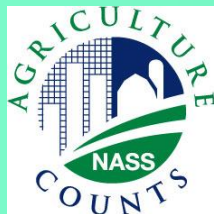


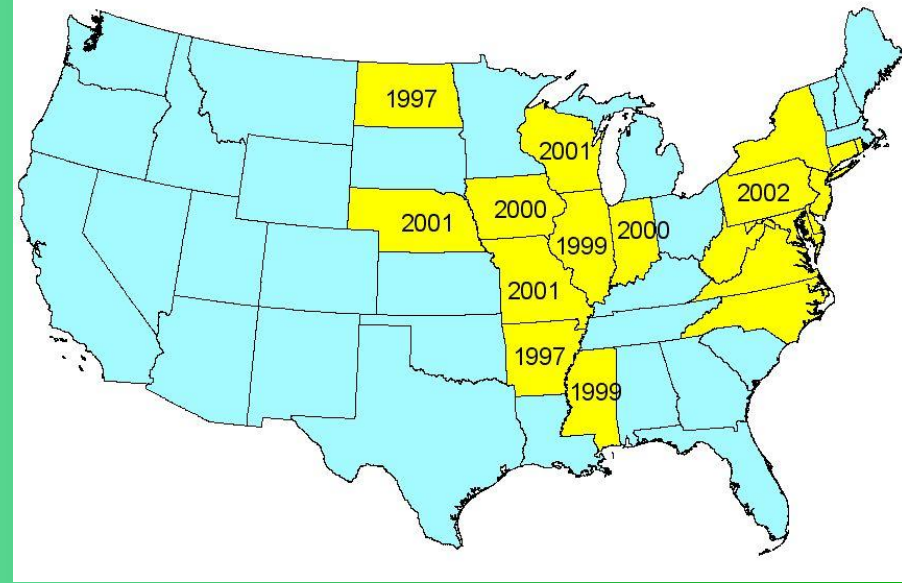
# Ten State Mid-Atlantic Cropland Data Layer Project

Remote Sensing Across the Great Lakes  
Rochester, NY  
4/6/2006



Rick Mueller  
Program Manager  
USDA/National Agricultural Statistics Service

# Cropland Data Layer Purpose



- Combine remote sensing imagery and NASS survey data to produce supplemental acreage estimates for the state's major commodities
- Production of a crop-specific land cover data layer for distribution in industry standard "GIS" format

# 10 State - Chesapeake Bay Watershed

- Towson University (CGIS)– project sponsor
- Based on crop year 2002
  - Agricultural Census: Agricultural Coverage Evaluation Survey (ACES)
  - June Agricultural Survey (JAS)
- Utilized both Landsat TM & ETM
- Map the agricultural extent and variety

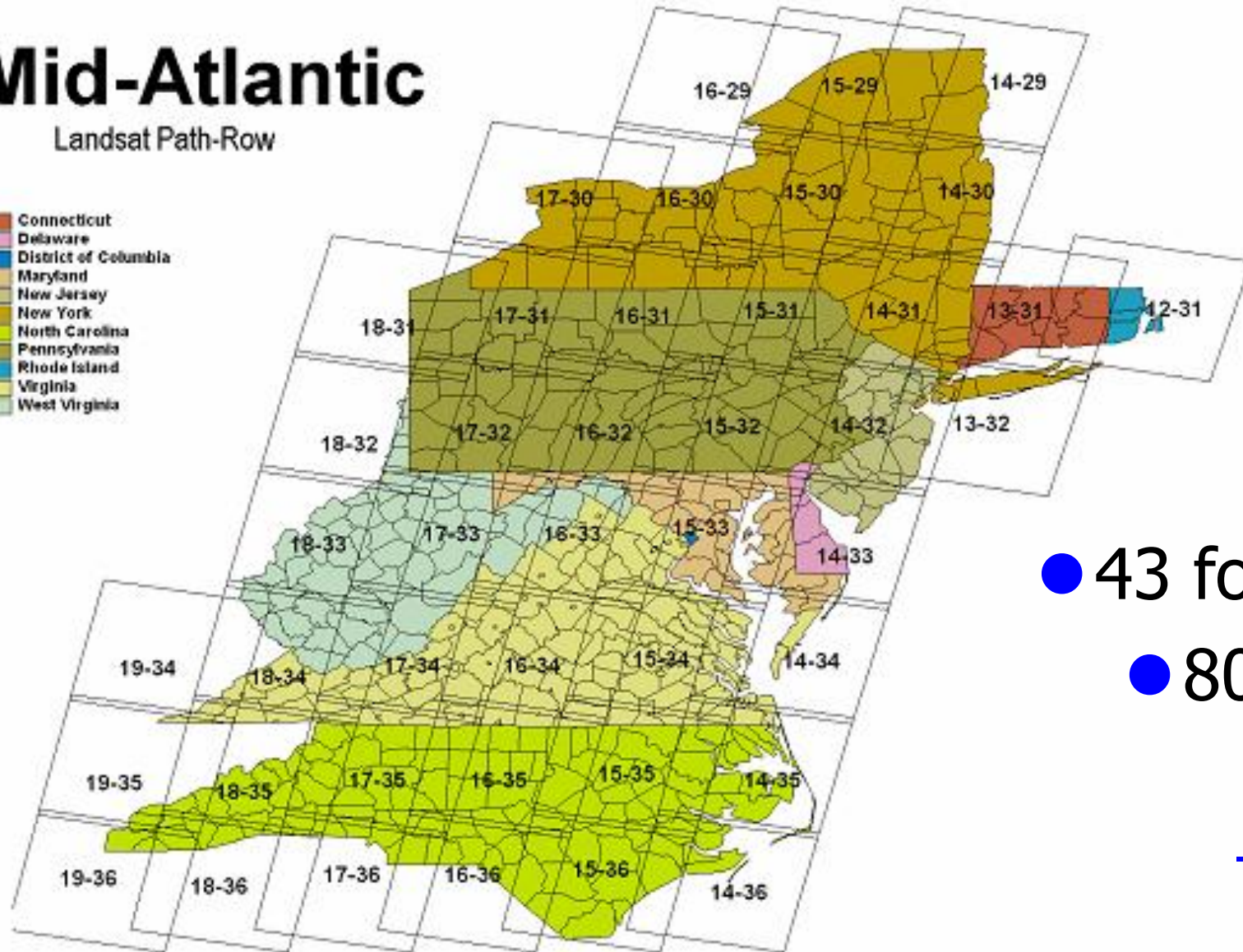
# Cropland Data Layer Background

- June Agricultural Survey (JAS) – National in Scope
  - 41,000 farms visited
  - 11,000 one-square mile sample area segments visited
  - Most states contain between 150 – 400 segments
  - Planted acreage estimate
- Dependant upon the ground survey data
  - Unbiased statistical estimator of crop area
    - State and county level estimates

