
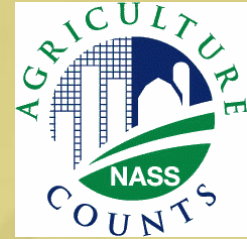


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Geographer

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National Agricultural Statistics Service
Research and Development Division
Spatial Analysis Research Section**



An Evaluation of Resourcesat-1 LISS-III vs AWiFS Imagery for Mapping Croplands

**Monitoring Agriculture from Space
with Commercial Imagery**

NASS Background

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

The screenshot shows the NASS website with various navigation options and data resources. Key sections include:

- Search NASS:** A search bar with a 'Go' button and a dropdown menu for 'All NASS'.
- Quick Stats (Agricultural Statistics Data Base):** A section for querying data by commodity, state, and year.
- Additional Crops County Resources:** Links to maps and data for various crops.
- Census of Agriculture:** Information on querying census data for different years.
- Interactive Data:** Tools for interacting with census datasets, including 'Interactive Census Maps for 2002 Census Highlights' and 'Table Lens Application for 1997 Census Data'.

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 the 2001 growing season, totaling \$9.1 million, 11 percent. Corn losses were \$6.6 million and wheat \$1.5 million, 5.6 percent. Deer damage resulted in losses of \$13.6 million, 6.1 percent losses were \$3.6 million, 1.6 percent.

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

In terms of yield, losses to deer were most severe in Central and Western Maryland, while geese were greater on the Eastern Shore. Corn yield losses of 9.6 bushels per acre and 7.4 bushels per acre in Central and Western Maryland, respectively. The Lower Eastern Shore reported the highest 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 48 percent of farms raising corn, 58 percent of farms growing soybeans and 27 percent of farms raising wheat.

Region	Crop	Acres Harvested	Harvested Yield (bushels)	Average Yield Loss (bushels)	Production Loss (bu)
Western Maryland	Corn	5,200	114,000	7.4	40,700
Eastern Shore	Soybeans	300	35,000	35.0	10,500

WISCONSIN AGRICULTURAL STATISTICS SERVICE
P.O. Box 80234 Madison, WI 53708-8034

2002 Dairy Producer Opinion Survey
November 2002

Wisconsin Milk Production To Recover

Milk production is expected to increase in Wisconsin during the next five years according to a survey conducted by the Wisconsin Agricultural 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.

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	5,800	-24
100-199	1,800	2,080	+9
200-499	700	900	+29
500+	200	440	+120
Total	17,500	13,900	-20

Percent of Herds by Size Group 2007 Projection

17% 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.

2002 Census of Agriculture - SVI Interactive Mapping - United States - Microsoft Internet Explorer

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

Download data as CSV | XML | PDF

Scale: National | Zoom or Data Withheld <= 20,000

Color: Green

Source: USDA-NASS 2002 Census of Agriculture @ USDA-NARS 2003-2006





NASS Spatial Analysis Research Section

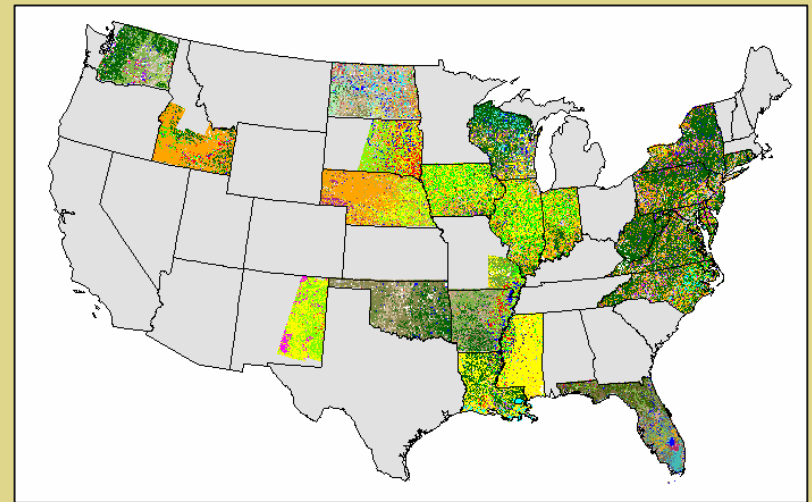
Developing methodologies and tools to improve NASS' ability to collect, manage, and disseminate statistics on US agriculture utilizing remotely sensed, GIS, and GPS data

Agriculture Atlas of the USA
Land Cover Classification
Mobile GIS
Crop Condition
Tree Inventorying

