

Remote Sensing of Agriculture

NASS' Cropland Data Layer Program

Claire Boryan

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USDA/NASS



NASS Overview

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

NASS - Data and Statistics - Microsoft Internet Explorer

Address: http://www.nass.usda.gov/Data_and_Statistics/index.asp

USDA United States Department of Agriculture
National Agricultural Statistics Service

The 2002 Census of Agriculture is the most comprehensive source of statistics portraying our nation's agriculture

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Data and Statistics

Quick Stats (Agricultural Statistics Data Base)

NASS publishes U.S., state, and county level agricultural statistics for many commodities and data series. Quick Stats offers the ability to query by commodity, state(s) and year(s), providing the most up-to-date statistics including all revisions. The query dataset can be downloaded for easy use in your database or spreadsheet.

- Query our Quick Stats Data Base

Additional Crops County Resources

Maps of crops county estimates for acreage and yield are available from NASS as both CSV data files and maps.

County data from Quick Stats data is also available in pre-extracted data sets by year and by crop.

Census of Agriculture

To query Census of Agriculture data, choose from the Census years below. To view the Census publications, click here:

- Data Queries for 2002, select below:

Select a Census Query

- Data Queries for 1997, 1992, 1987

Interactive Data

NASS provides a variety of tools for interacting with our Census datasets.

Interactive Statistical Maps

Interactive Census Maps for 2002 Census Highlights

Table Lens Application for 1997 Census Data

Last modified: 12/30/05

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2001 Wildlife Damage Survey

7.7 Percent of Crop Value Lost to Deer and Geese

Maryland farmers lost \$17.2 million of corn, soybeans and wheat to deer or geese during 2001, translates to Maryland farmers losing 7.7 percent of the crop value to deer and geese. Soybeans account for the greatest economic loss, totaling \$9.1 million, 11 percent. Corn losses were \$6.6 million, 5.8 percent and wheat \$1.5 million, 5.6 percent. Deer damage resulted in losses of \$13.6 million, 6.1 percent, while geese losses were \$3.6 million, 1.6 percent.

Production losses totaled 6.0 million bushels. Corn losses were 3.2 million bushels, soybean losses are 2.2 million bushels and wheat accounted for 0.6 million bushels. Production losses to deer were 4.7 million bushels and geese 1.3 million bushels.

In terms of yield, losses to deer were most severe in Central and Western Maryland, while geese damage greater on the Eastern Shore. Corn yield losses of 9.6 bushels per acre and 7.4 bushels per acre were reported in Central and Western Maryland, respectively. The Lower Eastern Shore reported the highest soybean loss of 6.1 bushels per acre.

Sixty-two percent of farms reported deer or geese damage to one or more crops. Damage was reported on percent of farms raising corn, 58 percent of farms growing soybeans and 27 percent of farms with wheat.

Maryland 2001 Crop Loss from Deer

Region	Crop	Acres Harvested	Harvested Yield (bushels)	Average Yield Loss (bushels)	Production Loss (Bu)	Economic Loss (\$)
Western Maryland	Corn	5,500	124,9	7.4	40,700	83
	Soybeans	300	36.7	6.1	1,800	18
	Wheat	200	45.2	2.3	460	1
Central Maryland	Corn	124,200	582.9	9.6	1,202,250	2,413
	Soybeans	92,000	34.2	3.3	305,750	1,478
	Wheat	38,300	63.3	3.3	126,350	318
Southern Maryland	Corn	25,800	132.9	4.9	146,250	299
	Soybeans	43,200	38.0	3.3	142,250	314
	Wheat	16,000	57.0	0.3	14,400	16
Upper Shore	Corn	157,000	159.2	3.1	800,700	1,241
	Soybeans	33,000	38.8	3.3	108,400	231
	Wheat	1,000	1.0	0.0	1,000	0

NEWS RELEASE

NATIONAL AGRICULTURAL STATISTICS SERVICE
United States Department of Agriculture - Washington, DC 20250
Ag Statistics Hotline: (800) 727-9540 • www.nass.usda.gov

Contact: Ellen Dougherty, (202) 690-8122
Jeff Geuder, (202) 720-2127

USDA FORECAST

Washington, Aug. 10, 2007

history in 2007, according to Agriculture's National Ag 13.1 billion bushels, 10.6 percent.

Based on conditions: per acre, up 3.7 bushels from behind the 160.4 bushels per million acres of corn for grain.

Yield forecasts are for Delta. Meanwhile, hot, dry conditions in the Midwest and eastern Corn Belt, Ohio

2002 Dairy Producer Opinion Survey

November 2002

Wisconsin Agricultural Statistics Service
P.O. Box 8934 Madison, WI 53708-8934
In cooperation with WI Department of Agriculture, Trade and Consumer Protection

Wisconsin Milk Production To Recover

Milk production is expected to increase in Wisconsin during the next few years according to a survey conducted by the Wisconsin Agriculture Statistics Service. This statewide survey of producers asked for their plans with the assumption that milk prices for the next five years will be at the same level as the past five years. The survey was conducted during May and June 2002.

Based on the survey, 60 percent of producers expect to keep the same herd size, 20 percent plan to increase herd size, and 20 percent intend to discontinue milking by 2007. Actual results will depend on future milk prices, input prices, financing availability, crop yields, and other factors.

The number of herds projected for 2007 shows that the diversity of small to large herds will continue. The most prevalent herd size will remain at 50 to 99 cows.

http://www.nass.usda.gov:8080 - 2002 Census of Agriculture - SVG Interactive Mapping - United S - Microsoft Internet Explorer

National Agricultural Statistics Service 2002 Census of Agriculture

United States | All data items are from Chapter 2 - Table 1. Area Summary Highlights: 2002 Selected crops harvested - Land in orchards (acres)

State: United States - County Level | Data Item: Selected crops harvested - Land in orchards (acres)

United States Total: 5,330,439

State: Total: County Total: County Total:

Download data as CSV | XML | PDF

Help | Print | Return to

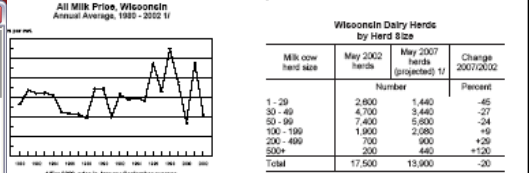
Legend

Scale: National | Zero or Data Withheld <= 20,000 | 20,001 to 40,000 | 40,001 to 60,000 | 60,001 to 80,000 | 80,001 to 100,000 | 100,001 >=

Comparisons: 6 | Color: Green

Source: USDA-NASS 2002 Census of Agriculture ©USDA-NASS 2005-2006

Navigate: Mouse-over a specific state/county to view the state/county level data. Right click to zoom (option-click for MAC users). Hold the Alt key and click+drag to pan. For additional assistance with this application, click here to view the support page.



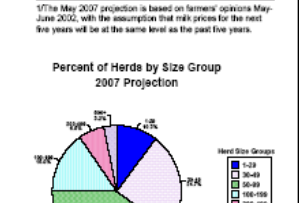
Wisconsin Dairy Herds by Herd Size

Milk cow herd size	May 2002 herds	May 2007 herds (projected) %	Change 2007/2002
1-29	2,800	1,440	-45
30-49	4,700	3,440	-27
50-99	7,400	5,600	-24
100-199	1,900	2,080	+40
200-499	700	900	+29
500+	200	440	+120
Total	17,500	15,900	-20

Wisconsin Dairy Farmer Plans for May 2007 1/ by Herd Size

Milk cow herd size	Herds	Keep same herd size	Increase herd size	Discontinue milking
9	2,600	47	17	36
49	4,700	71	9	20
99	7,400	65	19	18
199	1,900	53	37	10
499	700	33	59	8
899	200	22	78	0
Total	17,500	62	29	20

1/ The May 2007 projection is based on farmers' opinions May-June 2002, with the assumption that milk prices for the next five years will be at the same level as the past five years.



1/ The May 2007 projection is based on farmers' opinions May-June 2002, with the assumption that milk prices for the next five years will be at the same level as the past five years.

Research and Development Division

Geospatial Information Branch

Spatial Analysis Research

NASS - Research and Science - Windows Internet Explorer

http://www.nass.usda.gov/Research_and_Science/index.asp

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National Agricultural Statistics Service

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Research and Science

Spatial Data

Vegetation Condition Images

Cropland Data Layer

Image Gallery (2003) available for these states:
Arkansas, Illinois, Indiana, Iowa, N. Dakota, Mississippi, Missouri, Nebraska, Wisconsin)

Land Use Strata for Selected States

Census of Agriculture

2002 Census Map Gallery

2002 Maps: Gallery | Star Tree | List

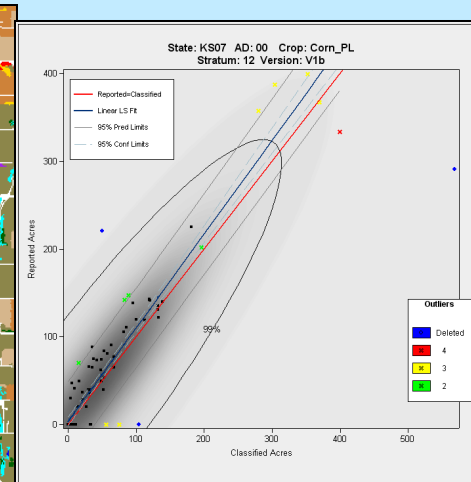
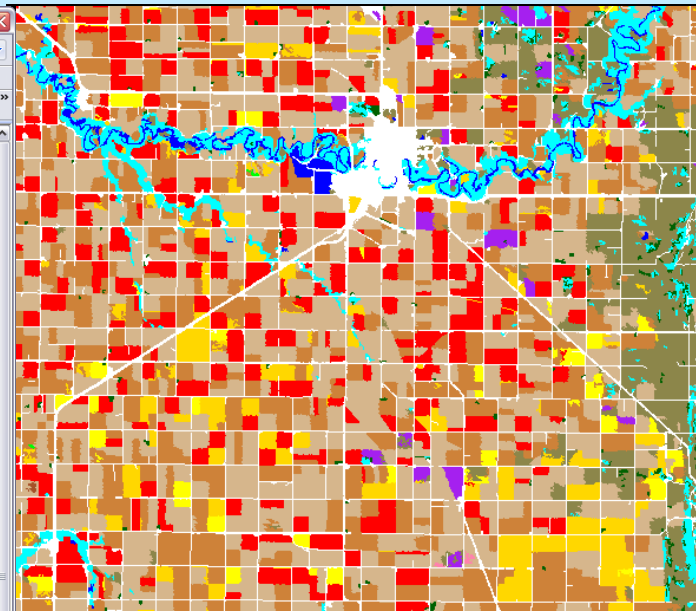
Interact with Data (1997)

Also See

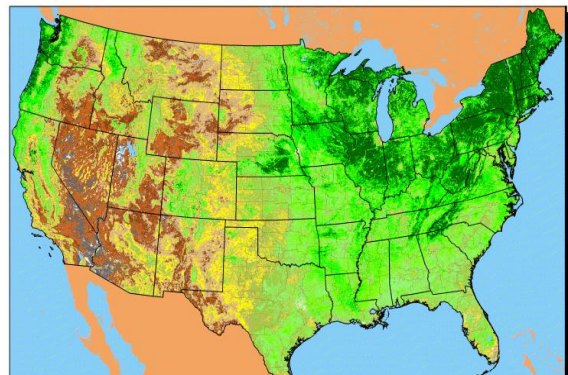
- Research Fellow and Associate Program
- Seasonal Summary of Crop Progress and Condition
- Remotely Sensed Data
 - Crop Acreage
 - Crop Yield
 - Future Vision

Media Help

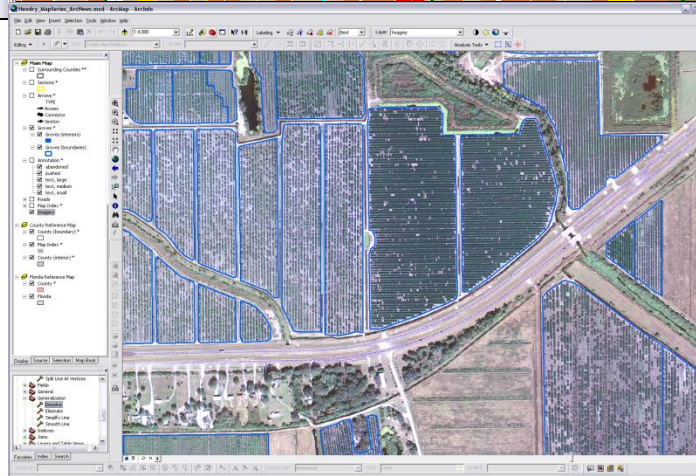
To view animated map files you must have Quicktime installed on your computer.



