# Acreage Estimate Production Throughout the Growing Season: An Update on the Cropland Data Layer

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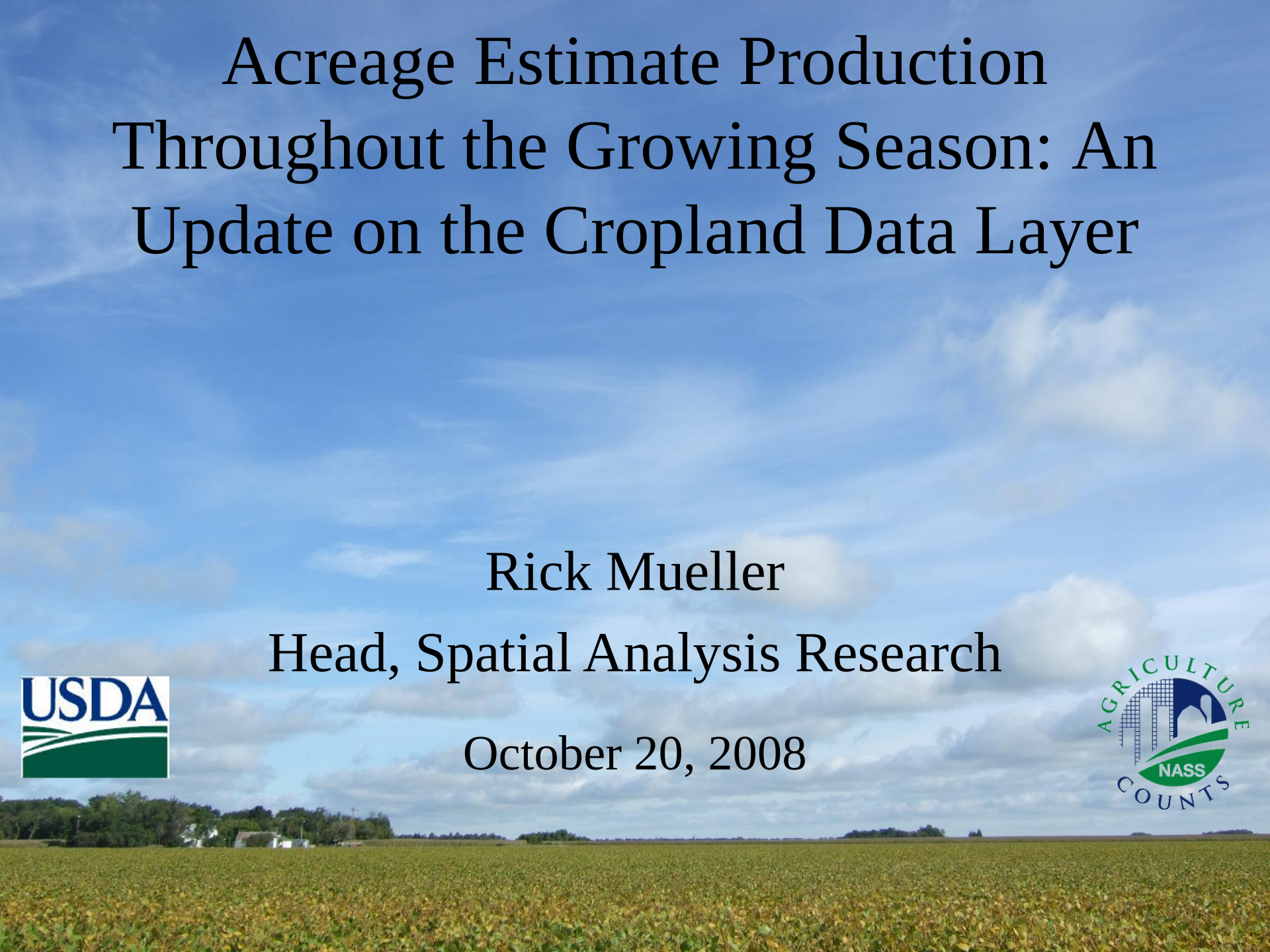
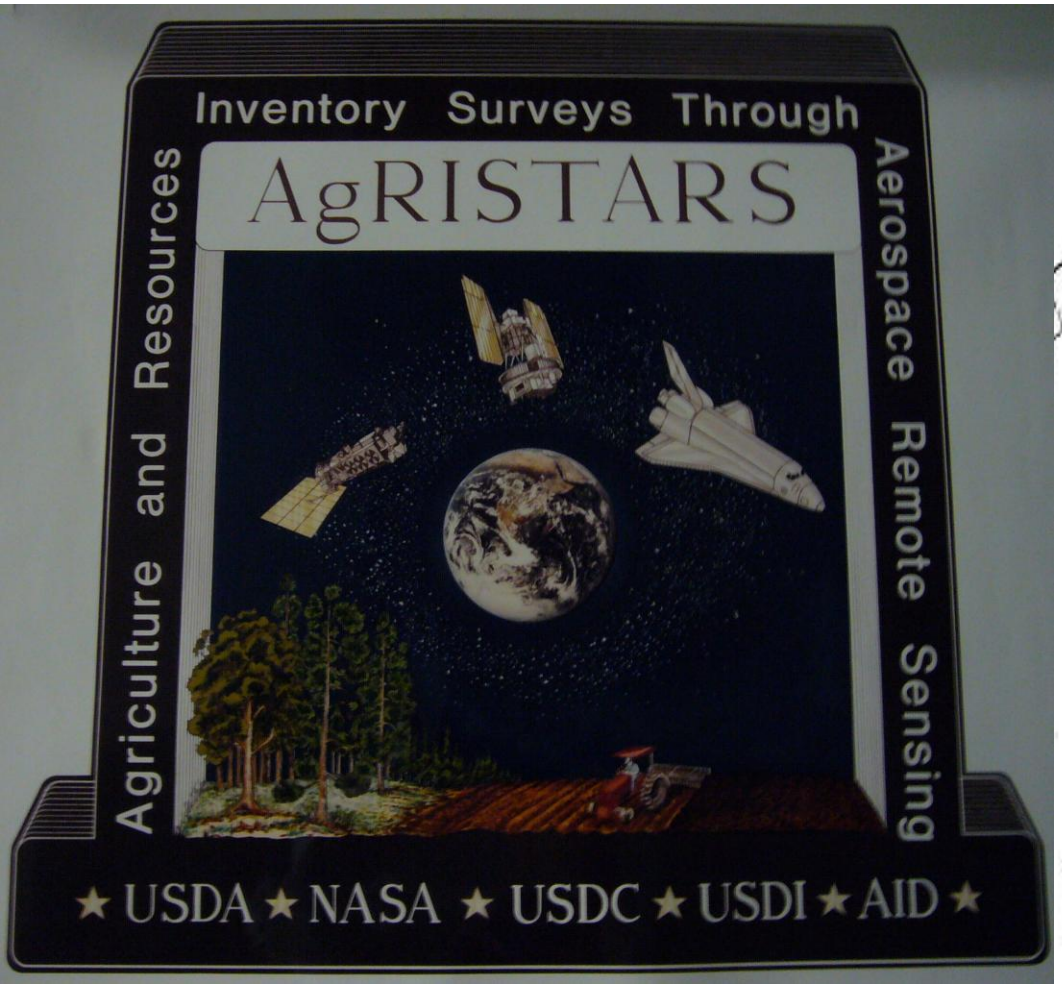
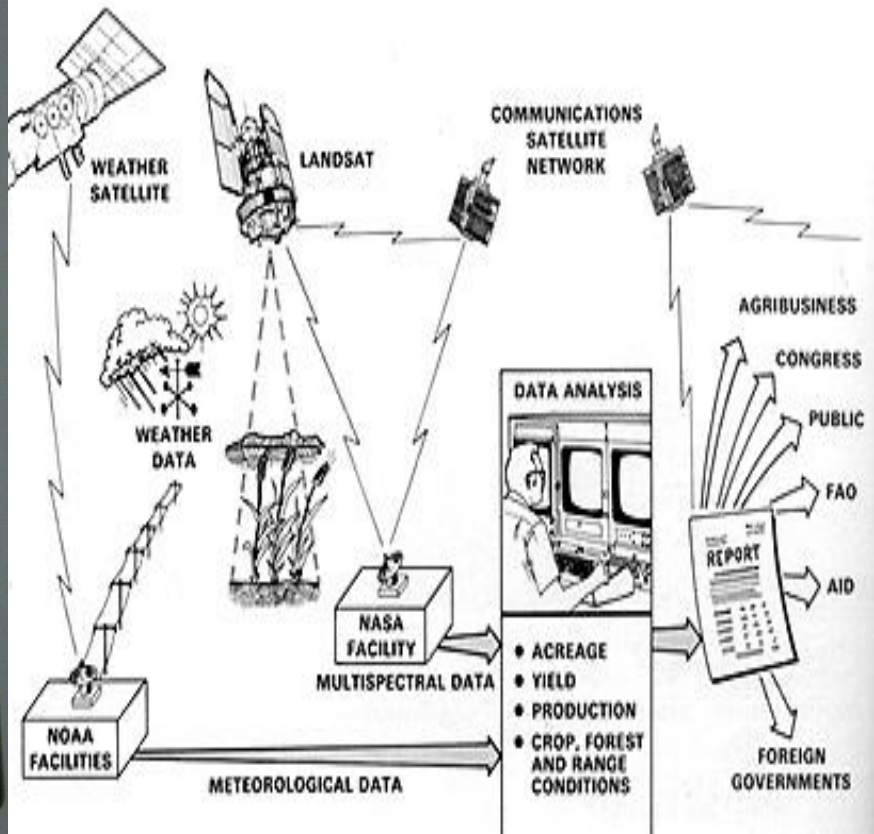
October 20, 2008