# Project Scope

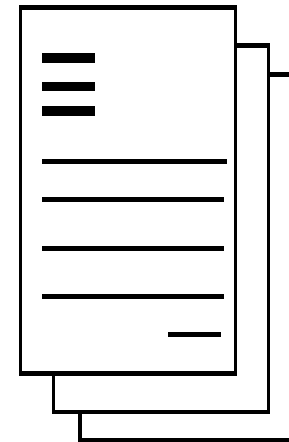
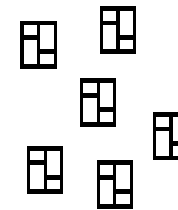
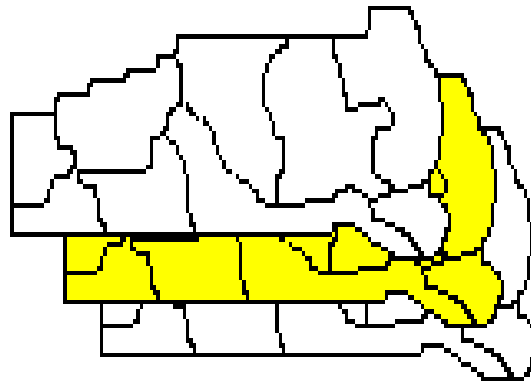
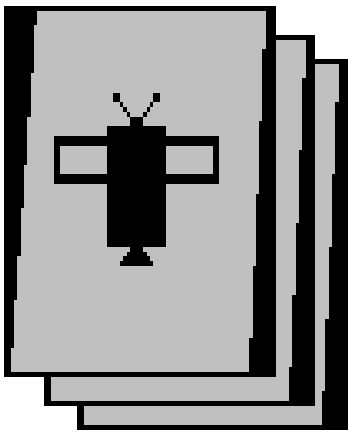
## Mid-Atlantic

Landsat Path-Row



- 43 footprints
- 80 scenes
  - 36 TM
  - 44 ETM

# Cropland Data Layer Inputs



Satellite  
Images

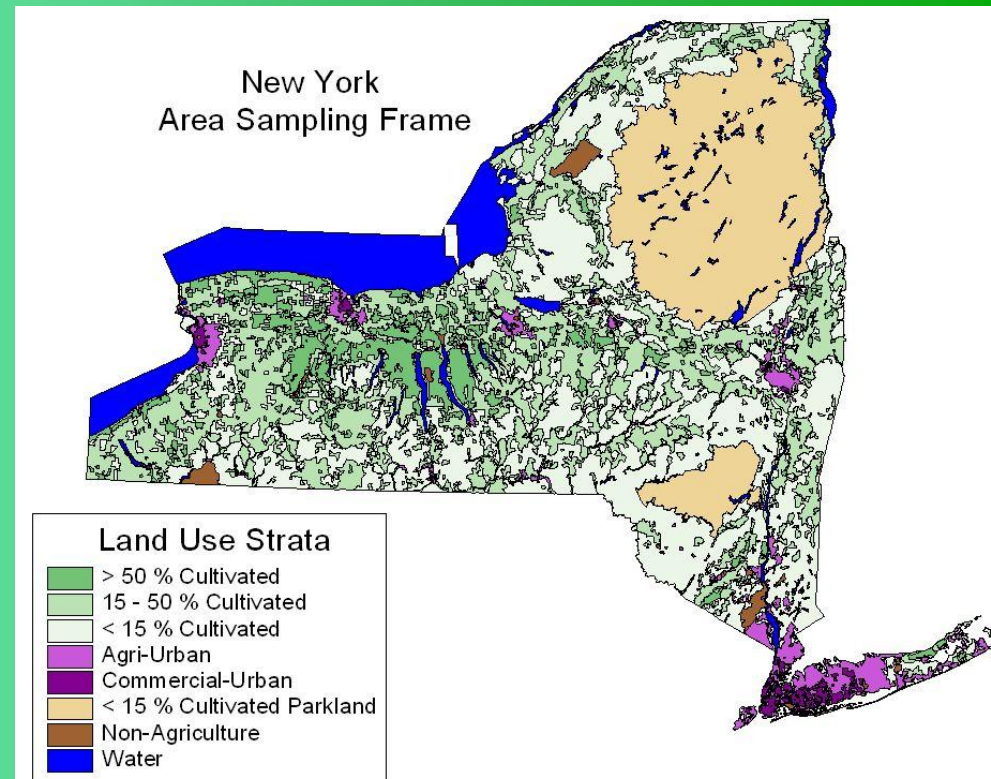
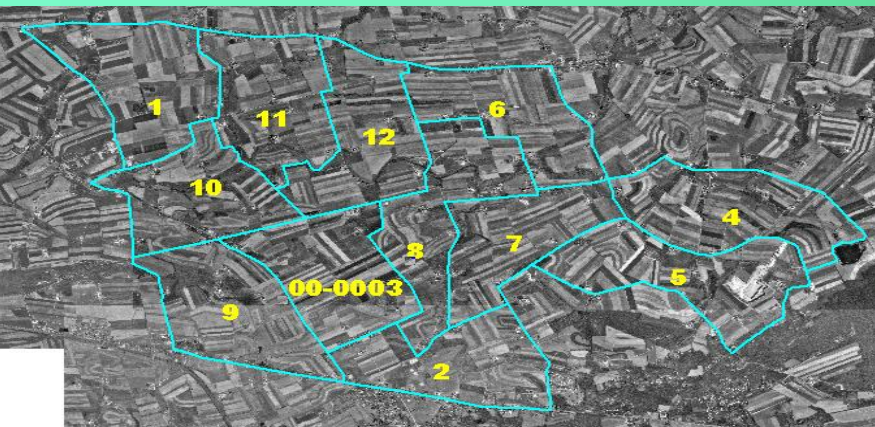
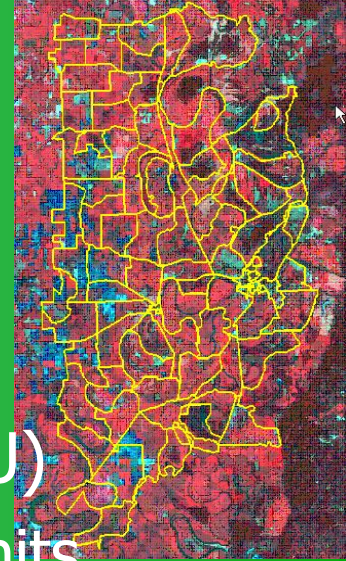
Area Frame  
Strata Boundaries

Segment  
Boundaries

Section D  
from Area  
Questionnaire

# Area Sampling Frame

- Stratify based on percent cultivated land
- Subdivide strata into primary sampling units (PSU)
  - Selected PSU's divided into secondary sampling units or segments



# 2002 Segment Sample Size

State	JAS	ACES	Total
CT	8	14	22
DE	23	1	24
MD	61	9	70
NC	319	29	348
NJ	48	16	64
NY	96	87	183
PA	179	101	280
RI	8	1	9
VA	146	132	278
WV	66	17	83
<b>Total</b>	<b>954</b>	<b>407</b>	<b>1361</b>

June Agricultural  
Survey

Agricultural Coverage  
Evaluation Survey



Enumerator records field extents, cover types and acreage



1 sq. mi. JAS segment annotated by enumerator on a 1:8,000-scale NAPP photo

# 2002 JAS Questionnaire

- Enumerators account for all land usage in segment
  - Draw off field location by direct observation
  - Directly link questionnaire to segment photo