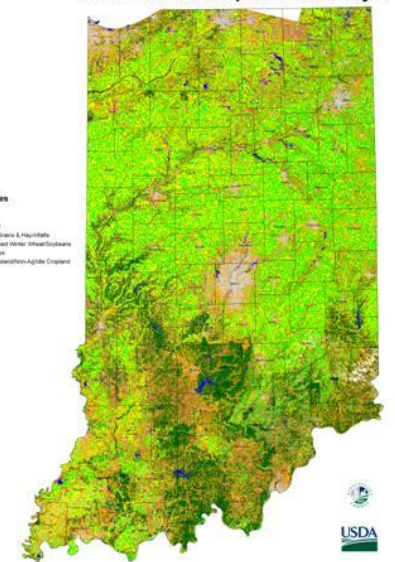
Continental U.S. Vegetation Condition - 2007
Period 33 (7/31 - 8/13)



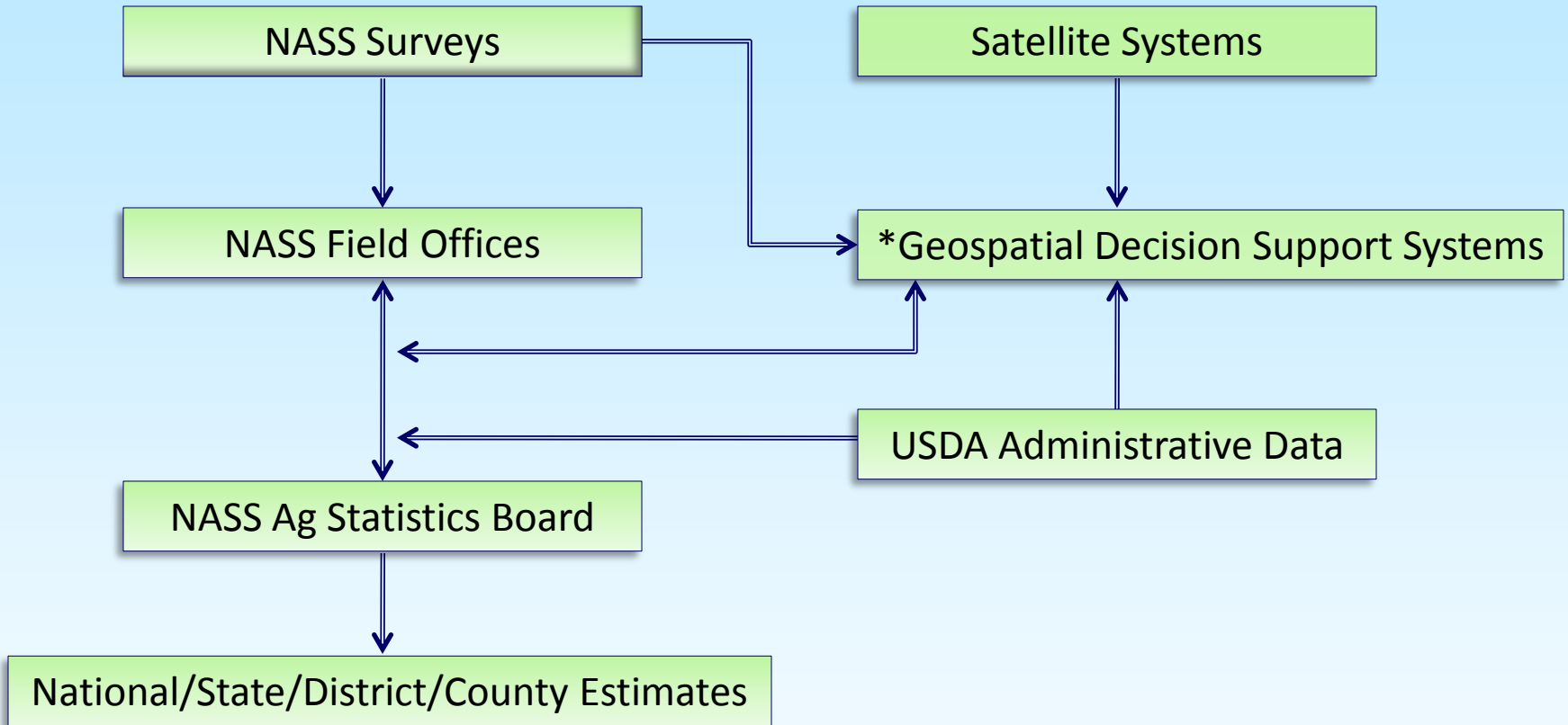
No Water Vapor Correction Applied



2006 Indiana Cropland Data Layer



NASS Estimation Systems



*NASS uses Geospatial Decision Support Systems to provide updated information to the Ag Statistics Board and data users.

Cropland Data Layer Program Objectives

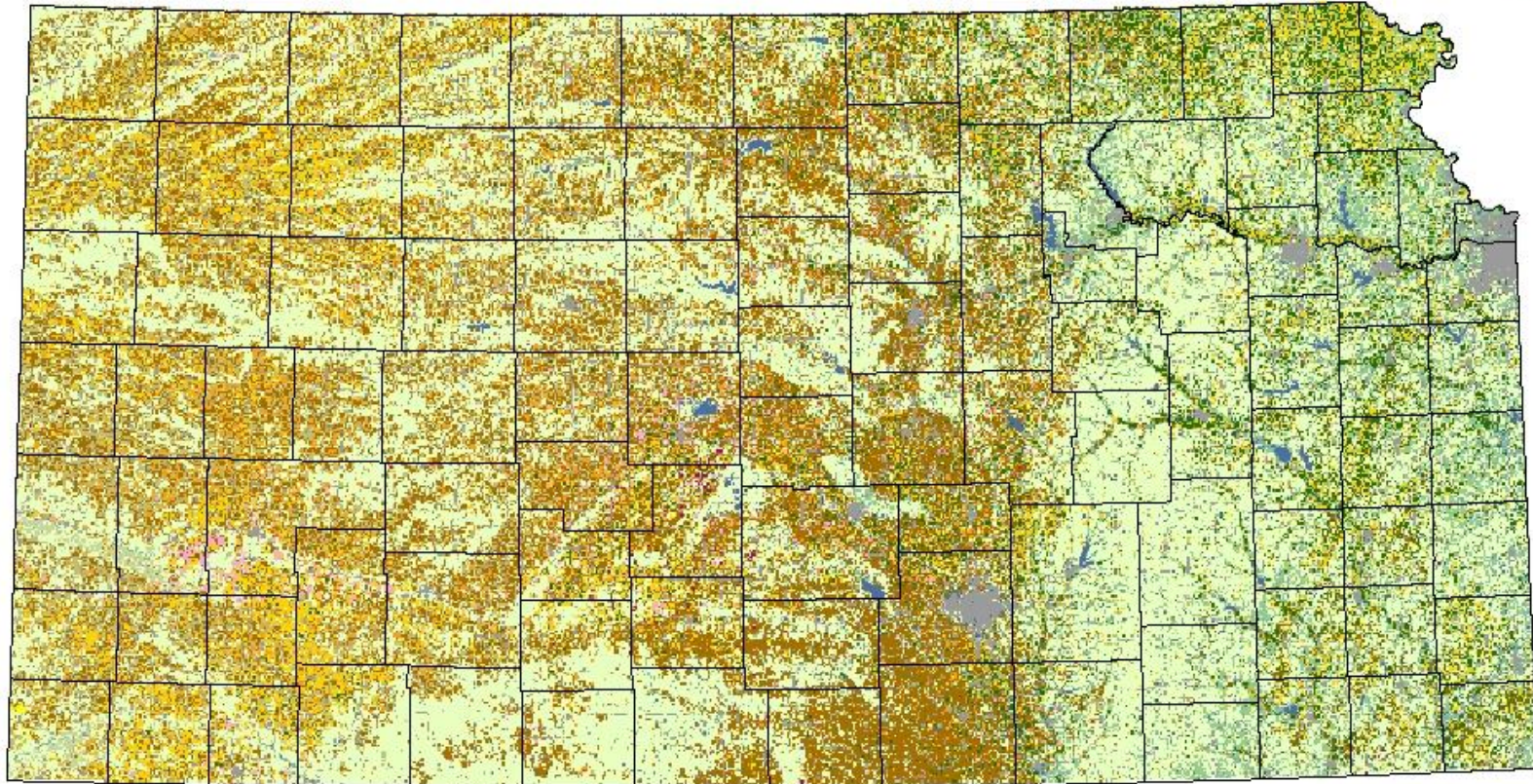
- “Census by Satellite”
 - Without area duplication
 - Major corn and soybean regions

- Provide timely, accurate, useful independent estimates
 - Measurable error
 - County and state level

- Output crop specific Cropland Data Layer
 - Distribute free to public [NRCS Geospatial Data Gateway](http://www.nrcs.usda.gov/Research_and_Science/) or http://www.nass.usda.gov/Research_and_Science/
 - Publish accuracy statistics/metadata
 - County and state level



Kansas 2008 Cropland Data Layer



Land Cover Categories

(Ordered by Decreasing Acreage)

Agriculture

- Pasture/Grass
- Winter Wheat
- Corn
- Fallow/Idle Cropland
- Sorghum
- Soybeans
- Alfalfa

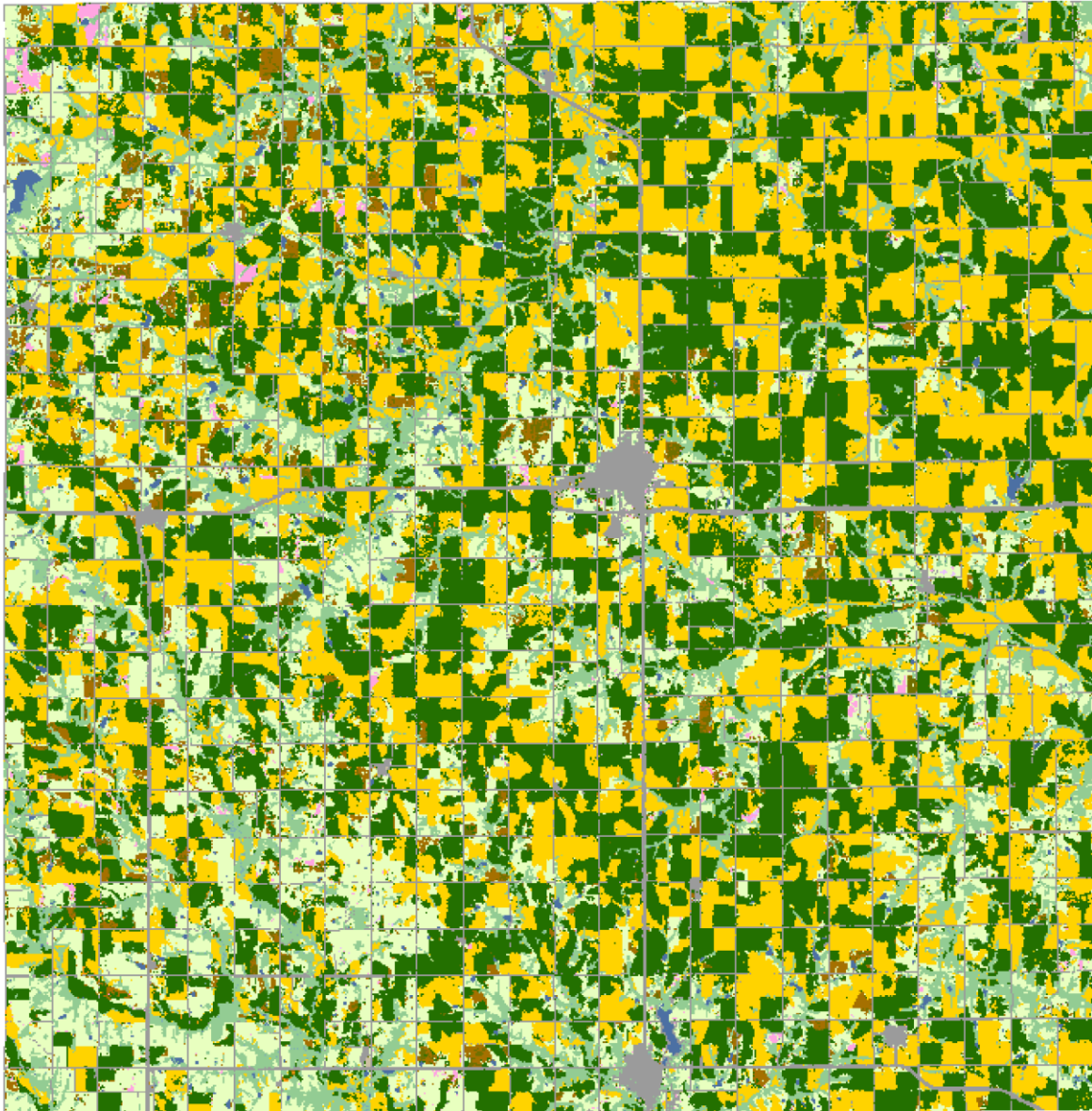
- W. Wht./Soy. Dbl. Crop.
- Sunflowers
- Rye
- Cotton
- Other Small Grains
- Clover/Wildflowers
- Oats

- Potatoes
- Seed/Sod Grass
- Canola
- Millet
- Other Crops
- Barley
- Other Tree Nuts & Fruits

Non-Agriculture

- Urban/Developed
- Woodland
- 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

Cropland Data Layer Program Components



- Advanced Wide Field Sensor (AWiFS) data
- Ground truth: FSA/CLU + 578 & NLCD
- Ancillary data sets
- Commercial Software Suite
- See5 Decision Tree Methodology
- Estimation

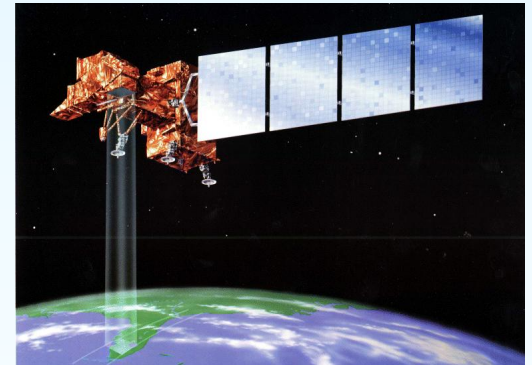
Landsat Imagery

1997-2005, 2008-2009

Landsat 5 launched 1984 (3 yr design life!)

