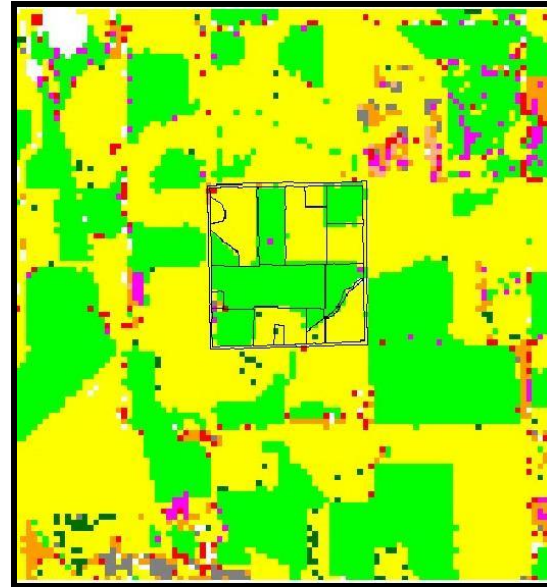
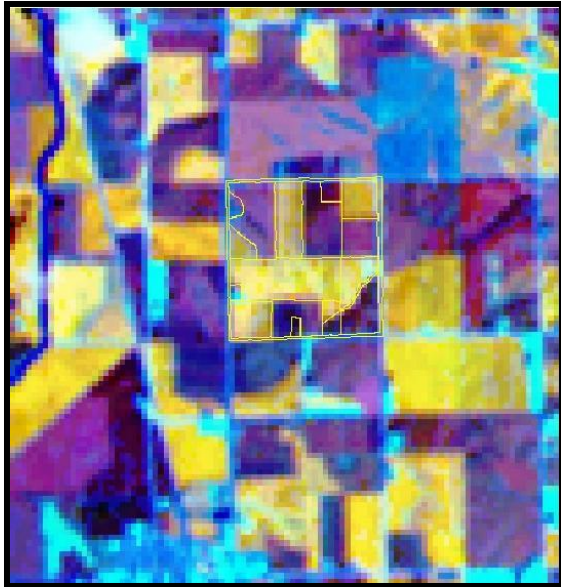


Multiresolution Landsat TM and AWiFS Sensor Assessment in Nebraska



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703-877-8000

claire_boryan@nass.usda.gov

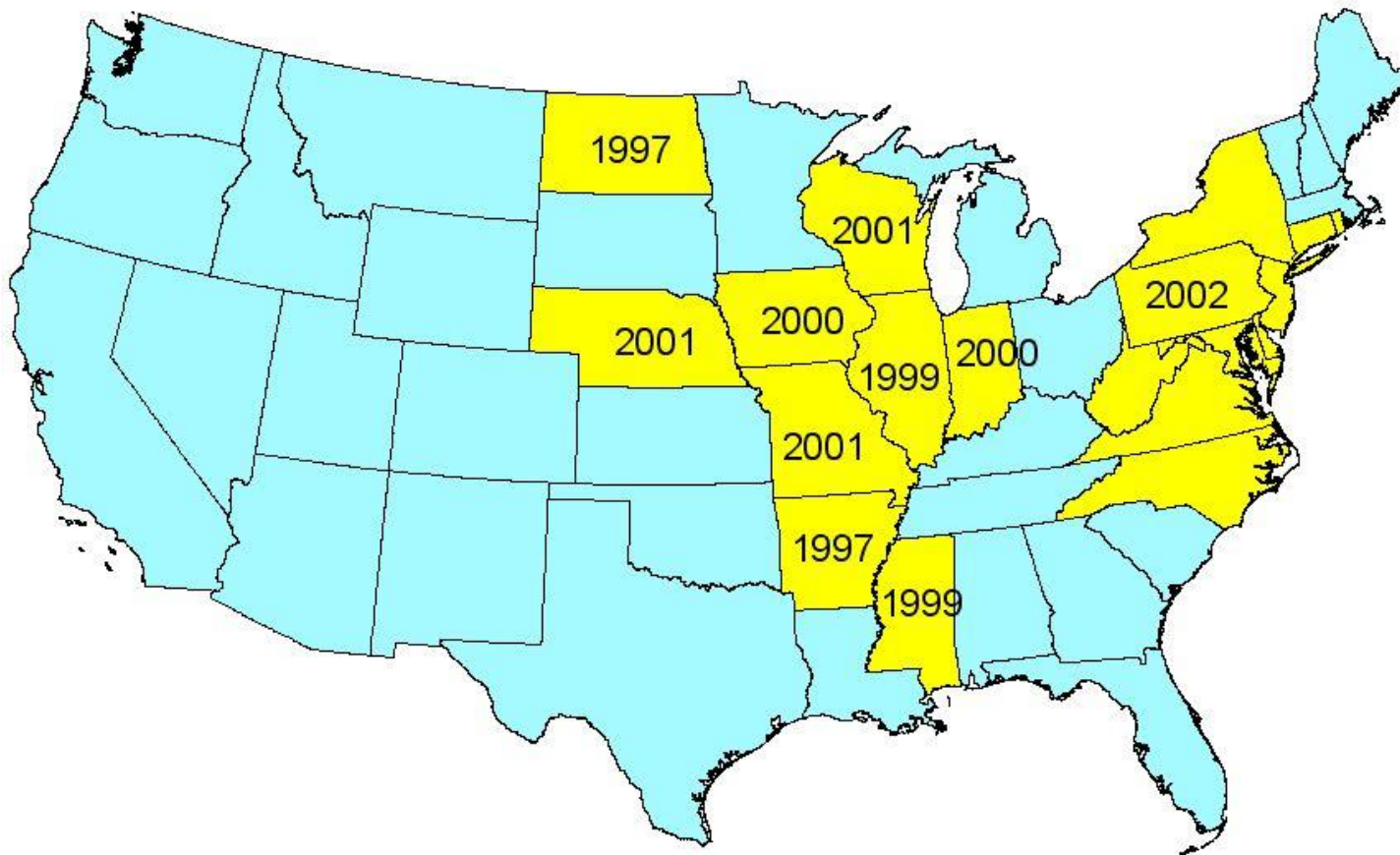




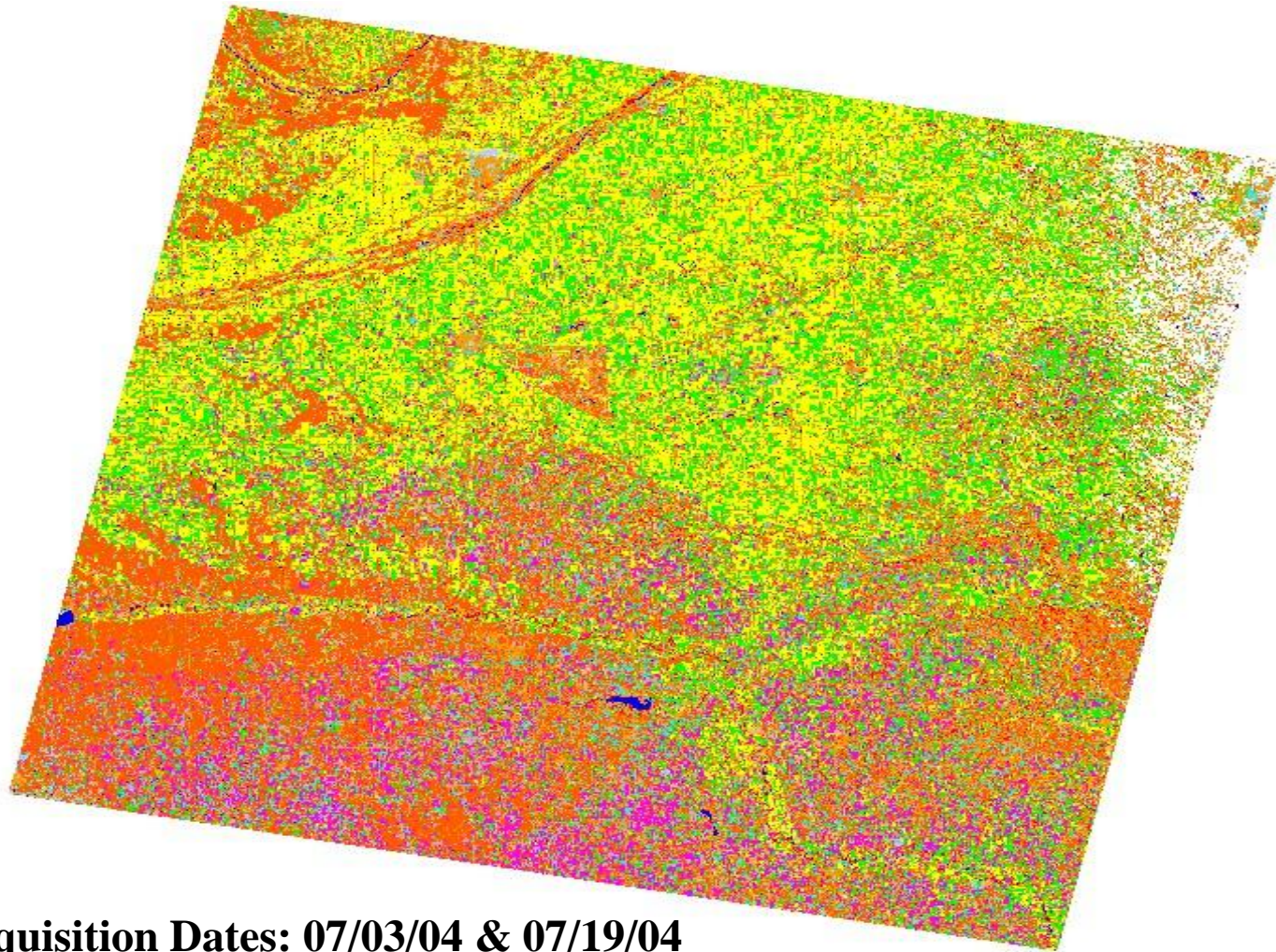
"Responsible for providing statistical data on US agriculture"

