

# CropScape: A New Web Based Visualization Portal for the Dissemination of NASS Geospatial Cropland Products

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WSS Seminar May 11, 2011



[nassgeodata.gmu/CropScape](http://nassgeodata.gmu/CropScape)





# The Cropland Data Layer

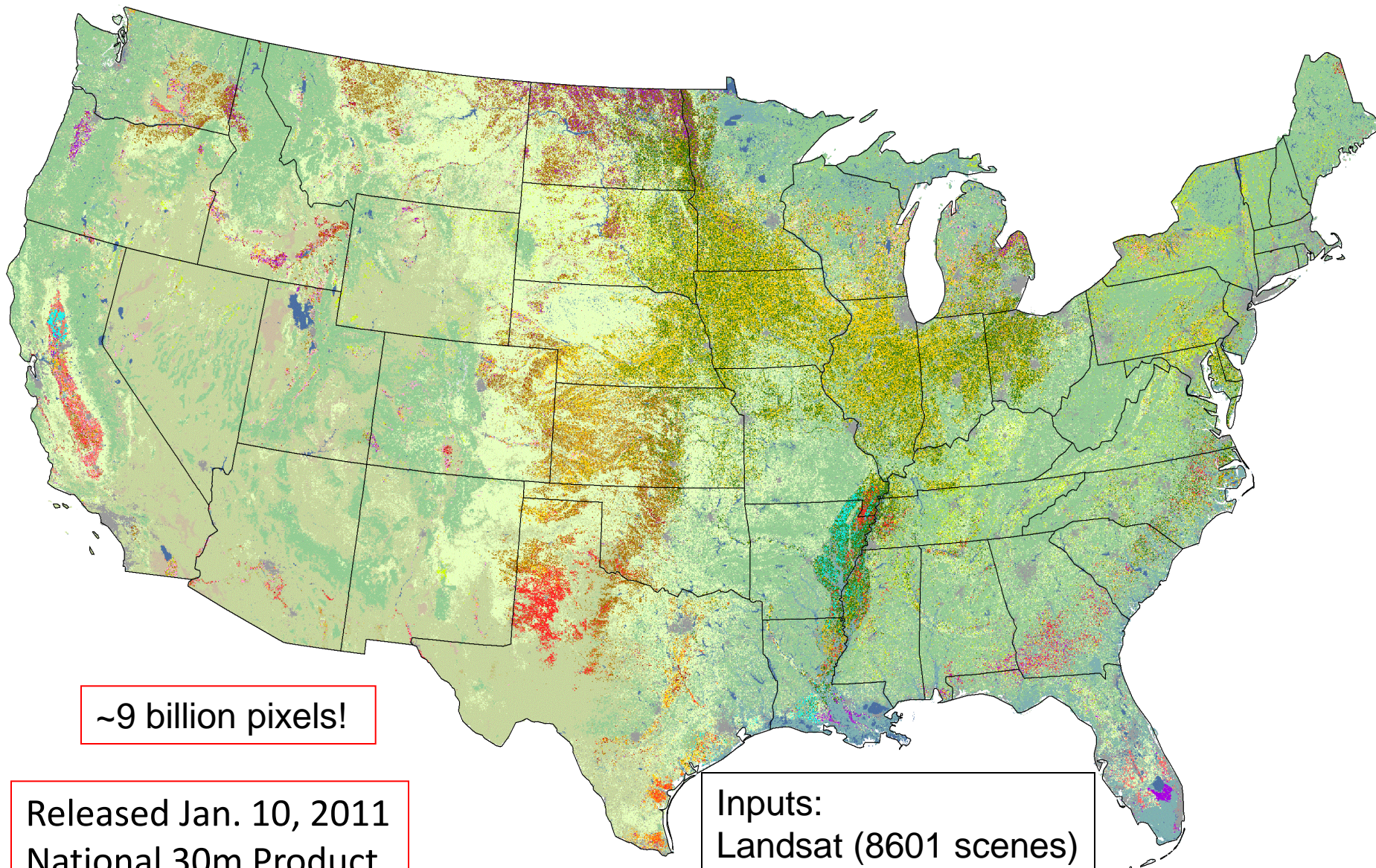
- “Census by Satellite”
  - *Annually* cover major program crops and regions
  - Crops accurately geo-located
- Deliver in-season remote sensing acreage estimates
  - NASS Official Reports
  - Update planted area
  - Reduce respondent burden
- Provide timely, accurate, useful estimates
  - Measurable error
  - Unbiased/independent/robust estimator
  - State, District, County



[nassgeodata.gmu.edu/CropScape](http://nassgeodata.gmu.edu/CropScape)



# 2010 Cropland Data Layers



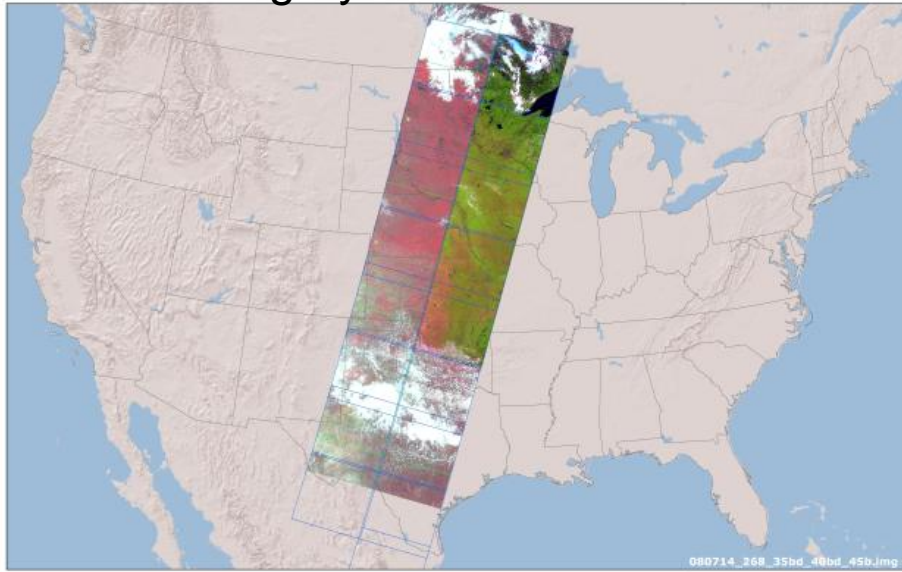
~9 billion pixels!

Released Jan. 10, 2011  
National 30m Product

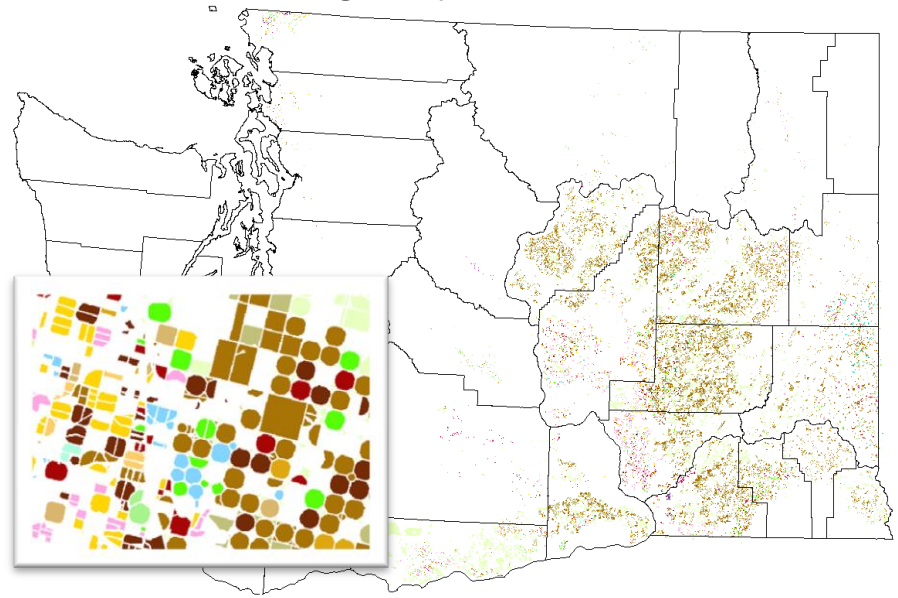
Inputs:  
Landsat (8601 scenes)  
AWiFS (1194 scenes)