## SECTION D - CROPS AND LAND USE ON TRACT

51

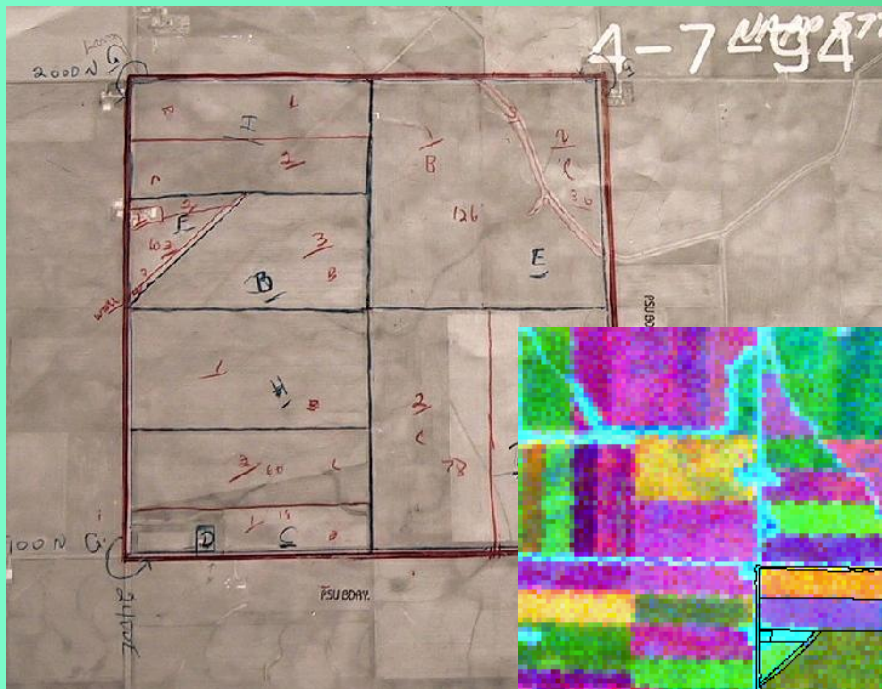
How many acres are inside this blue tract boundary drawn on the photo (map)? . . . . .

Now I would like to ask about each field inside this blue tract boundary and its use during 2002.

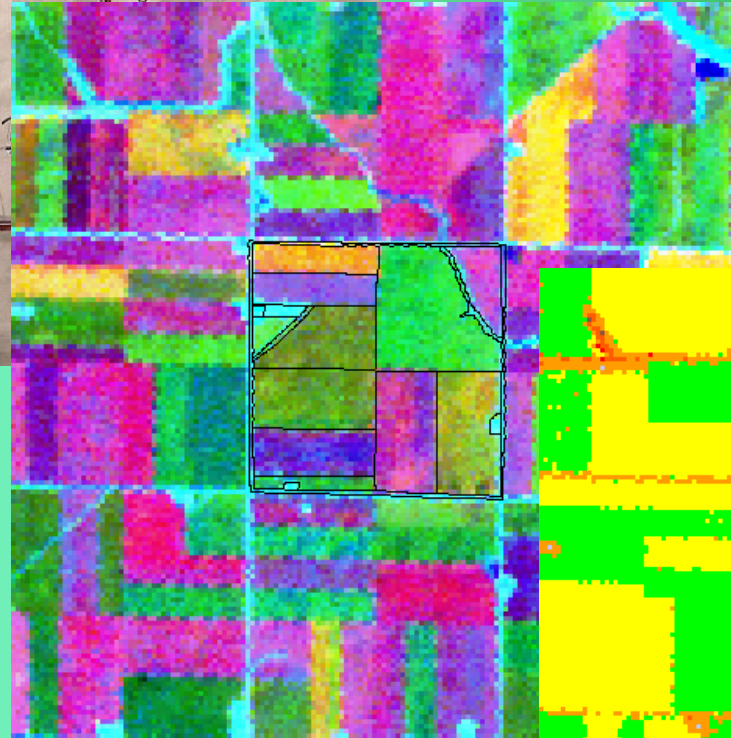
FIELD NUMBER	01	02	03	04	05
1. Total acres in field	828	828	828	828	828
2. Crop or land use. [Specify]					
3. Occupied farmstead or dwelling	843				
4. Waste, unoccupied dwellings, buildings and structures, roads, ditches, etc.	841	841	841	841	841
NP = Not Pastured	83_	83_	83_	83_	83_

16.	<b>Winter Wheat</b> (include cover crop)	Planted	540	540	540	540	540
17.		For grain or seed	541	541	541	541	541
22.	<b>Barley</b> (include cover crop)	Planted	535	535	535	535	535
23.		For grain or seed	536	536	536	536	536
24.	<b>Com</b> [Exclude pop com and sweet com]	Planted and to be planted	530	530	530	530	530
25.		For grain or seed	531	531	531	531	531
27.	<b>Sorghum</b> [Exclude crosses with Sudan]	Planted and to be planted	570	570	570	570	570
28.		For grain or seed	571	571	571	571	571