- **Produce acreage estimates with reduced error rates over the June Agricultural Survey.**
- **Create and distribute the Cropland Data Layer Product.**

19 Cropland Data Layer States



Multitemporal Landsat TM Scene Classification of Nebraska



Acquisition Dates: 07/03/04 & 07/19/04

Path/Row: 29/32

The Landsat Data Gap



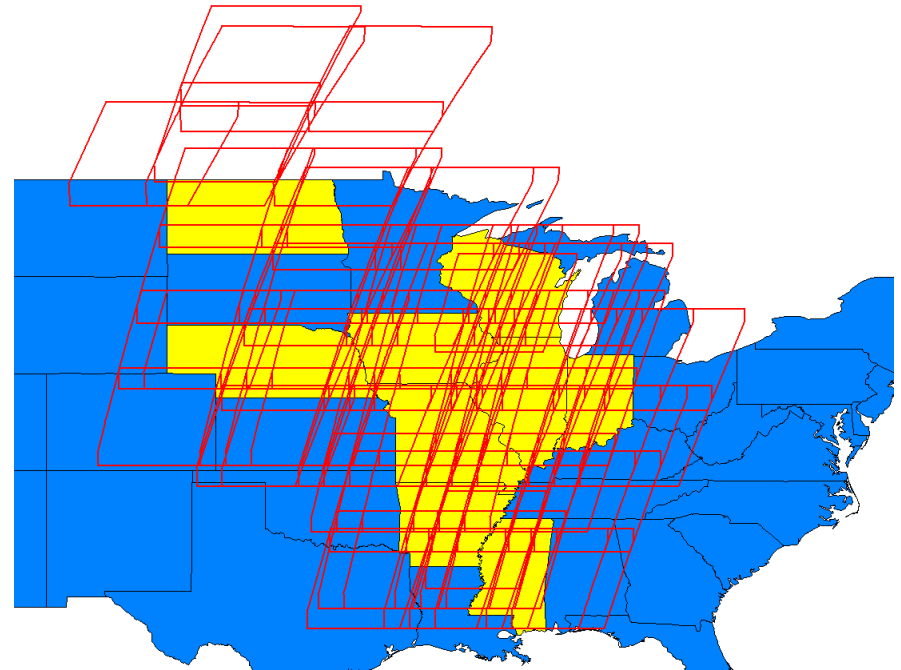
Source: USGS, Landsat Project:

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

Indian Remote Sensing Satellite: RESOURCESAT-1

Advanced Wide Field Sensor (AWiFS)

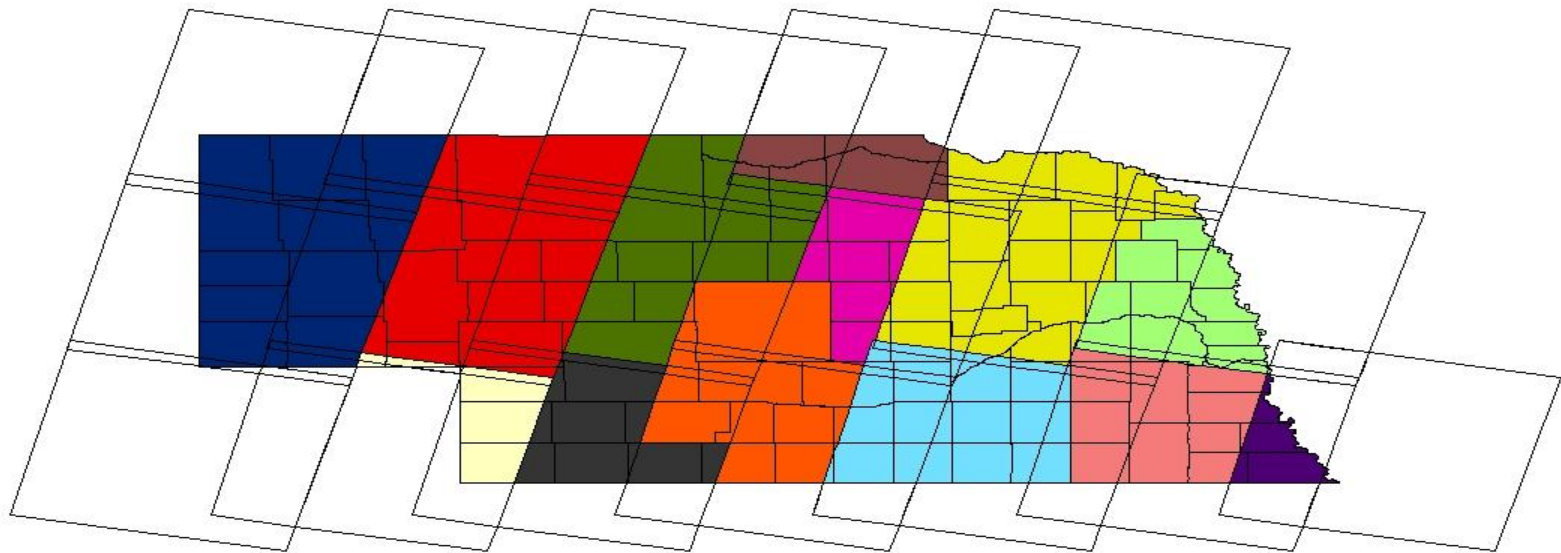
- **AWiFS:** Swath: 370 km each head, 740 km combined, 56 m resolution at nadir, 70 m resolution at field edges.
- **Spectral Bands**
- **B2: 0.52-0.59 (Visible Green)**
- **B3: 0.62-0.68 (Visible Red)**
- **B4: 0.77-0.86 (Near Infrared)**
- **B5: 1.55-1.70 (Middle infrared)**



***Imagery required extensive (30 –50 pt.) registration of scenes vs. 1 pt registration for Landsat TM data**

Multitemporal Analysis of Nebraska using Landsat TM data

Analysis District & Scene Observation Dates



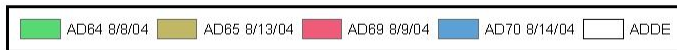
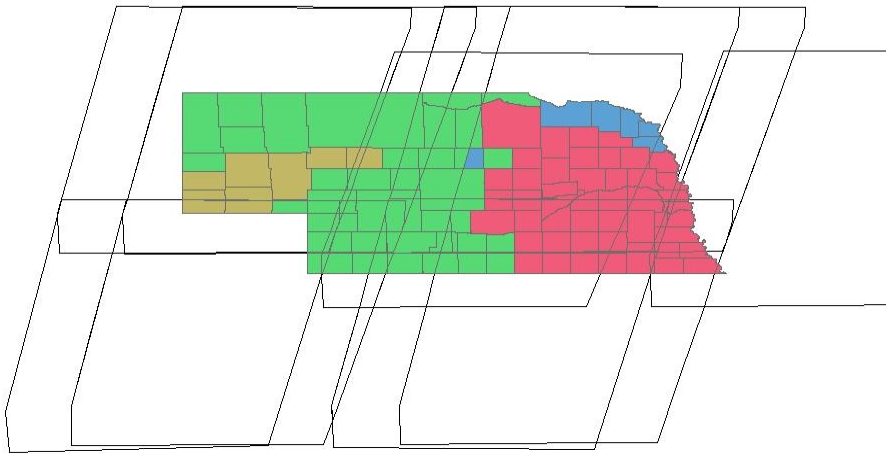
AD01 08/22/04 & 09/07/04	AD05 07/03/04 & 07/19/04	AD09 08/02/04 & 09/03/04	AD13 08/02/04 & 09/03/04
AD02 04/07/04 & 08/29/04	AD06 03/20/04 & 09/12/04	AD10 06/22/04 & 07/08/04	ADDE
AD03 07/12/04 & 08/29/04	AD07 05/07/04 & 09/12/04	AD11 07/08/04 & 08/25/04	
AD04 07/19/04 & 08/20/04	AD08 08/11/04 & 09/12/04	AD12 08/16/04 & 09/01/04	