# Inputs

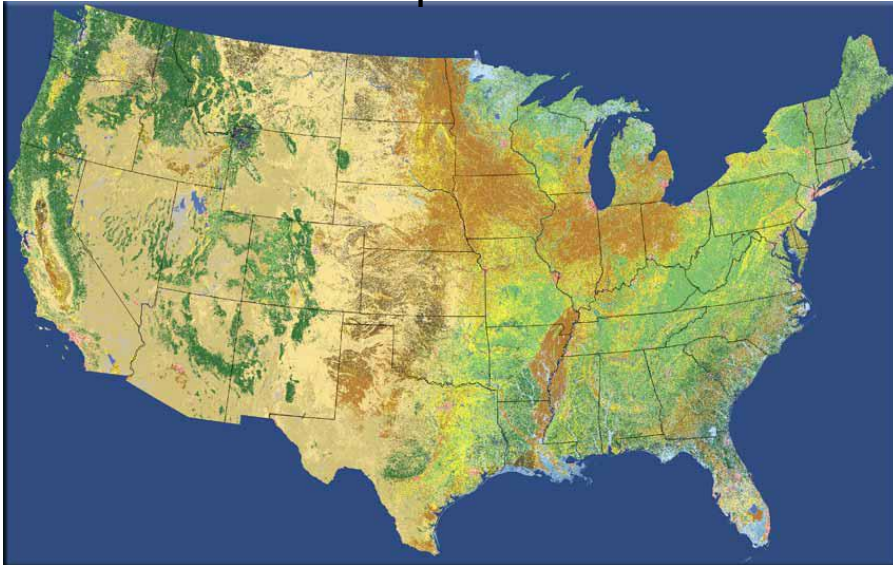
Satellite Imagery - AWiFS & Landsat TM



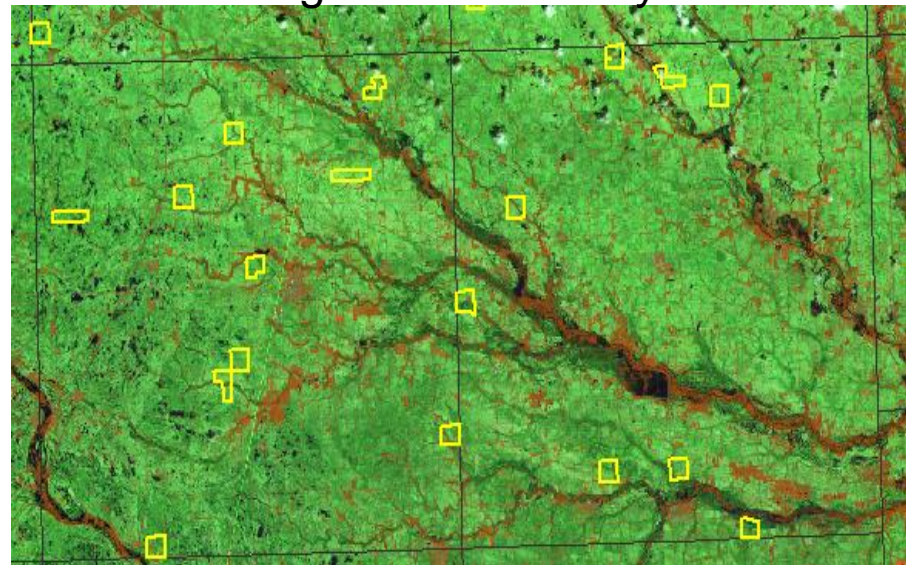
Farm Service Agency - Common Land Unit



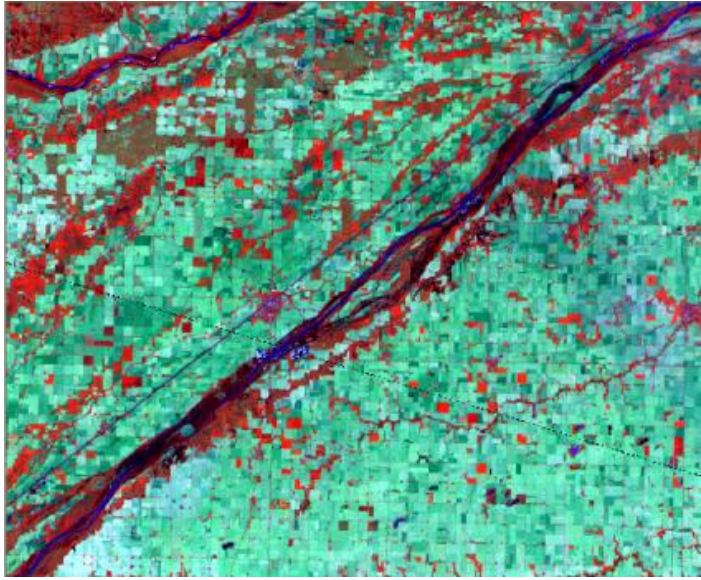
NLCD & Derivative products



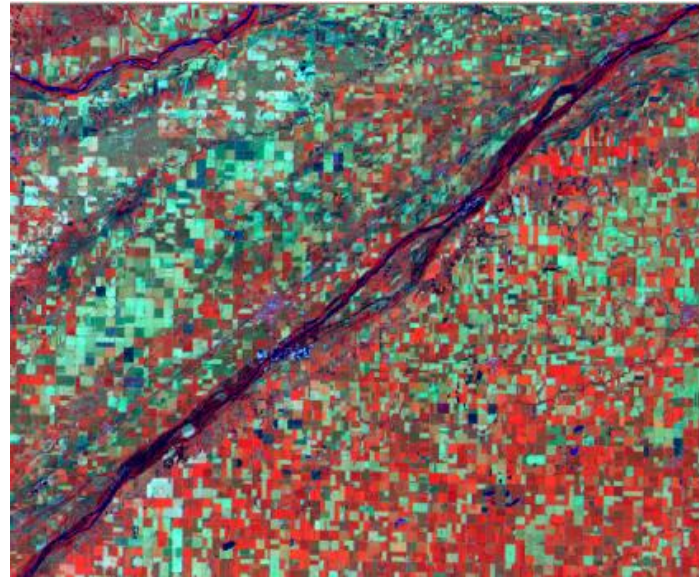
NASS June Agriculture Survey



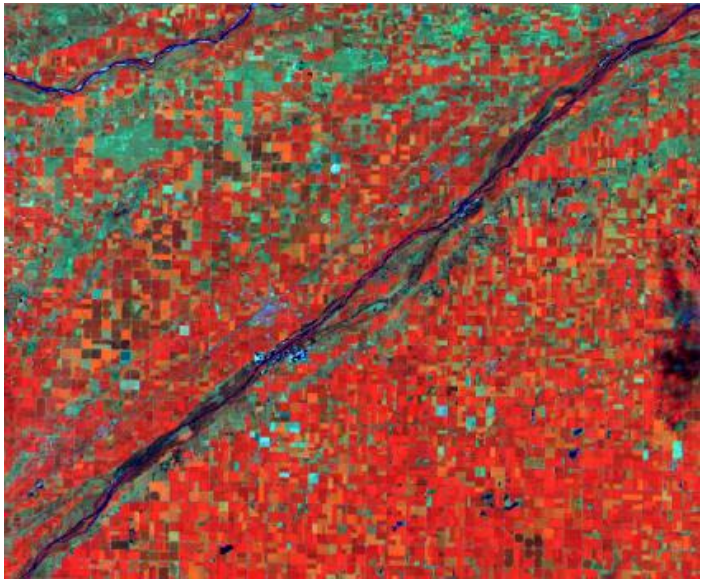
# Satellite images over time



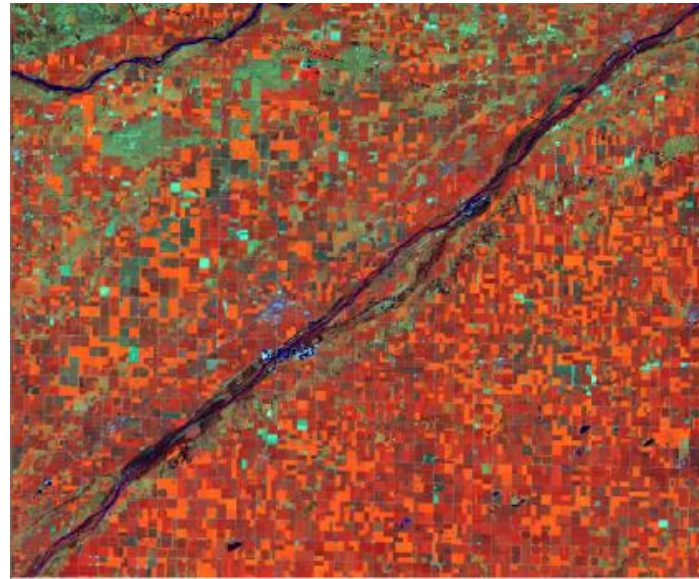
May 18



June 21



July 15



Aug 27



# 2010 Cropland Data Layer McLean County, IL

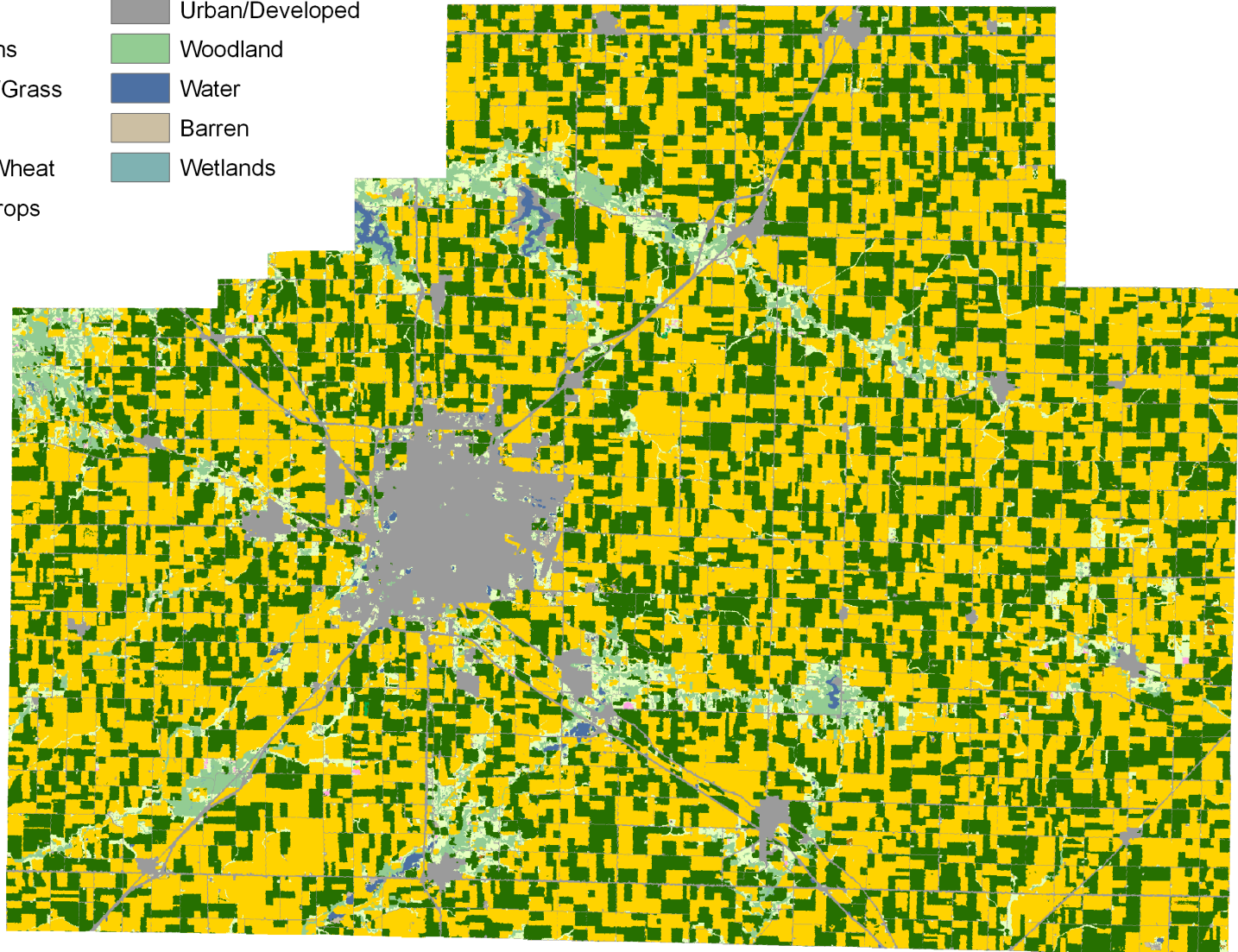
Land Cover Categories  
(by decreasing acreage)

## Agriculture

- Corn
- Soybeans
- Pasture/Grass
- Alfalfa
- Winter Wheat
- Other Crops

## Non-Agriculture

- Urban/Developed
- Woodland
- Water
- Barren
- Wetlands



[nassgeodata.gmu.edu/CropScape](http://nassgeodata.gmu.edu/CropScape)