# Cropland Data Layer (CDL) Discussion

- Legacy program
  - Issues: Budget/Satellites/Agency Support/Technology



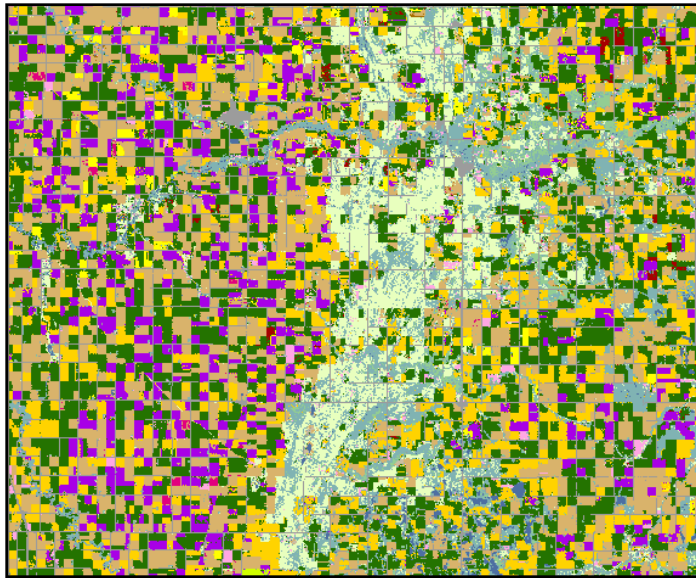



# CDL Program Objectives

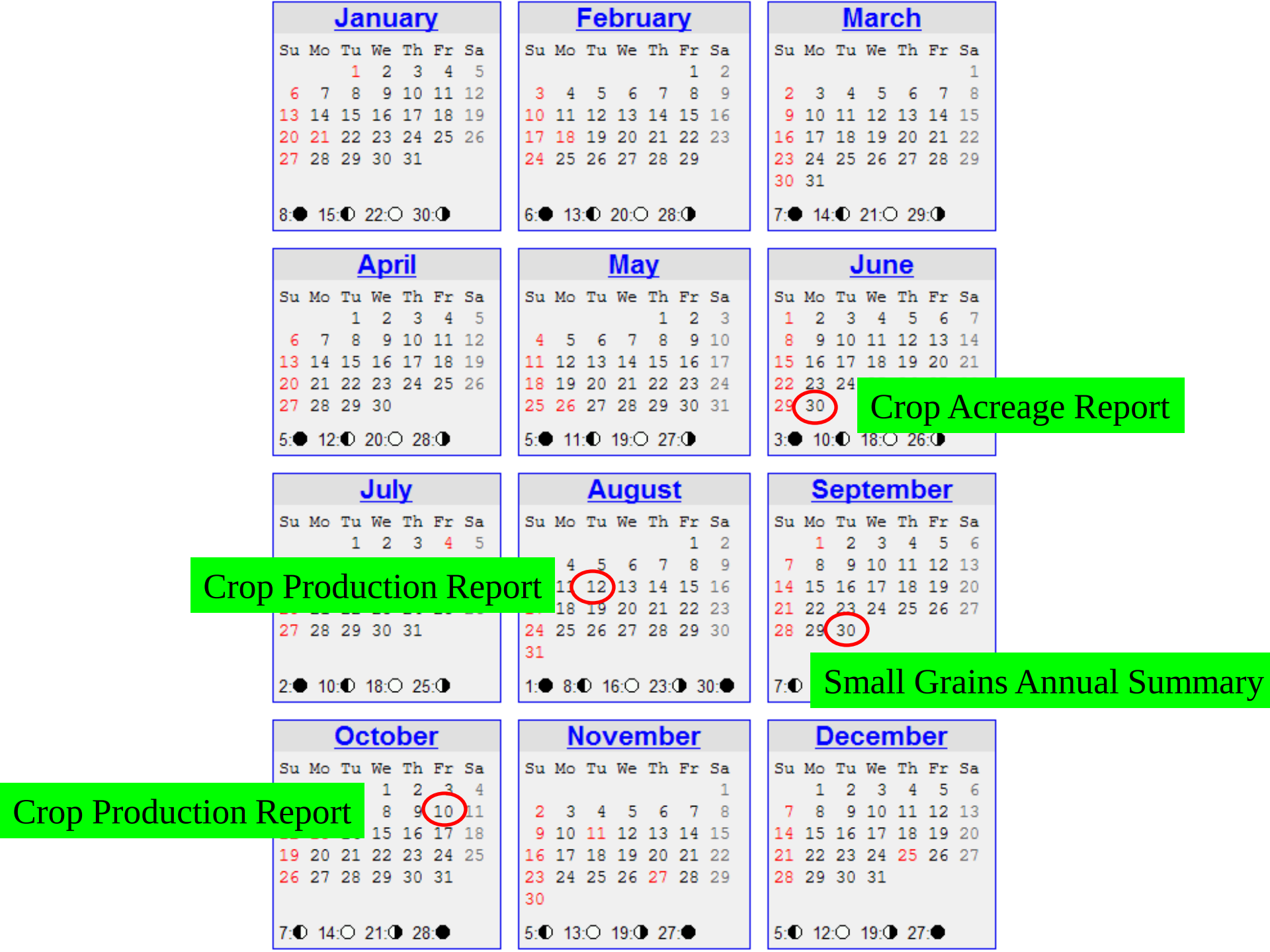
- **“Census by Satellite”**
  - Annually cover major producing corn and soybean regions
  - Indications reflect actual location of the crops
    - Not address on record via survey

- **Provide timely, accurate, useful indications**
  - Measurable error
  - Unbiased/independent estimator
  - State, county, district (ASD)

- **Operationalize indications delivery**
  - For June, August, and October
    - Ag Statistics Board
  - Update planted area



- **Output crop specific CDL**
  - Distribute to public at the cost of reproduction
    - NRCS Geospatial Data Gateway


January
Su Mo Tu We Th Fr Sa
1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30 31
8:● 15:◐ 22:○ 30:◑
February
Su Mo Tu We Th Fr Sa
1 2
3 4 5 6 7 8 9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29
6:● 13:◐ 20:○ 28:◑
March
Su Mo Tu We Th Fr Sa
1
2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 31
7:● 14:◐ 21:○ 29:◑
April
Su Mo Tu We Th Fr Sa
1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30
5:● 12:◐ 20:○ 28:◑
May
Su Mo Tu We Th Fr Sa
1 2 3
4 5 6 7 8 9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30 31
5:● 11:◐ 19:○ 27:◑
June
Su Mo Tu We Th Fr Sa
1 2 3 4 5 6 7
8 9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24
29 30
3:● 10:◐ 18:○ 26:◑
Crop Acreage Report
July
Su Mo Tu We Th Fr Sa
1 2 3 4 5
27 28 29 30 31
2:● 10:◐ 18:○ 25:◑
Crop Production Report
August
Su Mo Tu We Th Fr Sa
1 2
4 5 6 7 8 9
11 12 13 14 15 16
18 19 20 21 22 23
24 25 26 27 28 29 30
31
1:● 8:◐ 16:○ 23:◑ 30:●
September
Su Mo Tu We Th Fr Sa
1 2 3 4 5 6
7 8 9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30
7:◐
Small Grains Annual Summary
October
Su Mo Tu We Th Fr Sa
1 2 3 4
8 9 10 11
15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30 31
7:◐ 14:○ 21:◑ 28:●
Crop Production Report
November
Su Mo Tu We Th Fr Sa
1
2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30
5:◐ 13:○ 19:◑ 27:●
December
Su Mo Tu We Th Fr Sa
1 2 3 4 5 6
7 8 9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 31
5:◐ 12:○ 19:◑ 27:●