- Thematic Mapper (TM) Sensor

Landsat 7 launched 1999 Thematic Mapper (ETM+) Sensor



The Landsat Data Gap

Landsat 7 ETM+



Landsat 5 TM



News Release

November 30, 2005 Ron Beck

Landsat 5 Experiencing Technical Difficulties

On November 26, 2005, the back-up solar array drive on Landsat 5 began exhibiting unusual behavior. The solar array drive maintains the proper pointing angle between the solar array and the sun. The rotation of the solar array drive became sporadic and the solar array was not able to provide the power needed to charge the batteries. Maintaining power to the batteries is critical to sustain proper operation of the spacecraft. The primary solar array drive failed under similar circumstances last January. As a result of this current situation, imaging operations will be suspended for at least the next two weeks or until attempts to solve the problem have been resolved.

Source: USGS, Landsat Project:

http://landsat.usgs.gov/slc_enhancements/slc_off_level1_standard.php

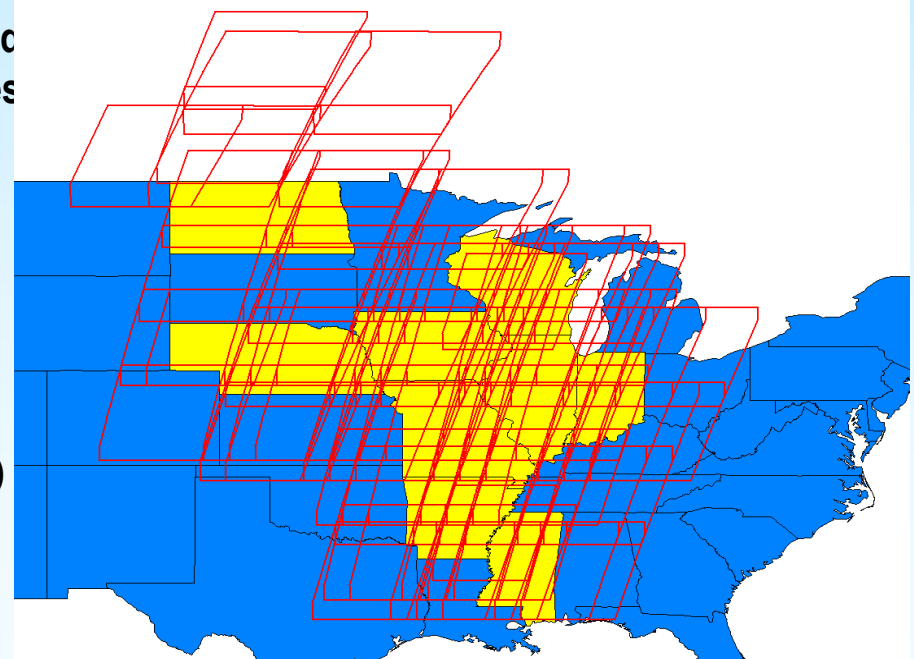
Indian Remote Sensing Satellite: RESOURCESAT-1

Advanced Wide Field Sensor (AWiFS)

States Targeted for Data Collection in August 2004

- **AWiFS:** Swath: 370 km each head, 740 km combined
56 m resolution at nadir, 70 m resolution at field edges
- **Spectral Bands**
- **B2: 0.52-0.59 (Visible Green)**
- **B3: 0.62-0.68 (Visible Red)**
- **B4: 0.77-0.86 (Near Infrared)**
- **B5: 1.55-1.70 (Shortwave Infrared)**

- **Temporal Resolution (5 Days)**

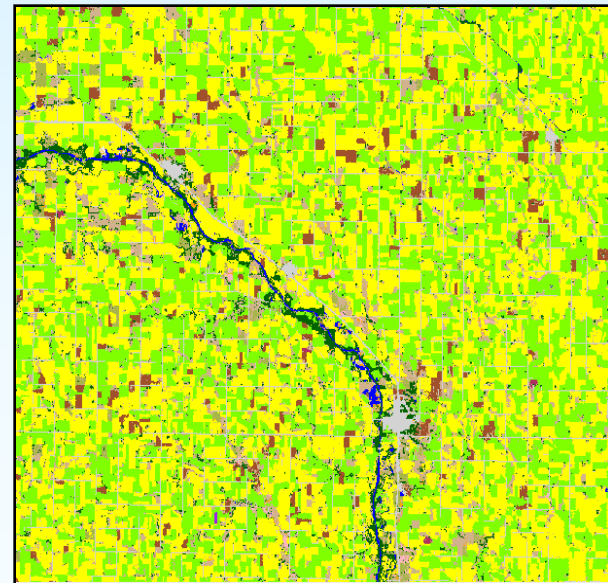
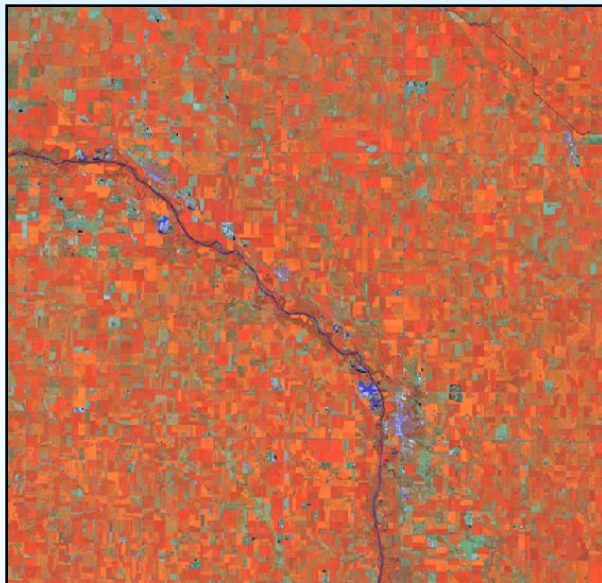


Sensor Specifications Compared

	<u>TM</u>	<u>AWiFS</u>
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

Crop Acreage Estimation: Landsat TM and AWiFS Assessments 2004-2005

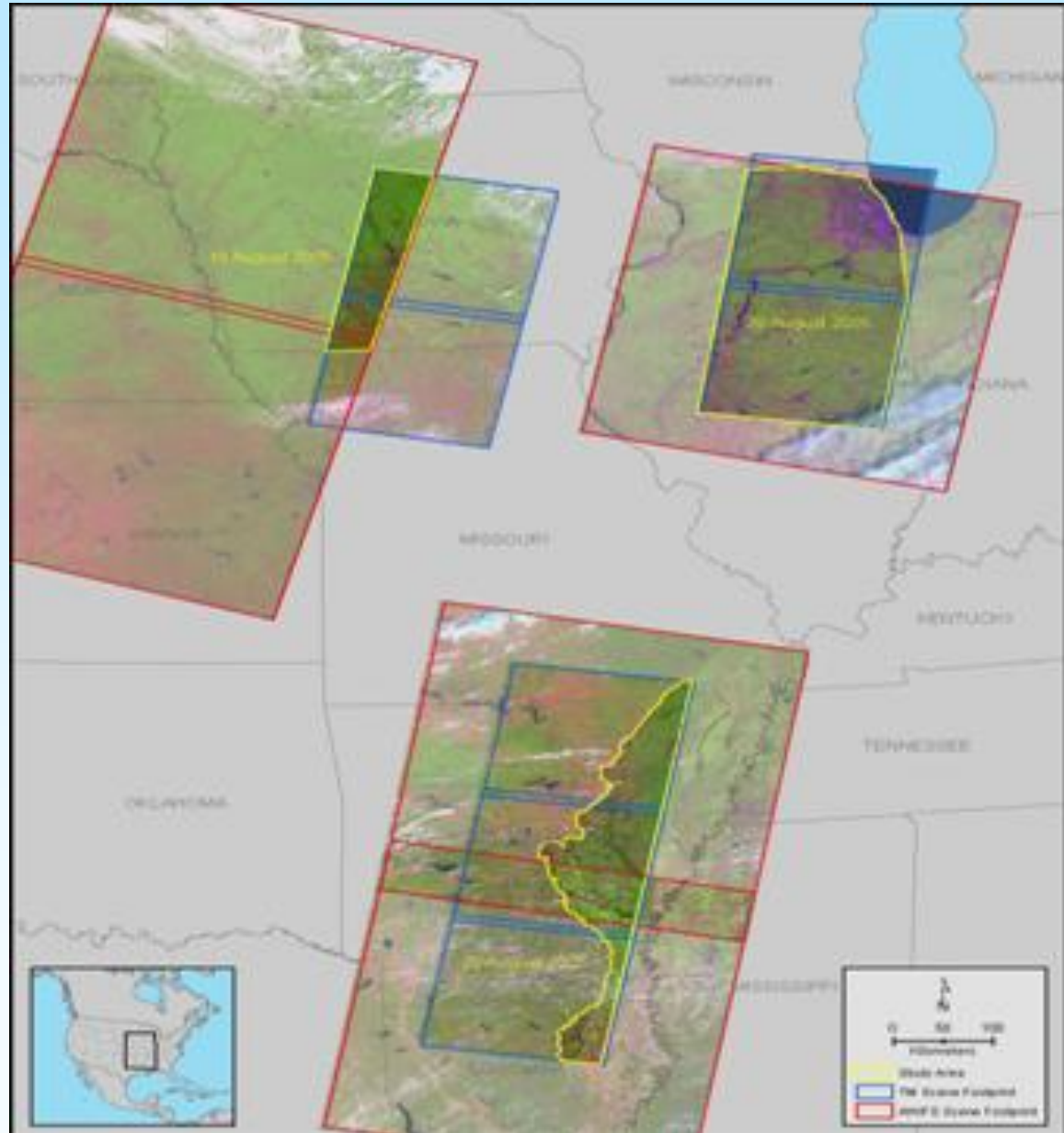
- Nebraska, 2004
- Arkansas (Delta Region), 2005
- Nebraska, 2005
- Coincident studies (AR, IL, IA) 2005



Coincident study sites

Three coincident areas chosen for analysis:

- Arkansas
 - 20 August 2005
- Iowa,
 - 18 August 2005
- Illinois
 - 29 August 2005



Need for Coincident Imagery

The best classification comparison would use not only data from the **same area** but from the **same time**. Thus controlling for variables including:



Atmospherics conditions

- Clouds
- Haze
- Smoke

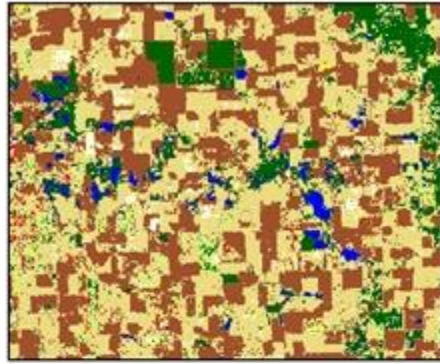
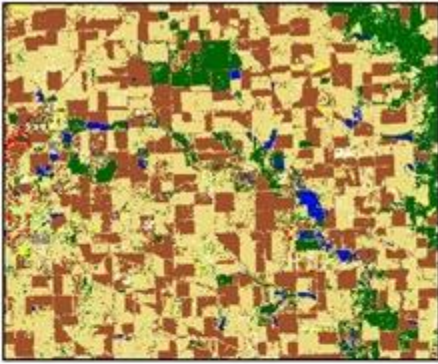
Ground conditions

- Soil moisture
- Vegetation phenology

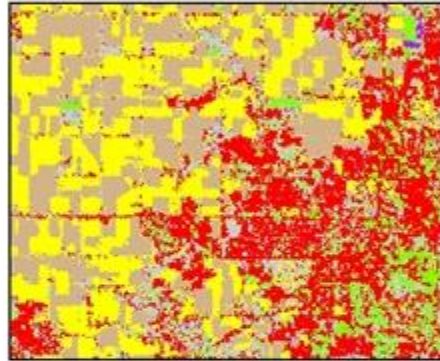
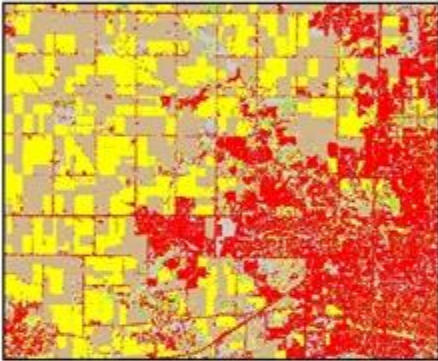
Sun angle