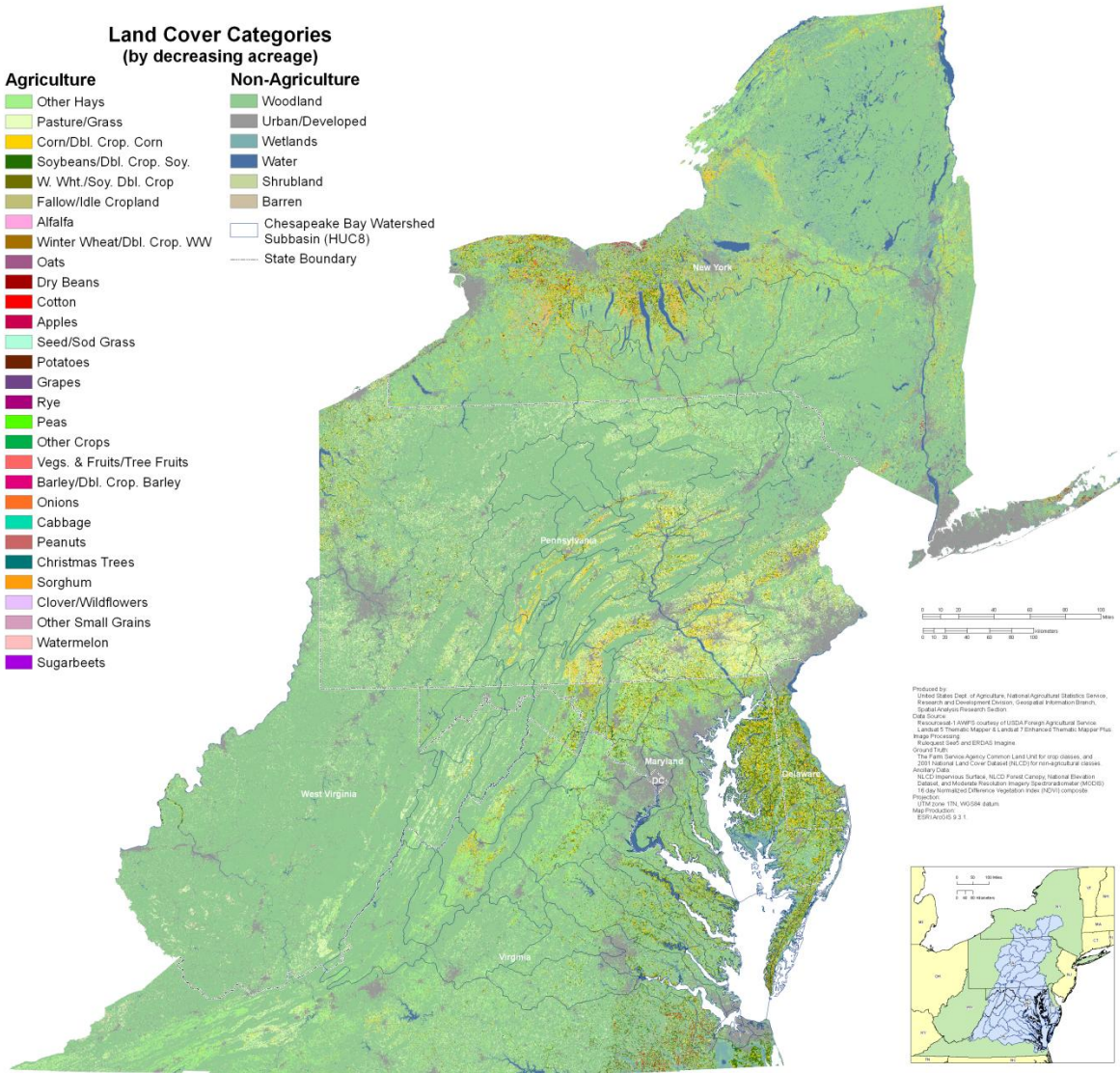


# Chesapeake Bay Watershed States 2009 Cropland Data Layers



USDA, National Agricultural Statistics Service

- Land Cover Categories  
(by decreasing acreage)**
- |                            |  |
|----------------------------|--|
| <b>Agriculture</b>         | <b>Non-Agriculture</b>                   |
| Other Hays                 | Woodland                                 |
| Pasture/Grass              | Urban/Developed                          |
| Corn/Dbl. Crop. Corn       | Wetlands                                 |
| Soybeans/Dbl. Crop. Soy.   | Water                                    |
| W. Wht./Soy. Dbl. Crop     | Shrubland                                |
| Fallow/Idle Cropland       | Barren                                   |
| Alfalfa                    | Chesapeake Bay Watershed Subbasin (HUC8) |
| Winter Wheat/Dbl. Crop. WW | State Boundary                           |
| Oats                       |  |
| Dry Beans                  |  |
| Cotton                     |  |
| Apples                     |  |
| Seed/Sod Grass             |  |
| Potatoes                   |  |
| Grapes                     |  |
| Rye                        |  |
| Peas                       |  |
| Other Crops                |  |
| Vegs. & Fruits/Tree Fruits |  |
| Barley/Dbl. Crop. Barley   |  |
| Onions                     |  |
| Cabbage                    |  |
| Peanuts                    |  |
| Christmas Trees            |  |
| Sorghum                    |  |
| Clover/Wildflowers         |  |
| Other Small Grains         |  |
| Watermelon                 |  |
| Sugarbeets                 |  |



Produced by  
United States Dept. of Agriculture, National Agricultural Statistics Service,  
Research and Development Center, Geographic Information Branch,  
Applied Analysis Research Center  
GIP Source  
Revised and RAMP'd courtesy of USDA Foreign Agricultural Service  
Leland T. Thomas, Major & Consultant, Ethelwood, Thomas, Major Plus  
Image Processing  
Revised and RAMP'd and ERDAS Imagine  
Original Data  
The Farm Service Agency Common Land Unit for crop classes, and  
2001 National Land Cover Database (NLCD) for non-agricultural classes  
Auxiliary Data  
NCIP Elevation Surface, NLCD Forest Canopy, National Elevation  
Dataset, and Moderate Resolution Imagery Size (MODIS)  
1:4 day Normalized Difference Vegetation Index (NDVI) composite  
Projection  
UTM zone 17N, WGS84 datum  
Map Production  
ESRI/ArcGIS 9.3.1



[nassgeodata.gmu.edu/CropScape](http://nassgeodata.gmu.edu/CropScape)





# CDL Visualization, Dissemination and Querying Needs

- Prior Dissemination Method:
  - Online bulk FTP downloading via NRCS Geospatial Data Gateway
  - Special request & delivery
    - Printed maps
    - CD/DVD delivery
    - Email generated
- No online geospatial information access
  - No geospatial crop visualization & browsing
  - No geospatial query capability
  - No geospatial online analytics
- NASS Needs...
  - Capabilities for on-line geospatial crop information access, geospatial query and on-line analytics via interactive maps
  - Disseminate all data to decision makers and users via real time retrieval, processing and publishing over the web through standards-based geospatial web services



[nassgeodata.gmu/CropScape](http://nassgeodata.gmu/CropScape)







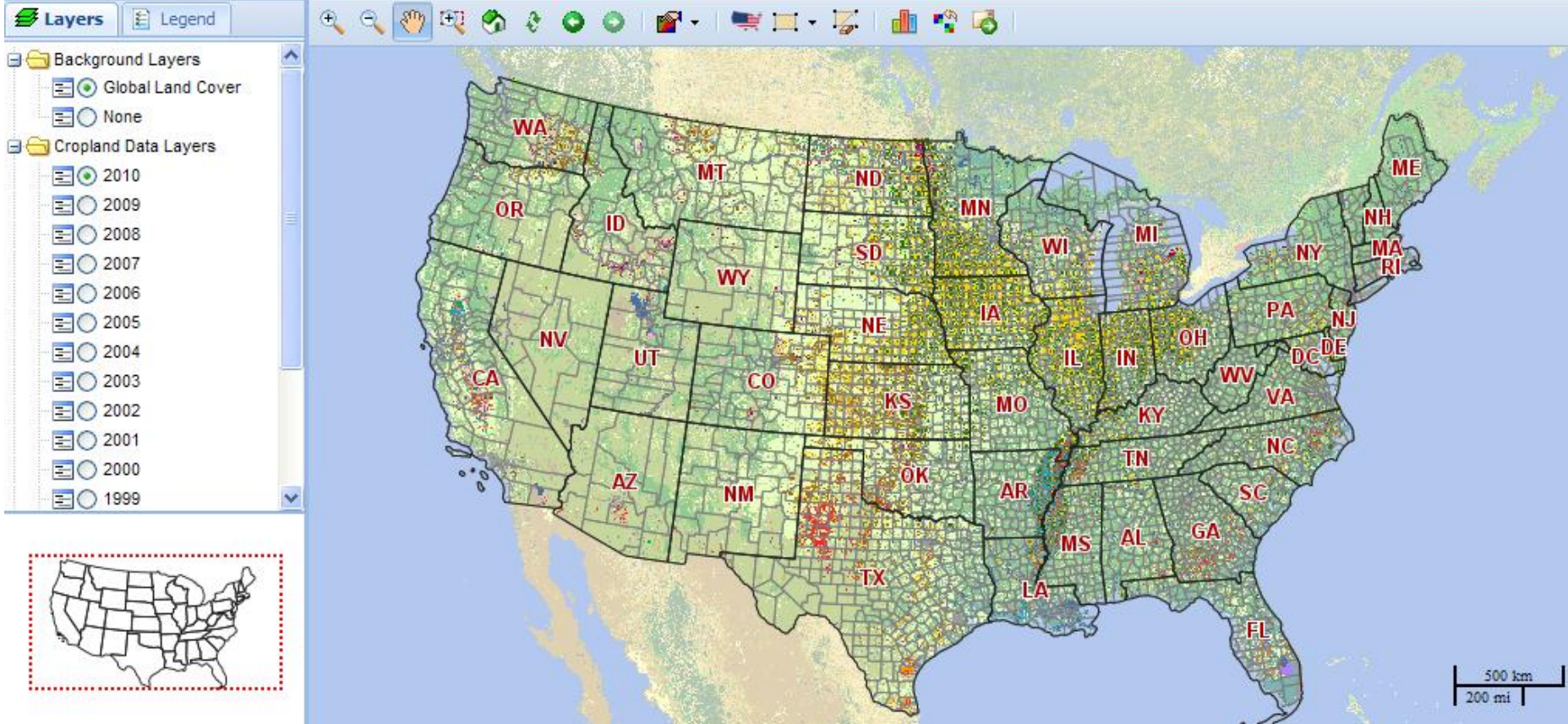
# Solution - CropScape

- A web service based interactive map visualization, dissemination and querying system for U.S. cropland
  - No burden on users
    - No client software development & installation
    - No special software tools needed
  - Equitable cropland information access, automatic and timely delivery, geospatial navigation, retrieval, queries and dissemination
- Collaboration with George Mason University/ Center for Spatial Information Science and Systems





# CropScope - Cropland Data Layer



[nassgeodata.gmu.edu/CropScope](http://nassgeodata.gmu.edu/CropScope)





# Technology Under the Hood

- Open Standard Geospatial Information Science Technology
  - Adoption of specifications and standards from the OGC Sensor Web Enabled initiative: WFS, WCS, CSW, WMS, WPS etc.
  - Re-using of SEPSeb Processing Service (WPS)
- Web Service Based Service Oriented Architecture
- Service Integration
  - Support of workflows: BPEL execution engine
  - Re-use all algorithms published in WPS
- GeoBrain Technology(GMU developed)
  - Open, standards compliant, interoperable, distributed, web GIS
  - Re-use functions/algorithms developed in GeoBrain



[nassgeodata.gmu.edu/CropScape](http://nassgeodata.gmu.edu/CropScape)



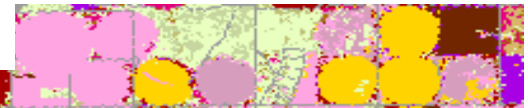


# CropScape Functions

- Select any historical CDL by state and year circa 1997
- Zoom in/out & Pan
- Search by county and year
- Sub-setting by state, county, and year
- Sub-setting for any area of interest by a bounding box
- Re-projecting data to a user specified map projection
  - Albers, Geographic, UTM
- Download the CDL subset in GeoTiff format
- Exporting selected CDL subset to Google Earth (KML)



[nassgeodata.gmu.edu/CropScape](http://nassgeodata.gmu.edu/CropScape)





# CropScape Functions –Cont.

- Online pixel counting & acreage statistics
- Online statistics graphing/charting
- Maps showing the change of crop types for a state, county, or any area specified between any two years of CDL
- On-the-fly single/multi crop map generation, display and download
- Web service implemented
  - Geospatial query statistics data delivery
  - CDL map AOI data delivery