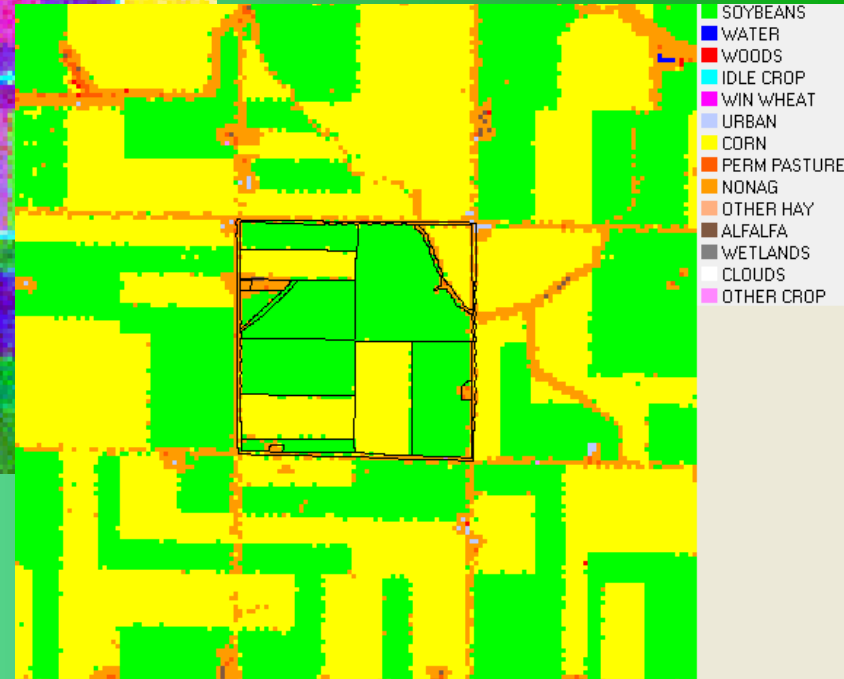
# Segment Processing



Field Enumeration



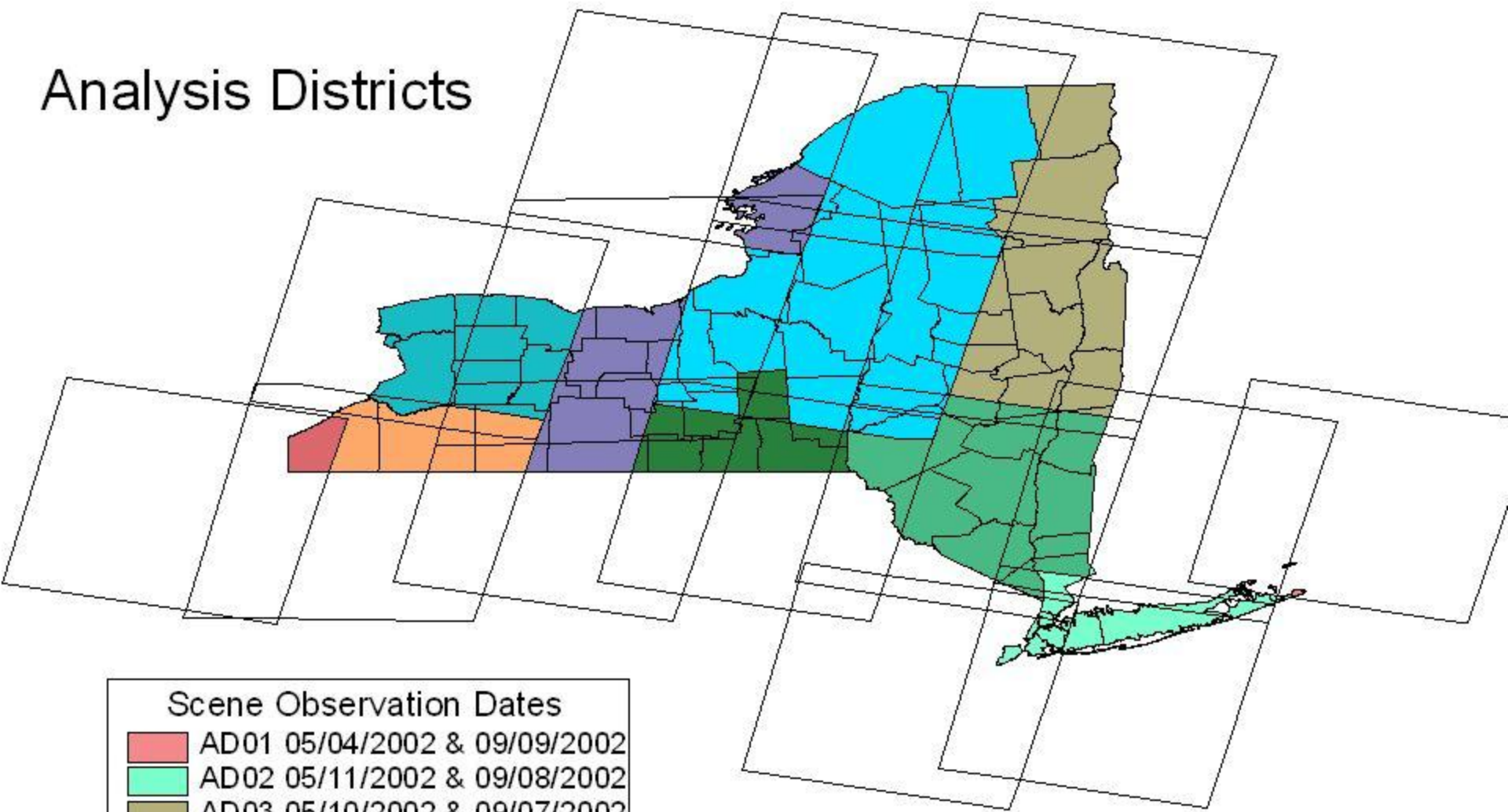
Digitizing & Labeling



Classification

- SOYBEANS
- WATER
- WOODS
- IDLE CROP
- WIN WHEAT
- URBAN
- CORN
- PERM PASTURE
- NONAG
- OTHER HAY
- ALFALFA
- WETLANDS
- CLOUDS
- OTHER CROP

# Analysis Districts



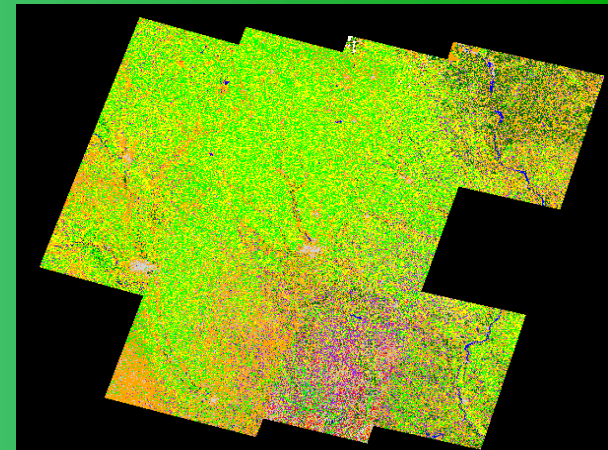
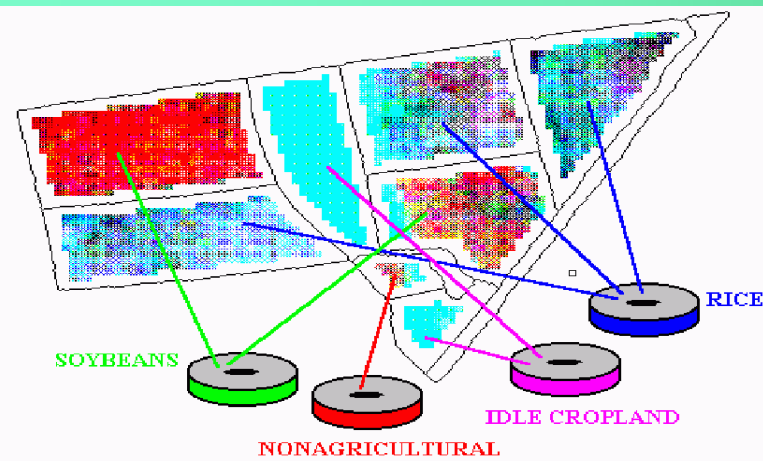
## Scene Observation Dates

AD01	05/04/2002 & 09/09/2002
AD02	05/11/2002 & 09/08/2002
AD03	05/10/2002 & 09/07/2002
AD04	05/10/2002 & 09/07/2002
AD07	05/25/2002 & 09/06/2002
AD11	08/04/2002
AD14	05/23/2002 & 07/10/2002
AD15	05/23/2002 & 09/12/2002
AD18	05/22/2002 & 08/10/2002
AD24	05/25/2002 & 09/06/2002