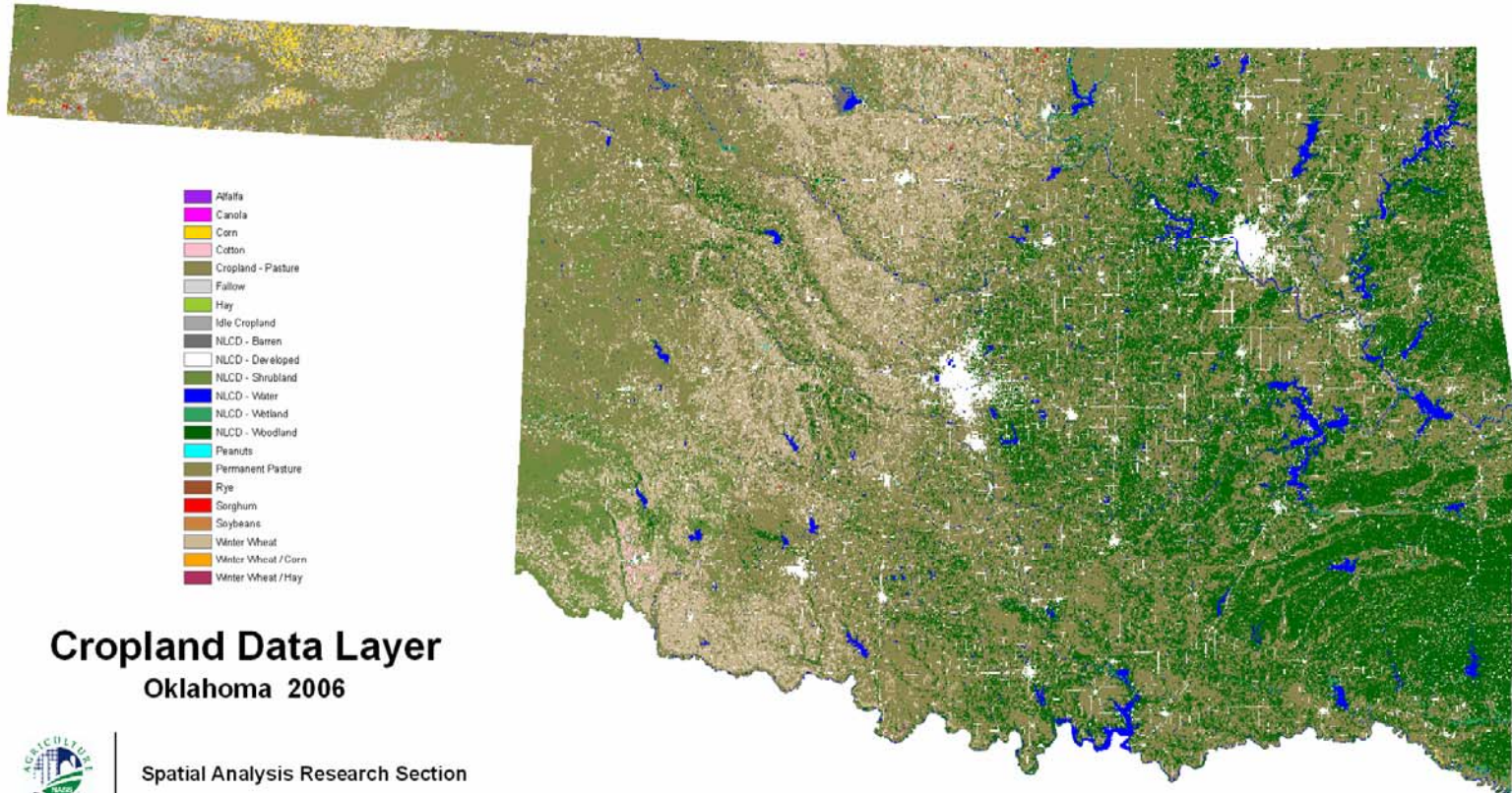
Yield Modeling
Change Detection
Crop Progress
County Level Crop Maps
Imagery Exploitation

Cropland Data Layer (CDL) Program

- State specific land cover classifications emphasizing row crop agriculture
 - Some regions done annually
 - Corn Belt, The Delta
 - Others “one-and-done”
 - Mid-Atlantic, Idaho, Florida
- Within NASS, CDL used to
 - Tighten confidence intervals on survey derived acreage estimates
 - Improve county level acreage estimates



Example CDL



Spatial Analysis Research Section



History of NASS AWiFS Use

- 2004
 - Obtained AWiFS August imagery
 - Used to augment TM images collected during entire summer
- 2005
 - Obtained AWiFS June and August imagery
 - Used to augment or replace TM
 - Assessed quantitative differences
- 2006
 - Switched from Landsat to Resourcesat at a USDA-wide level
 - Obtained AWiFS during entire summer growing season
- 2007
 - Proceeding forward primarily with AWiFS

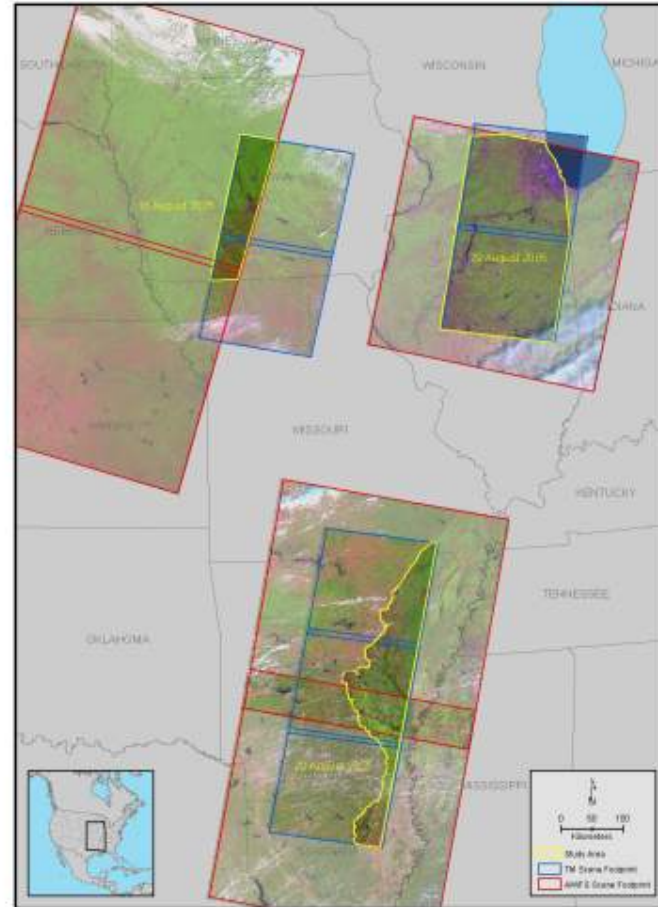


Why NASS Likes AWiFS

- Large swath width
- Inclusion of red, NIR, SWIR spectral bands
- Tolerable spatial resolution at 56 m sq
- Cost effectiveness
- Operational nature
- Fast data delivery by vendor
- Healthy satellite