# CropScape Defined

Visual Tools

Point Query

Stats/Change/Download

Layers Legend

- Background Layers
  - Global Land Cover
  - None
- Cropland Data Layers
  - 2010
  - 2009
  - 2008
  - 2007
  - 2006
  - 2005
  - 2004
  - 2003
  - 2002
  - 2001
  - 2000
  - 1999

Layer/Legend

Cropland Data Layer:

- Corn
- Cotton
- Rice
- Sorghum
- Soybeans
- Tobacco
- Sweet Corn
- Popcorn or Ornamental Cor
- Mint
- Barley
- Durum Wheat
- Spring Wheat
- Winter Wheat
- Other Small Grains
- Winter Wheat/Soybeans Db.
- Rye
- Oats
- Millet
- Speltz
- Canola
- Flaxseed
- Safflower
- Rape Seed



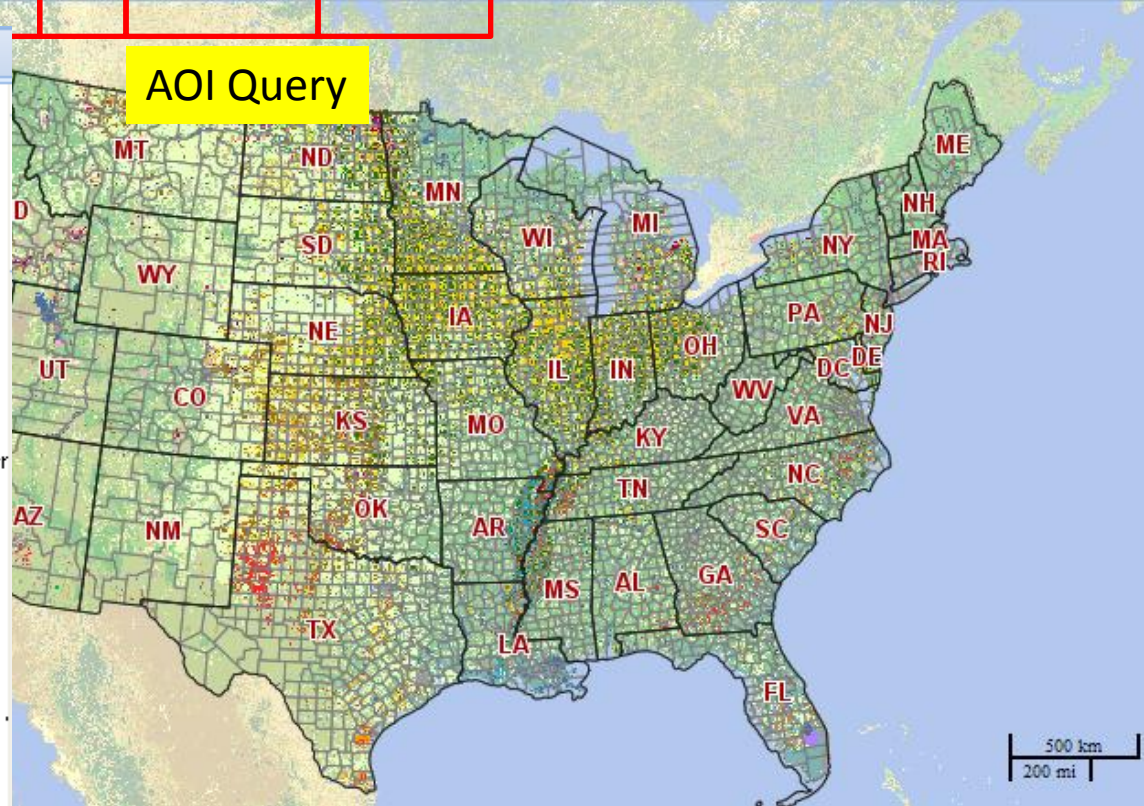
Map Overview

Visual Tools toolbar

Point Query toolbar

Stats/Change/Download toolbar

AOI Query



Define Area of Interest By State/ASD/County

Select a State

State: Iowa

Select an ASD

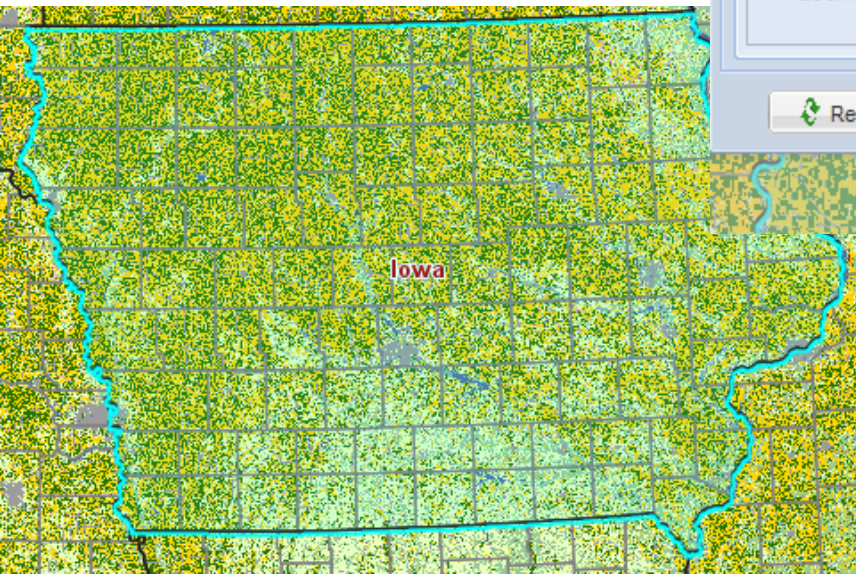
ASD: Select an ASD...

Or Select a County

County: Select a county...

Reset Submit Cancel

State



# Select AOI

Define Area of Interest By State/ASD/County

Select a State

State: Iowa

Select an ASD

ASD: [dropdown menu]

Or Select a County

County: [dropdown menu]

Reset

ASD

Define Area of Interest By State/ASD/County

Select a State

State: Iowa

Select an ASD

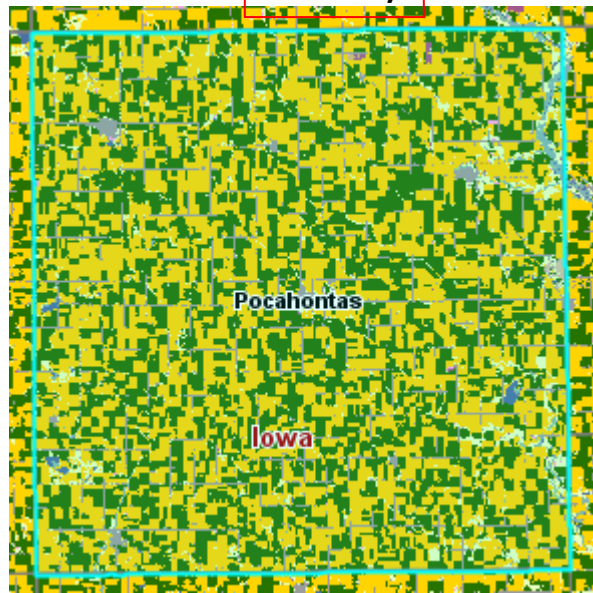
ASD: Select an ASD...

Or Select a County

County: Pocahontas

Reset Submit Cancel

County



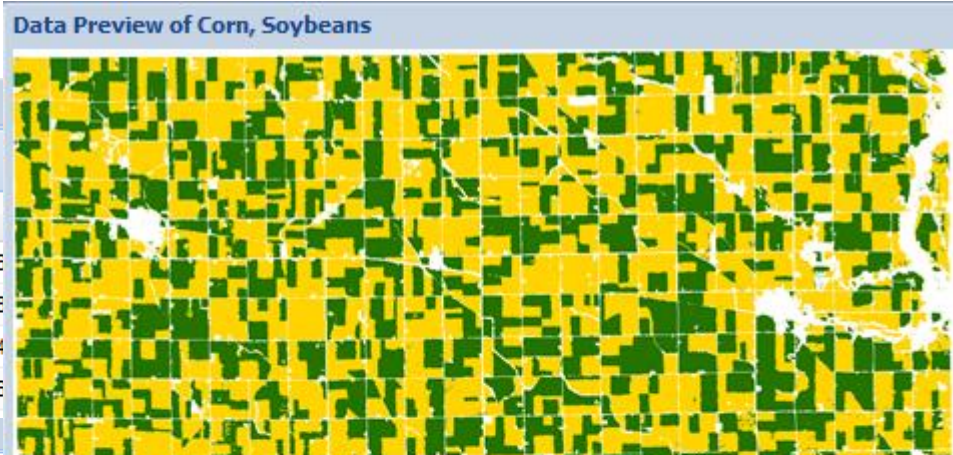
# CropScape Stats

Pie/Histogram/Graphic

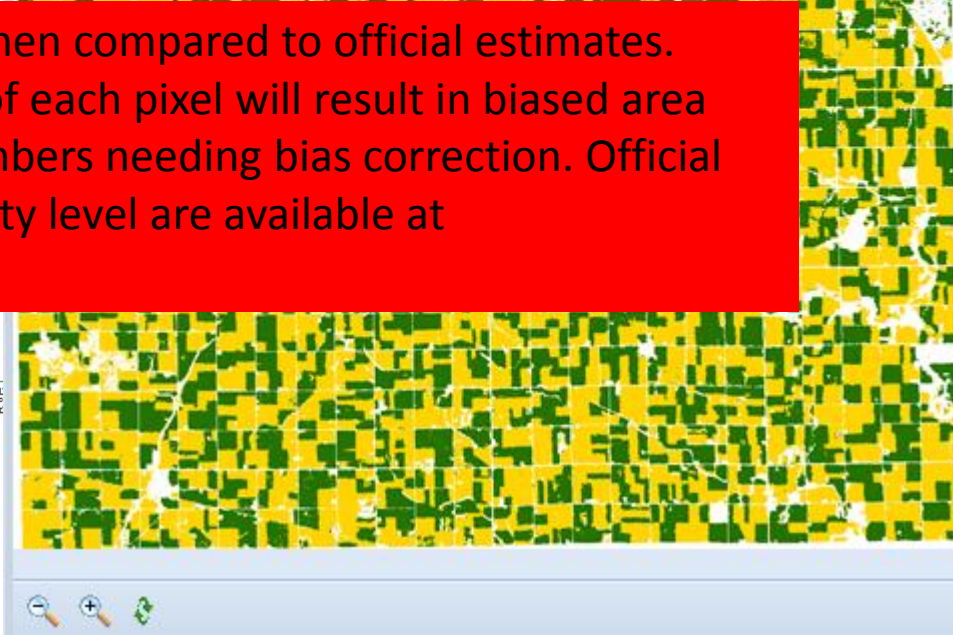
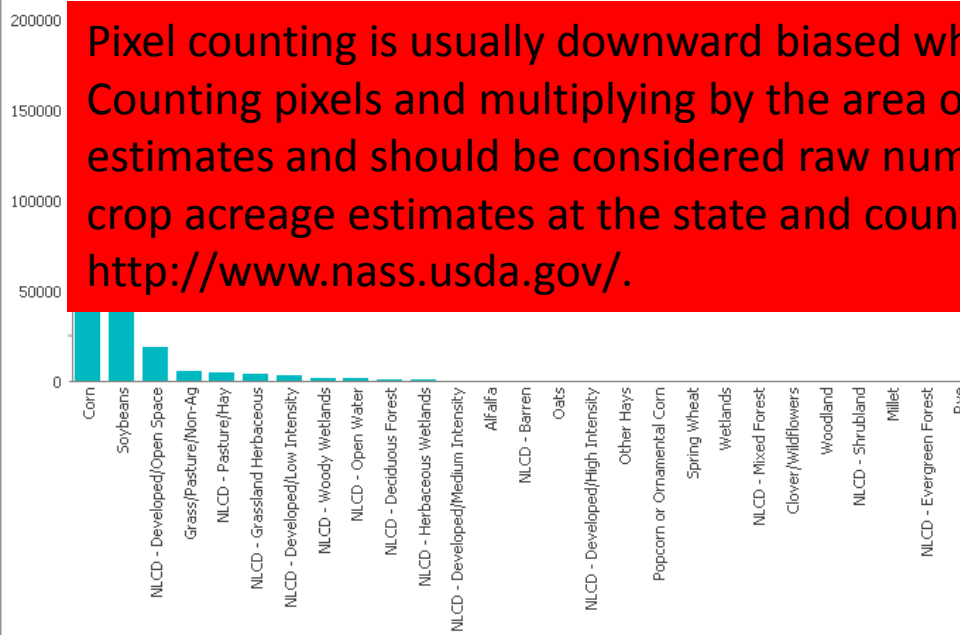
2010 Cropland Data Layer Statistics for Pocahontas, Iowa

Note: Pixel counts are not official estimates.