Nebraska – 2004

Unitemporal Analysis

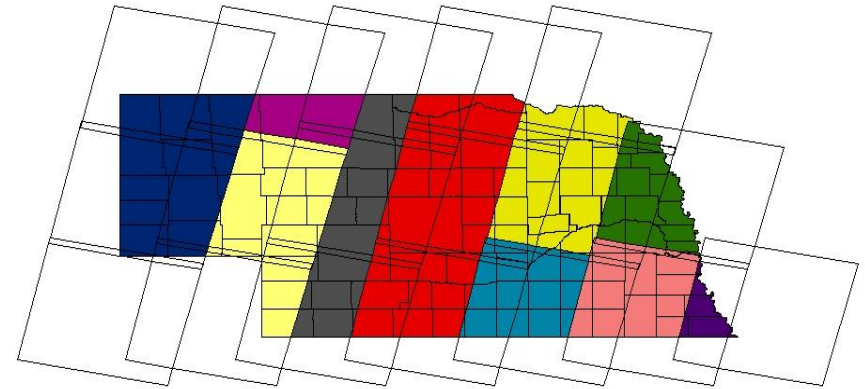
AWiFS

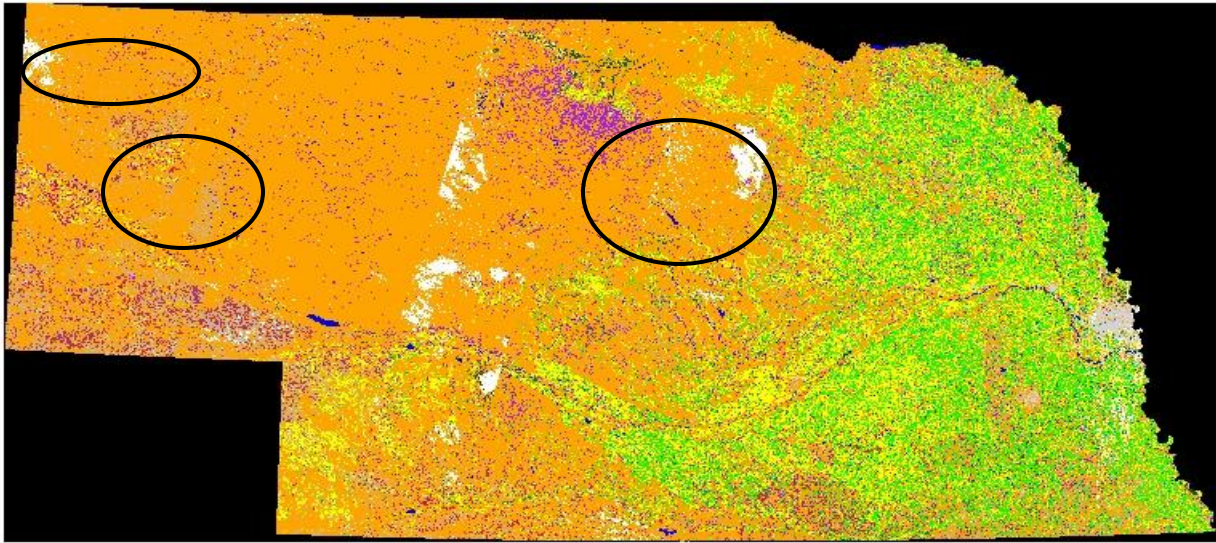
Analysis Districts (AD)
and Scene Observation Dates



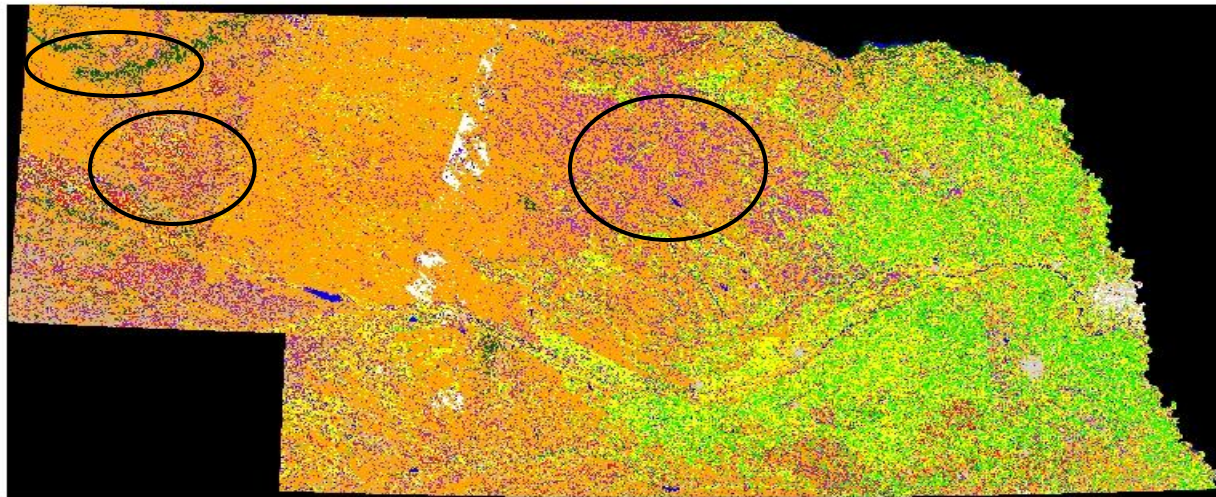
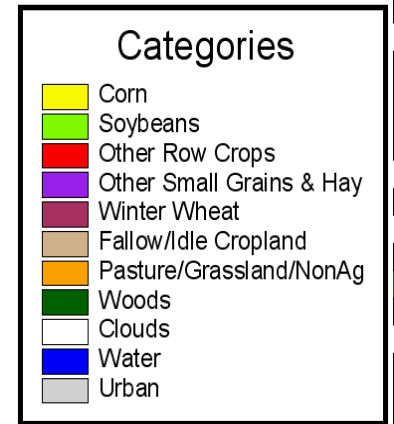
Landsat TM

