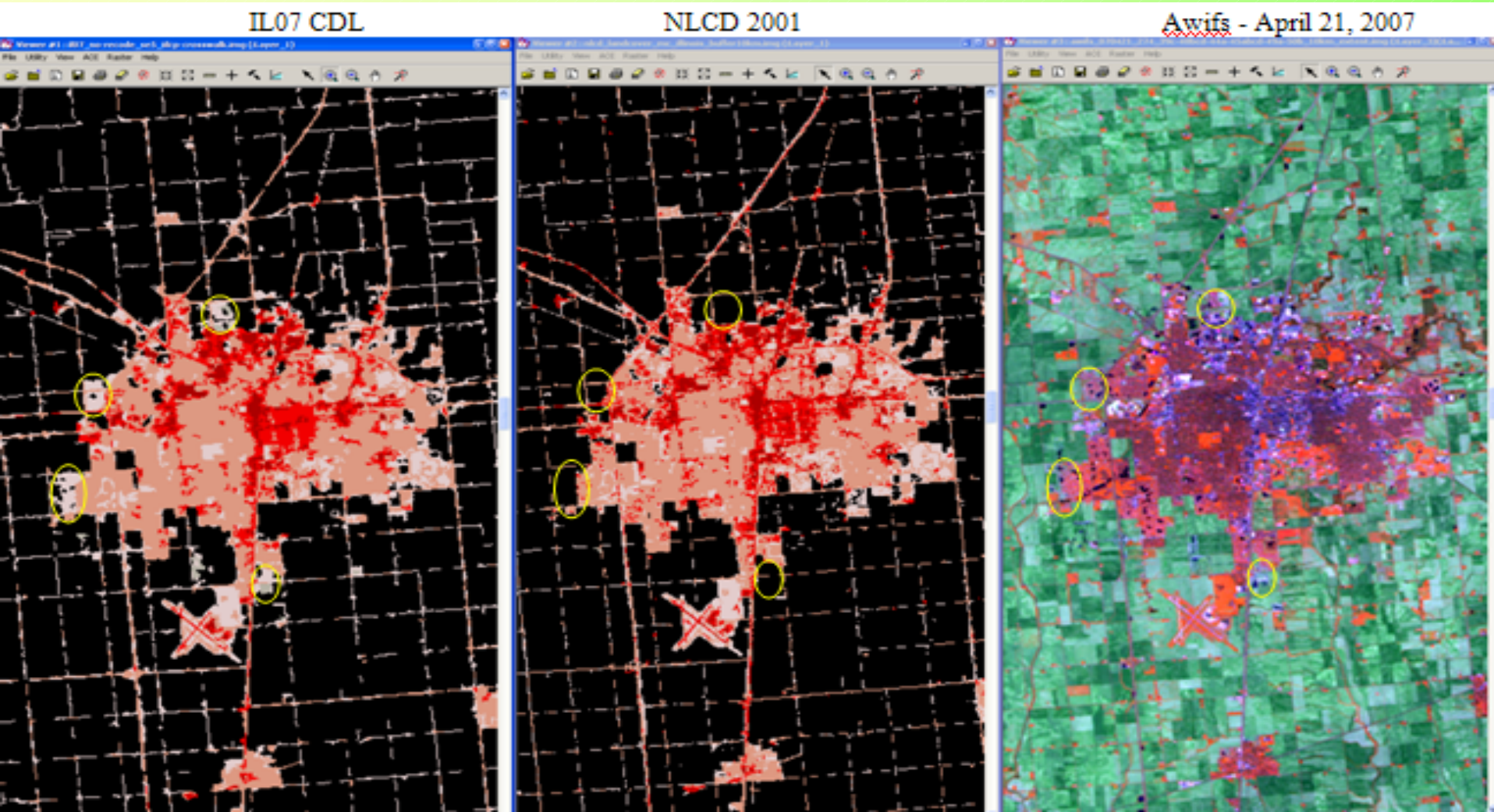
Example Classification Subset



CDL Classification

Resourcesat-1 AWiFS, 6 July 2007

Non Ag NLCD Updates (urban sprawl)