**NY 2002**  
**Project Coverage**

# Image Processing by Analysis District

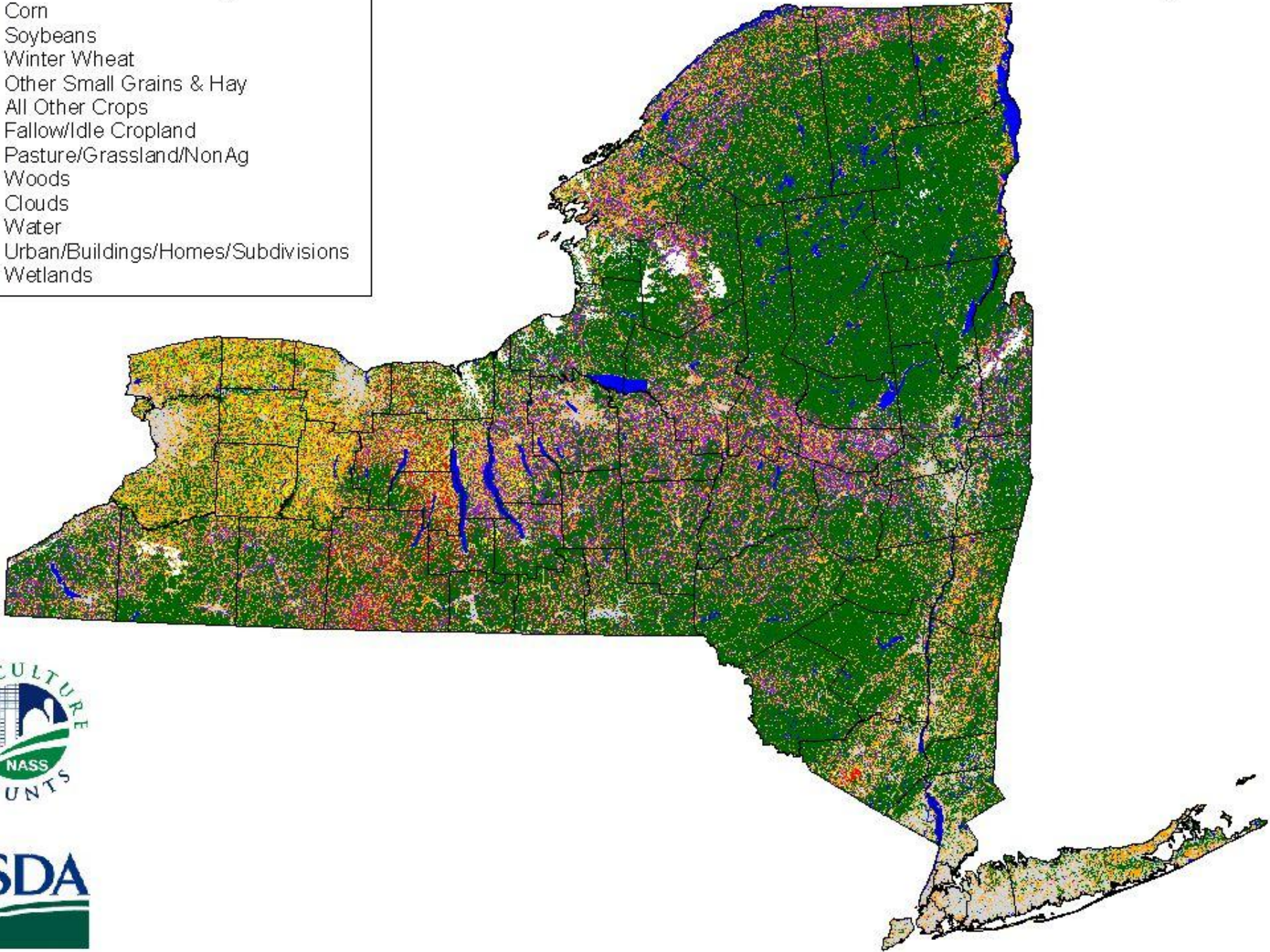
- Modified ISODATA clustering by cover type
- Maximum likelihood classification
- Stitch scenes to produce a statewide mosaic
- Release crop specific product in public domain



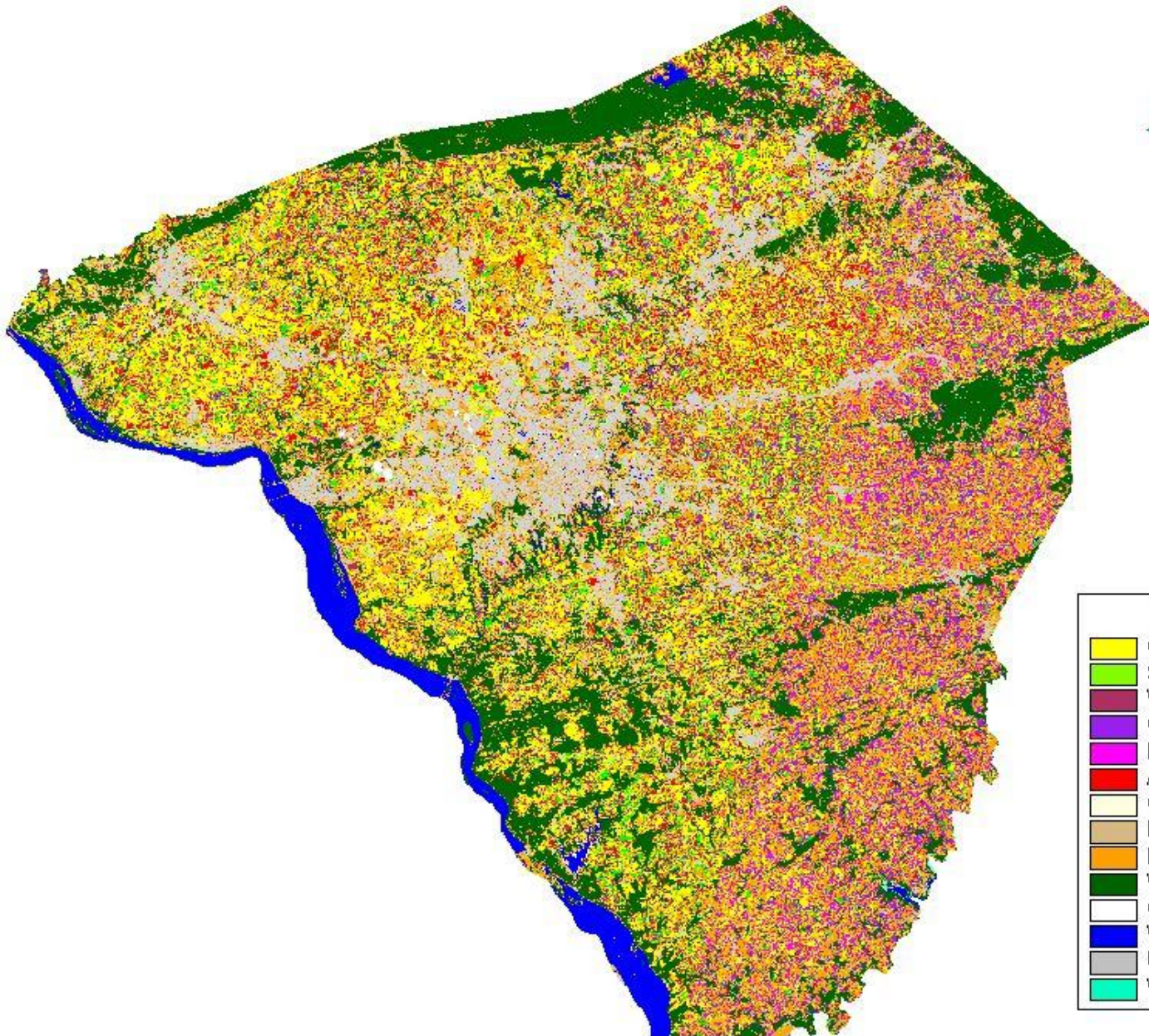
# 2002 New York Cropland Data Layer















## Land Use Categories

- Corn
- Soybeans
- Winter Wheat
- Other Small Grains & Hay
- All Other Crops
- Fallow/Idle Cropland
- Pasture/Grassland/NonAg
- Woods
- Clouds
- Water
- Urban/Buildings/Homes/Subdivisions
- Wetlands