Value	Category	Pixel Counts	Acreage
1	Corn	807149	179505.6
5	Soybeans	669233	148833.8
121	NLCD - Developed/Open Space	84172	18719.4
62	Grass/Pasture/Non-Ag	23425	5209.6

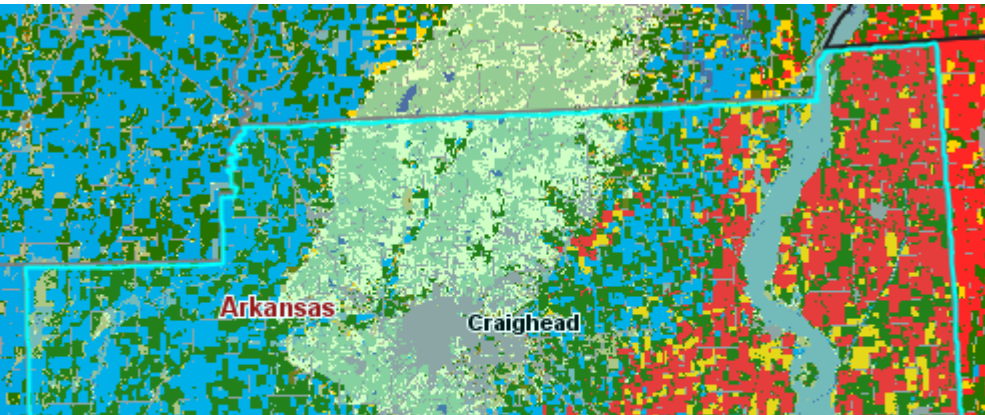


Pixel counting is usually downward biased when compared to official estimates. Counting pixels and multiplying by the area of each pixel will result in biased area estimates and should be considered raw numbers needing bias correction. Official crop acreage estimates at the state and county level are available at <http://www.nass.usda.gov/>.





# CropScape Change Analysis



**Change Analysis** ✕

Select the Reference Year:  ▾

Select the Other Year:  ▾

**Cropland Data Layer Changes between 2009 and 2008**

Note: Pixel counts are not official estimates.

<input type="checkbox"/>	2009	2008	Pixel Counts ▾	Acreage
<input type="checkbox"/>	Rice	Soybeans	133502	103453.6
<input type="checkbox"/>	Soybeans	Rice	129916	100674.7
<input type="checkbox"/>	Cotton	Cotton	120872	93666.3
<input type="checkbox"/>	Soybeans	Soybeans	106428	82473.4
<input type="checkbox"/>	NLCD - Developed/Open Space	NLCD - Developed/Open Space	85414	66189.2
<input type="checkbox"/>	NLCD - Woody Wetlands	NLCD - Woody Wetlands	83660	64830
<input type="checkbox"/>	NLCD - Deciduous Forest	NLCD - Deciduous Forest	73312	56811.1
<input type="checkbox"/>	Other Hays	Other Hays	61496	47654.6
<input type="checkbox"/>	Rice	Rice	39116	30311.8
			<b>1177212</b>	<b>912239.6</b>

# CropScape Download & Export

CDL Downloading - Please specify your choice(s)

Select Year(s)

Year:  2010  2009  2008  2007  
 2006  2005  2004  2003  
 2002  2001  2000  1999  
 1998  1997

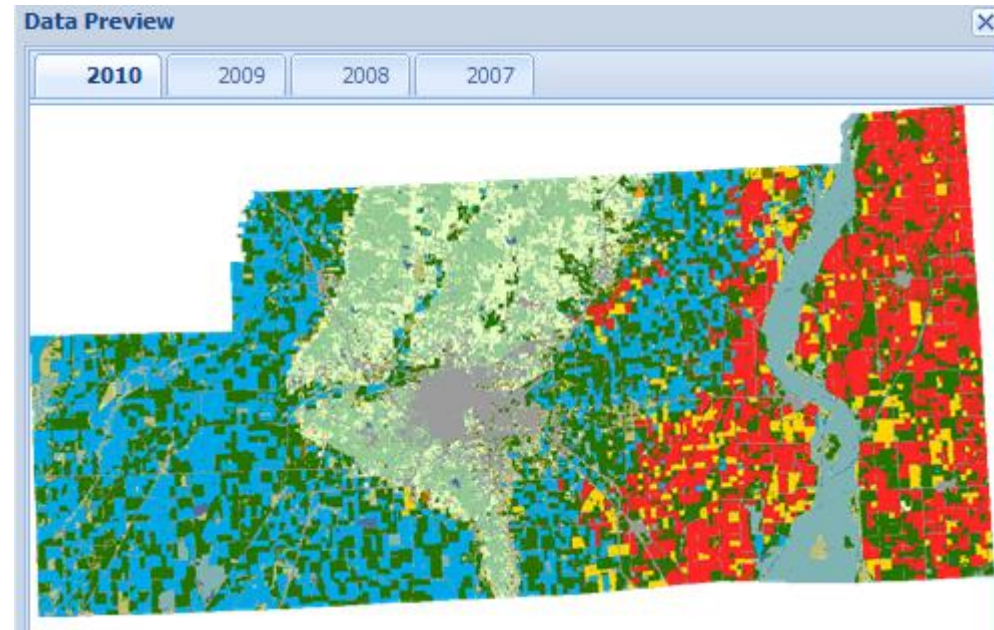
Specify Projection

Projection: USA Contiguous Albers Equal Area Conic USG  
USA Contiguous Albers Equal Area Conic USGS  
Degrees Lat/Lon, WGS84 Datum  
UTM Zone 15  
UTM Zone 16  
UTM Zone 14

Specify Years and Projection

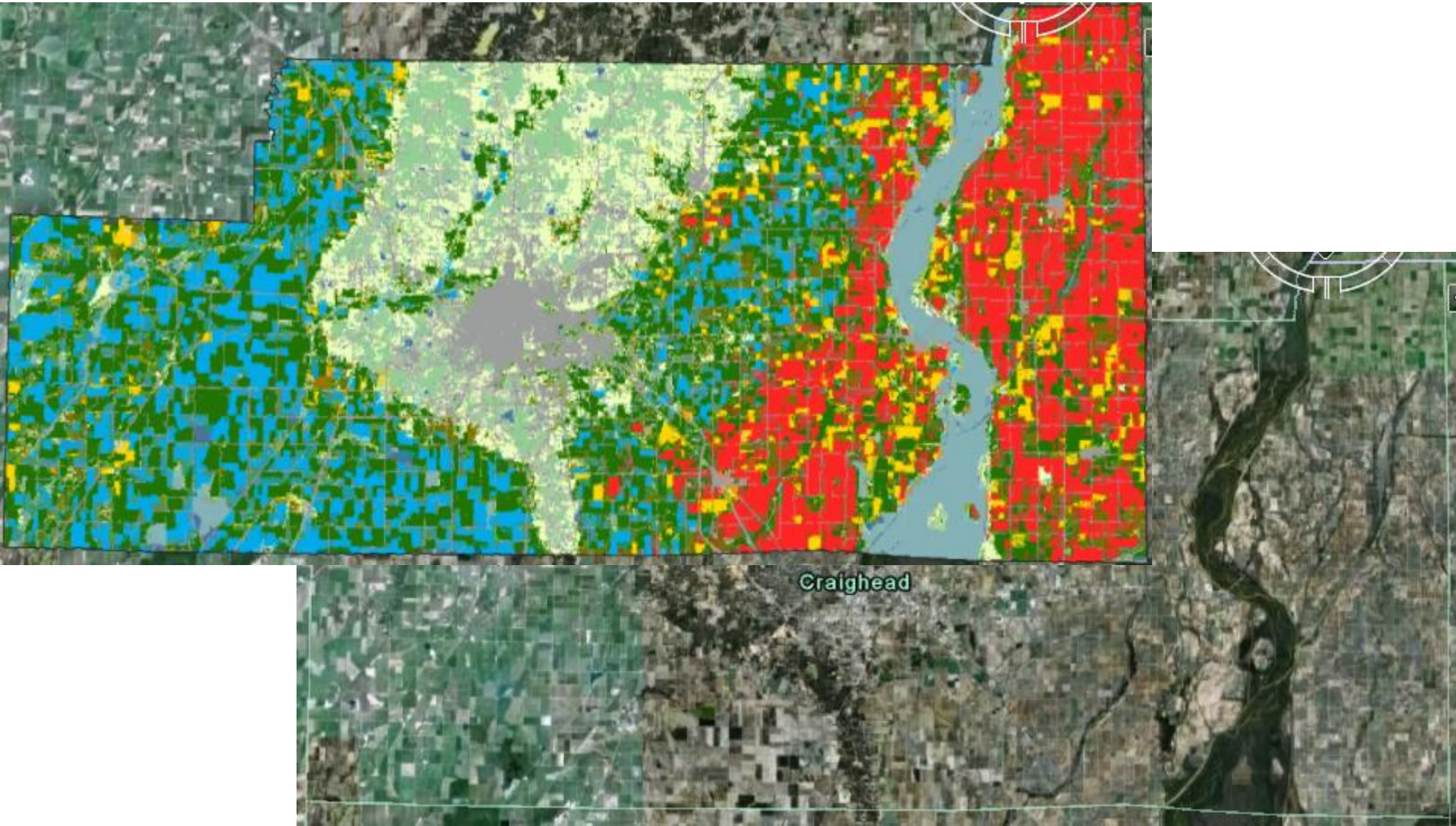
Download Files from Server

Preview and Download





# CropScape w/ Google Earth



[nassgeodata.gmu.edu/CropScape](http://nassgeodata.gmu.edu/CropScape)