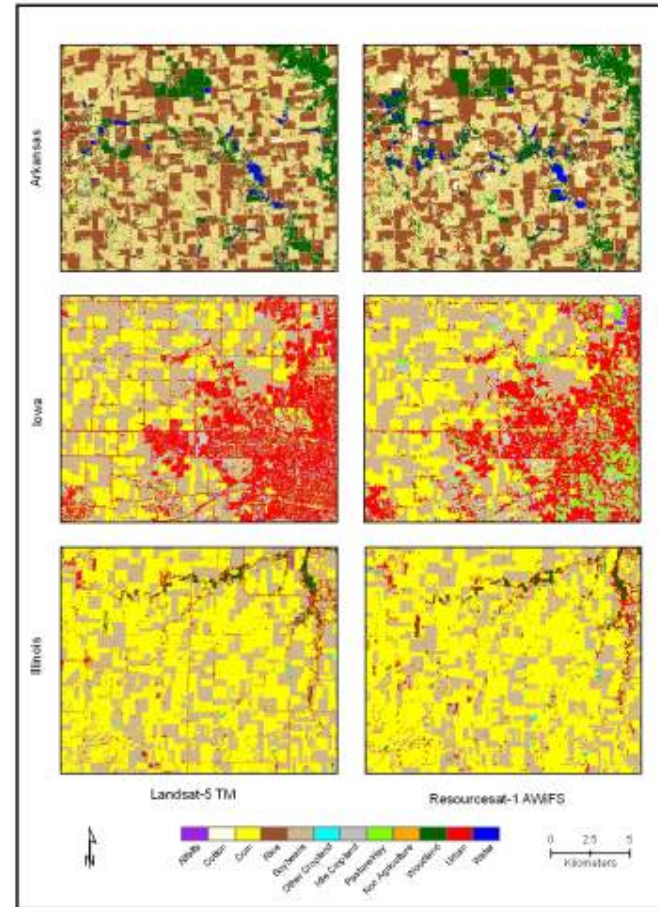
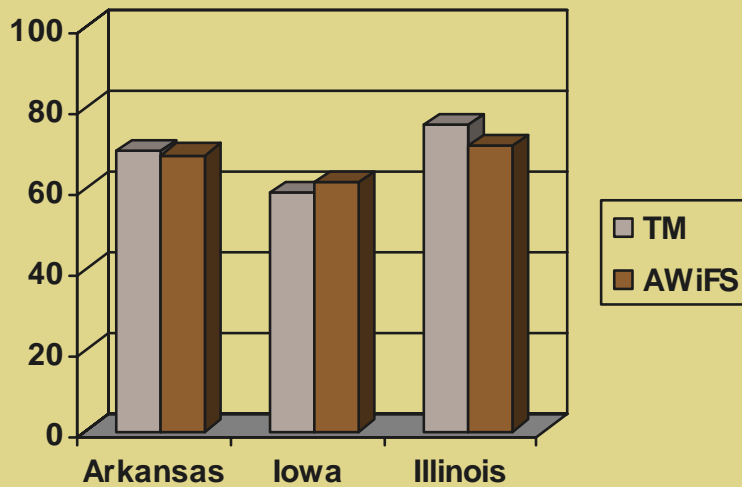
AWiFS versus TM Study

Compared classification accuracy over three study sites using same date coincident TM and AWiFS data from 2005 growing season



Results of TM versus AWiFS

Overall Accuracy





Hypothetical Question Raised

“Would classification accuracy improve if one had access to *AWiFS* swath width sized imagery but with *LISS-III*’s 23.5 m pixel resolution?”

- Better?
- Worse?
- No difference?

Testing of the question

- Can it be tested?
 - Yes!



- Conveniently, AWiFS and LISS-III
 - Ride in tandem on the same platform
 - Collect data in parallel
 - Are very similar instruments