Analysis Districts (AD)
and Scene Observation Dates

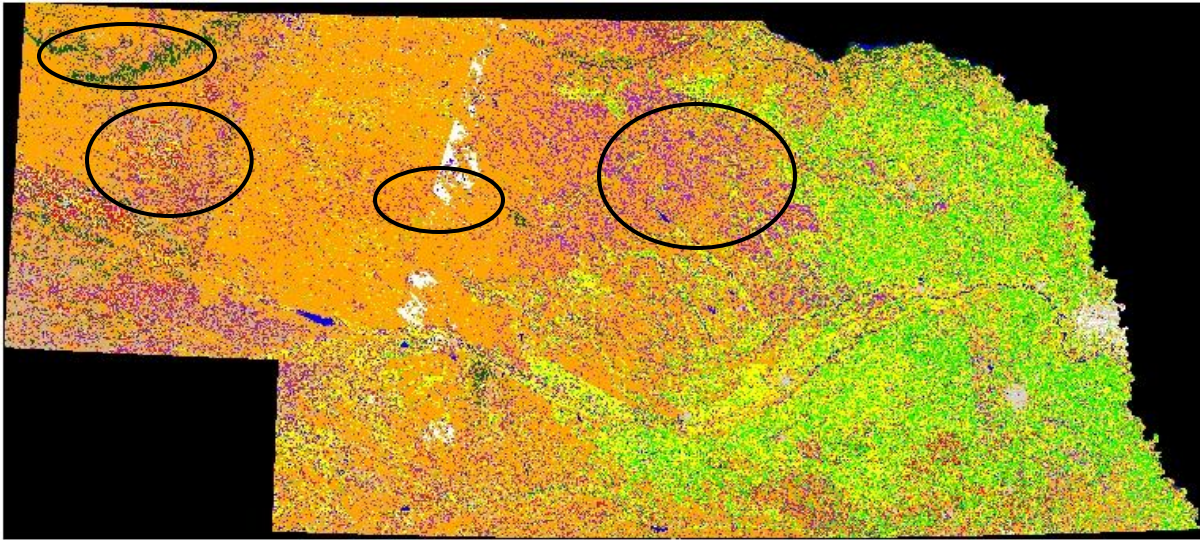




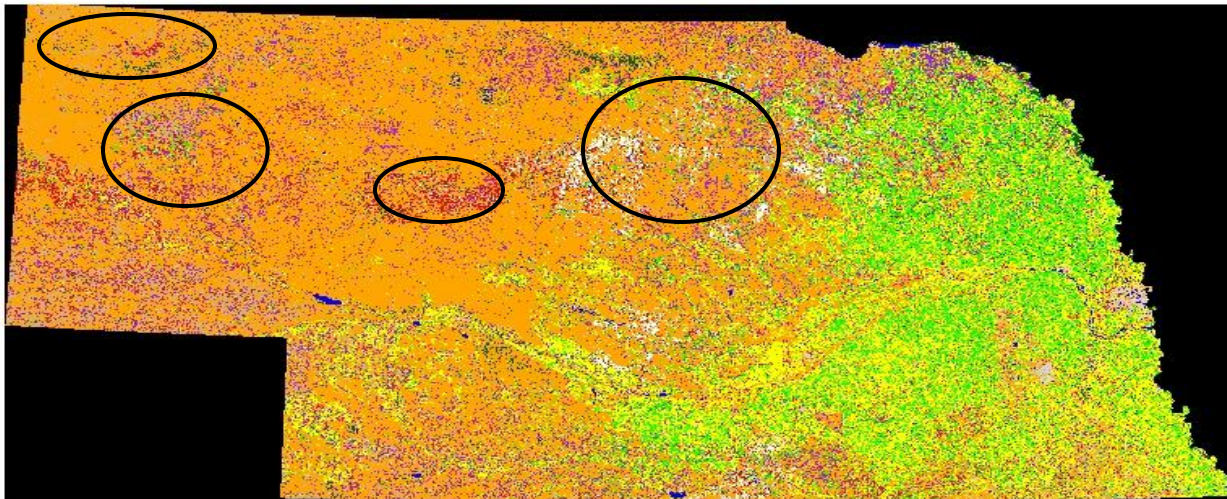
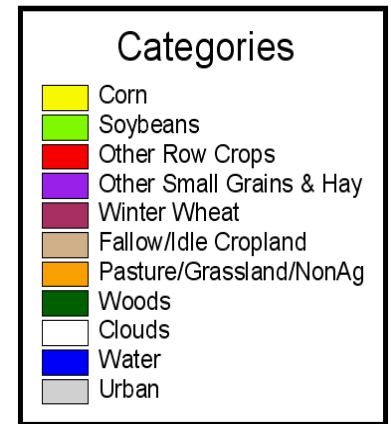
TM Multitemporal Classification



TM Unitemporal Classification



TM Unitemporal Classification

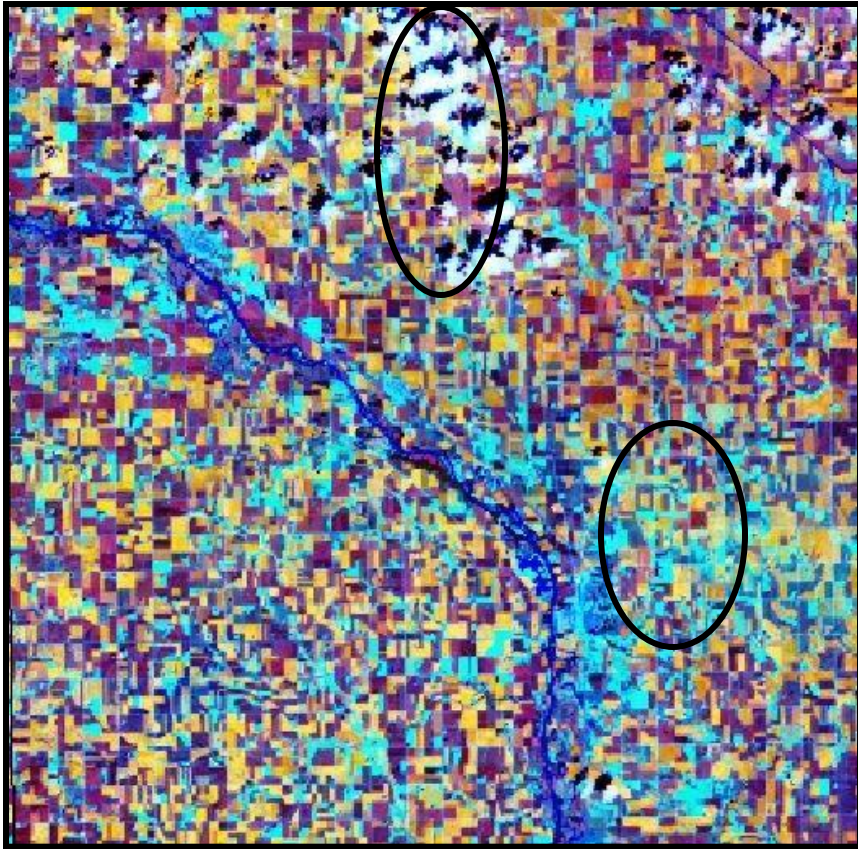


AWiFS Unitemporal Classification

Cuming County, Nebraska

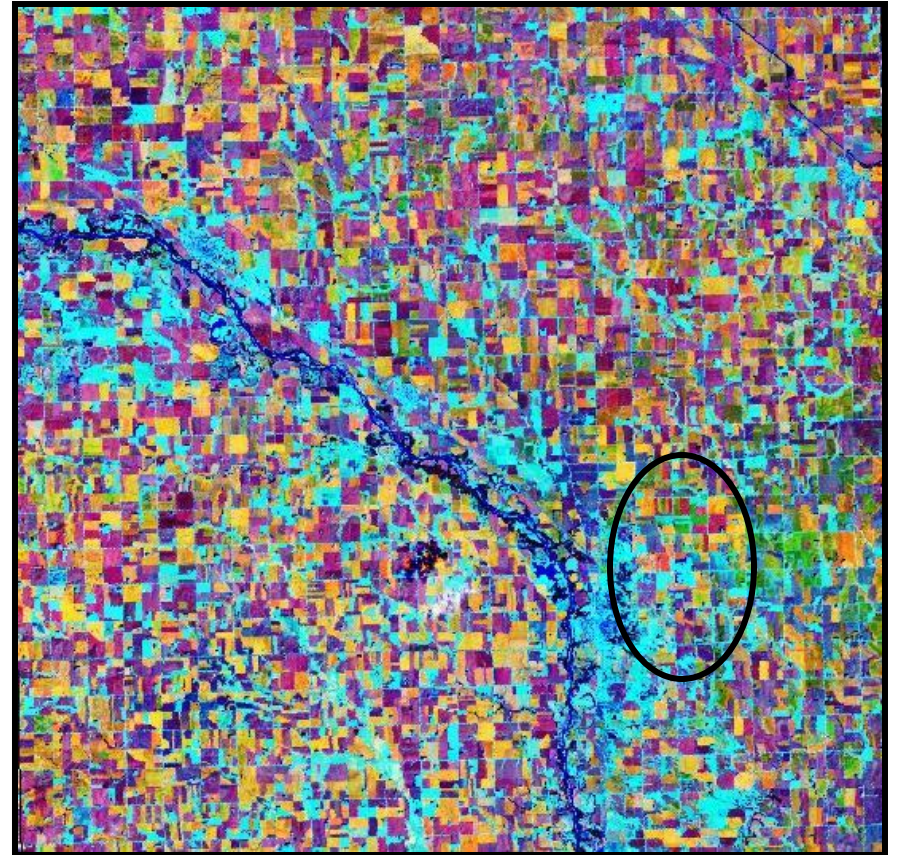
AWiFS: 08/09/2004

BANDS: 4, 5, 3 (RGB)














LANDSAT 5 TM: 08/29/2004

BANDS: 4, 5 3 (RGB)