# CropScape Mashups



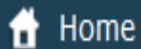
BIOENERGY  
KNOWLEDGE DISCOVERY FRAMEWORK  
U.S. DEPARTMENT OF ENERGY

Login

Request Account



Search



Home



Map



Data Library



About



Contact

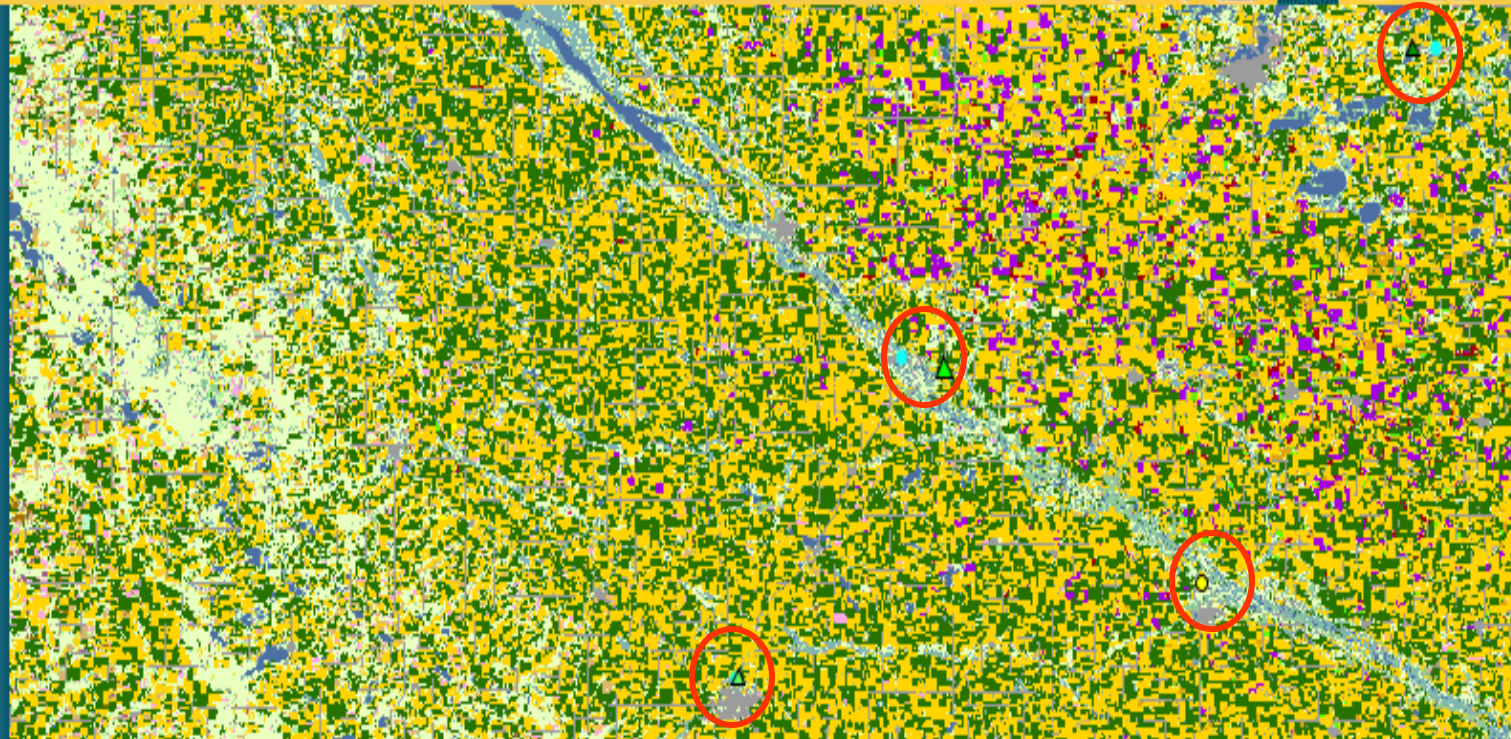
My Layers

Add Data

Attribute Query

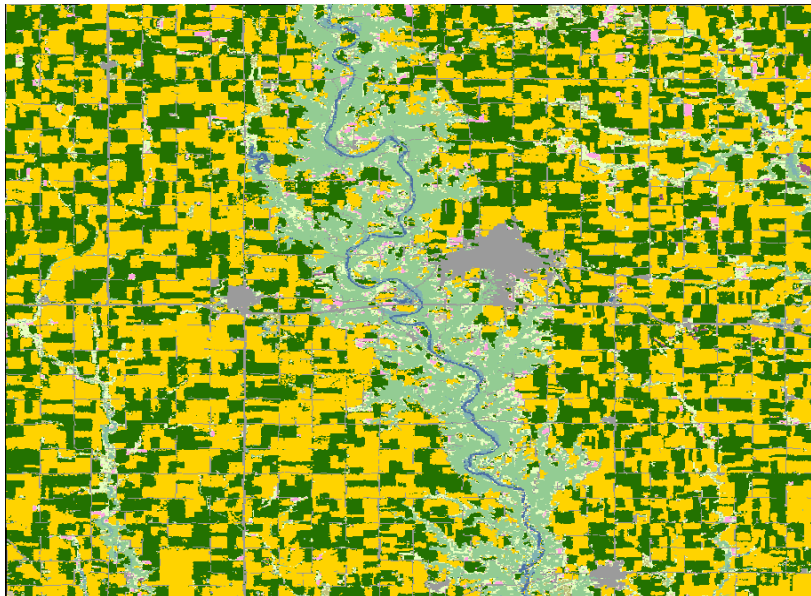


- Base Map
- Ethanol Refinery Capacity
- Transload
- Unit Train
- Biodiesel Refinery Capacity
- RFA Biorefineries
- 2010 Cropland Data Layer



# Web Service Examples

- 1) <http://nassgeodata.gmu.edu/CropScape/GetCDL?year=2009&fips=19015>
- 2) <http://nassgeodata.gmu.edu/CropScape/GetNASSStatData?year=2008&fips=19015&commcode=11199199>



Service a)

Year: 2008  
State: IA  
County: Boone  
Commodity: Corn For Grain  
Planted: 163500  
Harvested: 158500  
Yield: 166.0000  
Production: 26300000

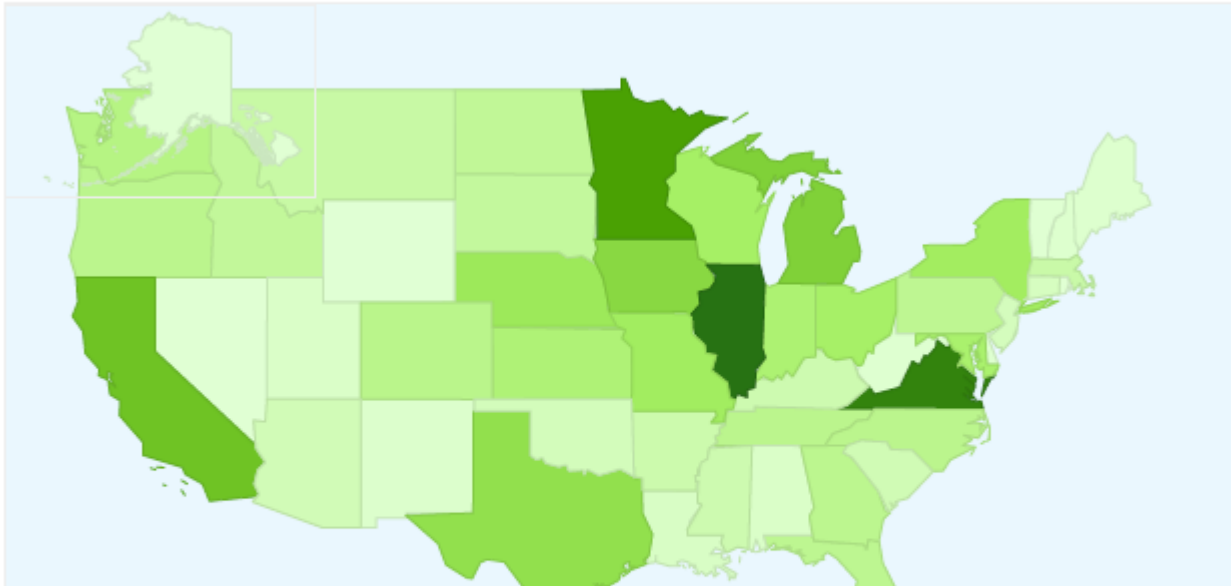
Service b)



# CropScape Metrics

CropScape  
Country/Territory Detail:  
United States

Jan 10, 2011 - May 9, 2011  
Comparing to: Site



<b>Visits</b> 12,056 % of Site Total: 88.99%	<b>Pages/Visit</b> 1.16 Site Avg: 1.15 (0.53%)	<b>Avg. Time on Site</b> 00:01:03 Site Avg: 00:01:01 (3.58%)	<b>% New Visits</b> 63.57% Site Avg: 64.16% (-0.93%)	<b>Bounce Rate</b> 88.27% Site Avg: 88.66% (-0.44%)
---	---	---	---	--

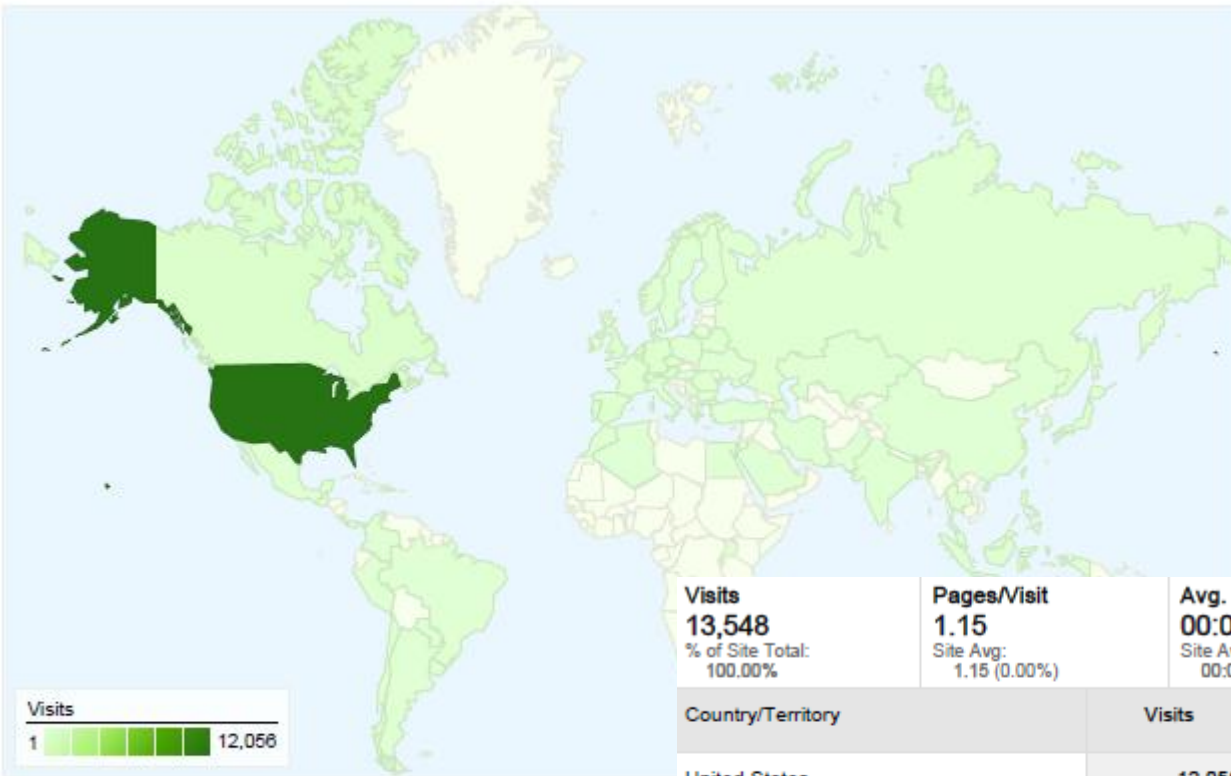
Region	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
Illinois	1,077	1.17	00:01:00	65.00%	88.58%
Virginia	971	1.20	00:01:18	28.94%	88.05%
Minnesota	780	1.15	00:01:01	57.95%	88.33%
California	592	1.19	00:00:59	70.78%	86.32%
District of Columbia	576	1.15	00:00:48	49.31%	88.54%
Michigan	519	1.14	00:00:57	77.07%	88.63%
Iowa	484	1.21	00:01:18	72.52%	83.06%
Texas	445	1.14	00:01:11	62.47%	88.76%