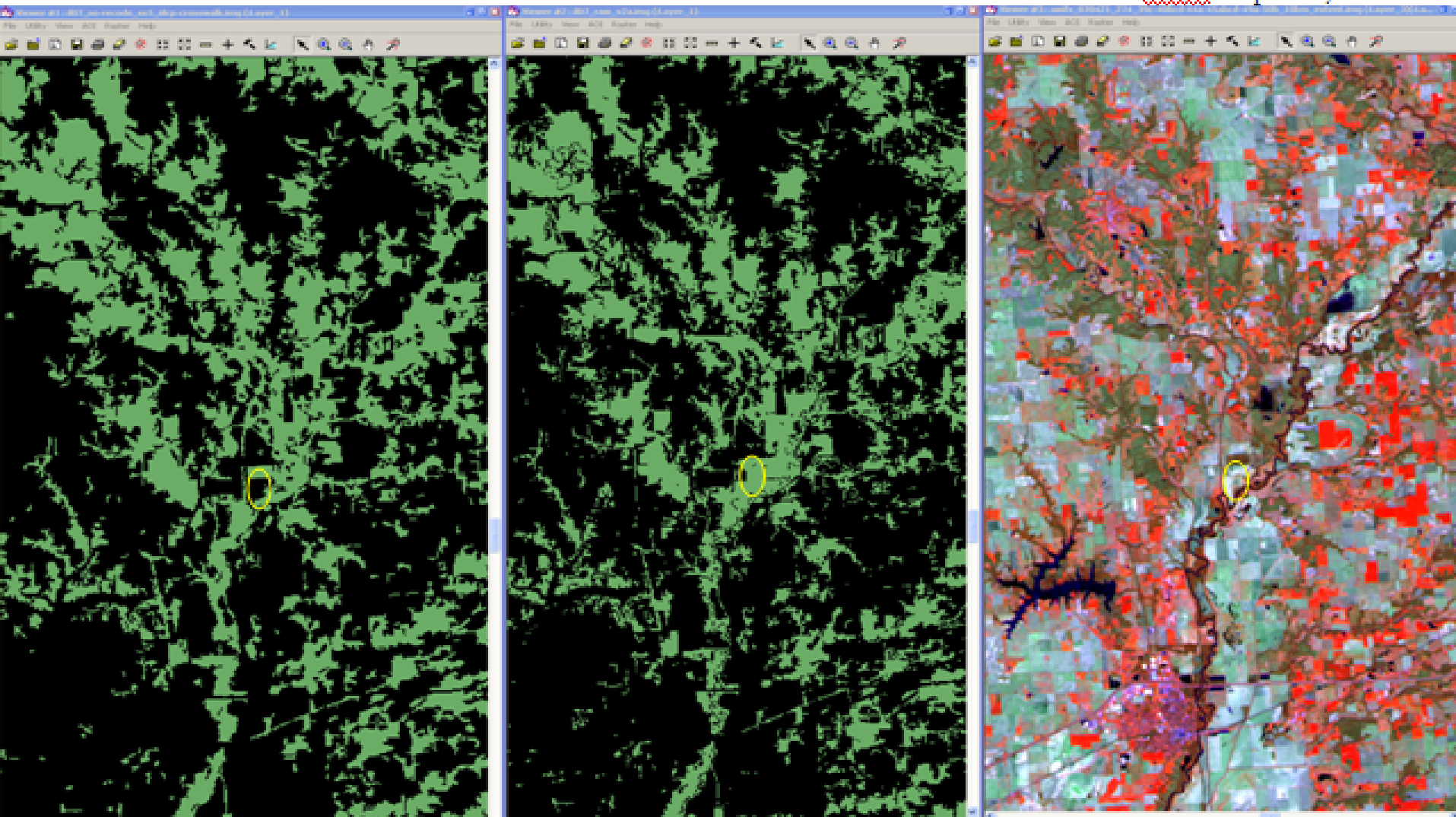


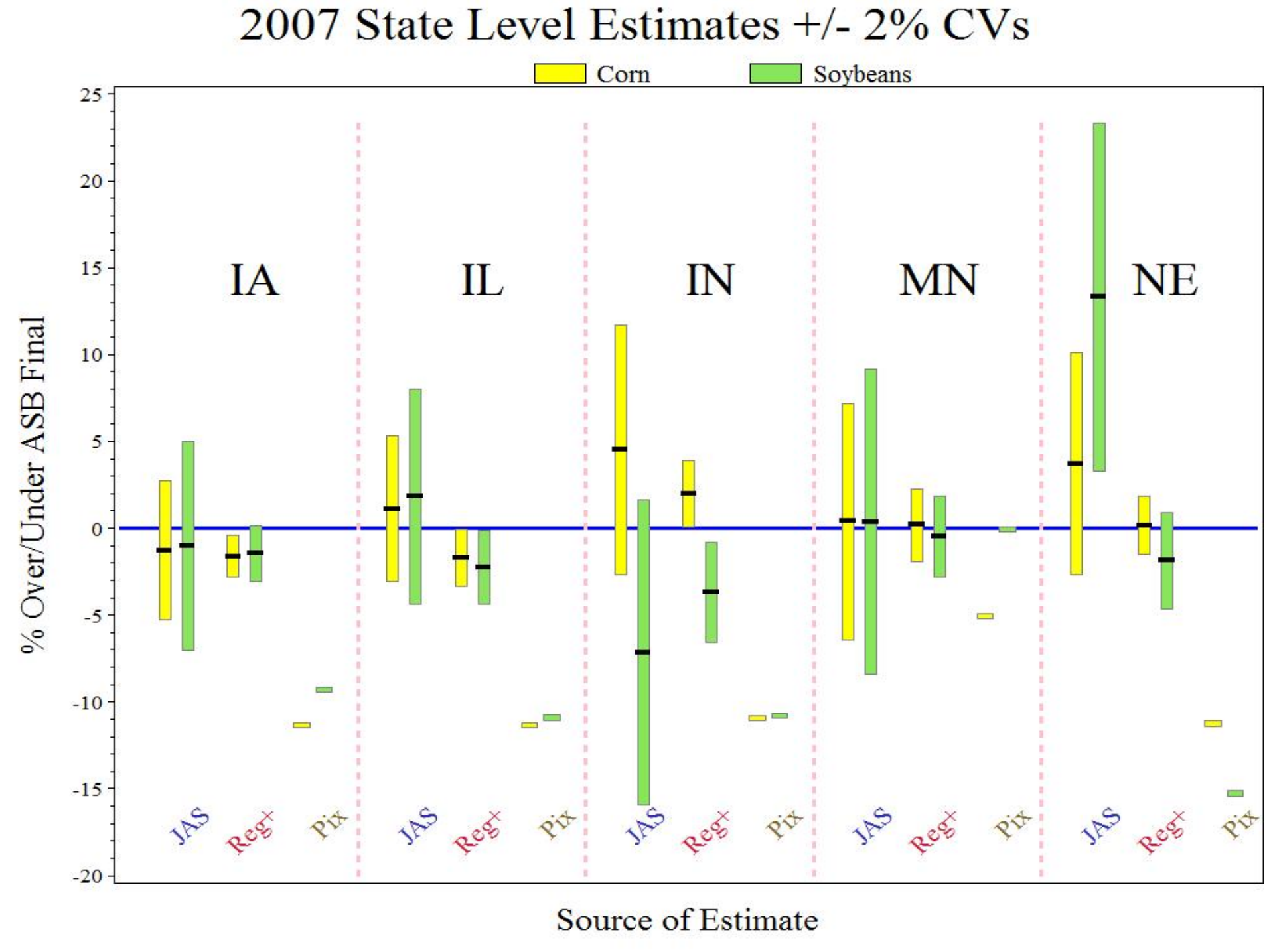
Non Ag NLCD Updates (forest clearing)

IL07 CDL

NLCD 2001

Awifs - April 21, 2007



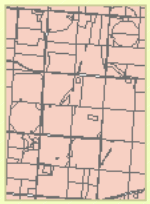

2007 State Level Estimates +/- 2% CVs
Corn
Soybeans
25
20
15
10
5
0
-5
-10
-15
-20
% Over/Under ASB Final
IA
IL
IN
MN
NE