- Seasonal variation

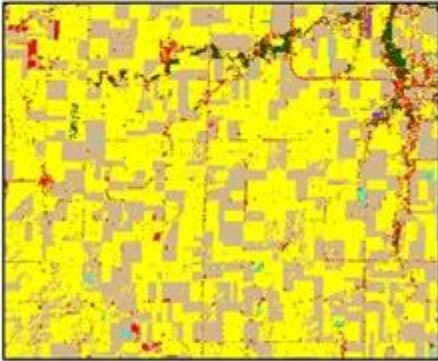
Arkansas



Iowa

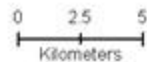
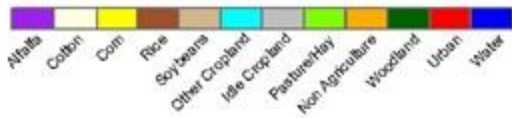


Illinois



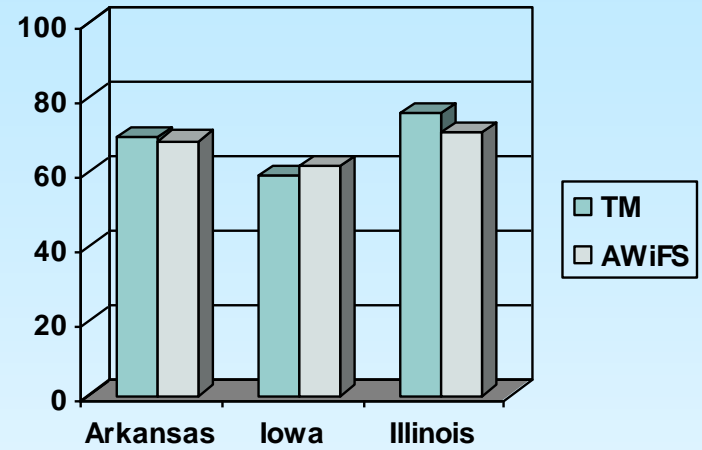
Landsat-5 TM

Resourcesat-1 AWiFS

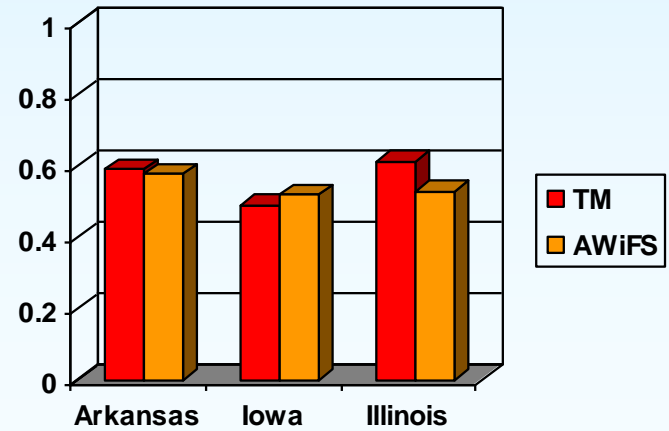


Results

Overall Accuracy



Overall Kappa



Conclusions:

AWiFS vs. TM evaluations 2004-2005

- AWiFS data are acceptable for crop acreage estimation over large crop areas such as the Midwest, the Delta and the Northern Great Plains.
- Improvements in classification accuracy are achieved due to increased temporal frequency of the AWiFS sensor (5 day) vs. the TM sensor (16 day) repeat cycle.
- The large footprint of the AWiFS sensor provides the opportunity to utilize training and ancillary data over large areas which leads to improved classification accuracies and production efficiencies.



IRS Resourcesat-1 A WiFS Imagery

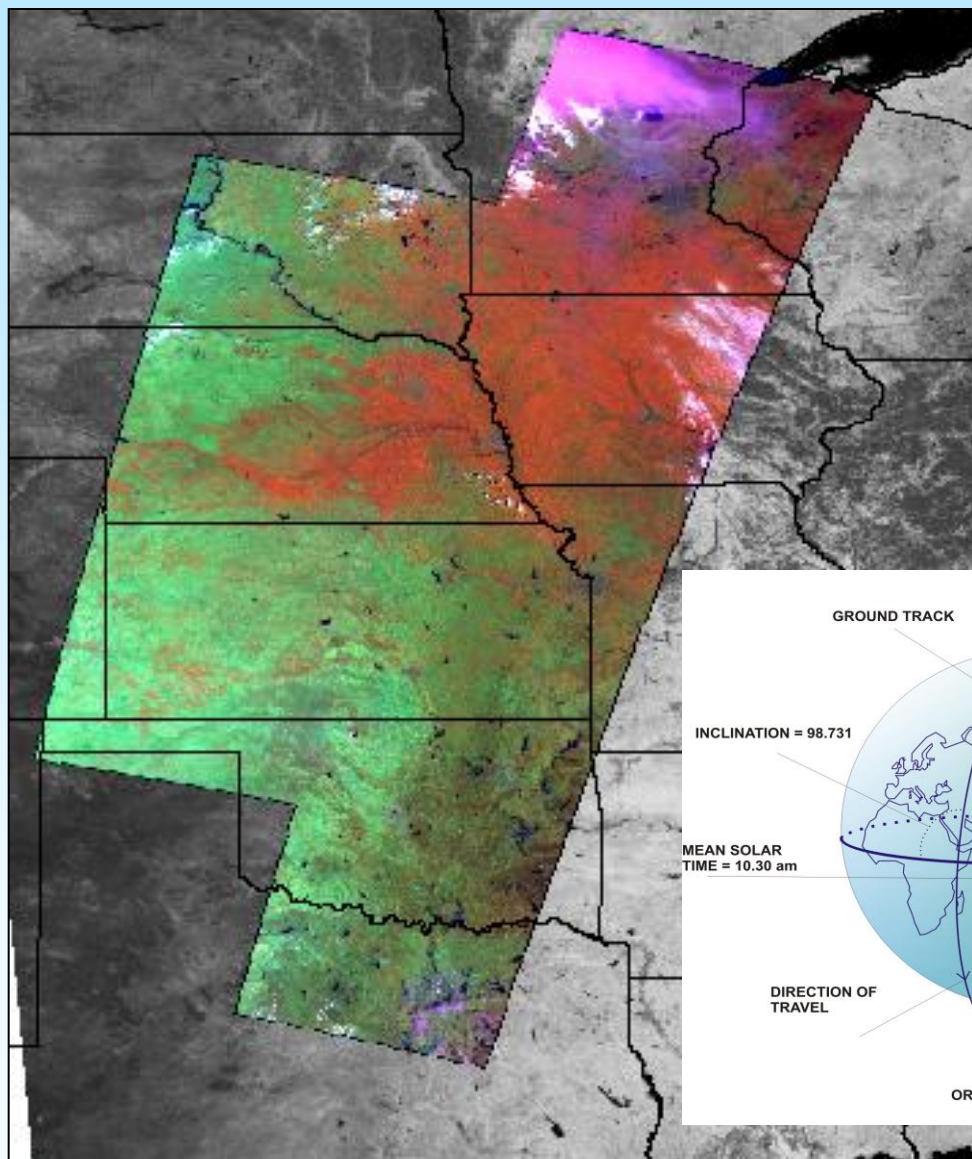
340 km swath per head
740 km combined

5-day revisit

4 spectral bands

- B2: 0.52 - 0.59
- B3: 0.62 - 0.68
- B4: 0.76 - 0.86
- B5: 1.55 - 1.7

56 m nadir/70 m field edges



13 Aug 2007



Department of Space
Indian Space Research Organisation

USDA Satellite Image Archive

Active Paths for P6-AWiFS CONUS

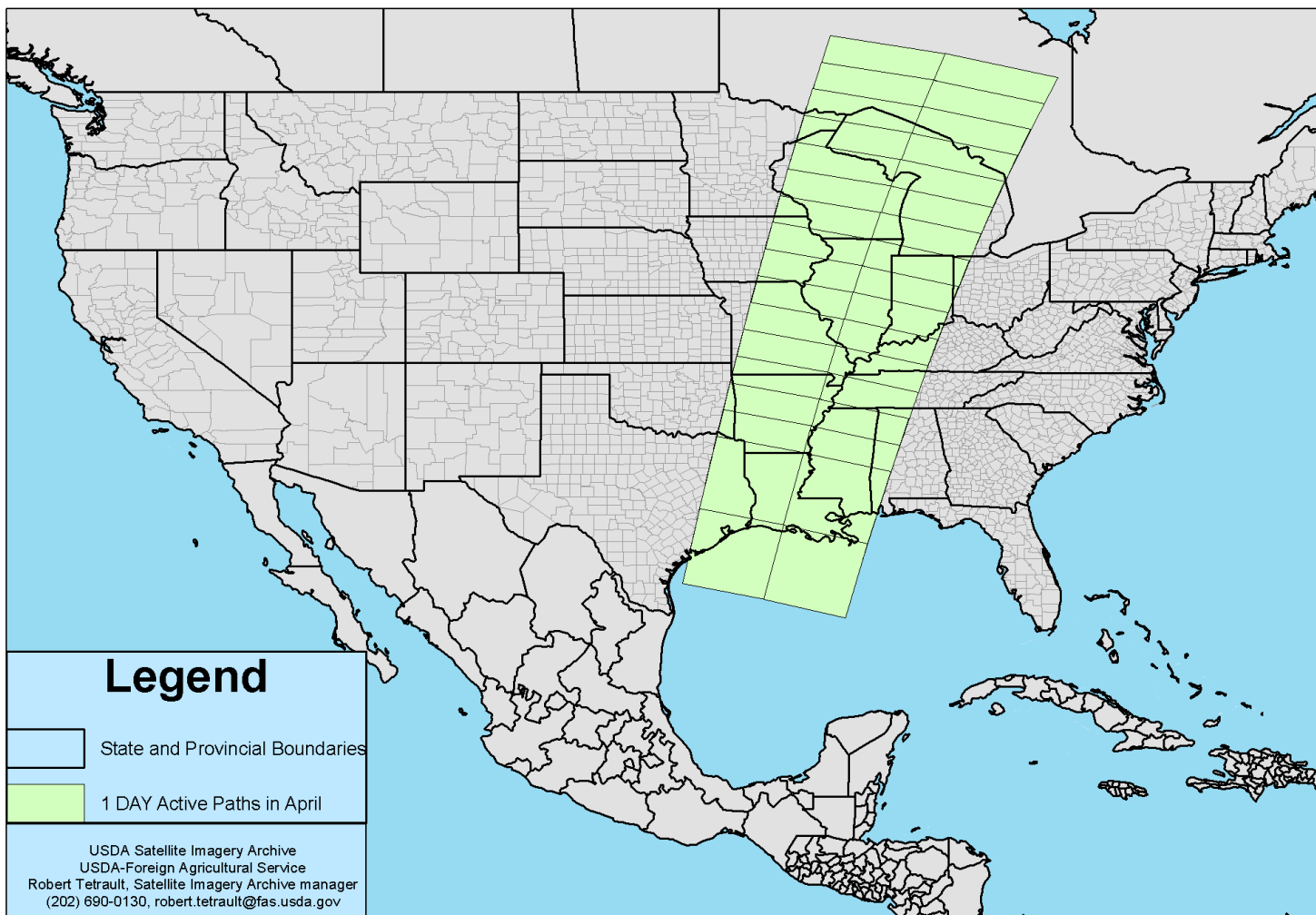
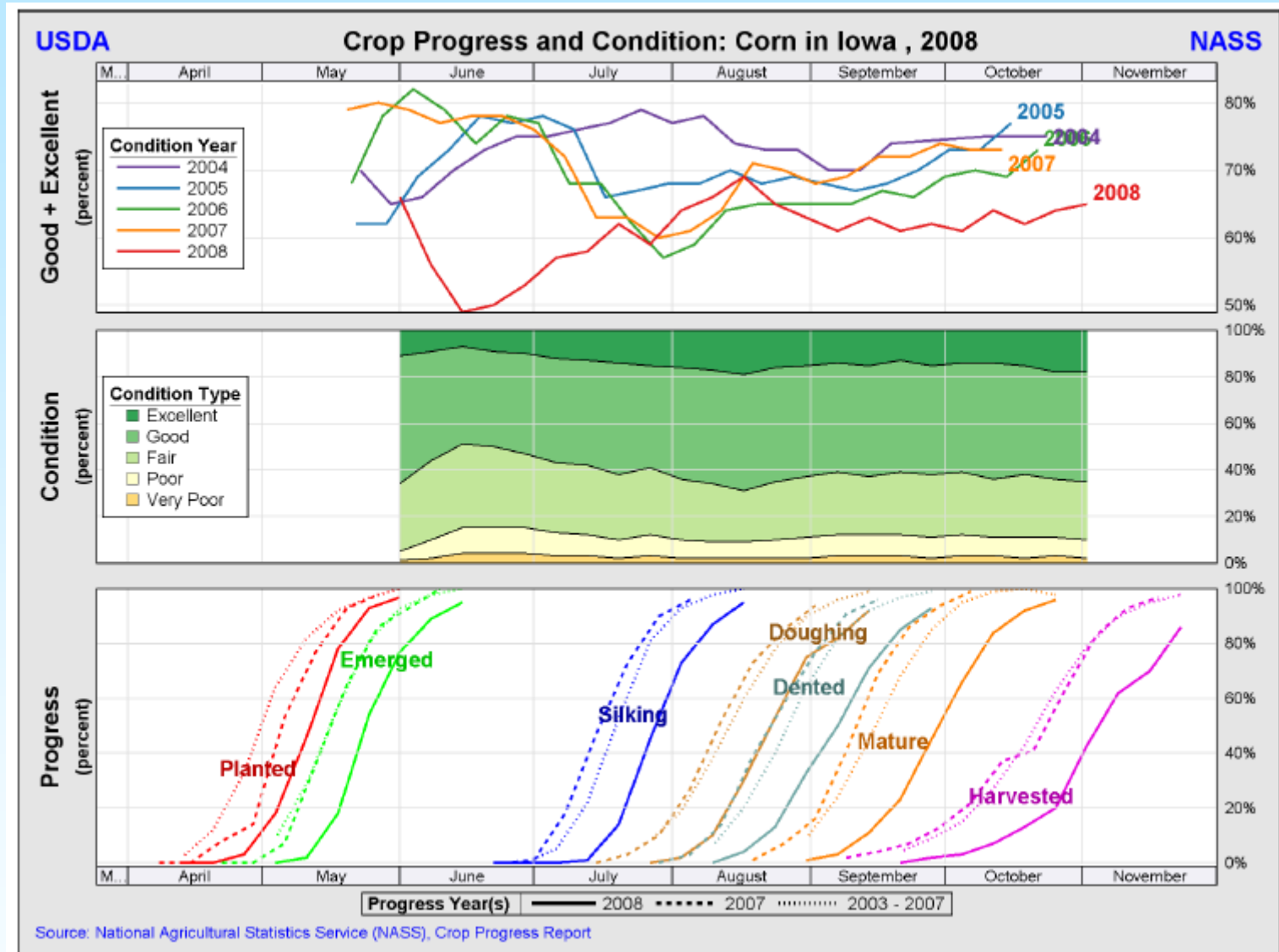
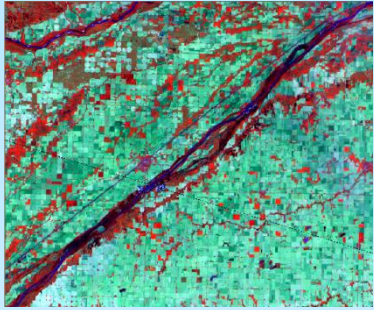