# CDL States and Commodities

| State | Corn | Soybeans | Winter Wheat | Cotton | Spring Wheat | Rice | Sorghum | Sugar-beets | Sugar-cane | Durum Wheat | Dry Beans | Sunflower | Canola |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Arkansas | F, RS | F,O, RS | F, RS | S,O, RS | | F, RS | F | | | | | | |
| Colorado | F, RS | | S,O, RS | | A | | F | | | | F | F, P | |
| Illinois | S,O, RS | S,O, RS | S,O, RS | | | | F | | | | | U | |
| Indiana | S,O, RS | S,O, RS | F, RS | | | | | | | | | | |
| Iowa | S,O, RS | S,O, RS | A | | | | | | | | | | |
| Kansas | F, RS | S,O, RS | S,O, RS | A | | | F, RS | | | | F | F, P | |
| Louisiana | F, RS | F, RS | A, RS | S,O, RS | | F, RS | F | | F, RS | | | | |
| Michigan | F, RS | F, RS | F, RS | | | | | | | | F | U | U |
| Minnesota | S,O, RS | S,O, RS | A | | S,O, RS | | | F, RS | | | F | F, P | F, P |
| Mississippi [1] | F, RS | F, RS | F, RS | S,O, RS | | F, RS | A, RS | | | | | | |
| Missouri | F, RS | S,O, RS | S,O, RS | F, RS | | F, RS | F | | | | | U | |
| Nebraska | S,O, RS | S,O, RS | S,O, RS | | | | F | | | | F | F, P | |
| North Dakota | F, RS | F,O, RS | A | | S,O, RS | | | F, RS | | F, O, RS | F, RS | F, P, RS | F, P, RS |
| Ohio | S,O, RS | S,O, RS | S,O, RS | | | | | | | | | | |
| Oklahoma | F | F | S,O, RS | F | | | F | | | | | U | U |
| South Dakota | F, RS | F,O, RS | F, RS | | F, RS | | | | | A | F | F, P | |
| Texas | F, RS | F, RS | S,O, RS | S,O, RS | | F | F | | | | F | F, P | |
| Wisconsin | S, O, RS | F, RS | F | | A | | | | | | L | U | |

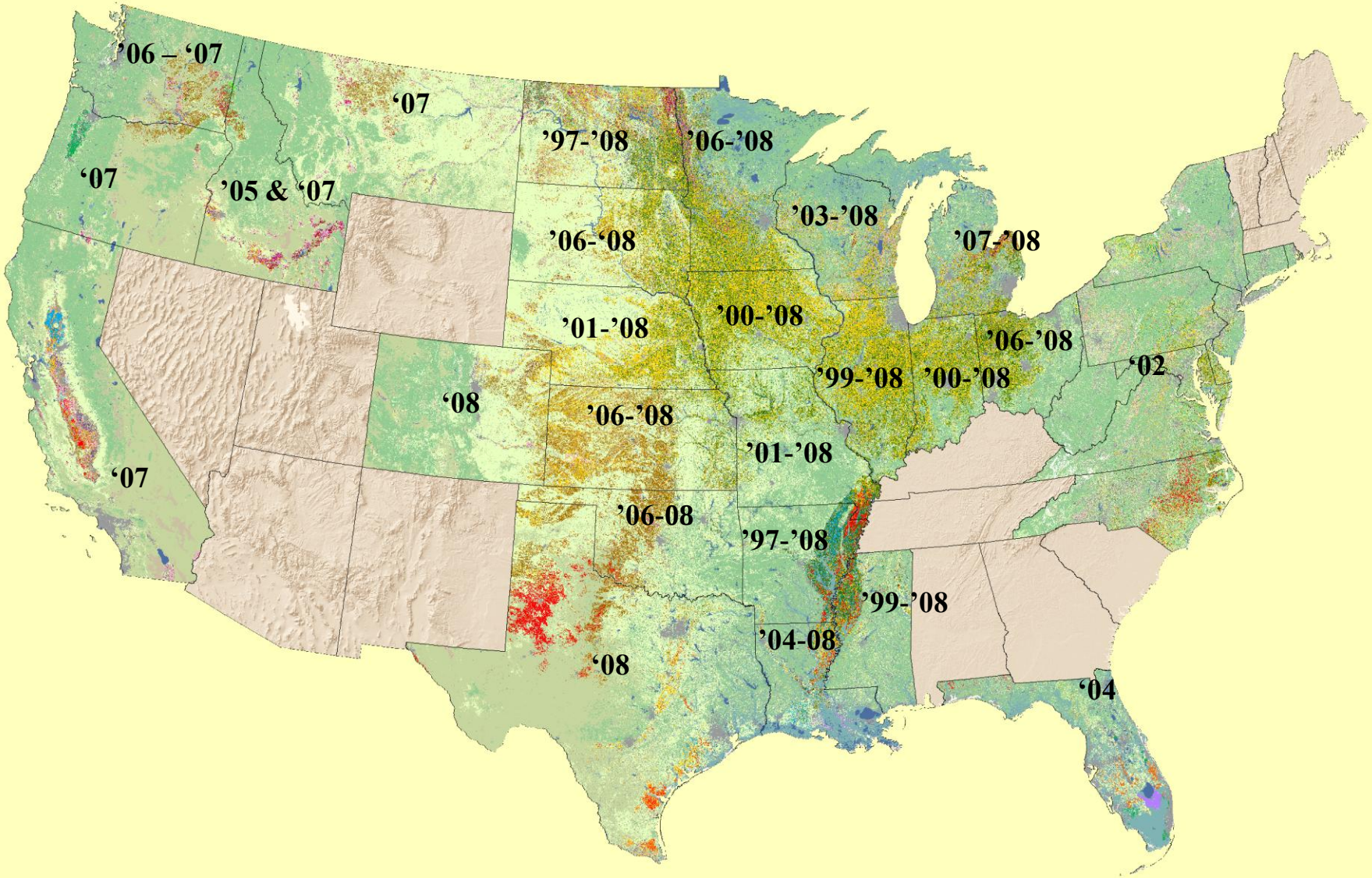
Green shading indicates states new to program in 2008.

[1] Unable to complete the MS 2008 Aug. RS estimation due to flooding & unusually late FSA signup

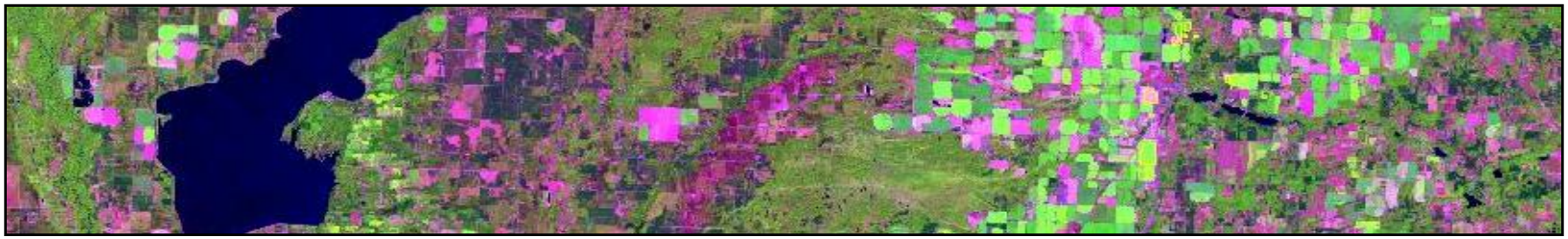
**Program Definitions:**

| | |
|---|---|
| S | Speculative State |
| F | Full Program State |
| A | Annual State |
| P | Estimates published |
| U | Estimates submitted, published in other states |
| L | Limited forecast state (none in Oct.) |
| RS | Remote Sensing |
| O | Objective Yield State |