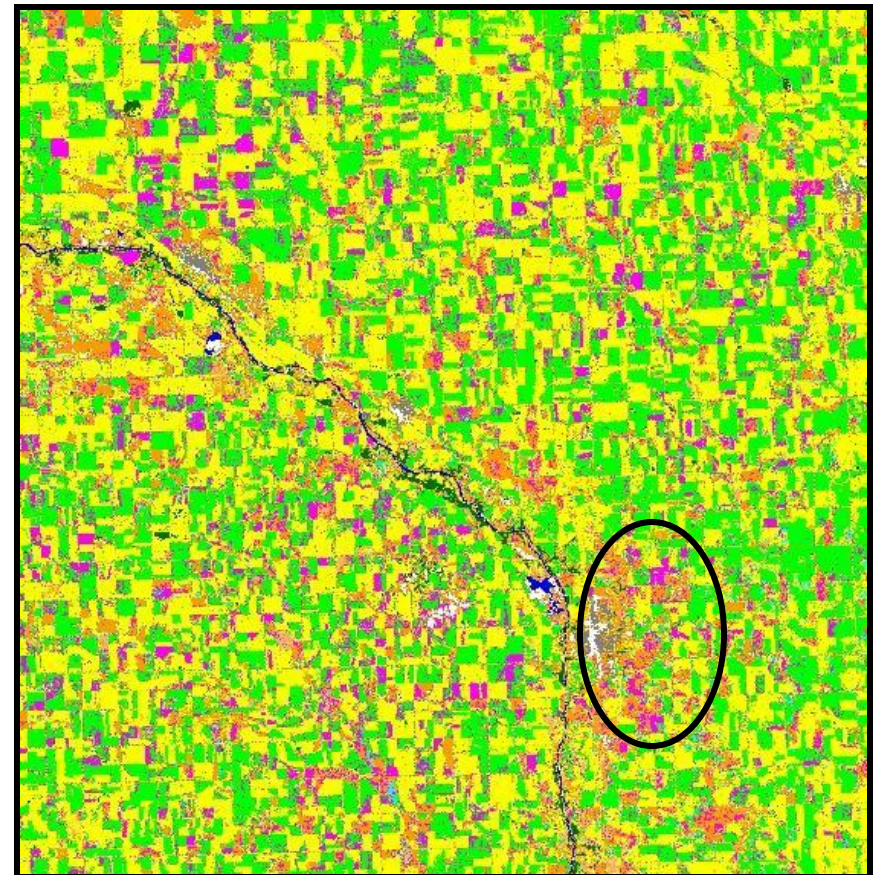
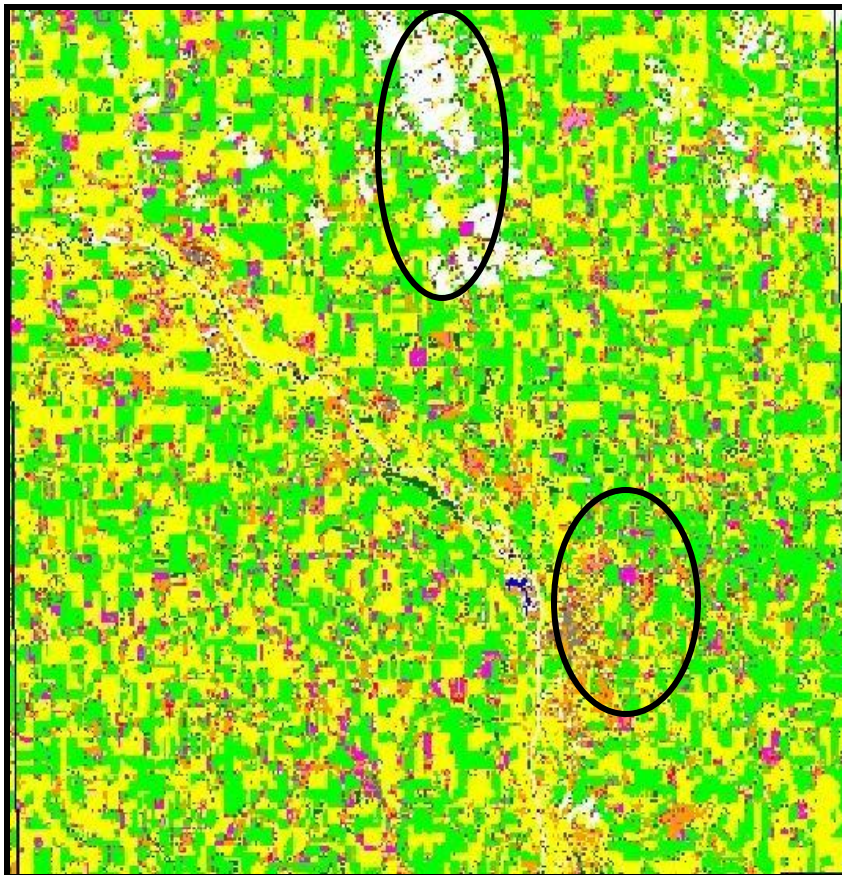


Classified Cuming County, Nebraska












Categories	
	Corn
	Soybeans
	Other Row Crops
	Other Small Grains & Hay
	Winter Wheat
	Fallow/Idle Cropland
	Pasture/Grassland/NonAg
	Woods
	Clouds
	Water
	Urban

AWiFS Unitemporal: 08/09/2004

TM Unitemporal: 08/29/2004



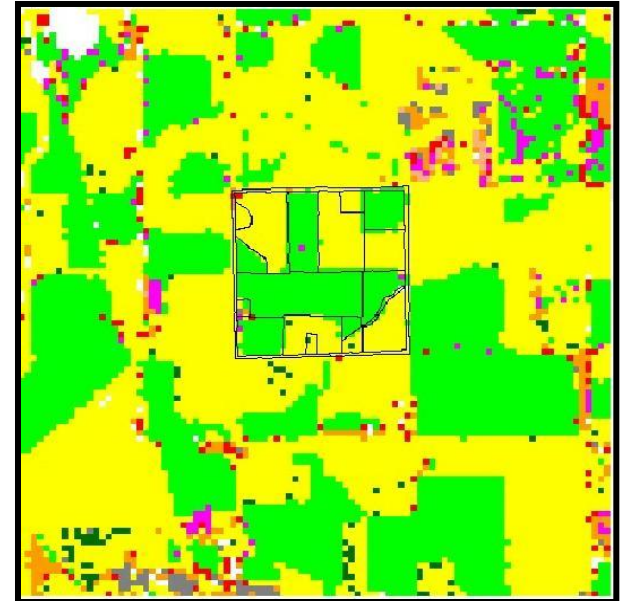
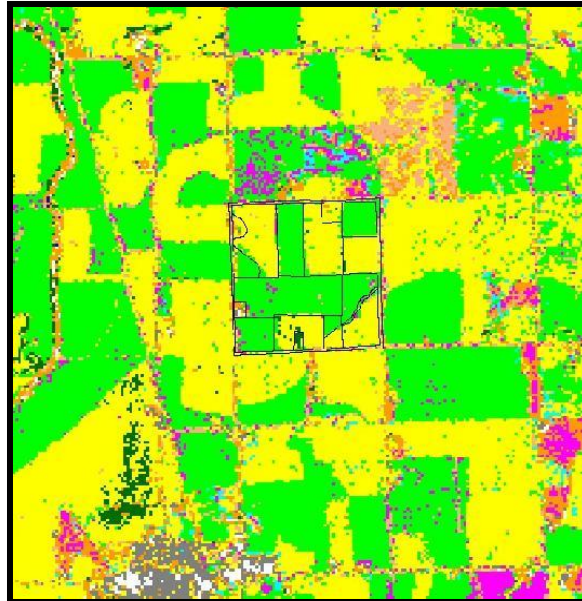
Segment Area Classifications

Categories	
	Corn
	Soybeans
	Other Row Crops
	Other Small Grains & Hay
	Winter Wheat
	Fallow/Idle Cropland
	Pasture/Grassland/NonAg
	Woods
	Clouds
	Water
	Urban

Multitemporal TM
4/07/04 & 08/19/04

Unitemporal LandsatTM
08/29/2004

AWiFS
08/09/2004



Kappa Statistics for Classifier Accuracy

Eastern Nebraska

Corn ----- TM -----

Area	Multi	Uni
AD01	93.89%	73.42%
AD02	96.18%	93.54%
AD03	93.91%	92.67%
AD04	92.85%	89.90%
AD05	96.85%	93.22%

AWIFS

Uni

86.47%

Analysis Districts & Scene Observation Dates

Soybean ----- TM -----

Area	Multi	Uni
AD01	99.12%	93.39%
AD02	96.81%	89.93%
AD03	98.72%	93.40%
AD04	95.41%	88.37%
AD05	96.67%	85.69%