JAS
Reg+
Pix
Source of Estimate

Cropland Data Layer and Acreage Estimation Processing Flow

Input Vector Data

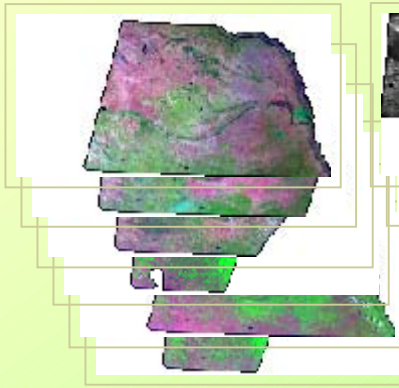
NASS JAS segments

FSA CLU

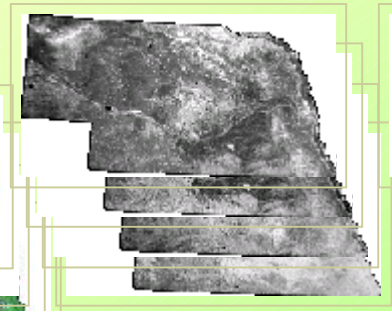


Input Raster Data

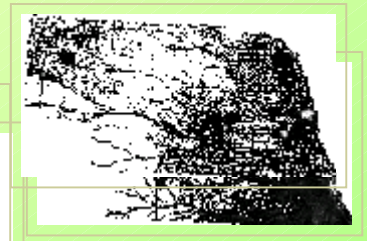
IRS Resourcesat-1 raw AWiFS summer time series