Image Timing

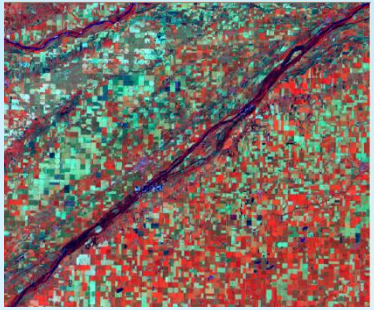


[http://www.nass.usda.gov/Charts and Maps/Crop Progress & Condition/](http://www.nass.usda.gov/Charts_and_Maps/Crop_Progress_&_Condition/)

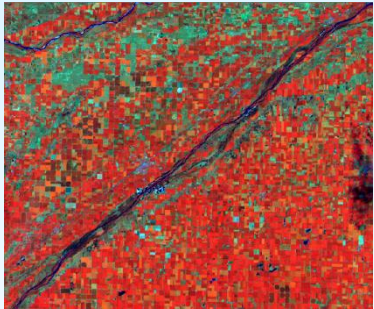
AWiFS Imagery Time Series



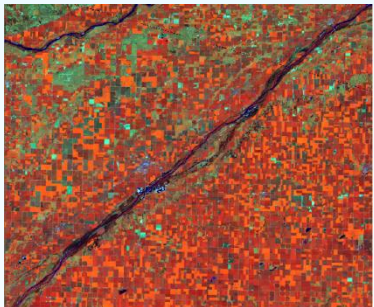
May 18



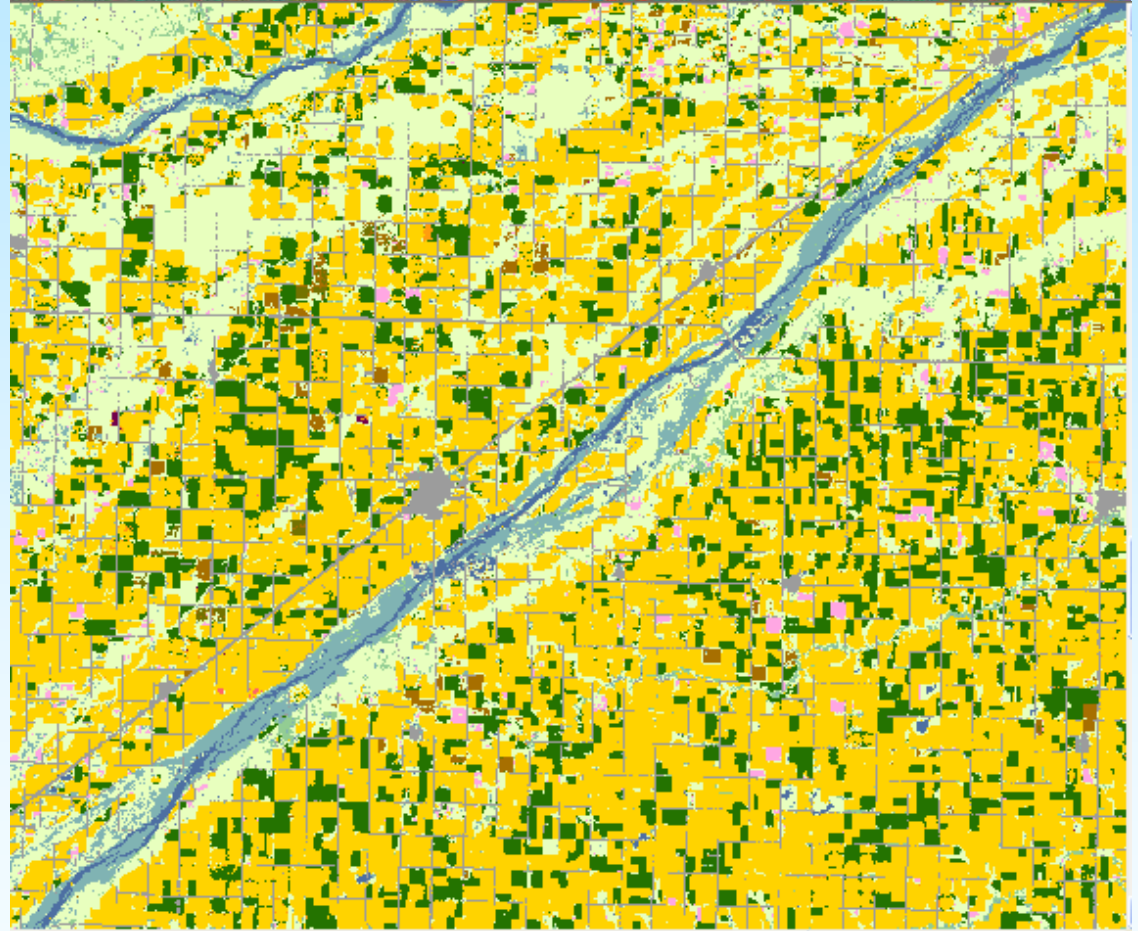
June 21



July 15



Aug 27

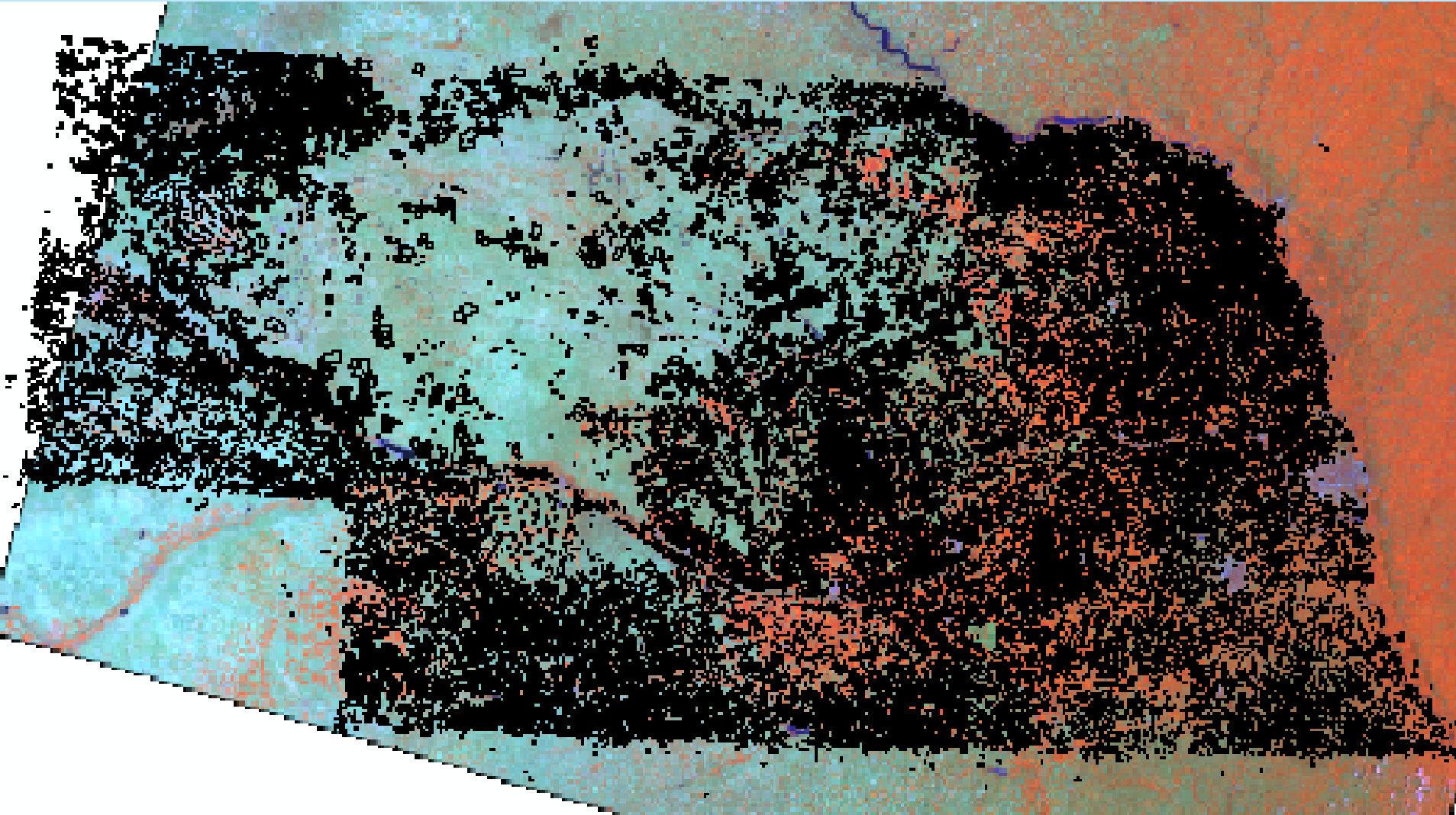


Cropland Data Layer Program Components

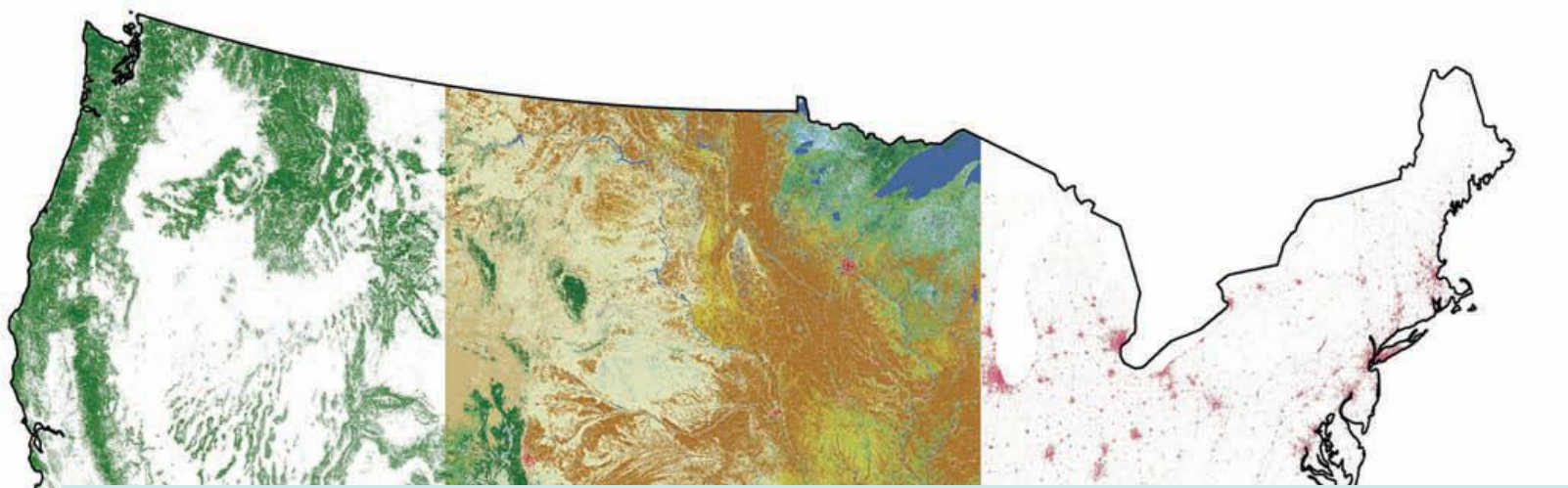


- Advanced Wide Field Sensor (AWiFS)
- Ground truth: FSA/CLU + 578 & NLCD
- Ancillary data sets
- Commercial Software Suite
- See5 Decision Tree Methodology
- Estimation