This country/territory sent 12,056 visits via 52 r

# CropScape Metrics

CropScape  
Map Overlay

Jan 10, 2011 - May 9, 2011  
Comparing to: Site



<b>Visits</b> <b>13,548</b> % of Site Total: 100.00%	<b>Pages/Visit</b> <b>1.15</b> Site Avg: 1.15 (0.00%)	<b>Avg. Time on Site</b> <b>00:01:01</b> Site Avg: 00:01:01 (0.00%)	<b>% New Visits</b> <b>64.18%</b> Site Avg: 64.16% (0.02%)	<b>Bounce Rate</b> <b>88.66%</b> Site Avg: 88.66% (0.00%)
---	--	--	---	--

Country/Territory	Visits	Pages/Visit	Avg. Time on Site	% New Visits	Bounce Rate
United States	12,058	1.16	00:01:03	63.57%	88.27%
Canada	304	1.13	00:00:50	84.54%	88.82%
Spain	174	1.11	00:00:41	78.16%	91.38%
Germany	166	1.04	00:00:19	30.12%	96.39%
United Kingdom	76	1.04	00:00:23	61.84%	96.05%
France	66	1.08	00:00:17	80.30%	93.94%
Mexico	61	1.23	00:01:55	45.90%	85.25%
Russia	58	1.16	00:01:08	56.90%	86.21%
Belarus	56	1.04	00:00:42	7.14%	96.43%

13,548 visits came from 69 countries/territories

Site Usage

<b>Visits</b> <b>13,548</b> % of Site Total: 100.00%	<b>Pages/Visit</b> <b>1.15</b> Site Avg: 1.15 (0.00%)	<b>Avg. Time on Site</b> <b>00:01:01</b> Site Avg: 00:01:01 (0.00%)
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# CropScape Metrics

All traffic sources sent a total of 13,548 visits

43.39% Direct Traffic

53.78% Referring Sites

2.83% Search Engines



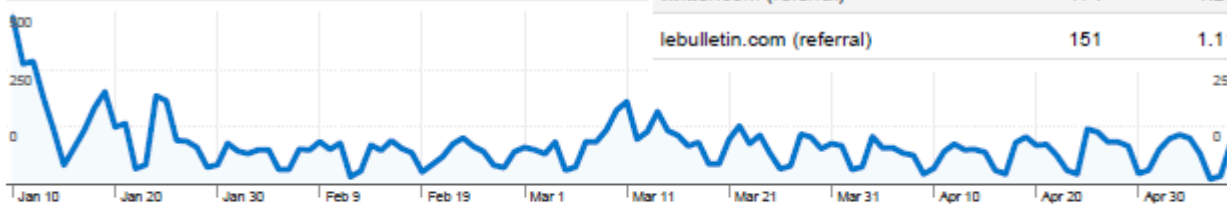
- Referring Sites  
7,286.00 (53.78%)
- Direct Traffic  
5,879.00 (43.39%)
- Search Engines  
383.00 (2.83%)

## Top Traffic Sources

Sources	Visits	% visits
(direct) ((none))	5,879	43.39%
nass.usda.gov (referral)	5,674	41.88%
bing (organic)	208	1.54%
twitter.com (referral)	174	1.28%
lebulletin.com (referral)	151	1.11%

Keywords	Visits	% visits
cropscape	129	33.68%
nassgeodata.gmu.edu/cropsca	68	17.75%
www.nassgeodata.gmu.edu/cro	43	11.23%
nassgeodata.gmu.edu/cropsca	16	4.18%
http://nassgeodata.gmu.edu/cr	14	3.66%

## CropScape Dashboard



## Site Usage

13,548 Visits

88.66% Bounce Rate

15,611 Pageviews

00:01:01 Avg. Time on Site

1.15 Pages/Visit

64.16% % New Visits

Browser	Visits	% visits
Internet Explorer	7,780	57.43%
Firefox	3,318	24.49%
Chrome	1,386	10.23%
Safari	1,004	7.41%
Opera	19	0.14%

Connection Speed	Visits	% visits
Unknown	9,151	67.55%
T1	2,290	16.90%
Cable	1,166	8.61%
DSL	850	6.27%
Dialup	78	0.58%





# CropScape Future Improvements

- Additional GIS layers
  - watershed, congressional districts, roads
- Multi-year crop acreage statistical change graphics for state, county, or area
- Change analysis mapping
- Map production/printing services
- More analysis functions





# CropScape Summary

- State of the art CDL visualization, querying and dissemination tool
- Interactive geospatial statistical analysis tools
  - Online/interactive analytics, charting and mapping
  - Geospatial information access, navigation
  - CDL map and statistical result retrieval and dissemination web services
- Open geospatial standards compliant



# Thank you!



Spatial Analysis Research Section  
USDA/NASS R&D Division

[nassgeodata.gmu/CropScape](http://nassgeodata.gmu/CropScape)

Backup slides

# 2011 Production Plans

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					

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					

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		

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

Acreage Report – Winter Wheat

Crop Production Report – Corn & Soybeans

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		

July						
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

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			

Crop Production Report – CDL Cotton, Rice, & Peanuts

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	

October						
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					

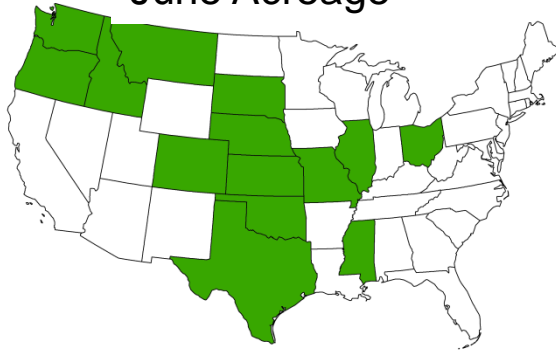
November						
Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