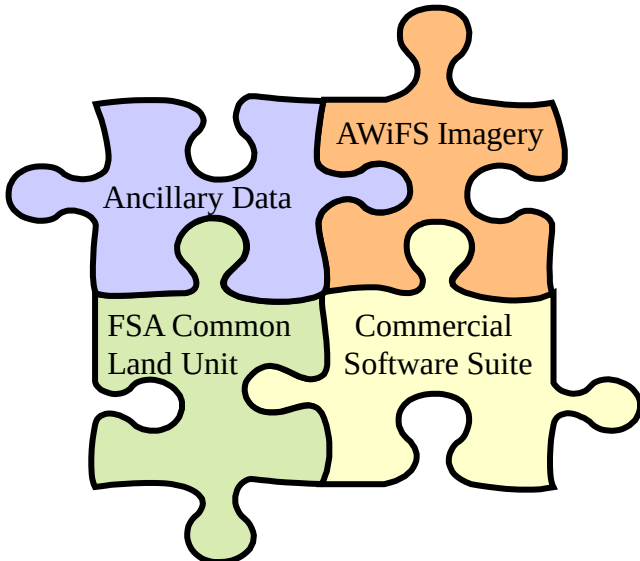
# Cropland Data Layers
## 1997 - 2008



# CDL Program

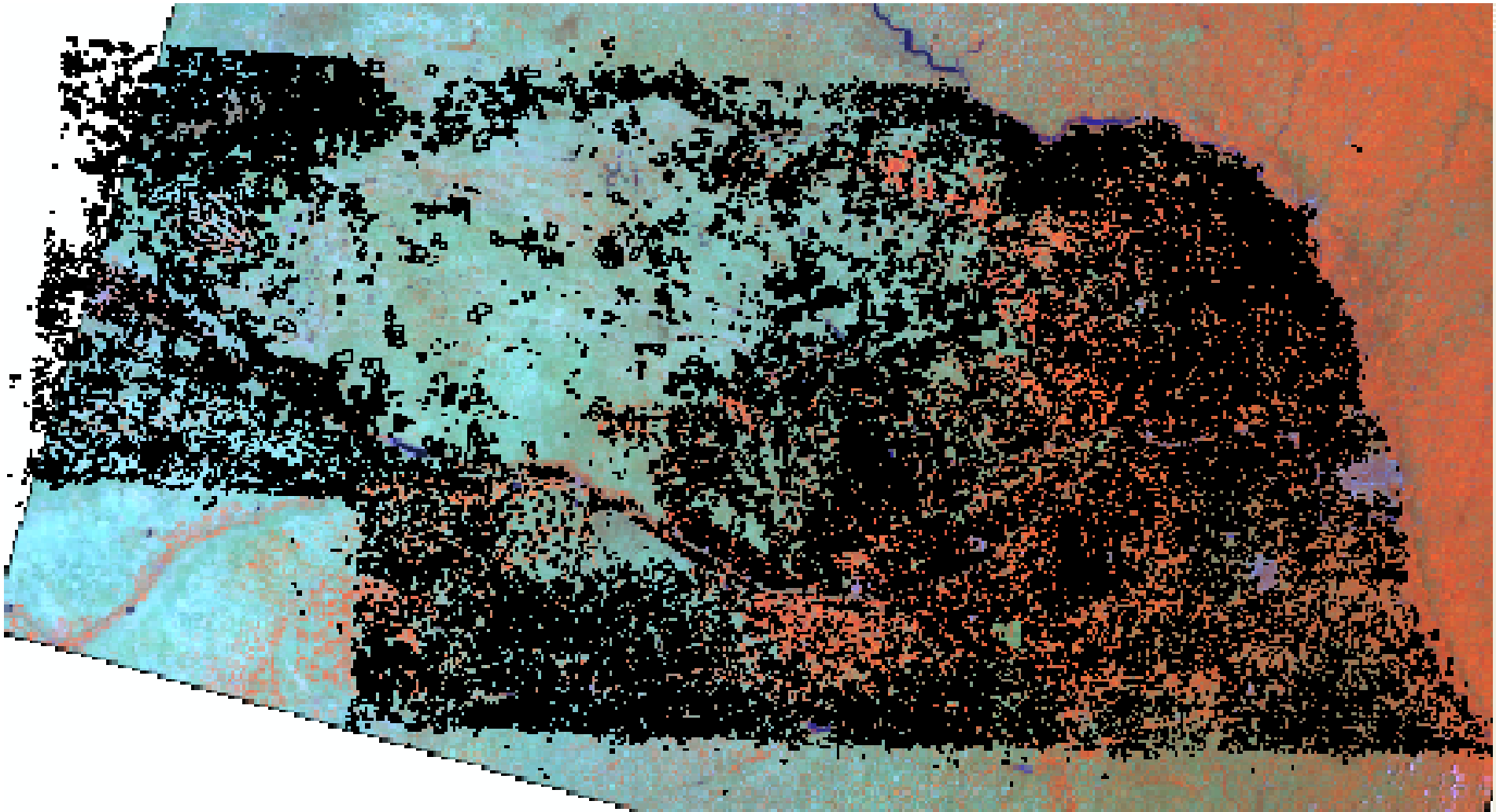


- Inputs
  - Resourcesat-1 AWiFS imagery
  - Farm Service Agency – Common Land Unit
  - Ancillary data
  - Commercial software suite
- Outputs
  - Acreage Estimates
  - Cropland Data Layer



# Agricultural Ground Truth

- Farm Service Agency (FSA)
  - Common Land Unit (CLU)
  - 578 attributed reporting data



# Agricultural Ground Truth

- Farm Service Agency (FSA)
  - Common Land Unit (CLU)
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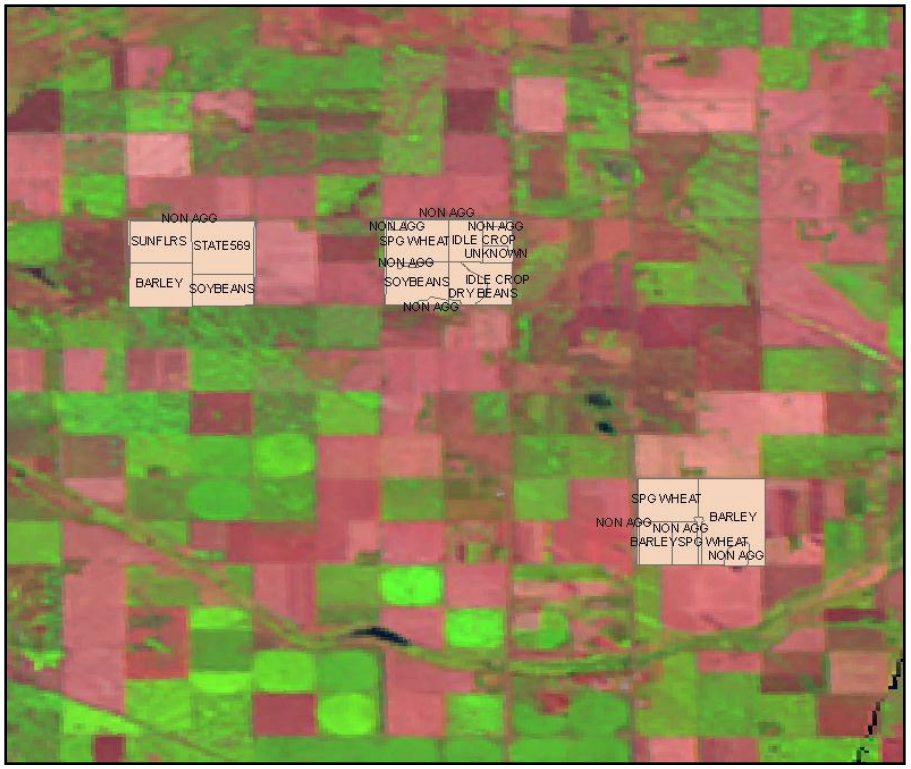
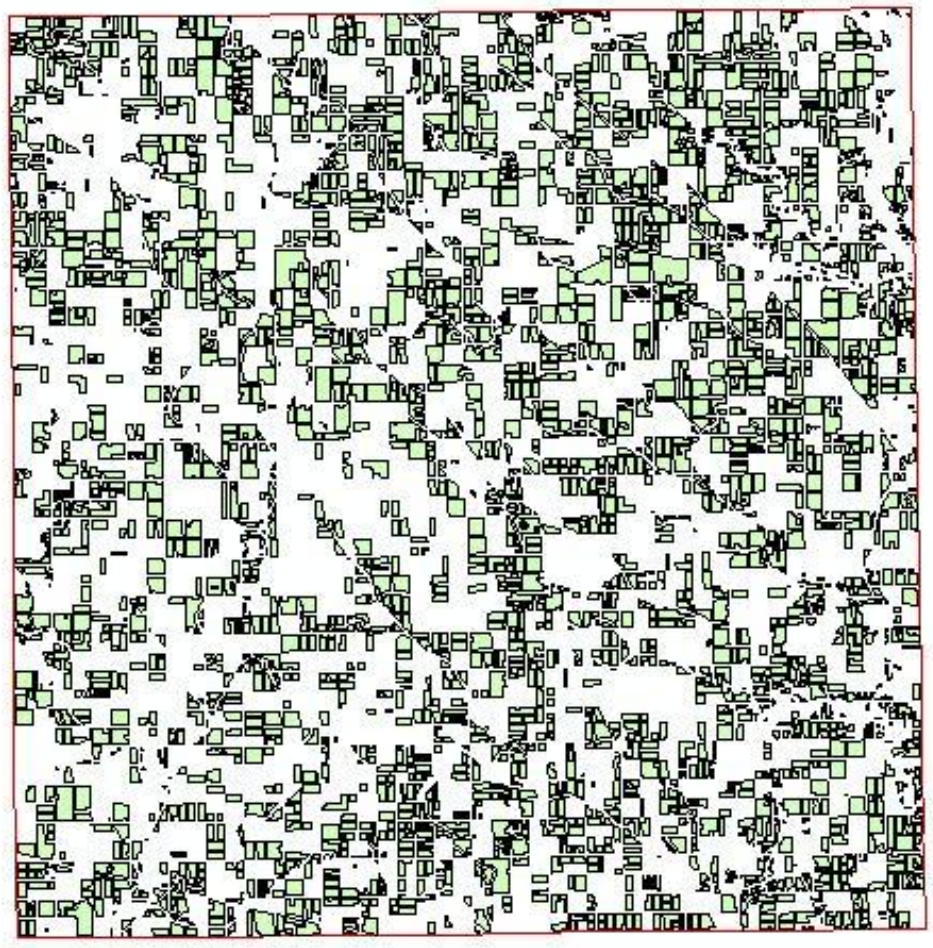
USDA United States Department of Agriculture
Farm Service Agency