Ground Truth - Agriculture

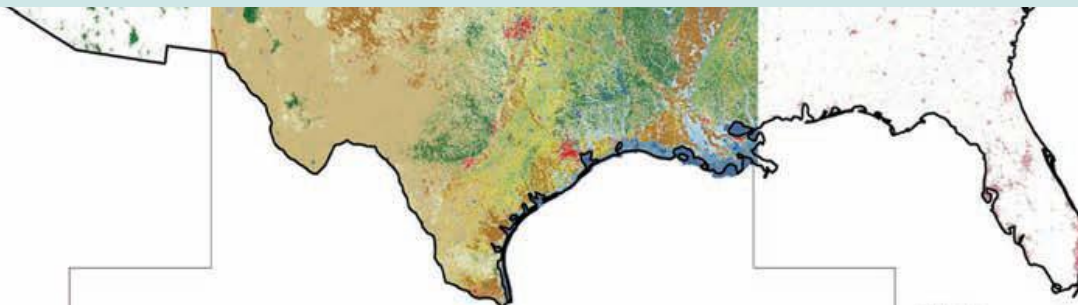


NASS June Agricultural Survey (JAS) data still
used for acreage estimation

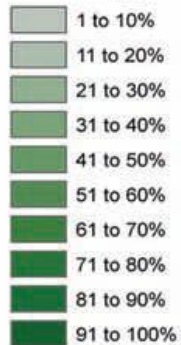


Non-Agricultural Ground Truth

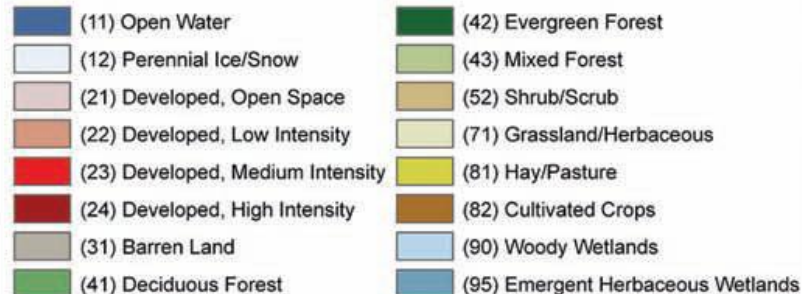
USGS, National Land Cover Dataset 2001



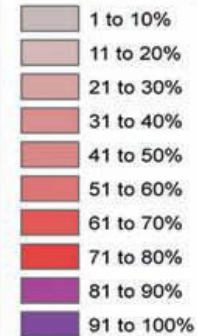
Tree canopy



Land Cover Class Value and Description



Urban Imperviousness

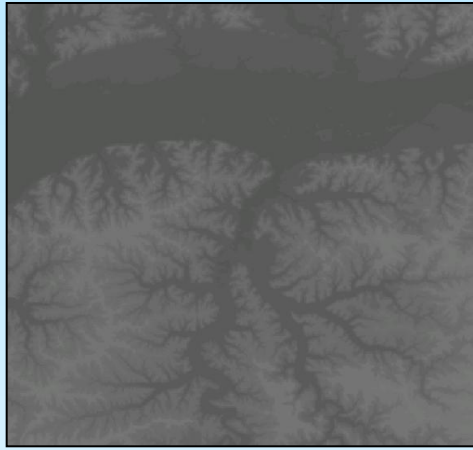


Cropland Data Layer Program Components

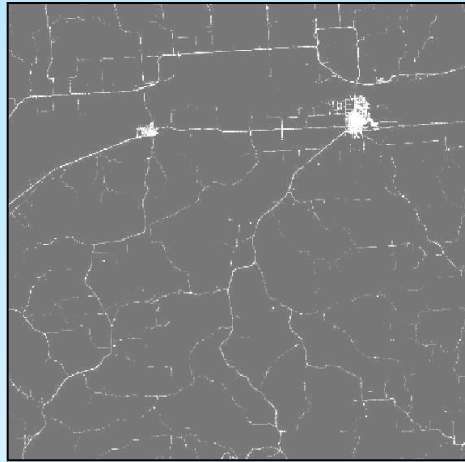


- Landsat TM and ETM+ vs. Advanced Wide Field Sensor (AWiFS)
- Ground truth: FSA/CLU + 578 & NLCD
- Ancillary data
- Commercial Software Suite
- See5 Decision Tree Methodology

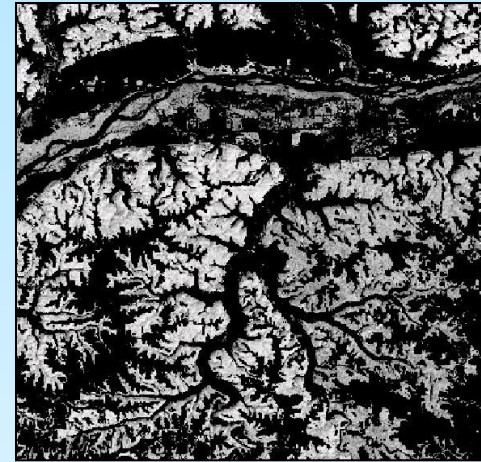
Ancillary Data – USGS/NASA Products



Elevation

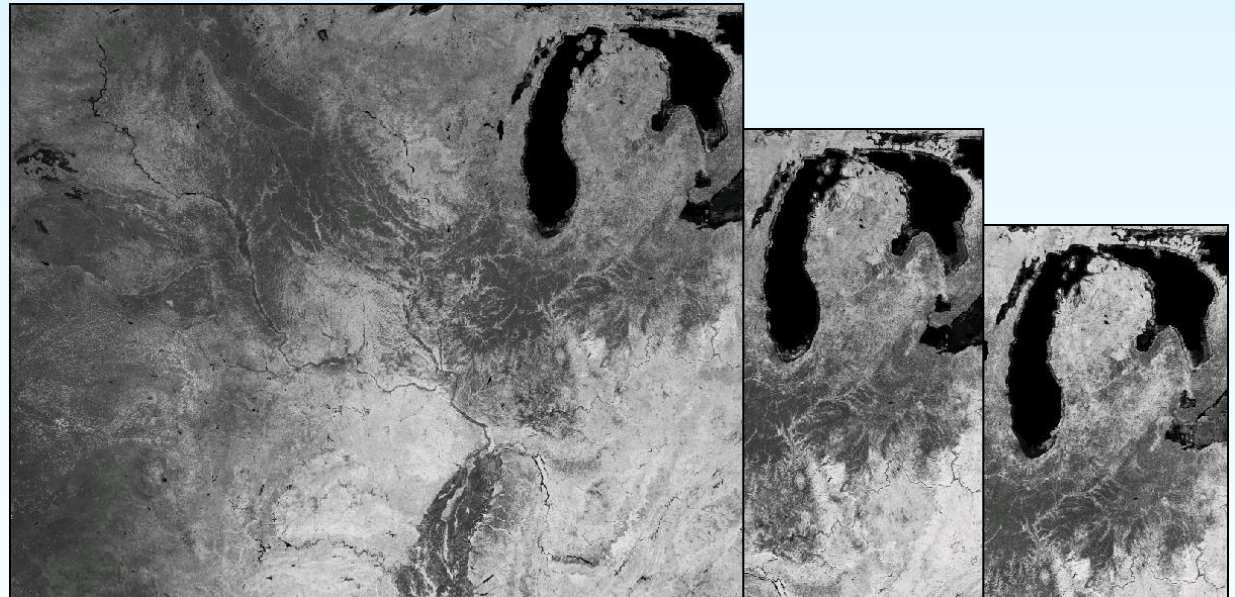


Imperviousness



Forest Canopy

NASA MODIS Terra
(16-day NDVI composite)



Cropland Data Layer Program Components



- Advanced Wide Field Sensor (AWiFS)
- Ground truth: FSA/CLU + 578 & NLCD
- Ancillary data sets
- Commercial Software Suite
- See5 Decision Tree Methodology
- Estimation

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



```

5dates.out - WordPad
File Edit View Insert Format Help

See5 [Release 2.03] Tue Dec 26 09:20:26 2006
-----

Options:
  10 boosting trials

Class specified by attribute `dep'

Read 62526 cases (23 attributes) from 5dates.data

----- Trial 0: -----

Decision tree:

band15 > 59:
...band14 <= 34:
:   ...band01 > 33:
:   :   ...band04 > 113: 8 (76)
:   :   :   band04 <= 113:
:   :   :   :   ...band07 > 105:
:   :   :   :   :   ...band05 <= 21: 3 (5/1)
:   :   :   :   :   :   band05 > 21:
:   :   :   :   :   :   :   ...band18 > 25: 1 (24)
:   :   :   :   :   :   :   :   band18 <= 25:
:   :   :   :   :   :   :   :   :   ...band08 > 66: 1
:   :   :   :   :   :   :   :   :   :   band08 <= 66:
:   :   :   :   :   :   :   :   :   :   :   ...band08 <=
:   :   :   :   :   :   :   :   :   :   :   :   band08 > 6
:   :   :   :   :   :   :   :   :   :   :   :   :   band07 <= 105:
:   :   :   :   :   :   :   :   :   :   :   :   :   :   ...band14 > 27:
:   :   :   :   :   :   :   :   :   :   :   :   :   :   :   ...band06 <= 21: 3 (2
:   :   :   :   :   :   :   :   :   :   :   :   :   :   :   :   band06 > 21:

```

Classifier Construction Options

Winnow attributes

Rulesets

Sort by utility bands

Boost trials

Subsets of values

Use sample of %

Lock sample

Cross-validate folds

Ignore costs file

Advanced options

Fuzzy thresholds

Global pruning


Pruning CF %

Minimum cases

OK Defaults Cancel

See5

File Edit Help

 **hypothyroid**

[class and attribute definitions \(hypothyroid.names\)](#)

[training cases to be analyzed \(hypothyroid.data\)](#)

[test cases \(hypothyroid.test\)](#)

[misclassification costs \(hypothyroid.costs\)](#)

[decision tree classifier \(hypothyroid.tree\)](#)

[ruleset classifier \(hypothyroid.rules\)](#)

[output file \(hypothyroid.out\)](#)

See5 Decision Tree Classifier

State-of-the-art technique for image classification

- Relatively cheap (\$750)

Incorporates a powerful ensemble method known as “boosting”

The “NLCD Mapping Tool” was integrated into ERDAS Imagine

- Provided gratis by USGS

NLCD Mapping Tool

Percent Calculation ...

NLCD Sampling Tool ...

Cubist Classifier...

See5 Classifier...

Accuracy Assessment...

Smart Eliminate...