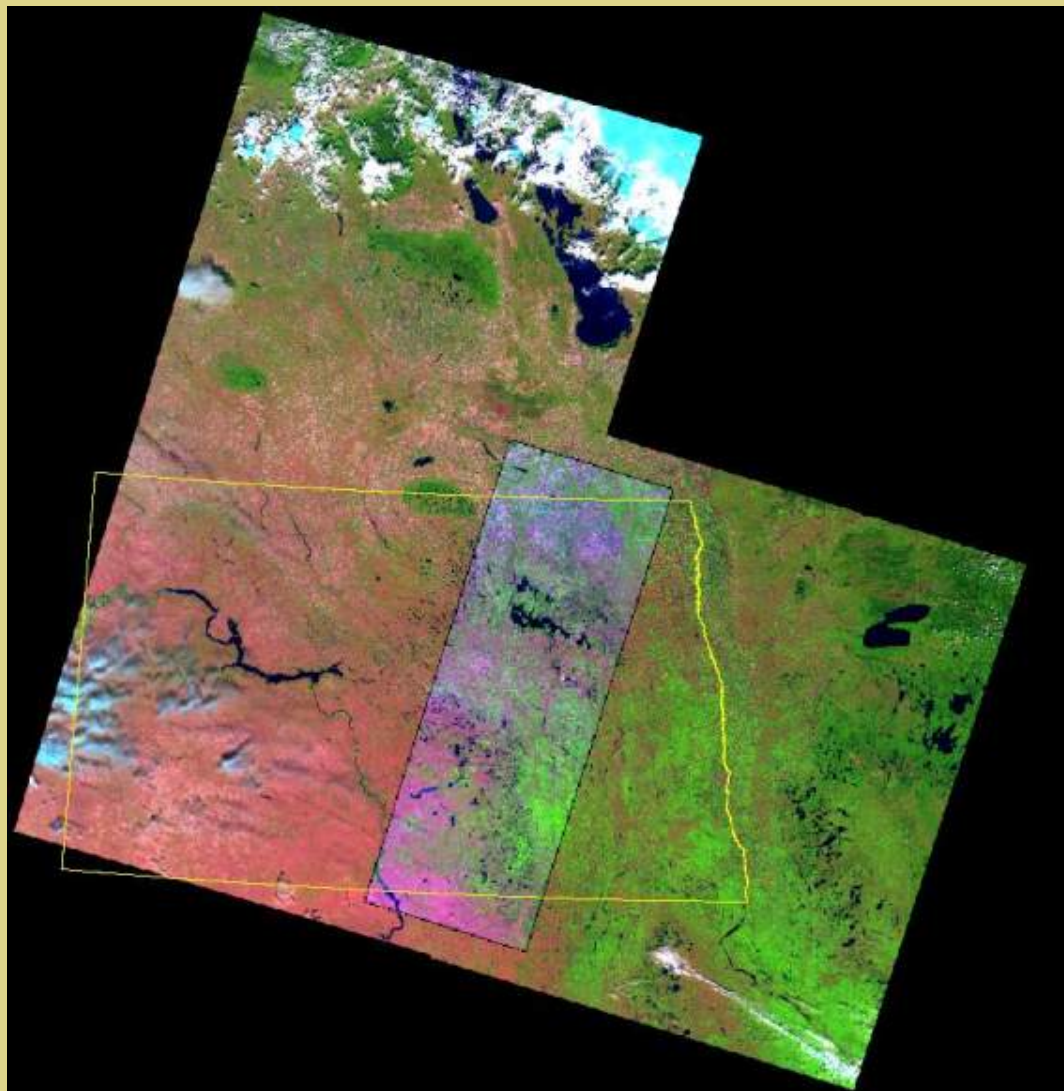
Sensor Specifications

	AWiFS	LISS-III
IGFOV	56m (nadir) 70m (field edge)	23.5 m
Spectral bands	B2: 0.52-0.59 B3: 0.62-0.68 B4: 0.77-0.86 B5: 1.55-1.70	B2: 0.52-0.59 B3: 0.62-0.68 B4: 0.77-0.86 B5: 1.55-1.70
Swath	370 km each head 740 km (combined)	141 km
Integration time	9.96 msec	3.32 msec
Quantization	10 bits	7 bits (SWIR band has 10-bit quantization, selected 7 bits out of 10 bits will be transmitted by the data handling system)
Number of gains	1	4 for B2, B3 and B4. For B5 dynamic range obtained by sliding 7 bits out of 10 bits

“The CCDs used in AWiFS are identical to those of LISS-III.”

North Dakota Test Case

22 August 2006



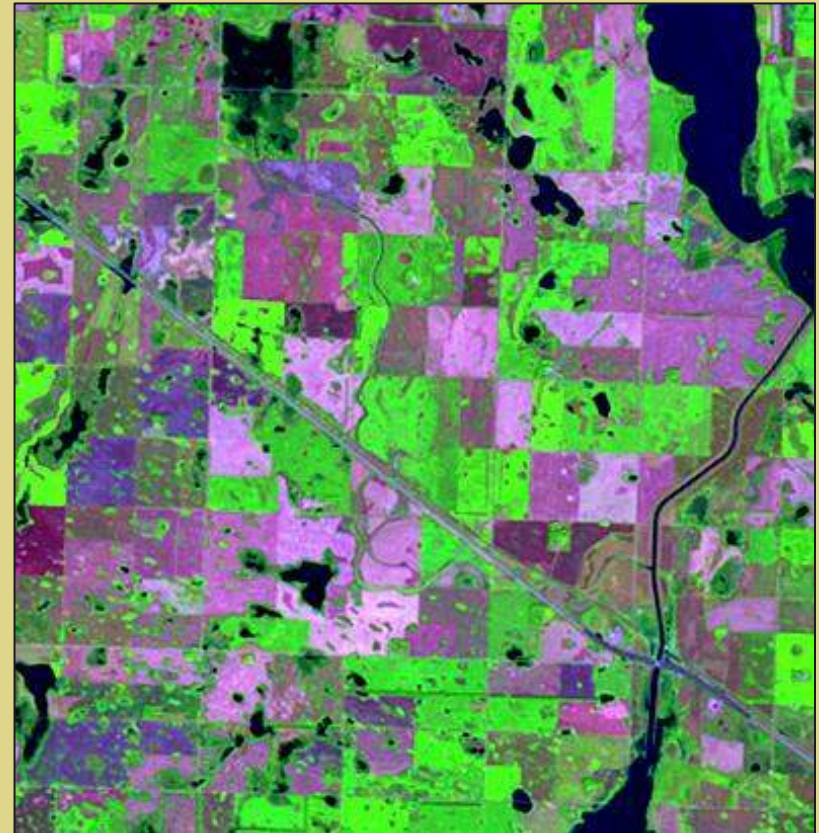


North Dakota Raw Data



AWiFS

Red=Red, Green=NIR, Blue=SWIR



LISS-III

Red=Red, Green=NIR, Blue=SWIR



Ground truth - two sources

- NASS - June Agricultural Survey (JAS)
- Farm Service Agency (FSA) - Common Land Unit (CLU) / 578 data



NASS



FSA

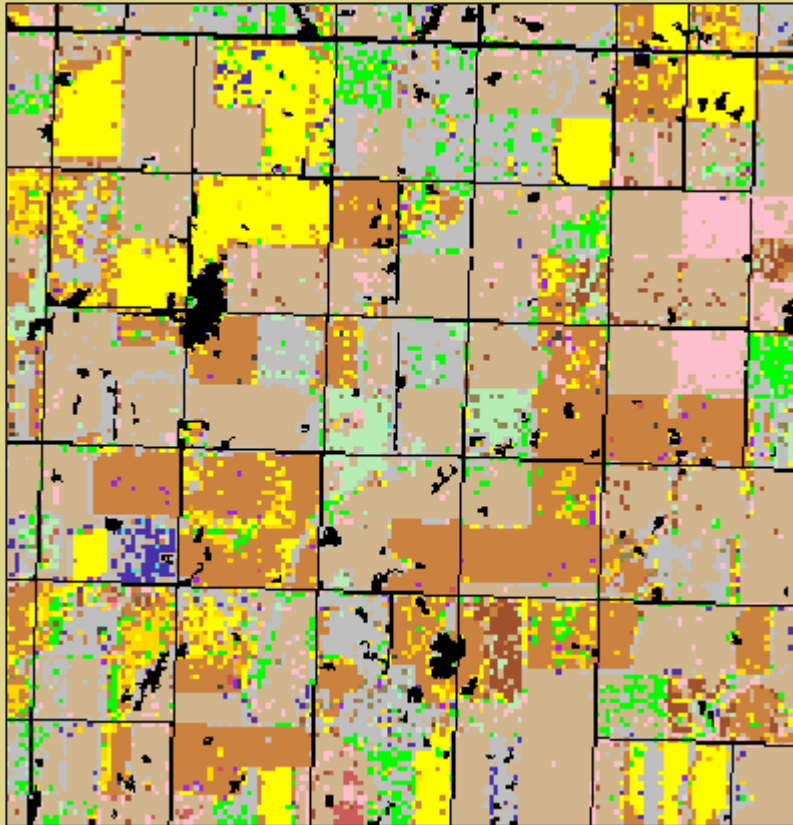


Methodology

- Reprojected/mosaicked to common projection
- Clipped AWiFS to LISS-III's extent
 - Only comparing the region of overlap
- Ran Supervised classification
 - Boosted Classification Tree (BCT) Analysis (implemented in See5.0)
 - Random half of FSA CLU/578 utilized for training
- Accuracy assessed
 - Against other half of ground truth.