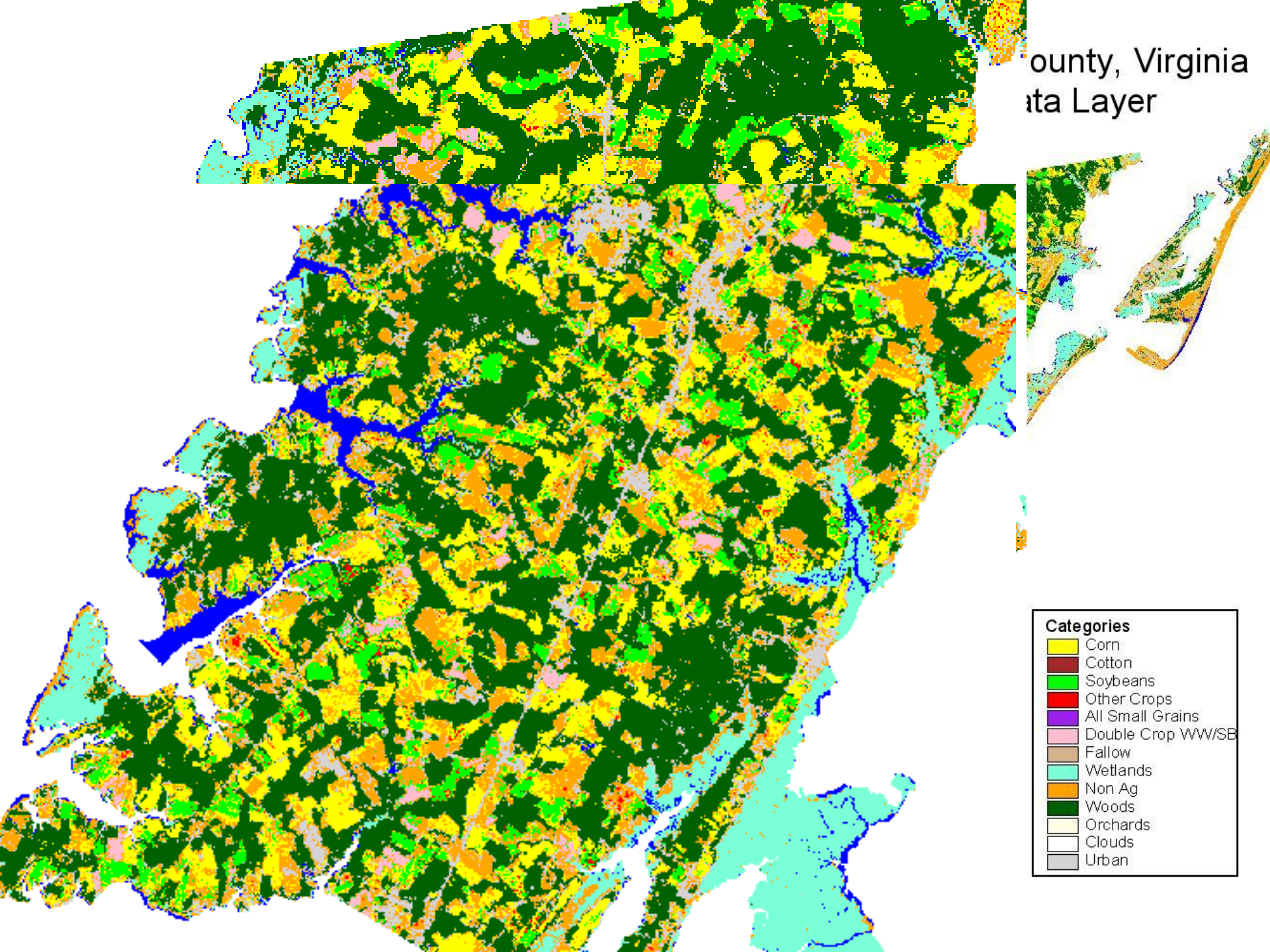


# 2002 Lancaster County Pennsylvania Cropland Data Layer



Land Use Categories	
	Corn
	Soybeans
	Winter Wheat
	Other Small Grains & Hay
	Double Cropped WW/Soybean
	All Other Crops
	Orchards
	Fallow/Idle Cropland
	Pasture/Grassland/NonAg
	Woods
	Clouds
	Water
	Urban/Buildings/Homes/Subdivisions
	Wetlands

# County, Virginia Data Layer



Categories	
Yellow	Corn
Brown	Cotton
Green	Soybeans
Red	Other Crops
Purple	All Small Grains
Pink	Double Crop WW/SB
Tan	Fallow
Light Blue	Wetlands
Orange	Non Ag
Dark Green	Woods
White	Orchards
White	Clouds
Grey	Urban

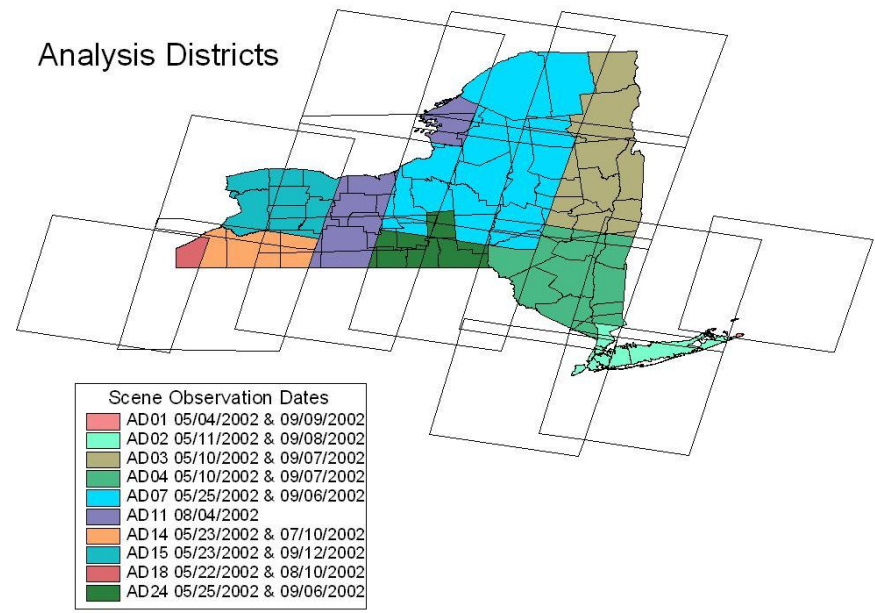


# Accuracy Assessment of the 2002 New York Cropland Data Layer by Crop

## Categorization of New York 2002 Crops

Regression Analysis By Crop  
R-Squared and Slope Values From Sample Estimation

R-Squared			Slope Coefficients		
<b>Corn</b>					
Analysis District	Strata 13	Strata 20		Strata 13	Strata 20
AD07	0.95	0.95		0.2707	0.2707
AD14	0.922			0.2326	
<b>Winter Wheat</b>					
AD11	0.805			0.2605	
AD14	0.863			0.2605	
<b>All Hay</b>					
AD07	0.896			0.2713	
AD11	0.754			0.1866	



# Accuracy Assessment of Analysis District 07 by Major Cover Type

## Analysis District AD07

LANDSAT TM/ETM+ PATH: 15, ROW(S): 29 & 30 - (05/25 + 09/06/2002)  
170 CROP / COVER TYPE SIGNATURES, 14 CHANNELS

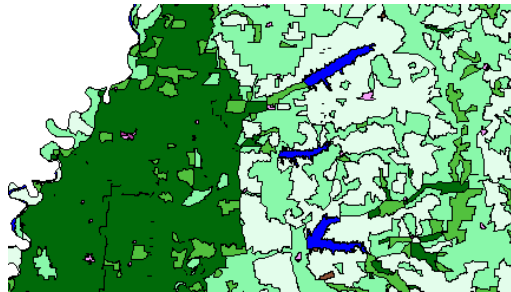
Category	Crop Cover	Orig # Category	Orig # Pixels	Percent Correct	Commission Error	Kappa Coefficient
1	<b>Corn</b>	6	1048	92.56	1.52	91.1
5	<b>Soybeans</b>	5	314	98.41	3.44	98.32
36	<b>Alfalfa</b>	3	282	81.91	16.3	81.04
25	<b>Other Hay</b>	12	1248	91.27	7.7	89.01
62	<b>Crop Past</b>	3	177	93.79	14.87	93.58
44	<b>Other Crop</b>	3	134	67.91	40.91	67.07
62	<b>Perm Past</b>	5	675	81.93	10.52	79.85
63	<b>Woods</b>	52	2087	97.89	2.9	96.76
	<b>Overall</b>	170	6007	91.59		89.34

# Program Summary

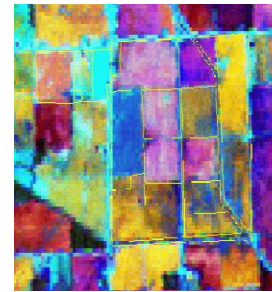
Raw Satellite Image



Area Sampling Frame



Segment Boundaries



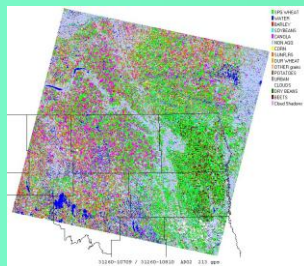
JAS Questionnaire

PAGE 2 SECTION D - CROPS AND LAND USE ON TRACT 11

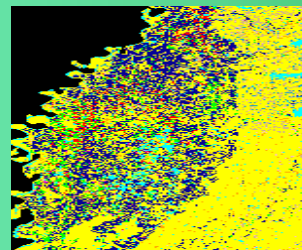
How many acres are inside the blue tract boundaries drawn on the photo (map)?