Cubist Info See5 Info

Close



Accuracy Assessment

```

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

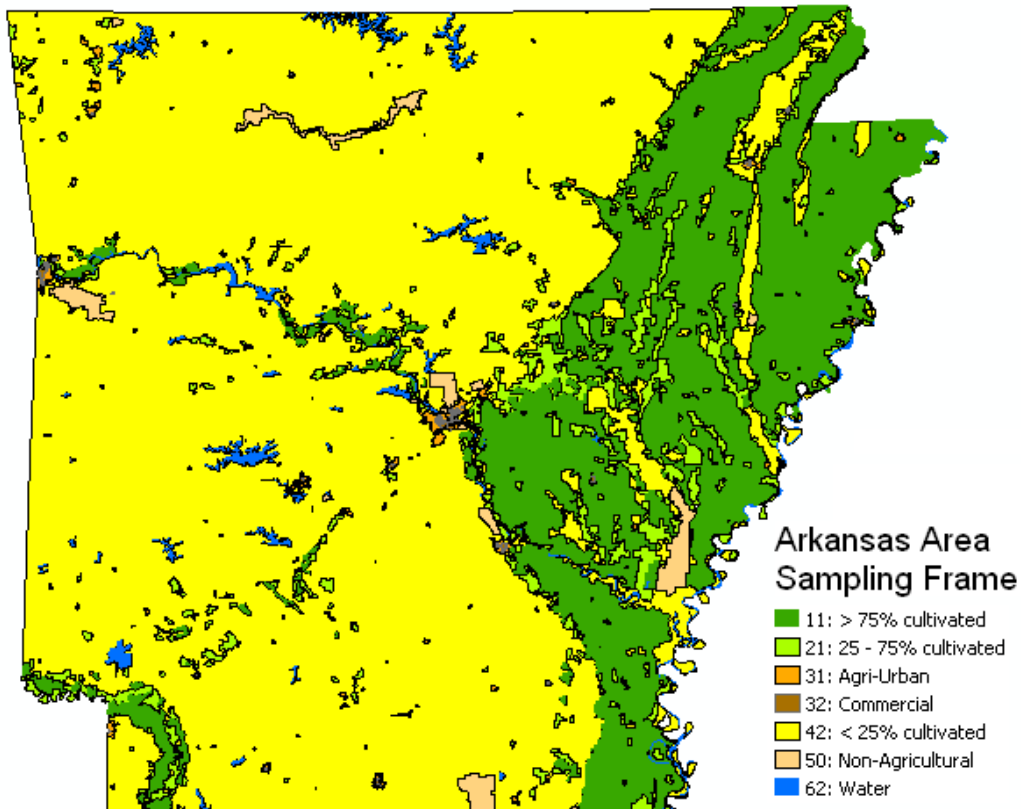
Cover Type	Attribute Code	*Correct Pixels	Producer's Accuracy	Omission Error	Kappa	User's Accuracy	Commission Error	Cond'l Kappa
Corn	1	28358	95.36%	4.64%	0.9528	93.08%	6.92%	0.9297
Cotton	2	11757	95.08%	4.92%	0.9505	94.59%	5.41%	0.9456
Rice	3	2	28.57%	71.43%	0.2857	66.67%	33.33%	0.6667
Sorghum	4	21251	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 Veggies & 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 identified in the error matrix.

Cropland Data Layer Program Components



- Advanced Wide Field Sensor (AWiFS)
- Ground truth: FSA/CLU + 578 & NLCD
- Ancillary data sets
- Commercial Software Suite
- See5 Decision Tree Methodology
- Estimation



SECTION D - CROPS AND LAND USE ON TRACT

How many acres are inside this blue tract boundary drawn on the photo (map)?

Now I would like to ask about each field inside this blue tract boundary and its use during 2000

FIELD NUMBER		01	02	
1.	Total acres in field	828	828	828
2.	Crop or land use. [Specify]			
3.	Occupied farmstead or dwelling	843		
4.	Waste, unoccupied dwellings, buildings and structures, roads, ditches, etc.	---	---	---
5.	Woodland	831	831	831
6.	Pasture	Permanent (not in crop rotation)	842	842
			856	856

**Estimation Components:
Area Sampling Frame+
June Ag Survey+
Questionnaire**

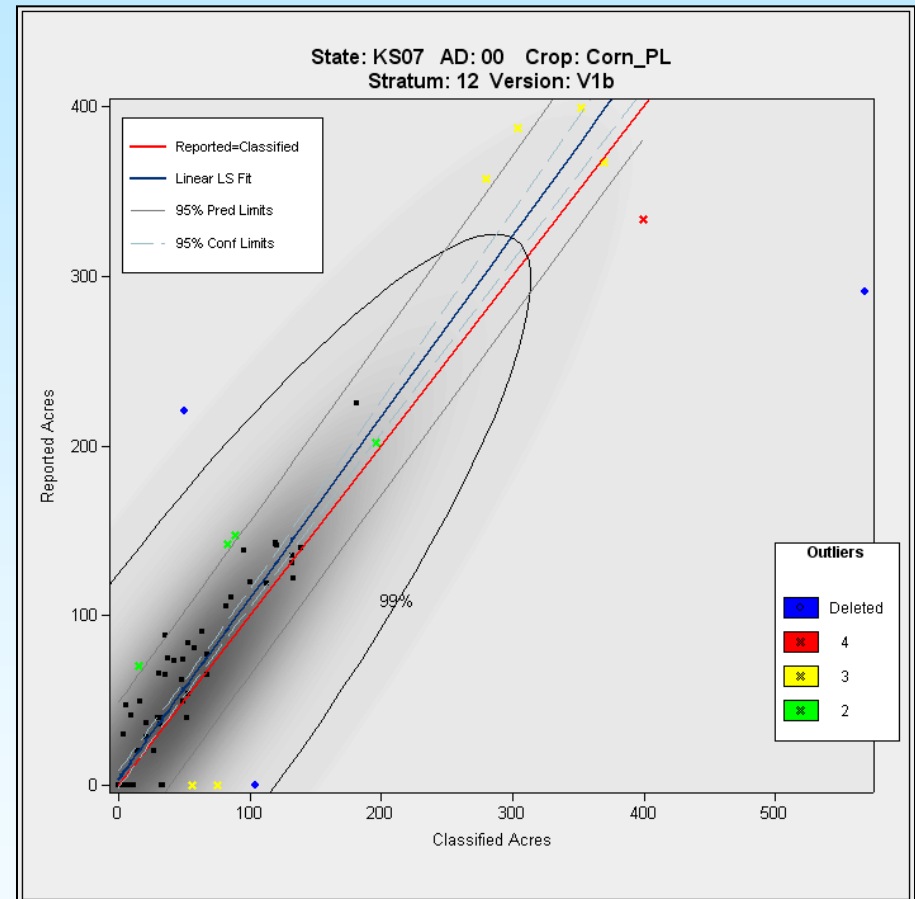
Regression-based Acreage Estimator

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

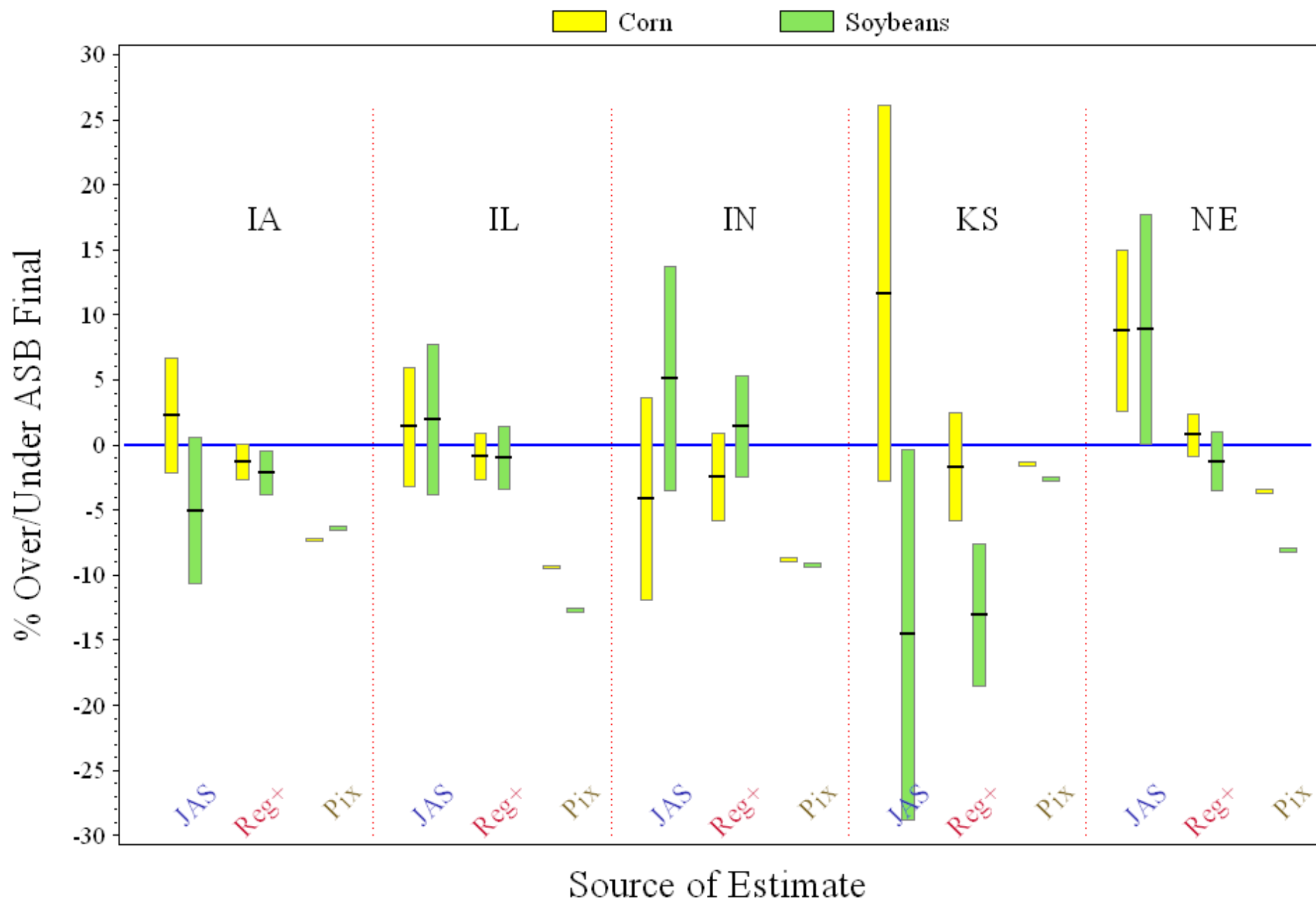
Using both CDL and JAS acreage results in estimates with reduced error rates over JAS alone

Outlier segment detection - removal from regression analysis



Acreage not just about counting pixels

2008 State Level Estimates +/- 2 CVs



January						
Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5

February						
Su	Mo	Tu	We	Th	Fr	Sa
		1	2			

March						
Su	Mo	Tu	We	Th	Fr	Sa
						1

CDL Production Schedule

8:●	15:○	22:○	30:○
-----	------	------	------

6:●	13:○	20:○	28:○
-----	------	------	------

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			

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

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	25	26	27	28
29	30					

Acreage Report
CDL winter wheat

July						
Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5

August						
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

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				

Crop Production Report
CDL cotton/rice/peanuts

Crop Production Report
CDL corn/soybeans

2:●	10:○	18:○	25:○
-----	------	------	------

1:●	8:○	16:○	23:○	30:○
-----	-----	------	------	------

7:○						
-----	--	--	--	--	--	--

Small Grains Annual Summary
CDL small grains

October						
Su	Mo	Tu	We	Th	Fr	Sa

November						
Su	Mo	Tu	We	Th	Fr	Sa

December						
Su	Mo	Tu	We	Th	Fr	Sa

Crop Production Report
CDL all crops

Historical:
Crop Production Annual Summary
CDL all crops/county estimates

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:○	28:○
-----	------	------	------

5:○	13:○	19:○	27:○
-----	------	------	------

5:○	12:○	19:○	27:○
-----	------	------	------

Cropland Data Layer and Acreage Estimation Processing Flow

Input Vector Data

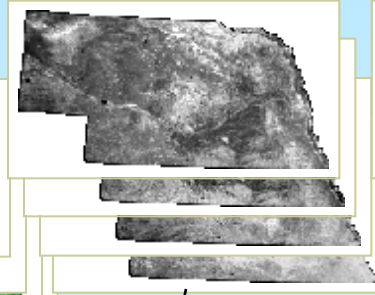
NASS JAS segments FSA CLU USGS NLCD



IRS Resourcesat-1 raw AWiFS summer time series



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



USGS NLCD 2001 Impervious & Canopy



USGS NED Elevation



Tabular Data

JAS eData FSA 578

Field	Value
1	100
2	200
3	300
4	400
5	500
6	600
7	700
8	800
9	900
10	1000
11	1100
12	1200
13	1300
14	1400
15	1500
16	1600
17	1700
18	1800
19	1900
20	2000
21	2100
22	2200
23	2300
24	2400
25	2500
26	2600
27	2700
28	2800
29	2900
30	3000
31	3100
32	3200
33	3300
34	3400
35	3500
36	3600
37	3700
38	3800
39	3900
40	4000
41	4100
42	4200
43	4300
44	4400
45	4500
46	4600
47	4700
48	4800
49	4900
50	5000

Non-agricultural Ground truth



Agricultural Ground truth

Link and assess data sets



Derives decision tree-based classification rules

Manages and visualizes datasets



Generated rule set