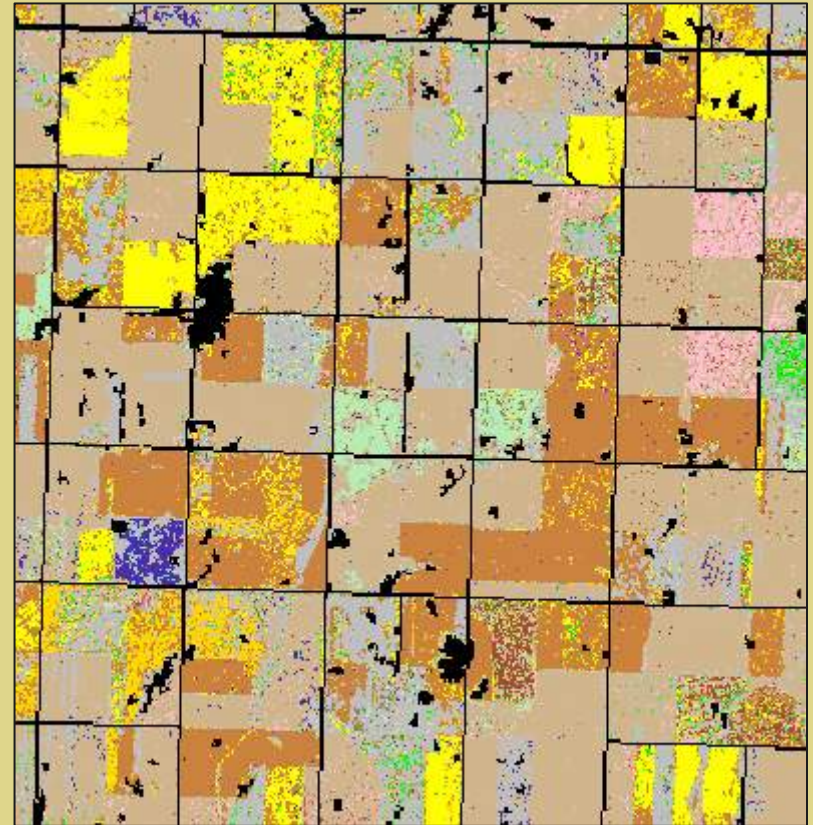


North Dakota - Results



AWiFS

50.1% pixels correct



LISS-III

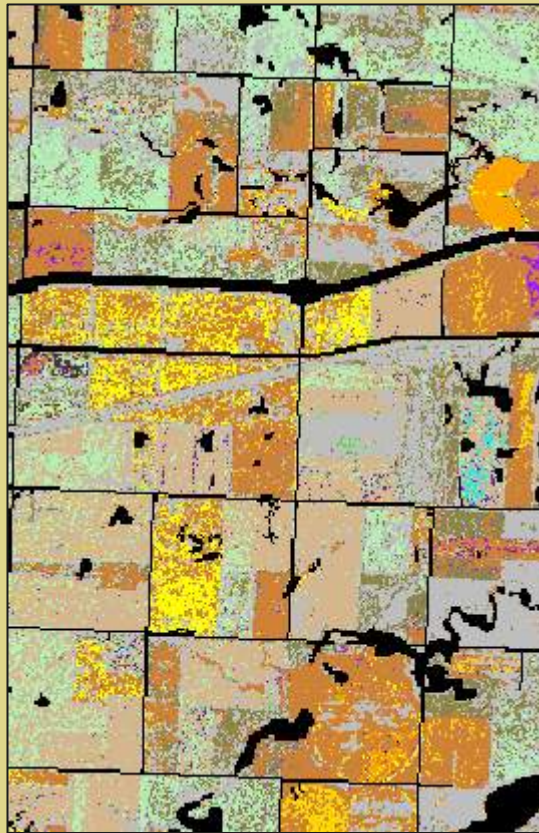
52.4% pixels correct

Post Classification Polishing

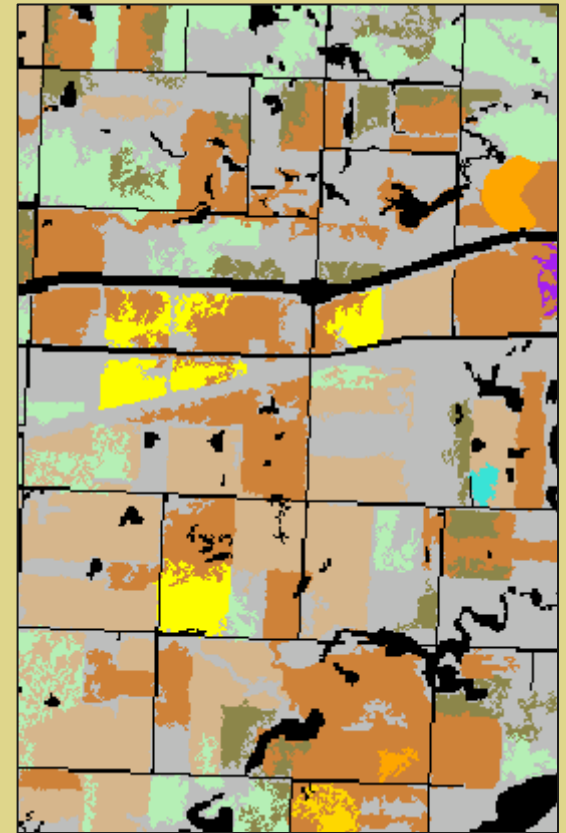
Method A. Applying a 20 acre minimum mapping unit