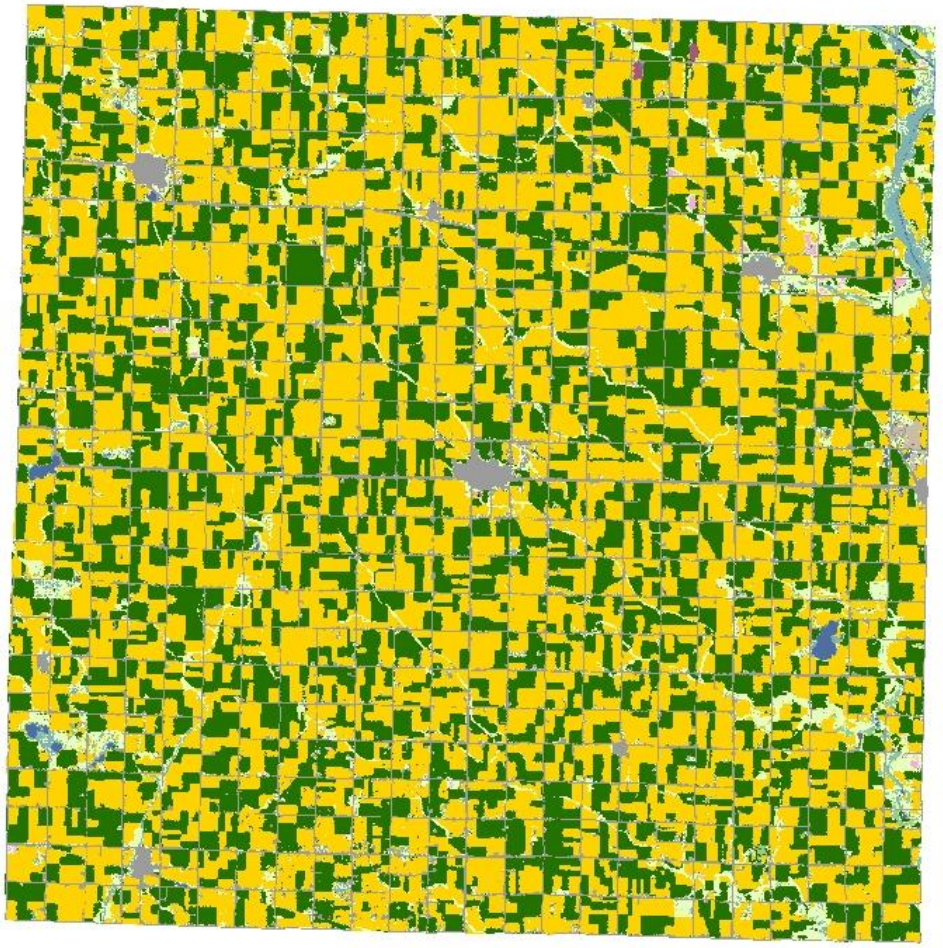

FSA




NASS



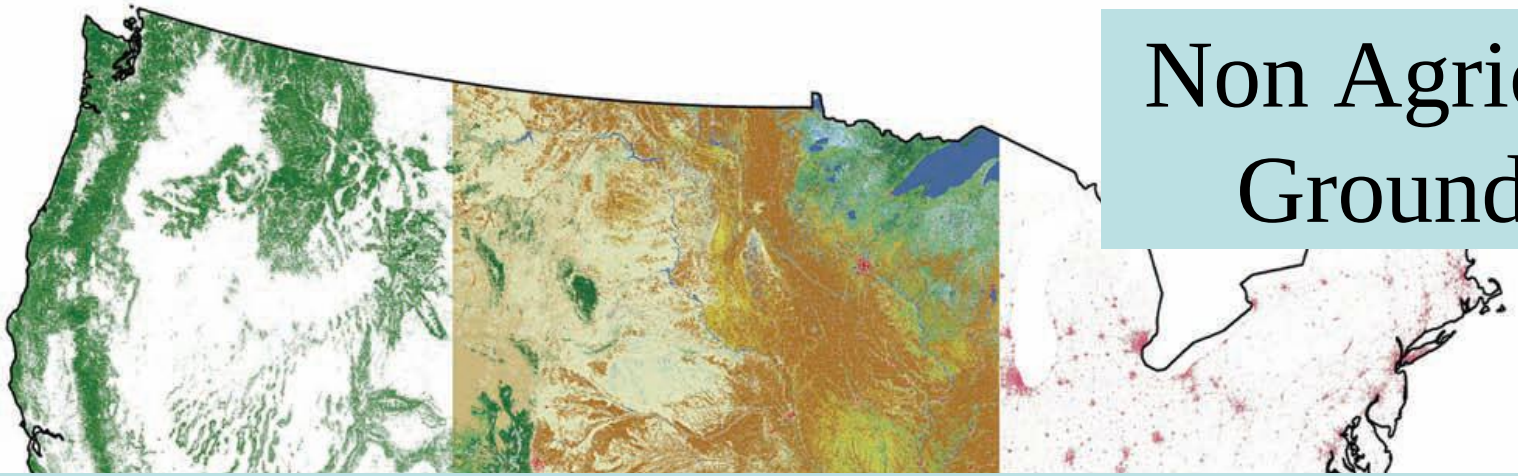
Matching CLU's used for sampling



CDL Classification

½ sample for training & ½ sample for testing
Filter multi-field CLU/high acreage variance
Comprehensive **program crop** coverage

# Non Agricultural - Ground Truth



- Proportional sampling
- 2001 National Land Cover Dataset from USGS
- Improve CDL coverage of non-ag classes

**Tree canopy**

- 1 to 10%
- 11 to 20%
- 21 to 30%
- 31 to 40%
- 41 to 50%
- 51 to 60%
- 61 to 70%
- 71 to 80%
- 81 to 90%
- 91 to 100%

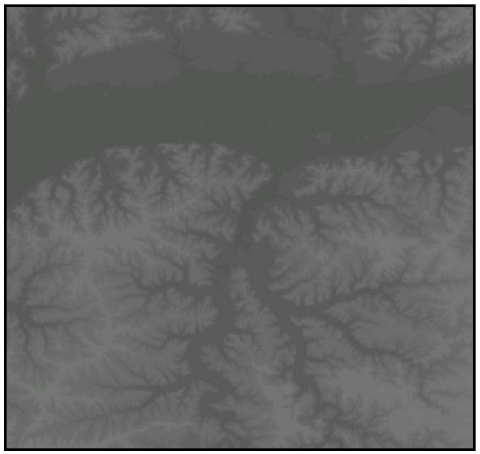
**Land Cover Class Value and Description**

- (11) Open Water
- (12) Perennial Ice/Snow
- (21) Developed, Open Space
- (22) Developed, Low Intensity
- (23) Developed, Medium Intensity
- (24) Developed, High Intensity
- (31) Barren Land
- (41) Deciduous Forest
- (42) Evergreen Forest
- (43) Mixed Forest
- (52) Shrub/Scrub
- (71) Grassland/Herbaceous
- (81) Hay/Pasture
- (82) Cultivated Crops
- (90) Woody Wetlands
- (95) Emergent Herbaceous Wetlands

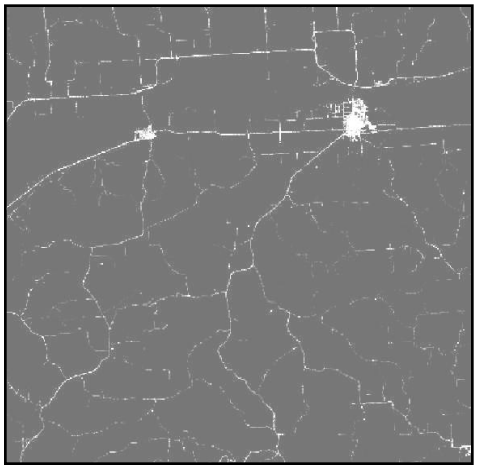
**Urban Imperviousness**

- 1 to 10%
- 11 to 20%
- 21 to 30%
- 31 to 40%
- 41 to 50%
- 51 to 60%
- 61 to 70%
- 71 to 80%
- 81 to 90%
- 91 to 100%