AWIFS

Uni

77.41%

Overall ----- TM -----

Area	Multi	Uni
AD01	96.01%	80.02%
AD02	96.19%	86.57%
AD03	95.60%	85.37%
AD04	93.50%	81.79%
AD05	92.88%	85.91%

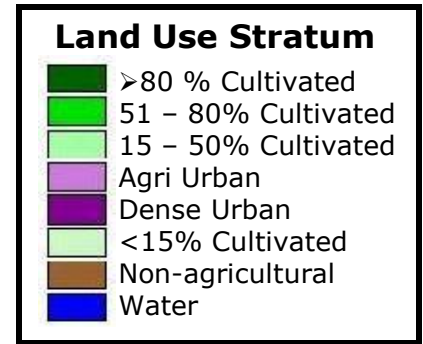
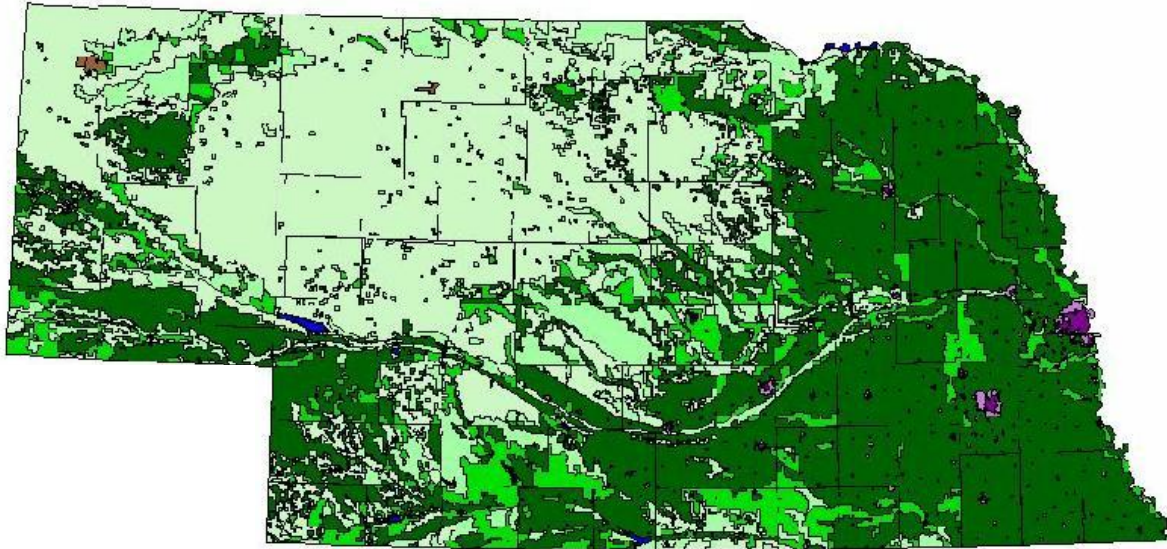
AWIFS

Uni

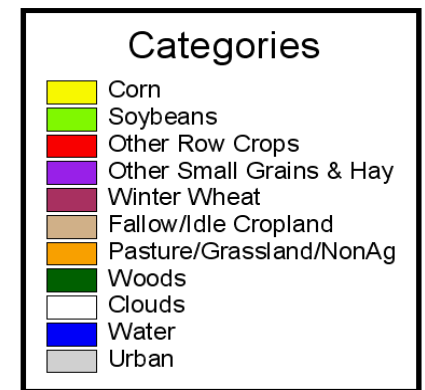
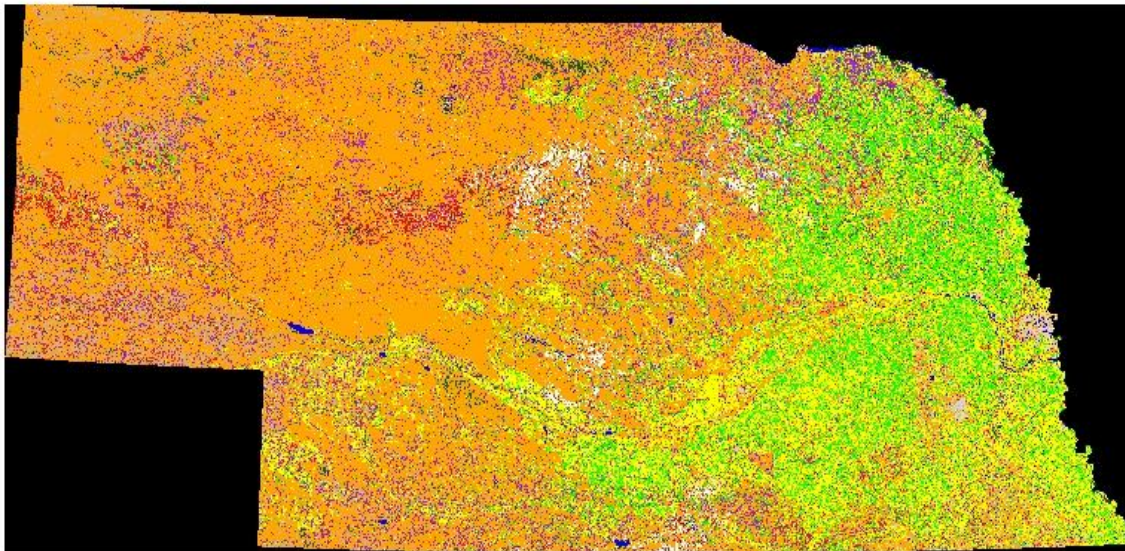
75.18%