Raw Scene



Initial BCT Classification

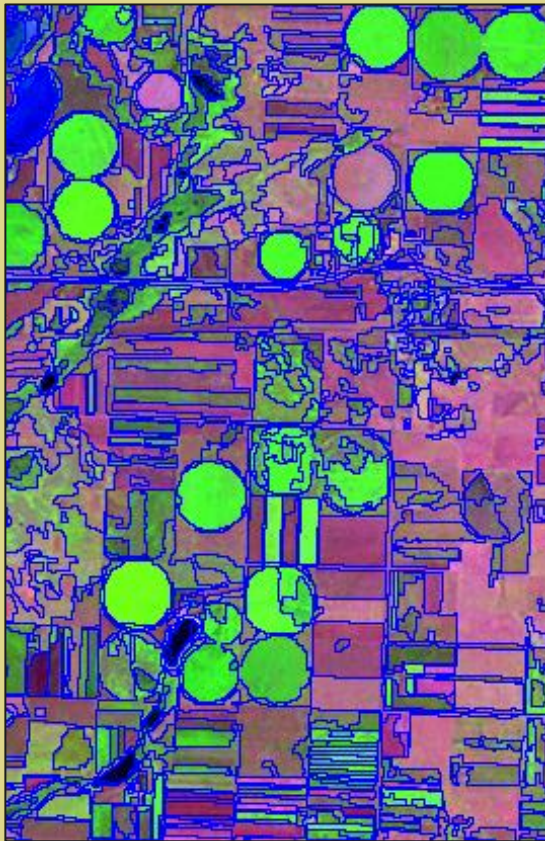


20 acre MMU

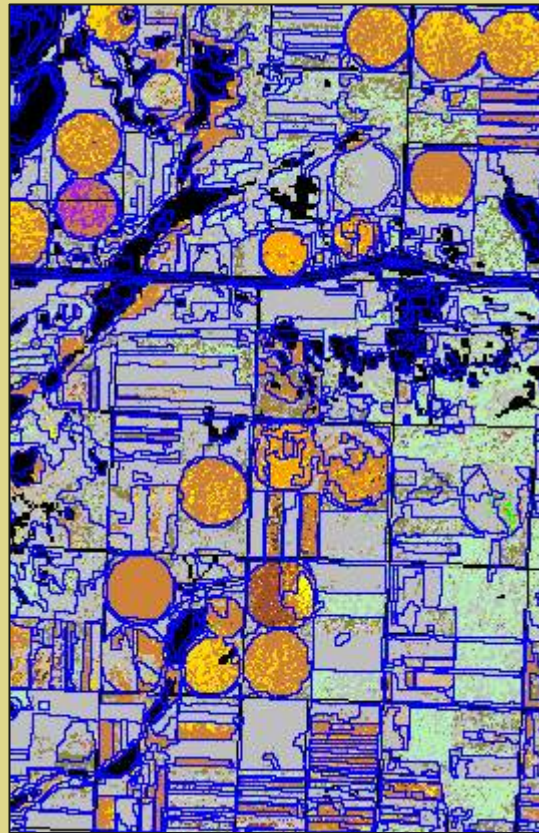


Post Classification Polishing

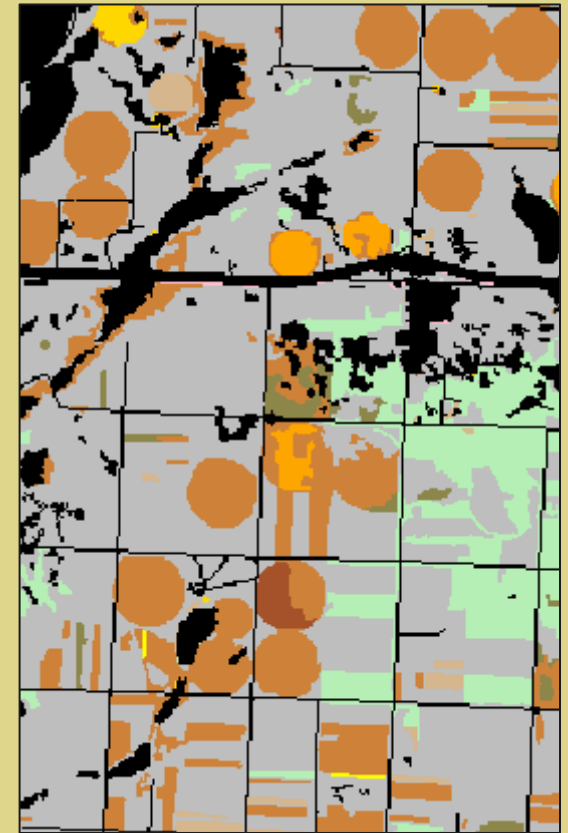
Method B. Definiens (eCognition) segment fill