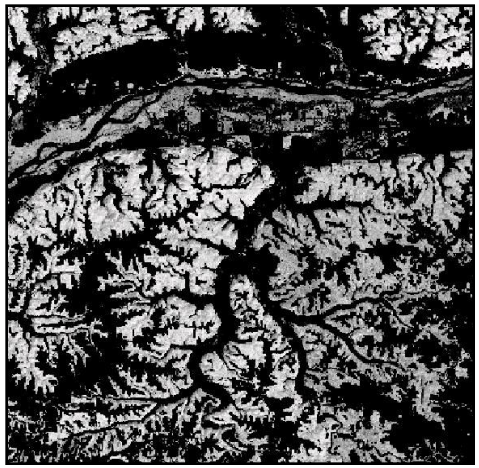
# Ancillary Data – USGS/NASA Products



Elevation

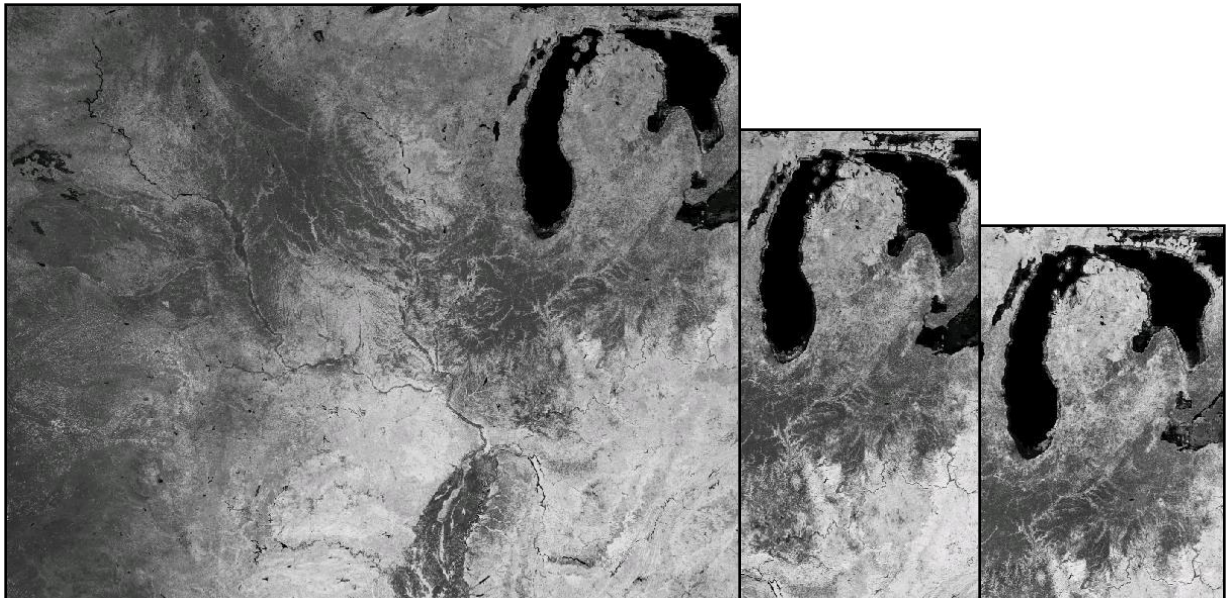


Imperviousness



Forest Canopy

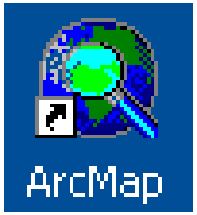
NASA MODIS Terra
(16-day NDVI composite)



# Commercial Software Suite


- Imagery Preparation
  - ERDAS Imagine

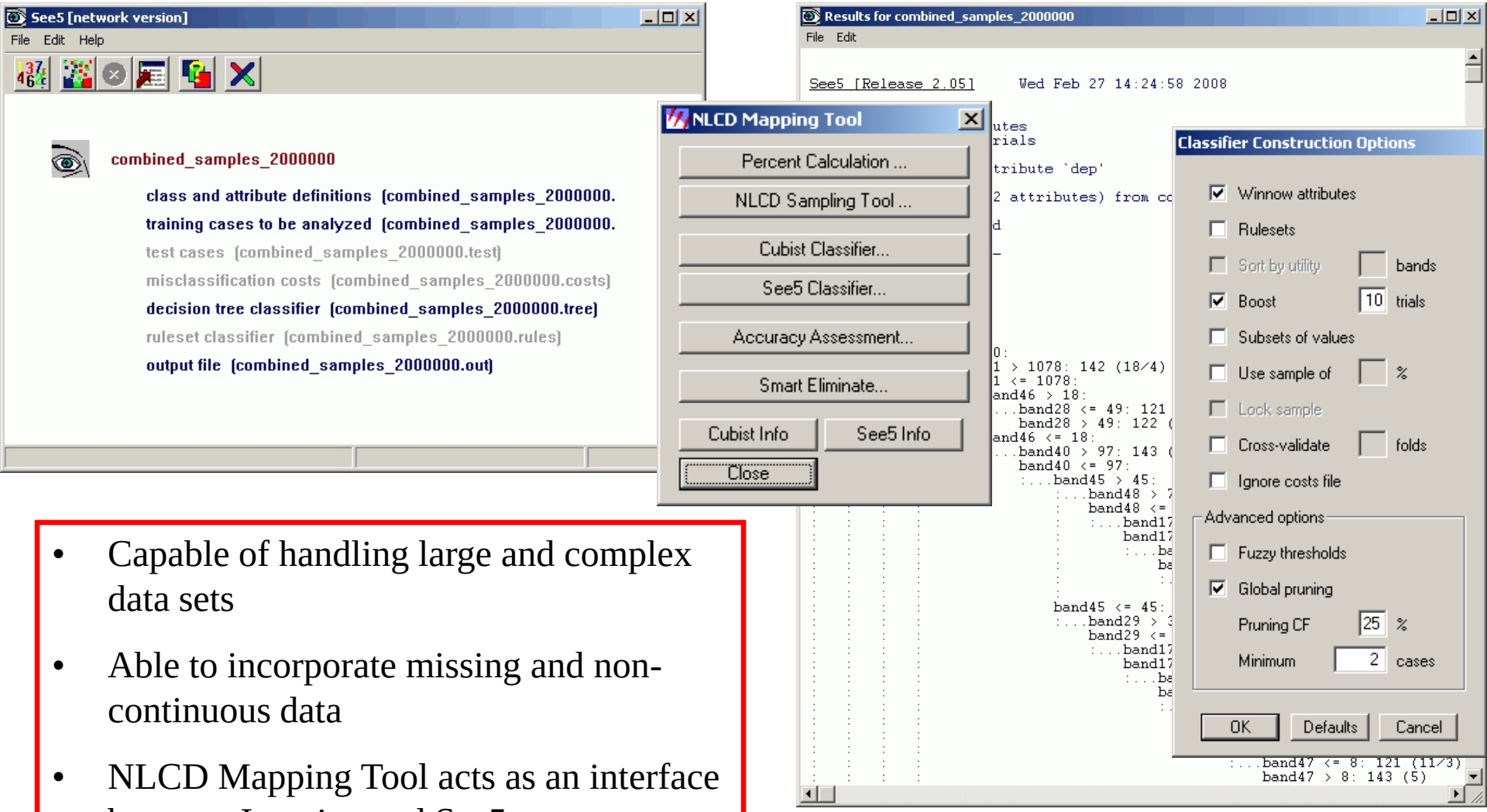

- Image classification
  - Decision tree software
    - See5.0 www.rulequest.com




- Ground Truth Preparation
  - ESRI ArcGIS


- Acreage Estimation
  - SAS/IML workshop

# Classification – See5 Decision Tree




- Capable of handling large and complex data sets
- Able to incorporate missing and non-continuous data
- NLCD Mapping Tool acts as an interface between Imagine and See5