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

Tract Number	01	02	03	04	05
1. Total acres field	625	628	628	628	628
2. Cropland (acres)	661				
3. Cropland harvested or drilled	661				
4. Field, abandoned (includes buildings and structures, roads, ditches, etc.)	661	661	661	661	661
5. Wetland	661	661	661	661	661
6. Pasture	661	661	661	661	661
7. Other (land use for pasture)	661	661	661	661	661
8. Use (select all that apply)	661	661	661	661	661
9. Use (select all that apply)	661	661	661	661	661
10. Abandoned to pasture	661	661	661	661	661
11. Abandoned to other use (select all that apply)	661	661	661	661	661
12. Other (select all that apply)	661	661	661	661	661
13. Other (select all that apply)	661	661	661	661	661
14. Other (select all that apply)	661	661	661	661	661
15. Other (select all that apply)	661	661	661	661	661
16. Other (select all that apply)	661	661	661	661	661
17. Other (select all that apply)	661	661	661	661	661
18. Other (select all that apply)	661	661	661	661	661
19. Other (select all that apply)	661	661	661	661	661



Categorized Images

















Mosaicked CDL

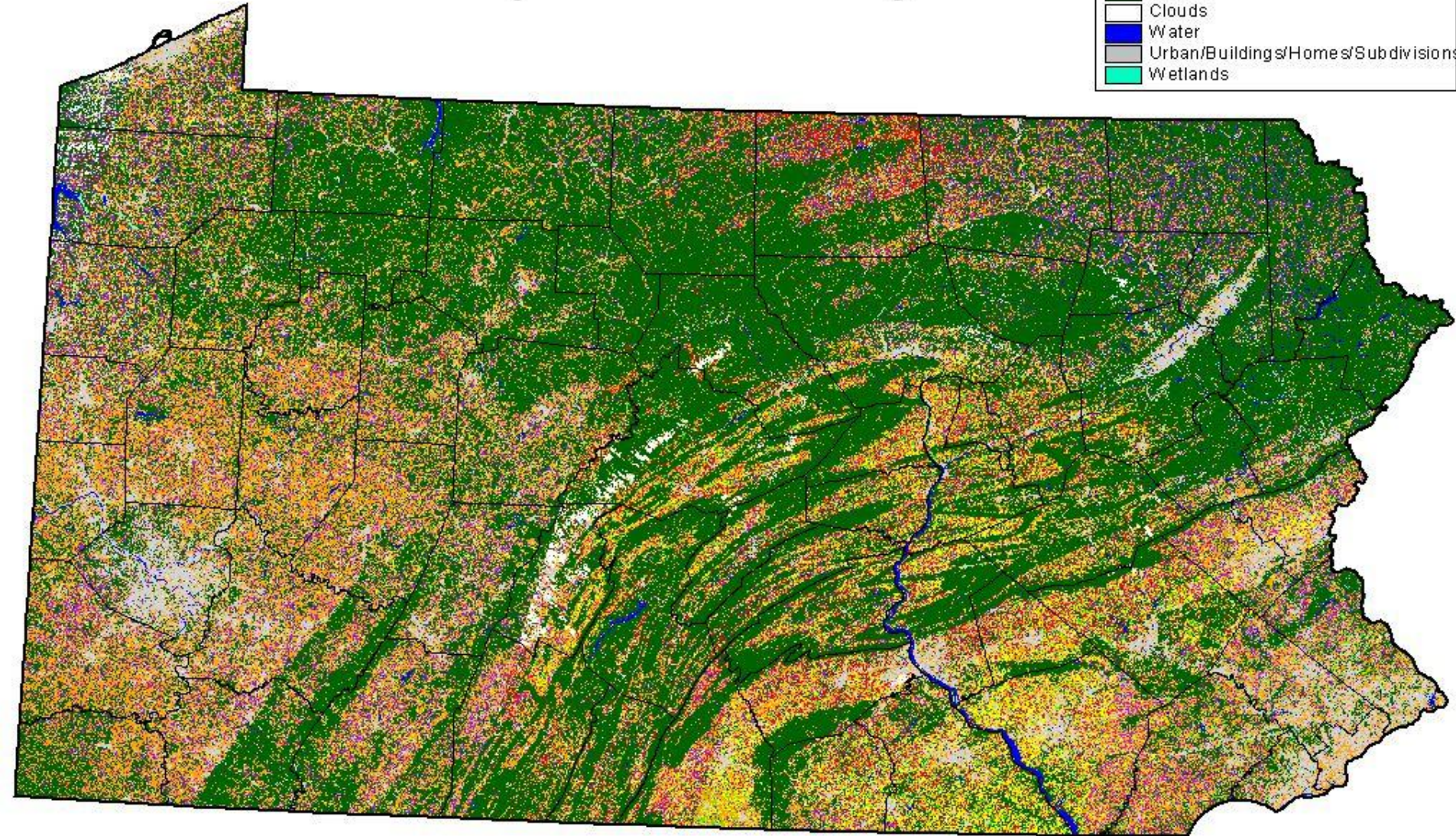
soybeans	2001	AR	Clay	21	129000	127000
soybeans	2001	AR	Conway	29	21000	20000
soybeans	2001	AR	Craighead	31	87000	85500
soybeans	2001	AR	Crawford	33	13000	12500
soybeans	2001	AR	Crittenden	35	166000	162500
soybeans	2001	AR	Cross	37	150000	149000
soybeans	2001	AR	Desha	41	87000	86000
soybeans	2001	AR	Drew	43	21000	20500
soybeans	2001	AR	Faulkner	45	7000	7000
soybeans	2001	AR	Franklin	47	2000	2000