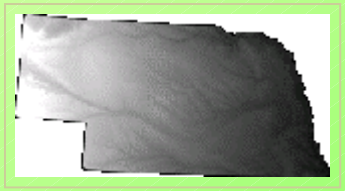
NASA Terra MODIS 16-day NDVI prior fall and summer time series



USGS NLCD circa 2001 Impervious & Canopy

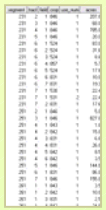


USGS NED Elevation

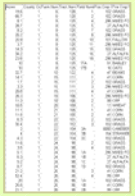


Tabular Data

JAS eData



FSA 578



All Input layers gridded to common cell size, map projection and areal extent

ESRI ArcGIS

Link and assess data sets

Ground truth

ERDAS IMAGINE®

Manages and visualizes datasets

Rulequest See5.0

Derives decision tree-based classification rules

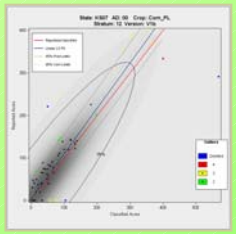
Generated rule set

ESRI ArcGIS

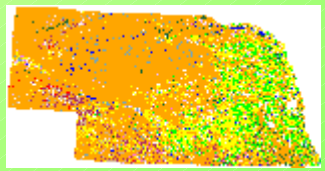
Extract JAS intersecting pixels

SAS

Customized for acreage estimation



Pixel count v. reported acreage



-- Cropland Data Layer --

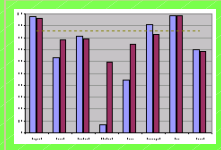
datagateway.nrcs.usda.gov

State and county crop acreage statistics

Internal to NASS only

Output

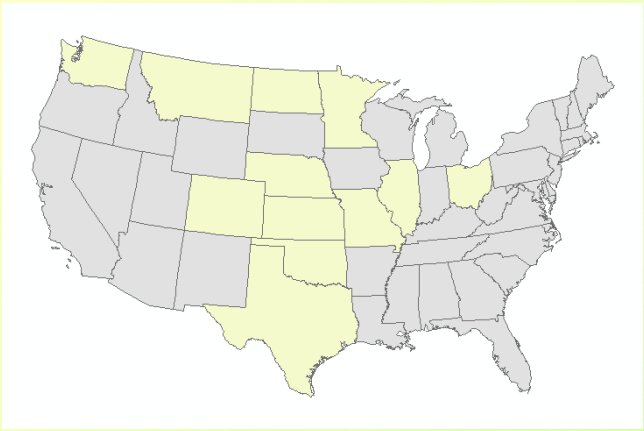
Confidence Layer



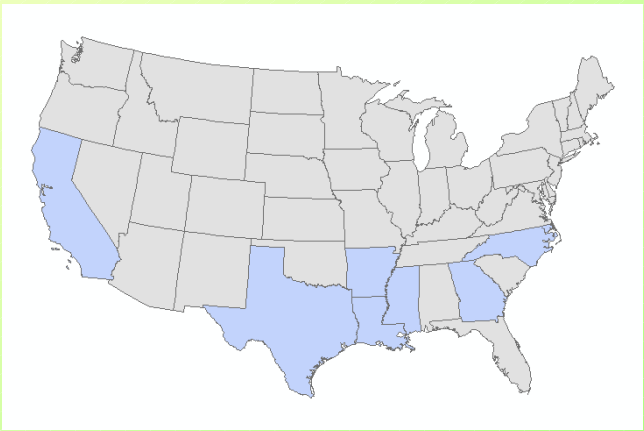
Accuracy Assessment

Diagnostics

CDL 2008?



Primary Wheat States



Primary Cotton States

- Expand geographic scope?
  - Wheat/cotton states next priority
  - Mid-Atlantic region (often asked about)
- Improved categories?
  - Grassland/Non Ag
- Imagery?
  - Future sensors
  - Finer resolution
- Other ancillary data?
  - Soils
  - Climate
- Derivatives?
  - Change detection
  - Crop rotation patterns
- Move up estimates delivery
  - Another 60 days to mid-August

Thank You

Rick Mueller, Claire Boryan, Mike Craig, Dave Johnson,
Bob Seffrin, Patrick Willis, Larry Beard, Zhengwei Yang

www.nass.usda.gov
datagateway.nrcs.usda.gov