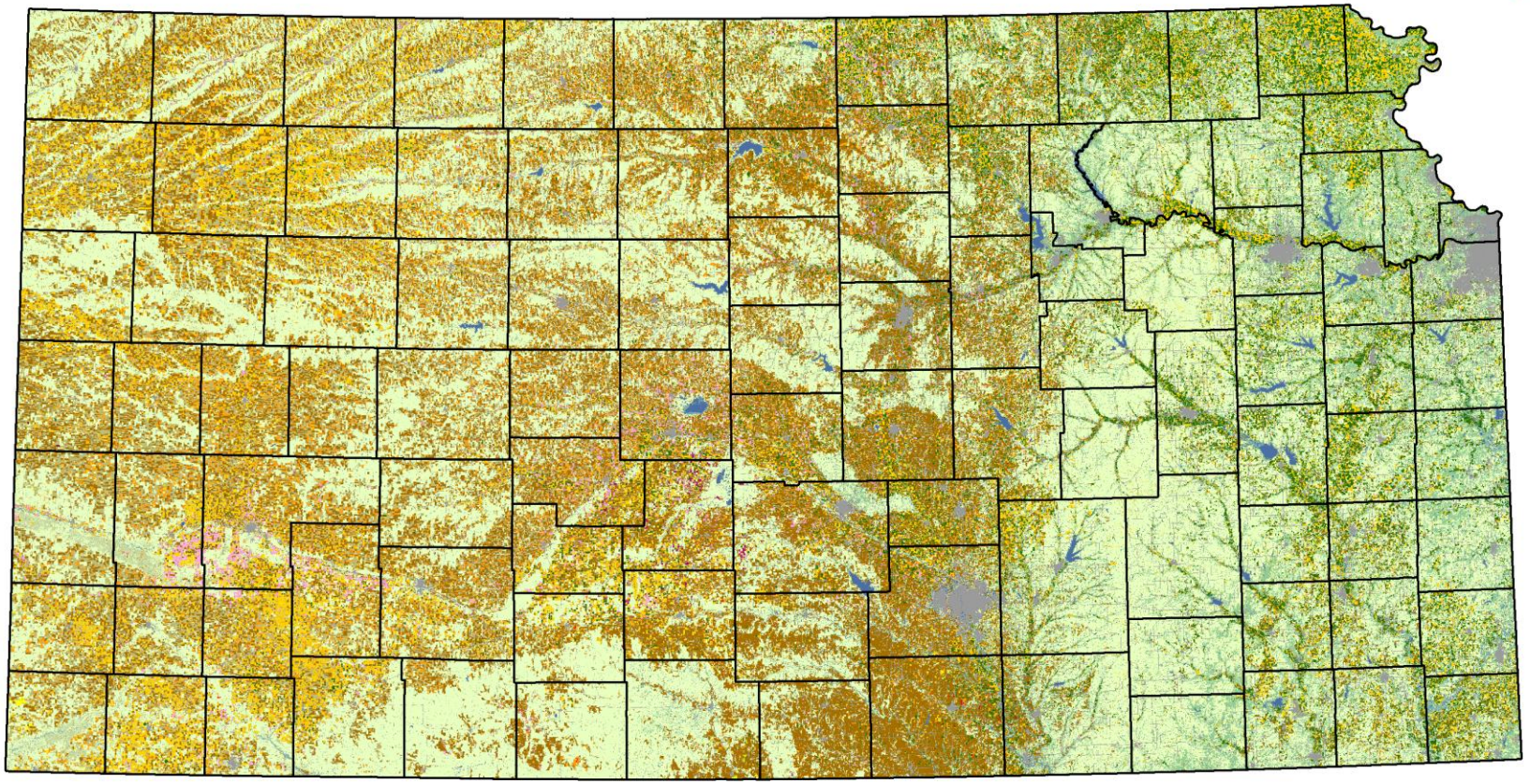
# Accuracy Statistics

| Crop-specific covers only | *Correct | Accuracy | Error | Kappa |
|---|---|---|---|---|
| OVERALL ACCURACY | 740009 | 93.56% | 6.44% | 0.8488 |

| Cover Type | Attribute Code | *Correct Pixels | Producer's Accuracy | Omission Error | Kappa | User's Accuracy | Commission Error | Cond'l Kappa |
|---|---|---|---|---|---|---|---|---|
| Corn | 1 | 28358 | 95.36% | 4.64% | 0.9528 | 93.08% | 6.92% | 0.9297 |
| Cotton | 2 | 11757 | 95.08% | 4.92% | 0.9505 | 94.59% | 5.41% | 0.9456 |
| Rice | 3 | 2 | 28.57% | 71.43% | 0.2857 | 66.67% | 33.33% | 0.6667 |
| Sorghum | 4 | 21251 | 89.85% | 10.15% | 0.8972 | 92.46% | 7.54% | 0.9236 |
| Soybeans | 5 | 12885 | 86.15% | 13.85% | 0.8604 | 88.61% | 11.39% | 0.8851 |
| Sunflowers | 6 | 102 | 89.47% | 10.53% | 0.8947 | 99.03% | 0.97% | 0.9903 |
| Peanuts | 10 | 512 | 90.14% | 9.86% | 0.9014 | 92.09% | 7.91% | 0.9208 |
| Barley | 21 | 785 | 71.95% | 28.05% | 0.7194 | 97.39% | 2.61% | 0.9739 |
| Durum Wheat | 22 | 48 | 42.86% | 57.14% | 0.4286 | 100.00% | 0.00% | 1.0000 |
| Spring Wheat | 23 | 205 | 56.47% | 43.53% | 0.5647 | 99.03% | 0.97% | 0.9903 |
| Winter Wheat | 24 | 580437 | 97.54% | 2.46% | 0.9631 | 94.00% | 6.00% | 0.9117 |
| Other Small Grains | 25 | 1120 | 56.97% | 43.03% | 0.5694 | 93.57% | 6.43% | 0.9356 |
| Win Wht /Soyb Dbl Crop | 26 | 14758 | 79.51% | 20.49% | 0.7932 | 90.06% | 9.94% | 0.8996 |
| Rye | 27 | 13249 | 66.90% | 33.10% | 0.6664 | 91.39% | 8.61% | 0.9129 |
| Oats | 28 | 2941 | 64.85% | 35.15% | 0.6479 | 95.18% | 4.82% | 0.9517 |
| Millet | 29 | 439 | 77.02% | 22.98% | 0.7701 | 96.48% | 3.52% | 0.9648 |
| Canola | 31 | 337 | 75.90% | 24.10% | 0.7590 | 98.83% | 1.17% | 0.9883 |
| Alfalfa | 36 | 19653 | 88.21% | 11.79% | 0.8807 | 91.78% | 8.22% | 0.9168 |
| Dry Beans | 42 | 115 | 88.46% | 11.54% | 0.8846 | 93.50% | 6.50% | 0.9350 |
| Potatoes | 43 | 49 | 96.08% | 3.92% | 0.9608 | 100.00% | 0.00% | 1.0000 |
| Other Crops | 44 | 50 | 45.87% | 54.13% | 0.4587 | 80.65% | 19.35% | 0.8064 |
| Misc Vegs & Fruits | 47 | 33 | 54.10% | 45.90% | 0.5410 | 86.84% | 13.16% | 0.8684 |
| Watermelon | 48 | 24 | 77.42% | 22.58% | 0.7742 | 85.71% | 14.29% | 0.8571 |
| Peas | 53 | 188 | 72.59% | 27.41% | 0.7258 | 96.91% | 3.09% | 0.9691 |
| Clover/Wildflowers | 58 | 21 | 36.21% | 63.79% | 0.3621 | 75.00% | 25.00% | 0.7500 |
| Fallow/Idle Cropland | 61 | 30612 | 69.78% | 30.22% | 0.6922 | 90.48% | 9.52% | 0.9025 |
| Peaches | 67 | 9 | 36.00% | 64.00% | 0.3600 | 100.00% | 0.00% | 1.0000 |
| Other Tree Nuts & Fruit | 71 | 69 | 33.82% | 66.18% | 0.3382 | 83.13% | 16.87% | 0.8313 |

*Correct Pixels represents the total number of independent validation pixels correctly identifed in the error matrix.

# Kansas 2008 Cropland Data Layer



## Land Cover Categories

(Ordered by Decreasing Acreage)