Nebraska Land Use Stratification - 2004

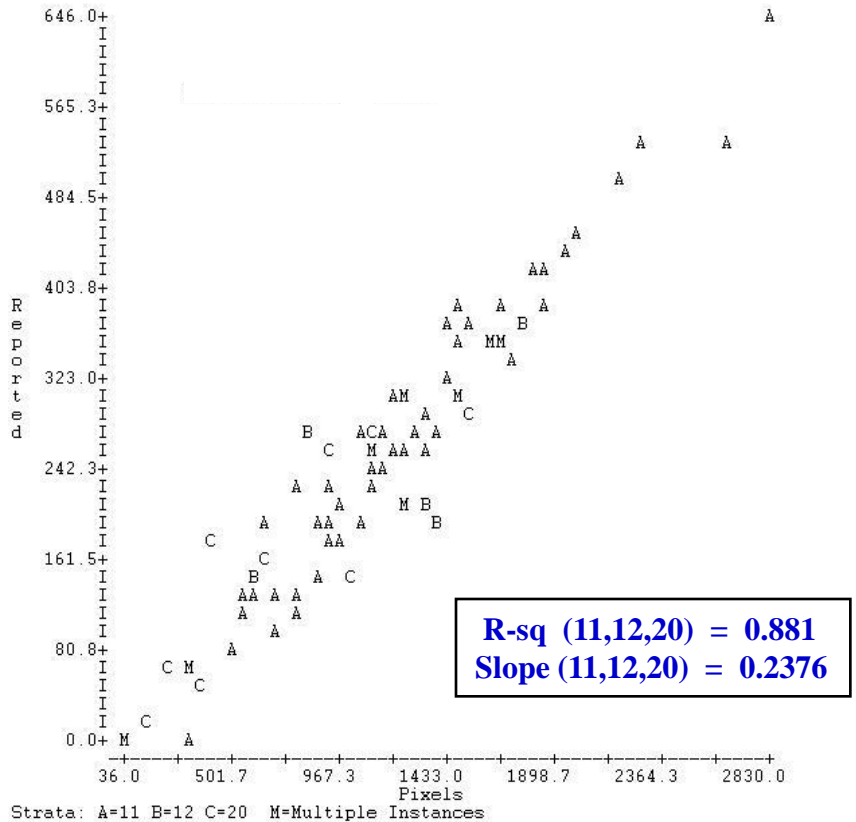


Nebraska Unitemporal AWiFS Classification - 2004

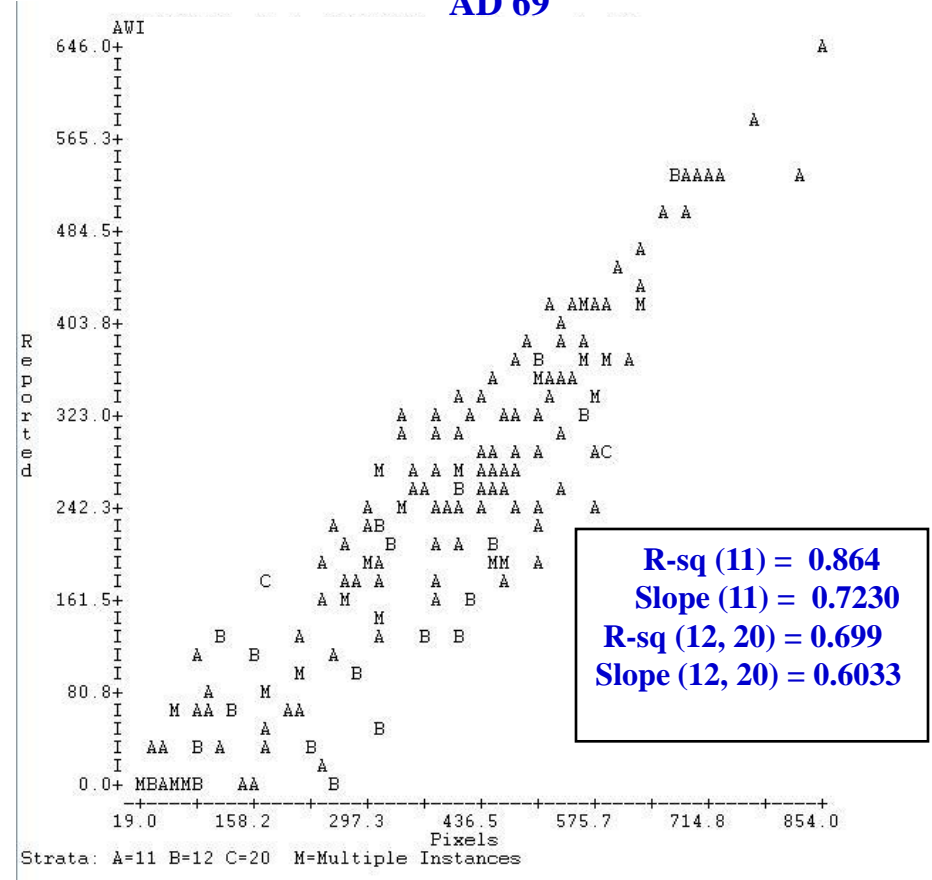


Regression Analysis from Unitemporal Sample Estimation

**Landsat TM Corn
AD 24**



**AWiFS Corn
AD 69**



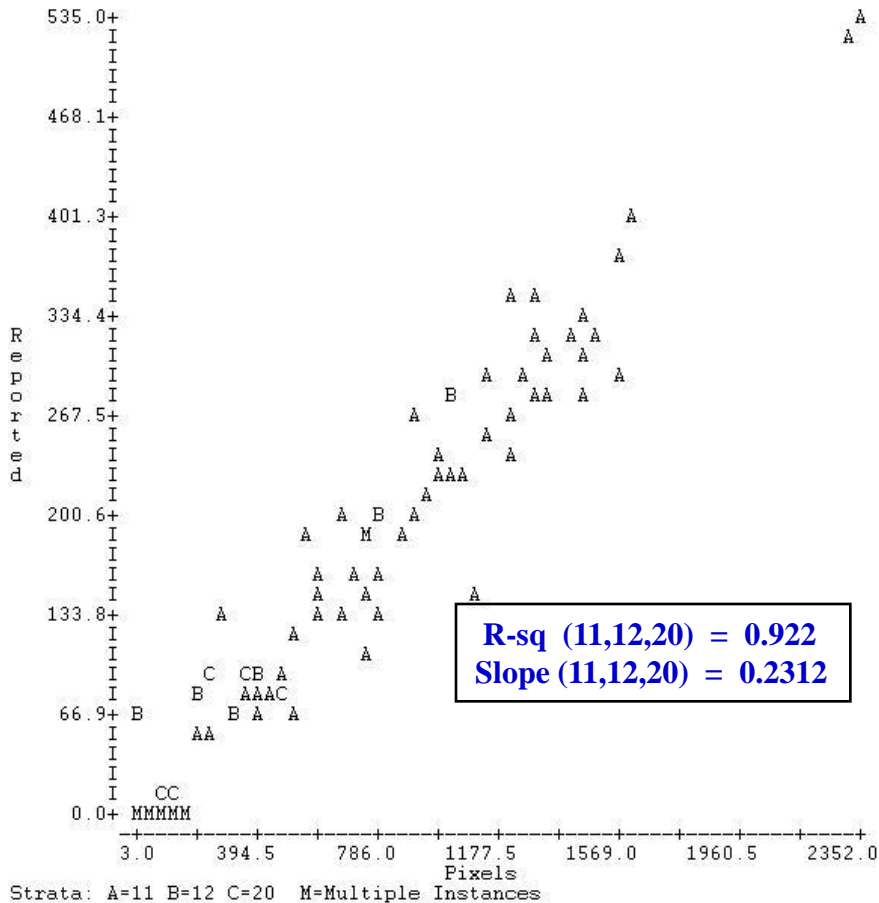
Pixel Sq meter/acres- .2224

Outliers Removed

Pixel Sq meters/acres - .7747

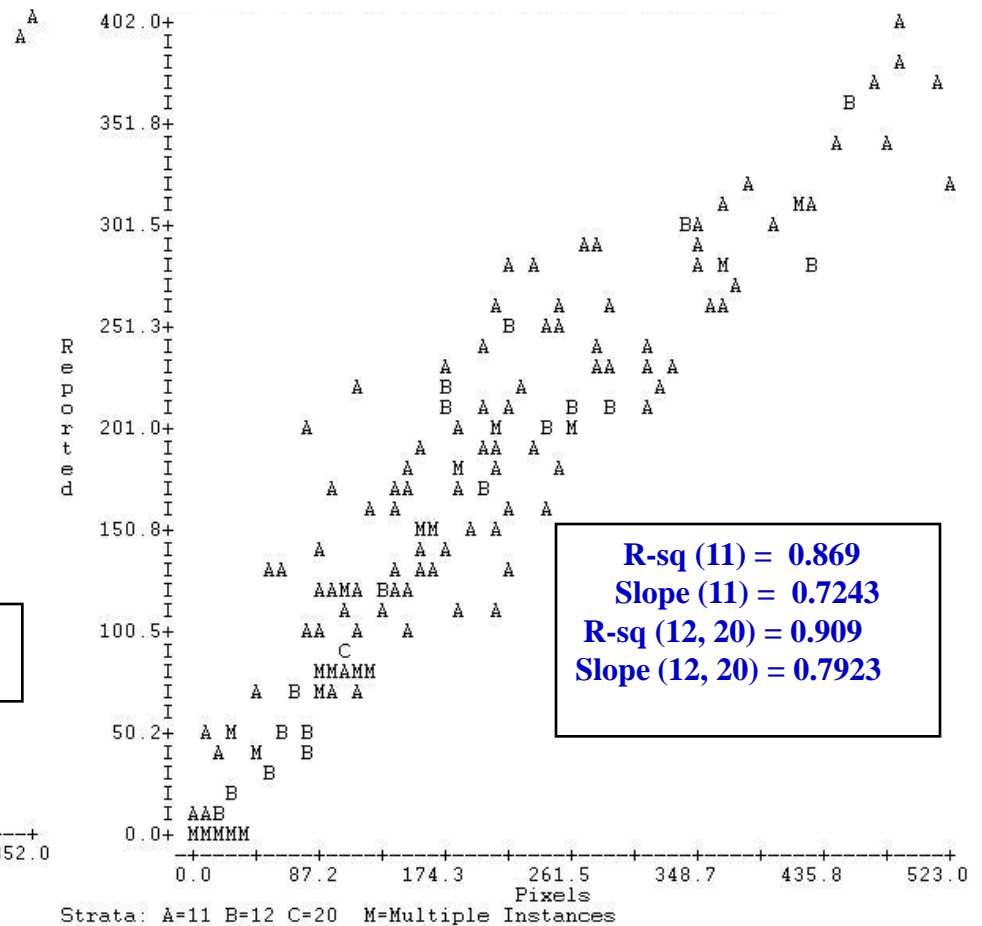
Regression Analysis from Unitemporal Sample Estimation