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

Small Grains Summary

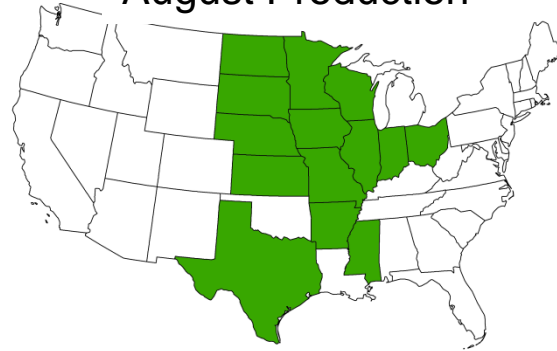
Crop Production Report – All Crops

June Acreage



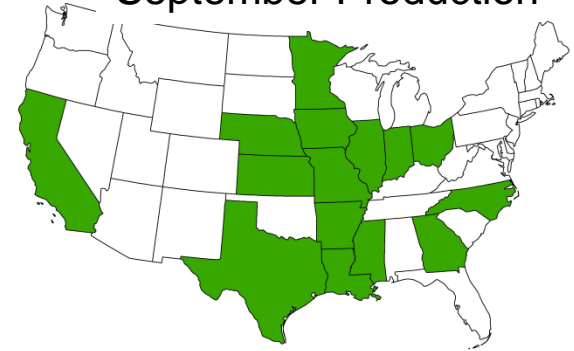
14 states – winter wheat

August Production



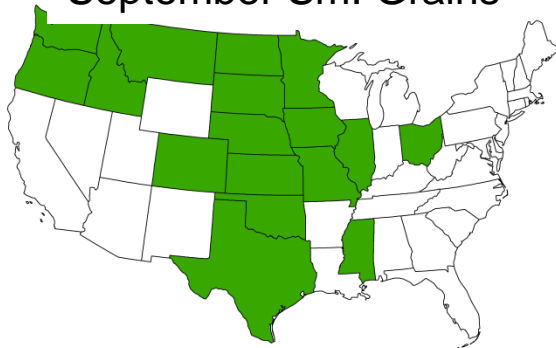
14 – corn & soybeans

September Production



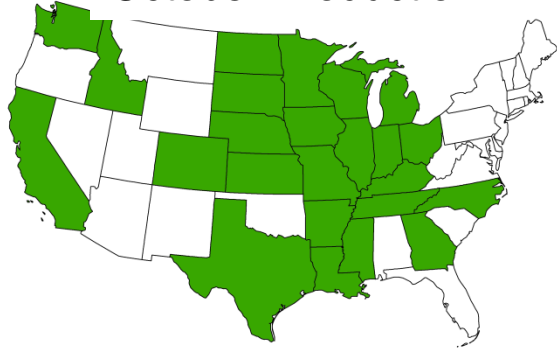
15 – rice, cotton & peanuts

September Sm. Grains



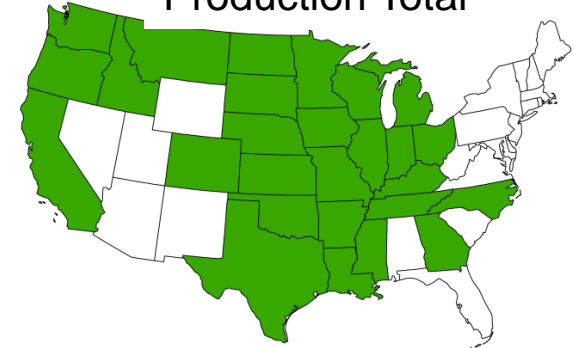
17 – all small grains

October Production



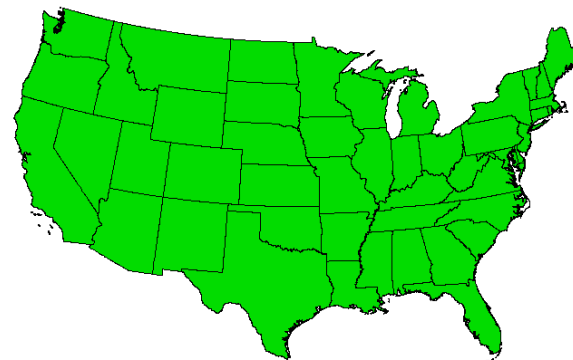
24 – all crops

Production Total



27 – operational

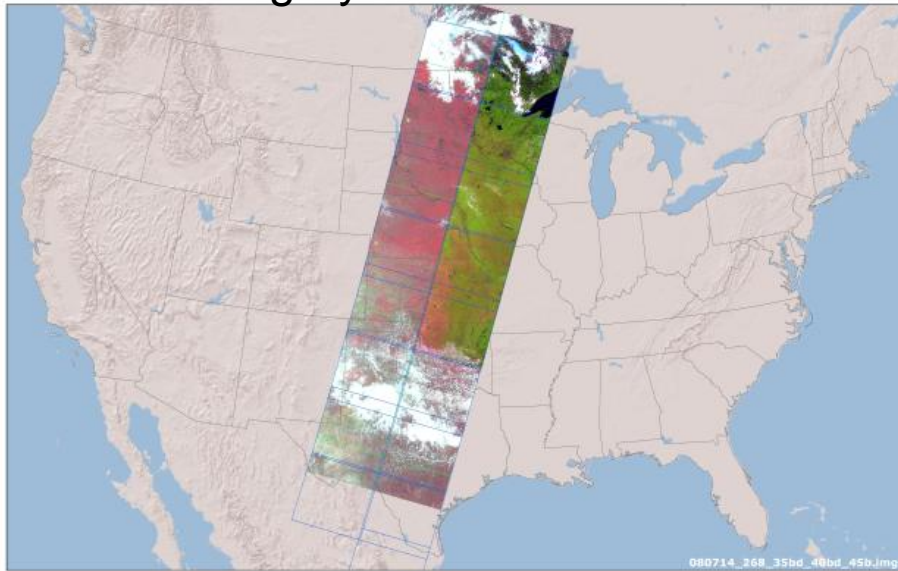
CDL 2011  
in-season production  
@ 30m



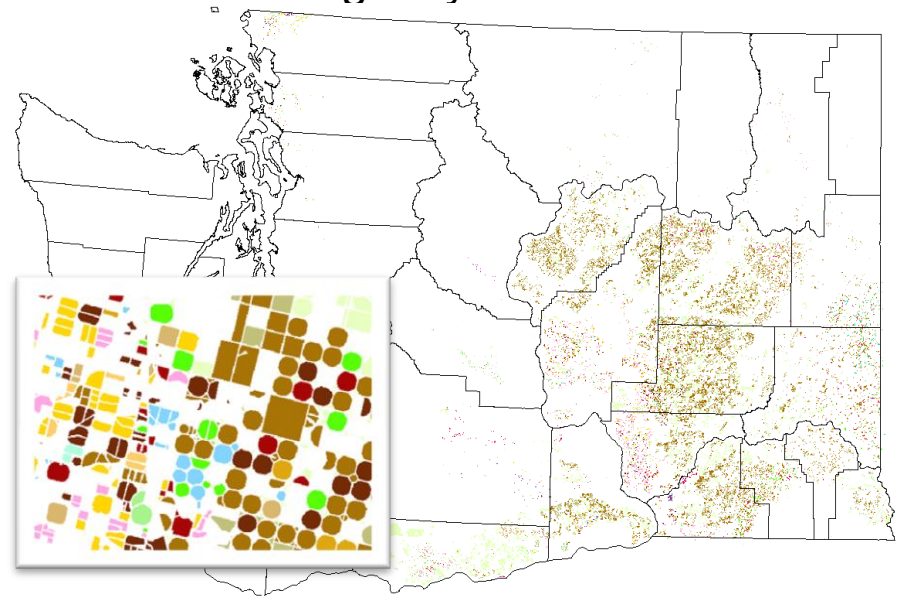
48 states  
post season  
@ 30m

# 2011 Cropland Data Layer Inputs

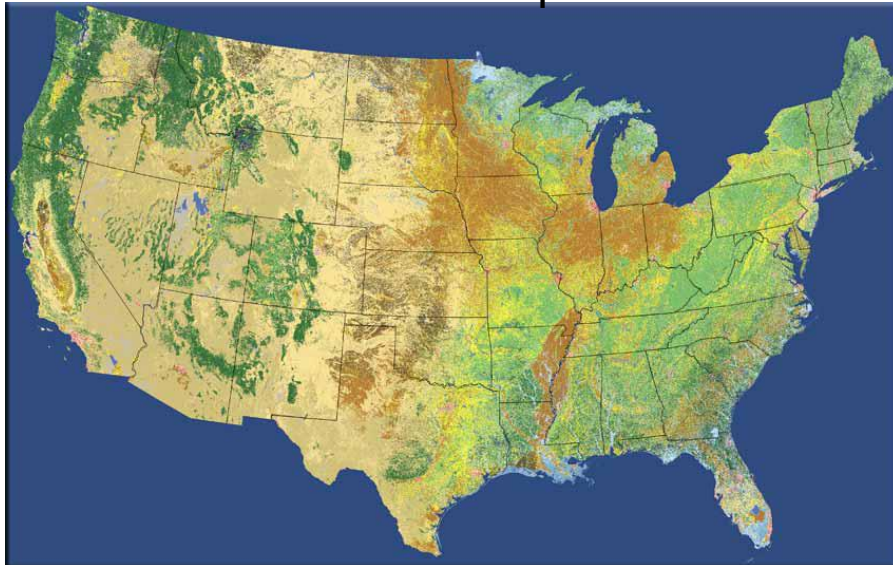
Satellite Imagery – DMC & Landsat



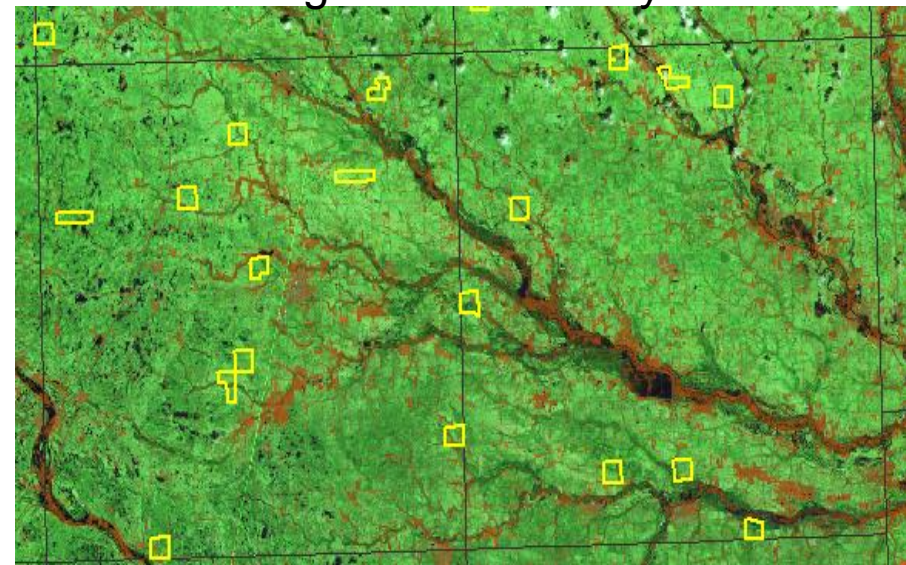
Farm Service Agency: Common Land Unit



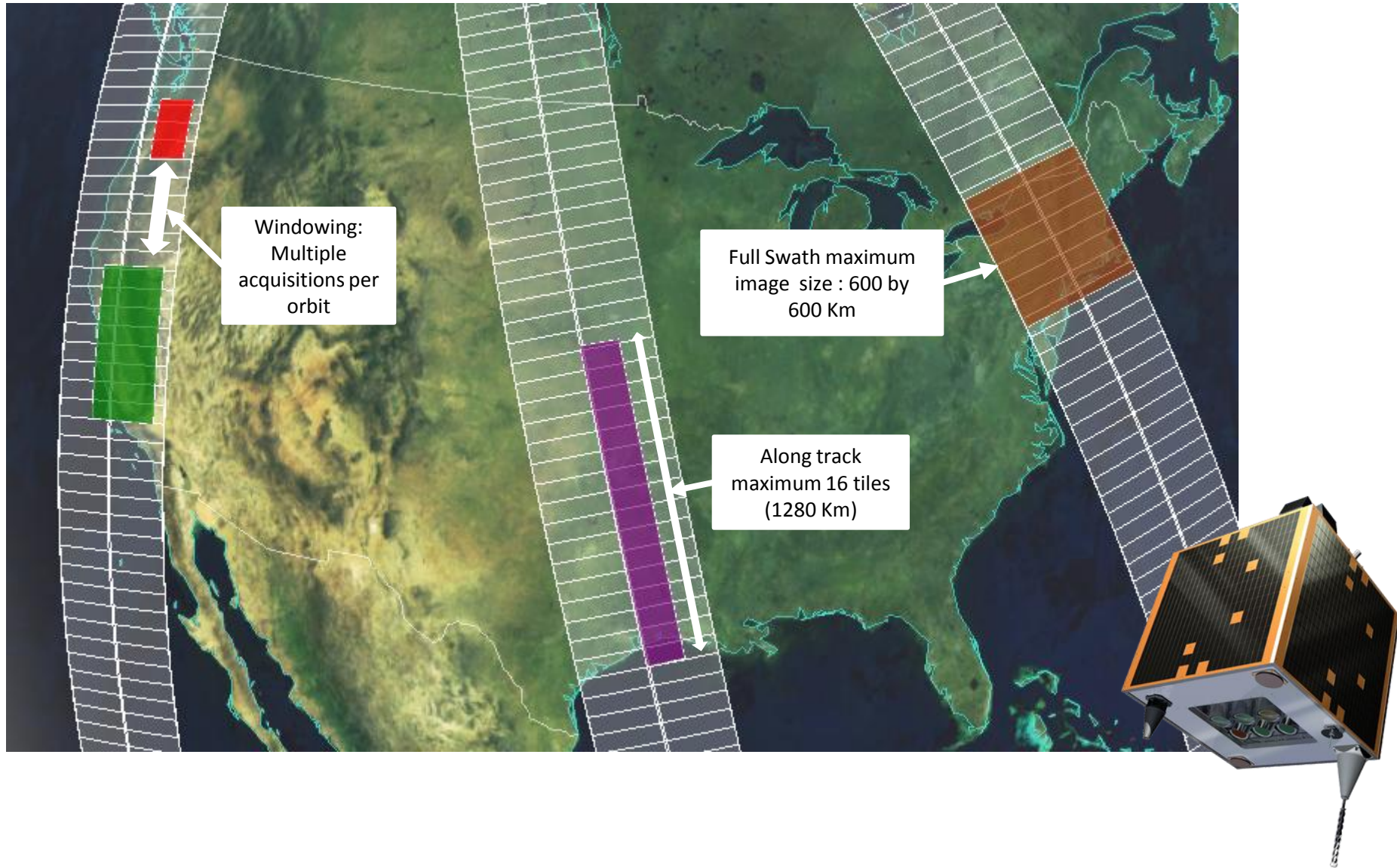
2006 NLCD & Derivative products



NASS June Agriculture Survey



# 2011 Deimos-1/UK2 Satellite Tasking





# Comparative Satellite Information

	Deimos-1/UK2	<del>AWiFS</del>	Landsat
Launch Date	Jul 2009	<del>Oct. 2003</del>	1984 & 1999
Resolution	22m	<del>56m</del>	30m
Spectral Bands	B2: 0.52 – 0.60 B3: 0.63 – 0.69 B4: 0.77 – 0.90	<del>B2: 0.52 - 0.59 B3: 0.62 - 0.68 B4: 0.77 - 0.86 B5: 1.55 - 1.70</del>	B2: 0.52 - 0.60 B3: 0.63 - 0.69 B4: 0.75 – 0.90 B5: 1.55 – 1.75
Swath	600km	<del>740km</del>	185km
Revisit Rate	4 Days	<del>5 Days</del>	16 Days
Radiometric Resolution	8 or 10 bit	<del>10 bit</del>	8 bit