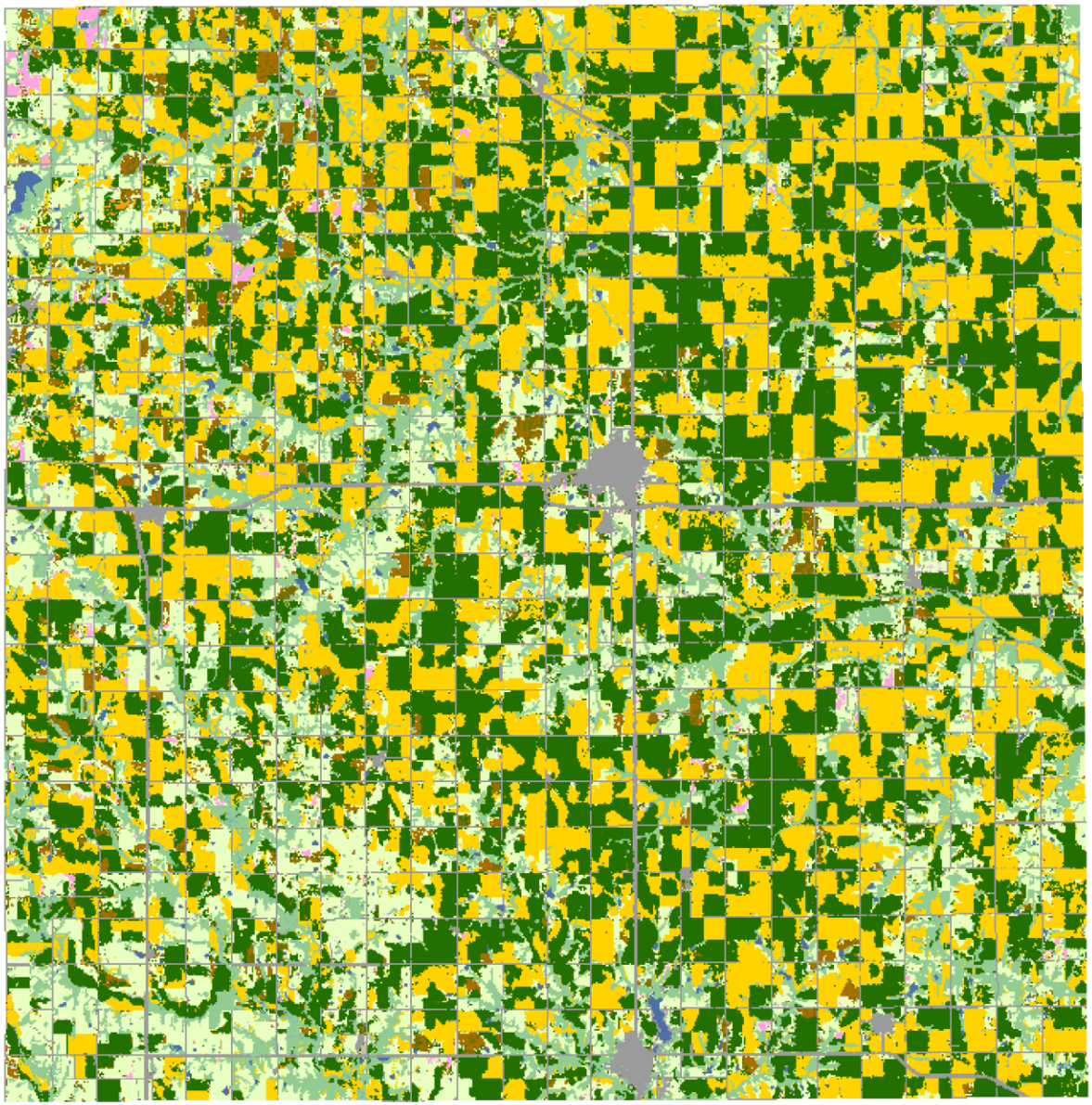
### Agricultural

- Winter Wheat
- Corn
- Sorghum
- Soybeans
- Alfalfa
- W. Wht./Soy. Dbl. Crop.
- Sunflowers
- Rye
- Cotton
- Other Small Grains
- Clover/Wildflowers
- Oats
- Potatoes
- Seed/Sod Grass
- Canola
- Millet
- Other Crops
- Barley
- Other Tree Nuts
- Peas
- Apples
- Misc. Vegs. & Fruits

### Non-Agricultural

- Grass/Pasture/Non-Ag
- Urban/Developed
- Woodland
- Fallow/Idle Cropland
- Water
- Wetlands
- Shrubland
- Barren

# Brown County, Kansas
# 2008 Cropland Data Layer



## Land Cover Categories

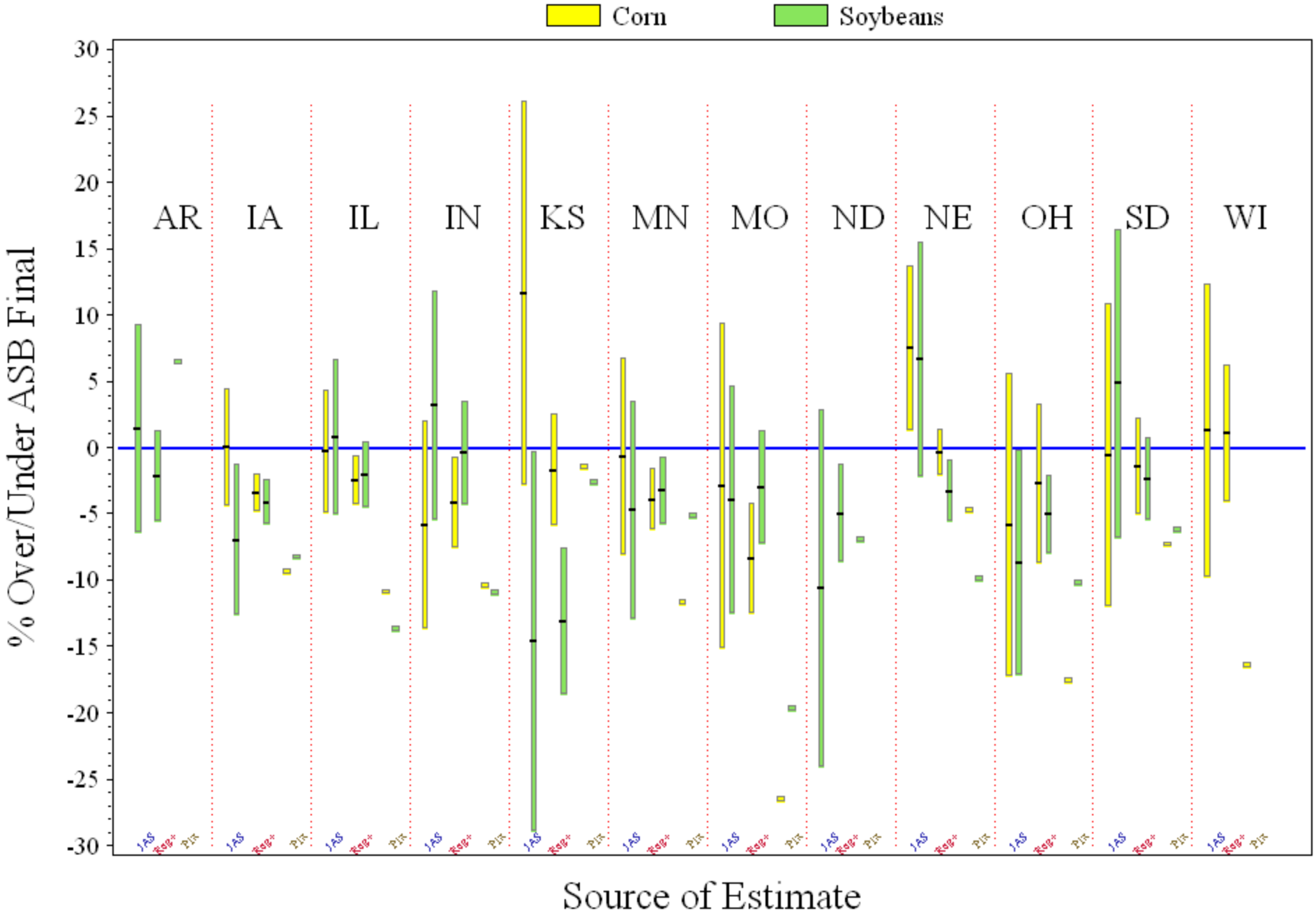
(Ordered by Decreasing Acreage)

### Agricultural

- Soybeans
- Corn/Sweet Corn
- Winter Wheat
- Alfalfa
- Win. Wht./Soyb. Dbl. Cropped
- Sorghum
- Clover/Wildflowers
- Other Crops/Grass Seed/Sod
- Other Small Grains
- Sunflowers
- Oats
- Cotton
- Barley
- Seed/Sod Grass
- Other Tree Nuts

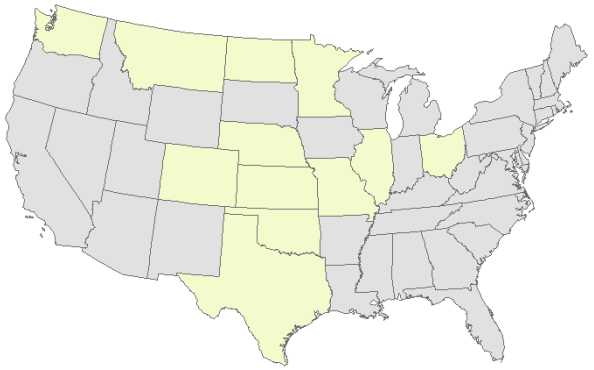
### Non-Agricultural

- Grass/Pasture/Non-Ag
- Woodland
- Urban/Developed
- Water
- Wetlands
- Barren
- Fallow/Idle Cropland
- Shrubland

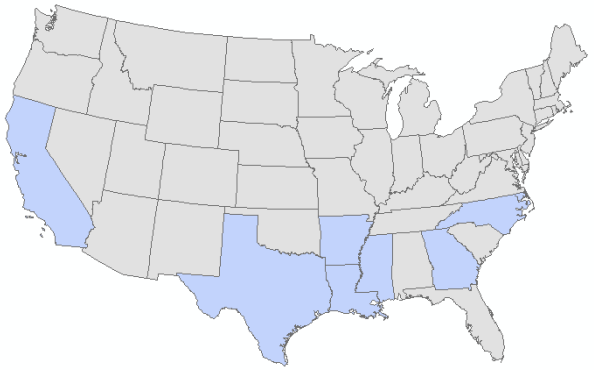

2008 State Level Estimates +/- 2% CVs
Corn
Soybeans
% Over/Under ASB Final
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
AR
IA
IL
IN
KS
MN
MO
ND
NE
OH
SD
WI
JAS
Sep+
PIK
Source of Estimate

# Cropland Data Layer Future

- Improve acreage timing
  - Sept. Small Grain Summary
  - August district level estimates
- Expand geographic scope
  - Cotton, Winter, Durum and Spring Wheats
- Derivatives
  - Change detection
  - Crop rotations
- National program
  - Leverage resource partnerships



Primary Wheat States



Primary Cotton States