Estimates



# 2002 Pennsylvania Cropland Data Layer

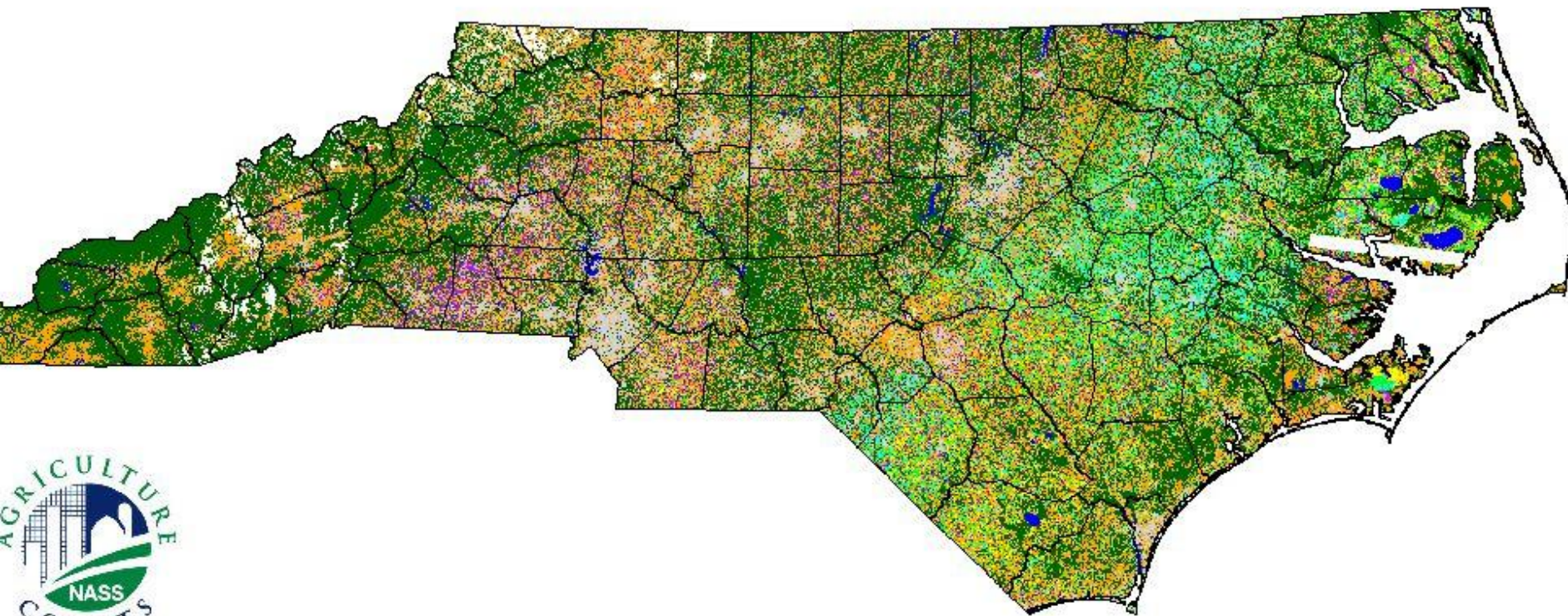
Land Use Categories	
	Corn
	Soybeans
	Winter Wheat
	Other Small Grains & Hay
	Double Cropped WW/Soybean
	All Other Crops
	Orchards
	Fallow/Idle Cropland
	Pasture/Grassland/NonAg
	Woods
	Clouds
	Water
	Urban/Buildings/Homes/Subdivisions
	Wetlands



Land Use Categories

- Corn
- Soybeans
- Cotton
- Peanuts & Tobacco
- Winter Wheat
- Double Cropped WW/Soybean
- All Other Crops
- Pasture/Grassland/NonAg
- Woods
- Clouds
- Water
- Urban/Buildings/Homes/Subdivisions
- Wetlands

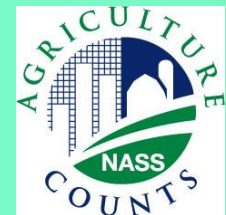
# North Carolina 2002 Cropland Data Layer

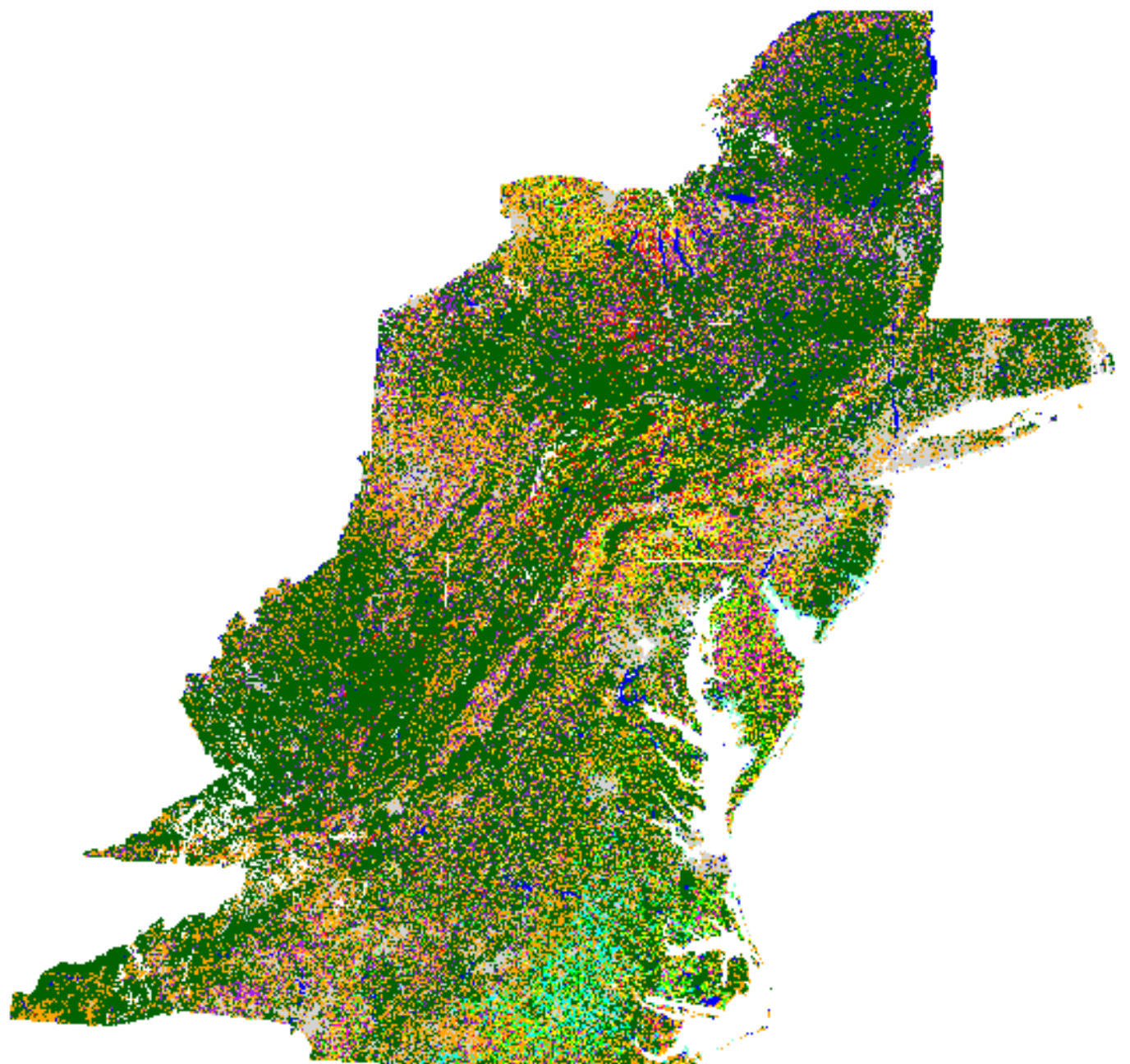


# Mid-Atlantic CDL Project Conclusion

- Project sponsor: Towson U.
- Produced for crop year 2002
- Categorization & accuracy assessment
  - GeoTiff images
  - .html

In no case is farmer reported data revealed or derivable from the public use Cropland Data Layer





[www.nass.usda.gov/research/Cropland/SARS1a.htm](http://www.nass.usda.gov/research/Cropland/SARS1a.htm)