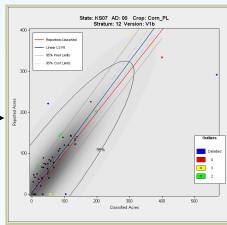


Extract JAS intersecting pixels

Estimation



Customized for acreage estimation



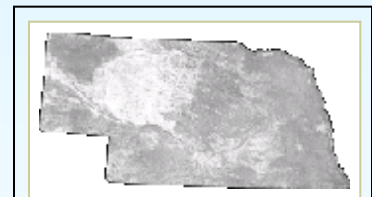
Pixel count vs. reported acreage

-- Cropland Data Layer --

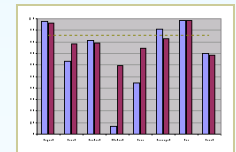
State and county crop acreage statistics

NASS Internal Only

Output



Confidence Layer



Accuracy Assessment

Diagnostics

Research 2008-2009

Single Crop Planting Intensity and Crop Rotation Assessment

Goal: To determine the specific counties with high percentages of single crop planting intensity and derive the predominant crop rotation patterns in Nebraska, Iowa and Illinois



Corn



Soybeans

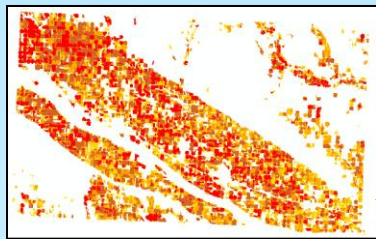
Single Crop Planting Intensity Methodology



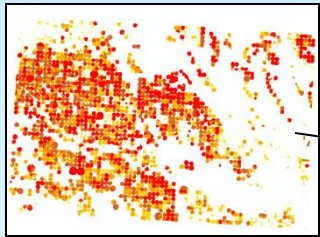
1. Inputs include: Cropland Data Layers (CDLs) for 2004-2008
2. CDLs are recoded such that crop under evaluation = 1
3. The recoded CDL's are added together using the ERDAS Imagine Modeler
4. The output is the Crop Intensity Image which is ready for evaluation

Corn Planting Intensity in Nebraska

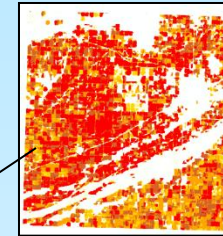
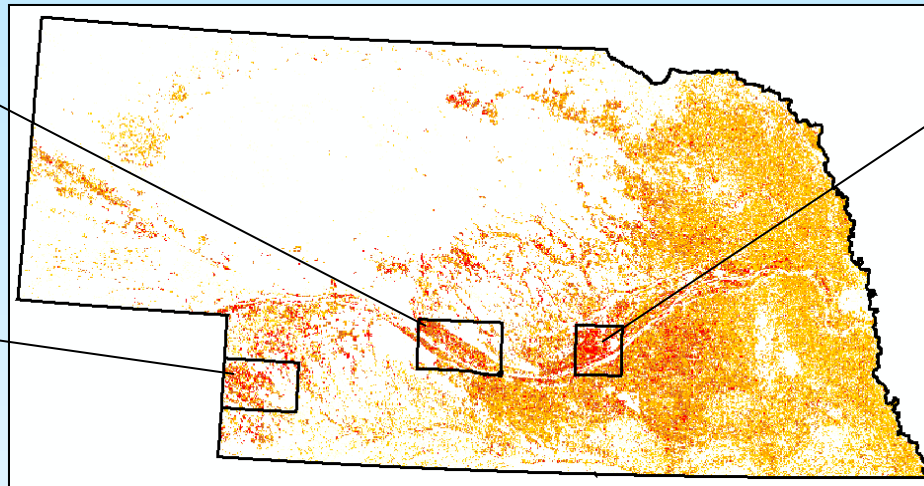
2004 - 2008



Dawson, NE

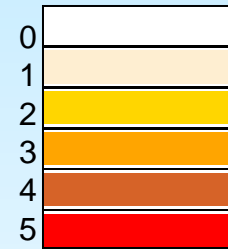


Chase, NE



Hall, NE

Years
Planted
to Corn



Hall County	Chase County	Dawson County	State Total
5 years in a row planted to corn: 43%	5 years in a row planted to corn: 28%	5 years in a row planted to corn: 21%	5 years in a row planted to corn: 7%
4 out of 5 years planted to corn: 22%	4 out of 5 years planted to corn: 21%	4 out of 5 years planted to corn: 29%	4 out of 5 years planted to corn: 13%

Corn Planting Intensity, 2004 - 2008

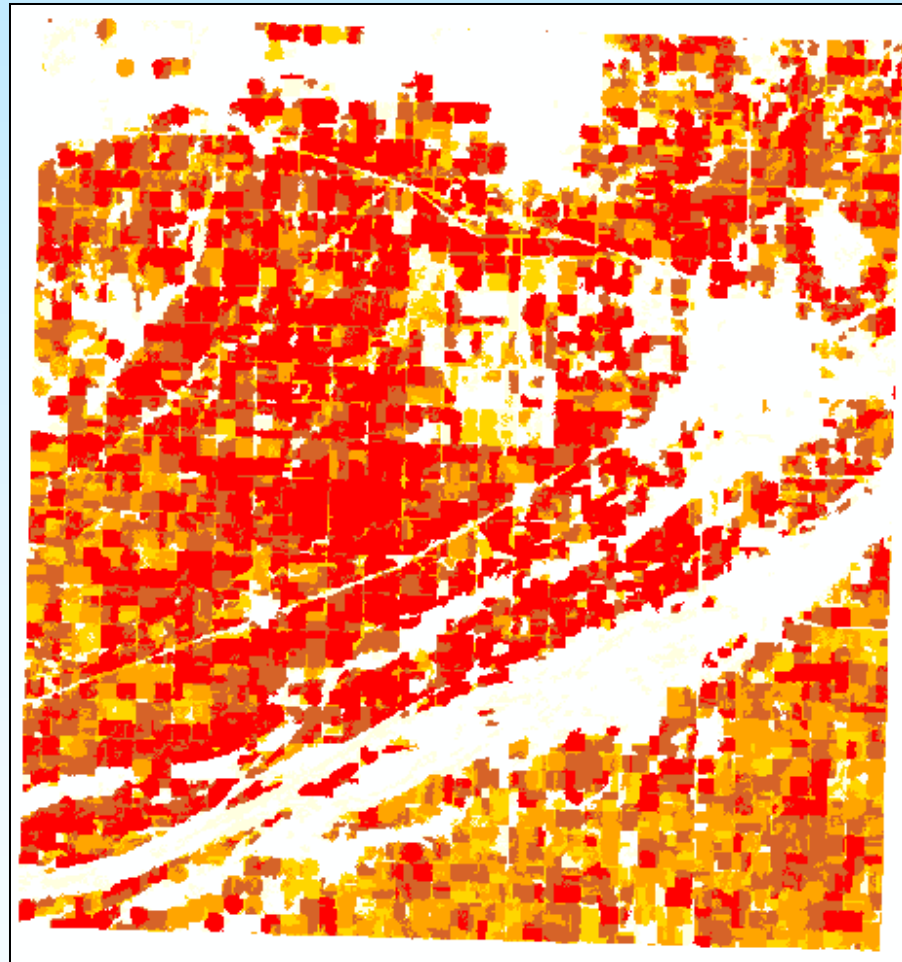
Hall County, Nebraska

Hall County

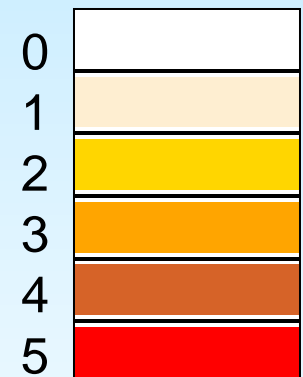
5 years in a row planted to corn: **43%**
(5% > than 2003-2007)

4 out of 5 years planted to corn: **22%**
(2% < than 2003-2007)

AWiFS 8/13/2007
Bands 3/4/2
Red/Green/Blue



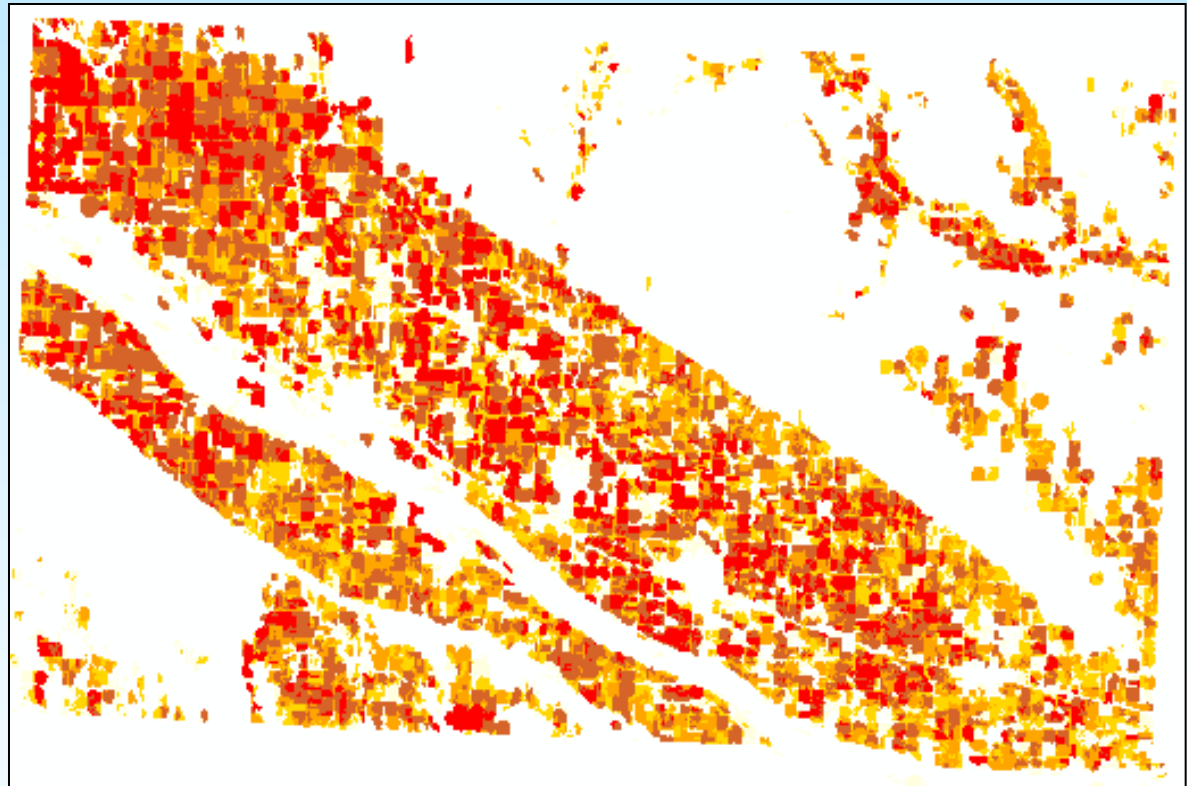
Years
Planted to Corn



Percentages derived from total acreage in corn production

Corn Planting Intensity, 2004 - 2008

Dawson County, Nebraska

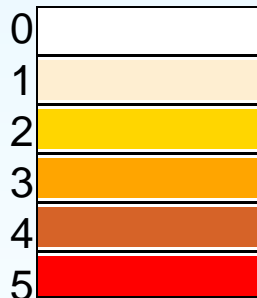


Dawson County

5 years in a row planted
to corn: **21%**
(1% > than 2003-2007)

4 out of 5 years planted
to corn: **29%**
(1% > than 2003-2007)

Years Planted
to Corn



Percentages derived from total acreage in corn production

AWiFS 8/13/2007
Bands 3/4/2
Red/Green/Blue

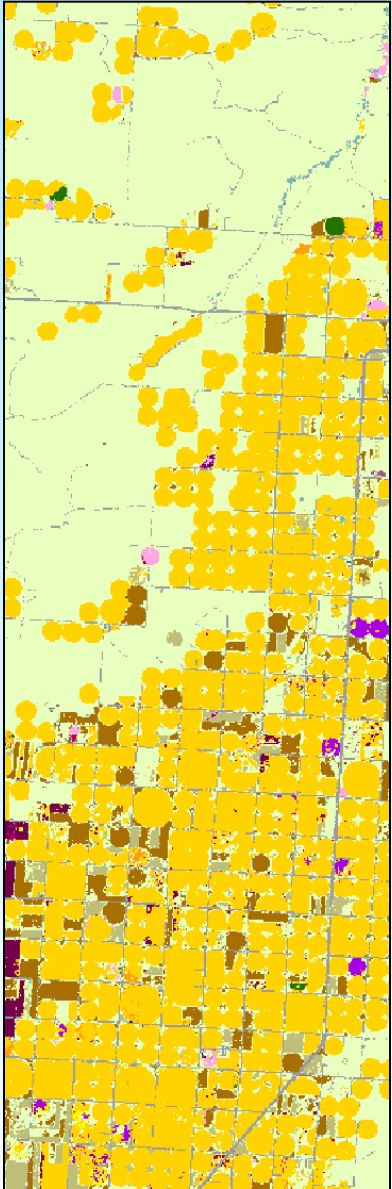
Crop Rotation Methodology



1. Inputs include: Cropland Data Layers (CDLs) for 2004 - 2008
2. CDLs are recoded to
2008: Corn: 1, Soy: 2, Other: 3
2007: Corn: 10, Soy: 20, Other: 30
2006: Corn: 100, Soy: 200, Other: 300
2005: Corn: 1,000, Soy: 2,000, Other: 3,000
2004: Corn: 10,000, Soybeans: 20,000, Other: 30,000
3. The recoded CDLs are added together using the ERDAS Imagine Modeler
4. The output is the Crop Rotation Image which is ready for evaluation

Crop Rotation Results Nebraska

**Crop Rotation Patterns (Corn and Soybean) 04- 08
As Percentage of
Total Cultivated Cropland**



Corn (04), Soy (05), Corn (06), Soy (07), Corn (08)	10.1%
Soy (04), Corn (05), Soy (06), Corn (07), Soy (08)	9.3%
Corn (04), Corn (05), Corn (06), Corn (07), Corn (08) (.3% < than 2003-2007)	7.5%
Additional acreage into corn production (07):	309,688 acres
Additional acreage into corn production (08):	503,221 acres

Total Cultivated Cropland derived from NASS' Nebraska 2008 CDL

Cropland Data Layer Summary

■ Operational Program since 2007

- Early delivery of estimates, 2008 and 2009
 - Winter Wheat – June
 - Corn and Soybeans – August & October
 - Small Grains – September
- Provides measureable statistical error
- Results considered for setting national acreage estimate

■ Components

- AWiFS/MODIS/Landsat TM
- Farm Service Agency
 - Common Land Unit (training/testing)
- Commercial Software
- June Agricultural Survey
 - Regression estimator

■ Distribution

- datagateway.nrcs.usda.gov
- http://www.nass.usda.gov/Research_and_Science/



Thank You

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



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