Raw Segmented Scene



Initial BCT Classification



Majority Fill Segments

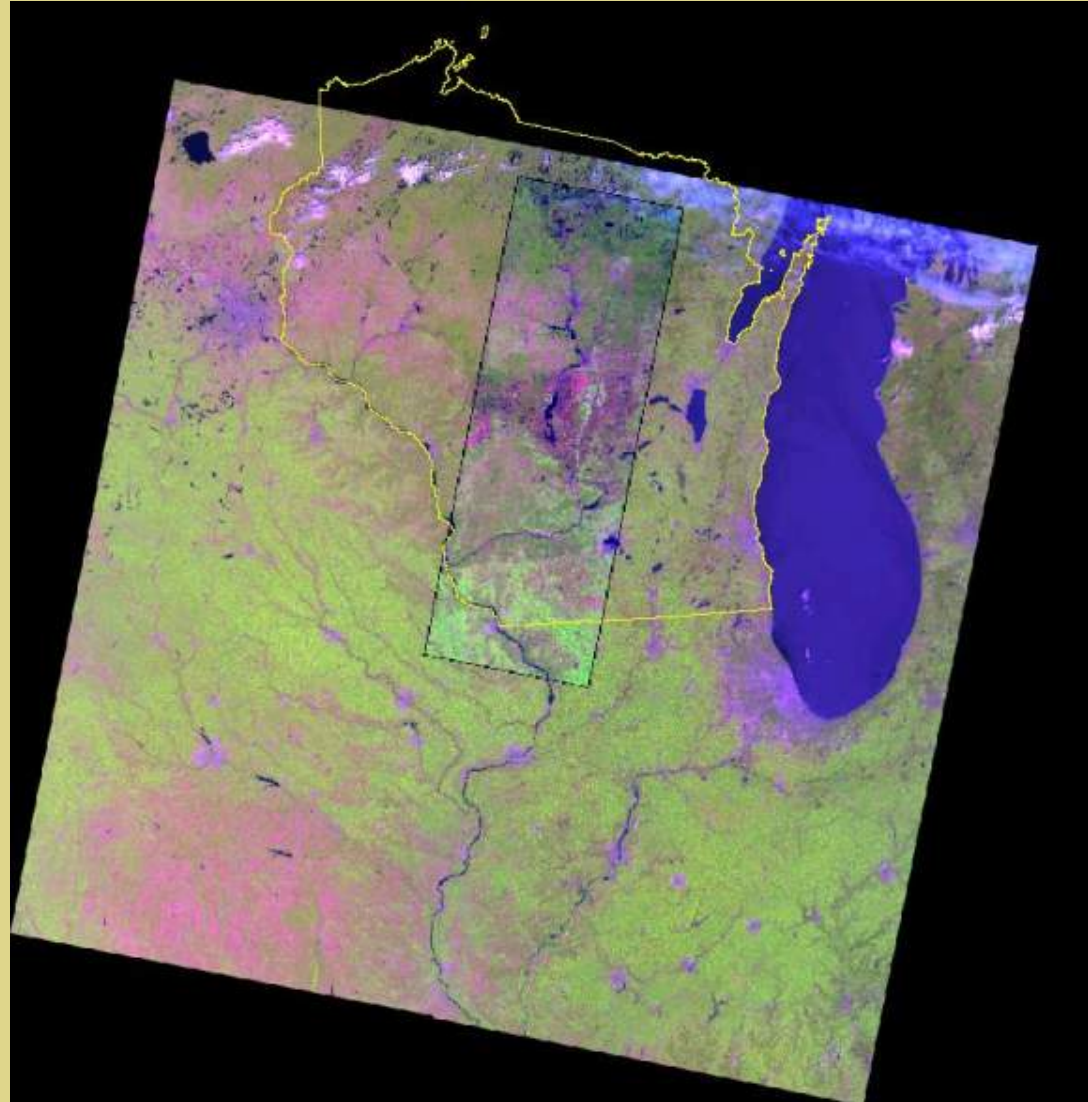


North Dakota Summary

	AWiFS	LISS-III
Standard Classification	50.1%	52.4%
20 Acre MMU Applied	54.6%	57.6%
Segment Majority Filled	53.9%	55.5%