**Landsat TM Soybeans
AD 24**



Pixel Sq meter/acres- .2224

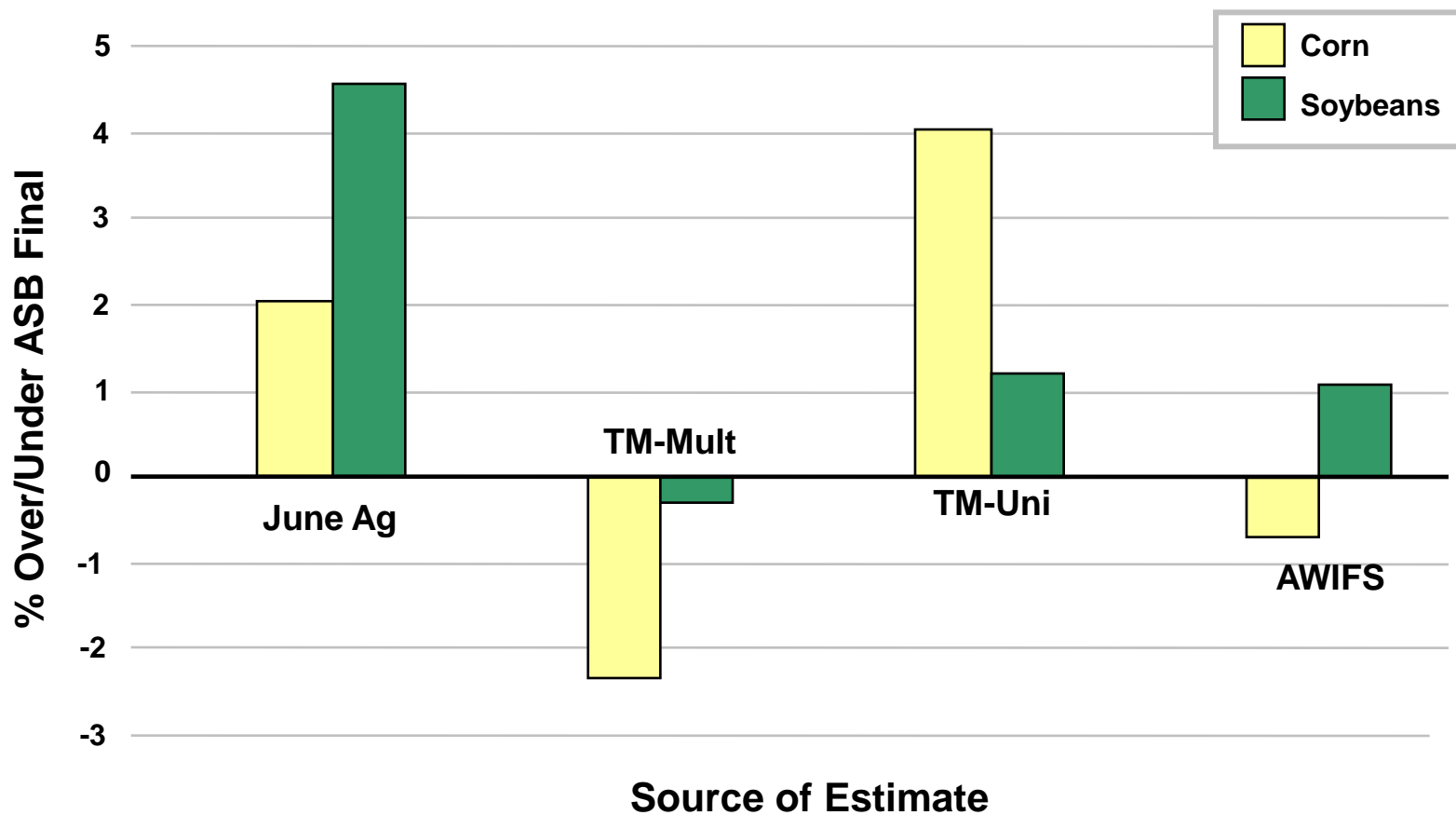
**AWiFS Soybeans
AD 69**



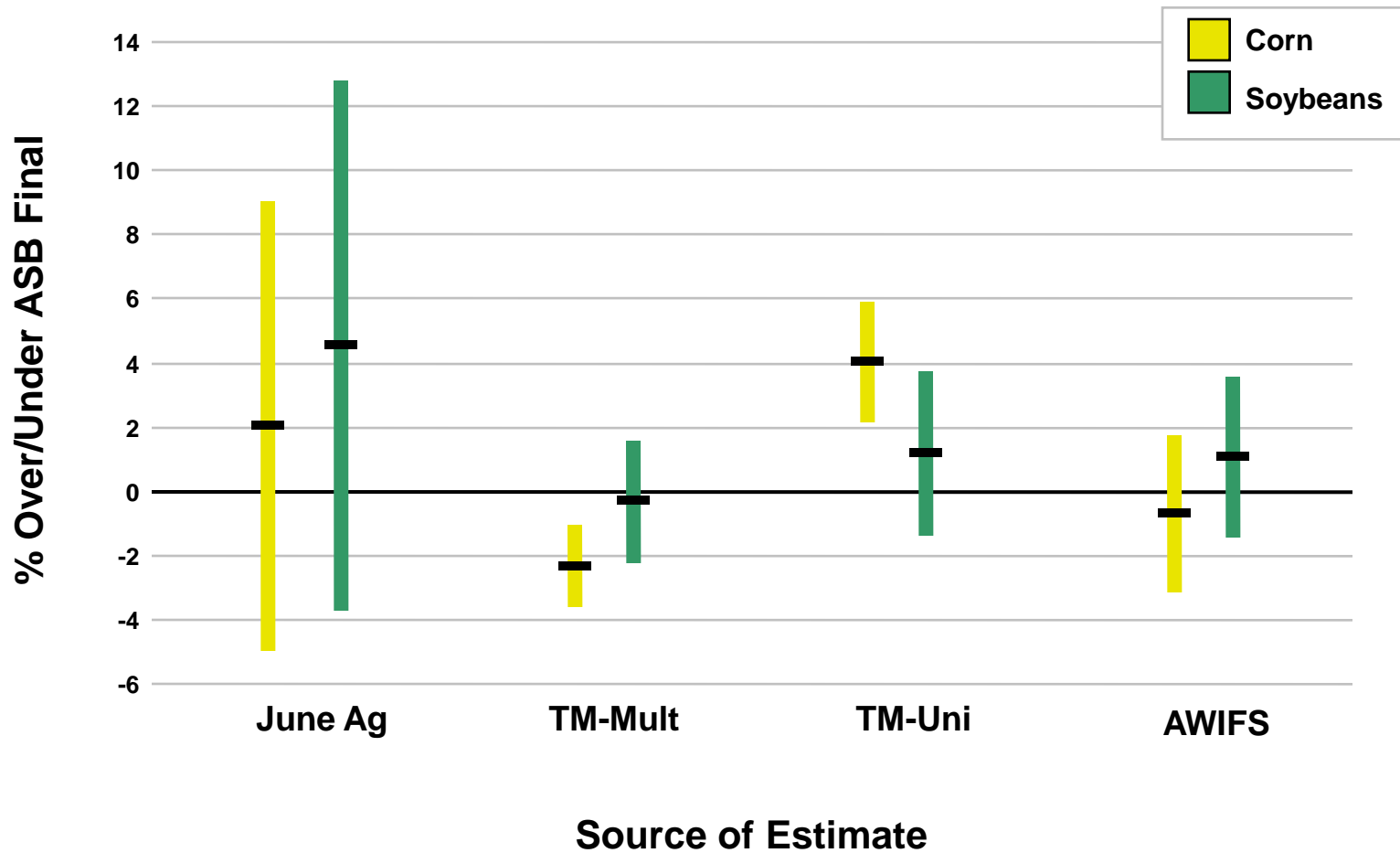
Outliers Removed

Pixel Sq meters/acres - .7747

State Level Estimates as % Over/Under Agricultural Statistics Board (Final)



State Level Estimates +/- 2 CVs (Coefficient of Variation)



Conclusions

- **Classification results derived using the AWiFS data are not as accurate as those derived using either multitemporal or unitemporal Landsat data.**
- **Reductions in classification accuracy can be attributed to:
Spatial resolution - AWiFS (56m) vs. TM (30m)
Spectral Resolution- AWiFS (4 bands) vs. TM (7 bands)**
- **In the future, improvements in classification accuracy are likely to be achieved due to increased temporal frequency of the AWiFS sensor (5 day) vs. the TM sensor (16 day) repeat cycle.**
- **This should significantly increase the availability of cloud free imagery.**

Conclusions

- **AWiFS data appears acceptable for crop acreage estimation over large crop areas such as the Mid-West, the Delta and the Northern Great Plains.**
- **Furthermore, unitemporal AWiFS provided reasonable and consistent estimates for production of the Crop Land Data Layer product.**
- **We anticipate that use of multitemporal AWiFS data would improve the results to a level that is acceptable for NASS.**