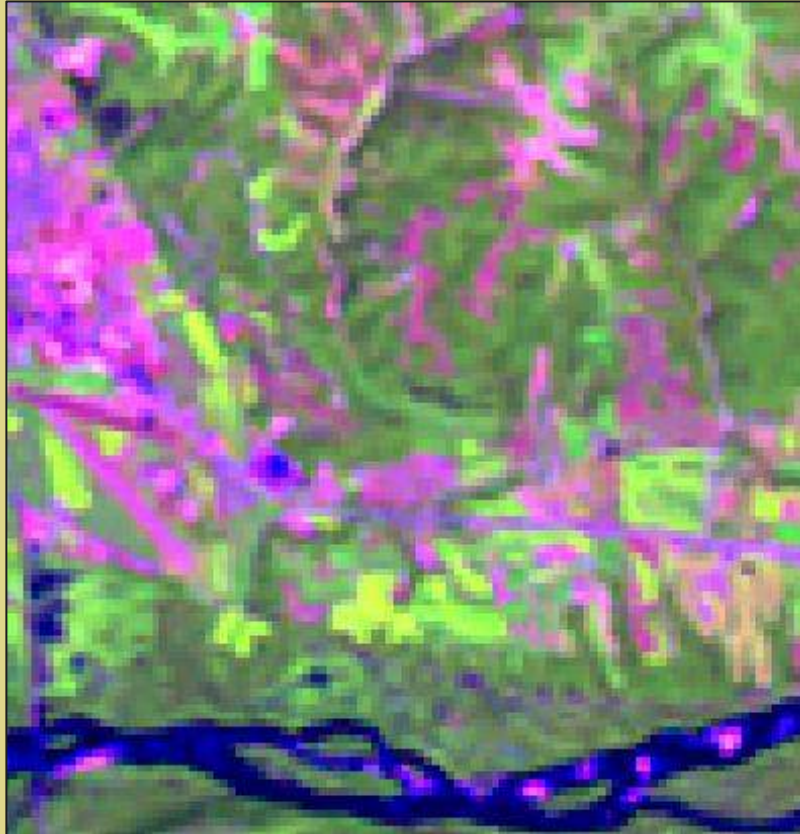
Wisconsin Test Case

31 July 2006



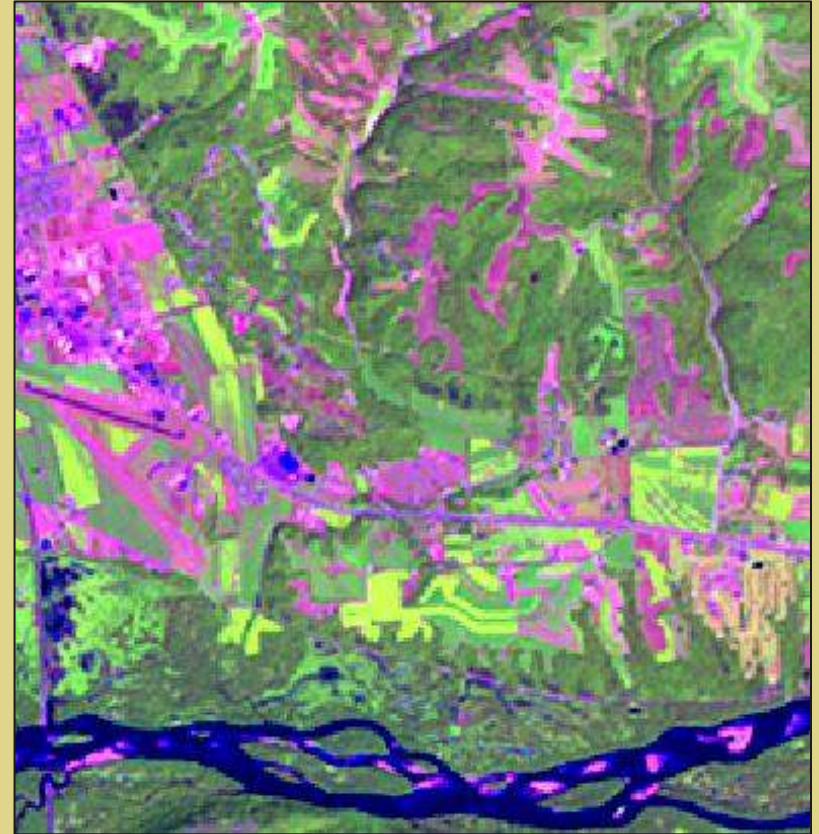


Wisconsin Raw Data



AWiFS

Red=Red, Green=NIR, Blue=SWIR

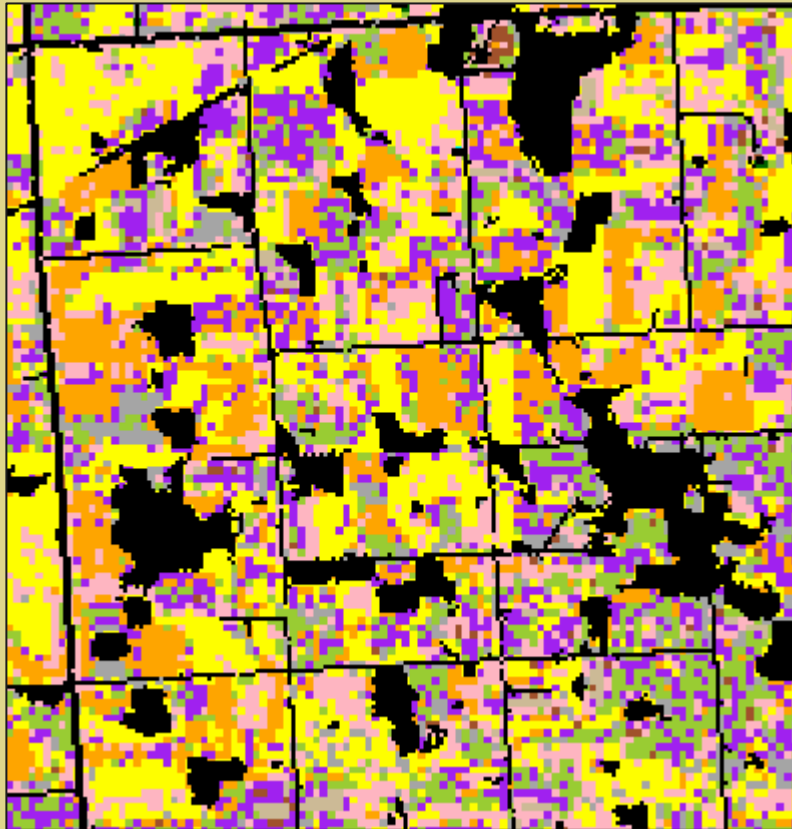


LISS-III

Red=Red, Green=NIR, Blue=SWIR

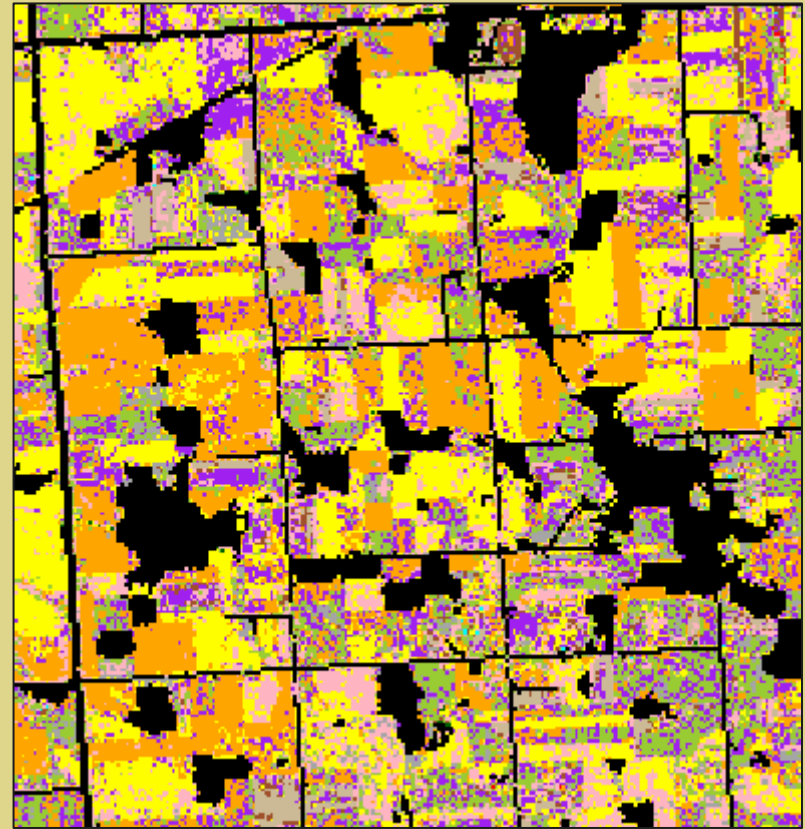


Wisconsin - Results



AWiFS

50.4% pixels correct



LISS-III

55.9% pixels correct



Wisconsin Summary

	AWiFS	LISS-III
Standard Classification	50.4%	55.9%
10 Acre MMU Applied	53.0%	60.0%
Segment Majority Filled	51.7%	59.6%



Conclusions

- A LISS-III resolution sensor with an AWiFS swath would improve NASS' ability to map croplands!
- A 5-10 % gain in map accuracy is suggested
- Accuracy gains are greater in areas with smaller field sizes
- Optimal resolution for mapping croplands is still not known but it is likely closer to 23 m than 56 m
- LISS-III is impractical today for NASS regional scale classification efforts due to limiting 141 km swath width, 26 day revisit rate, and cost

Thank You

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