

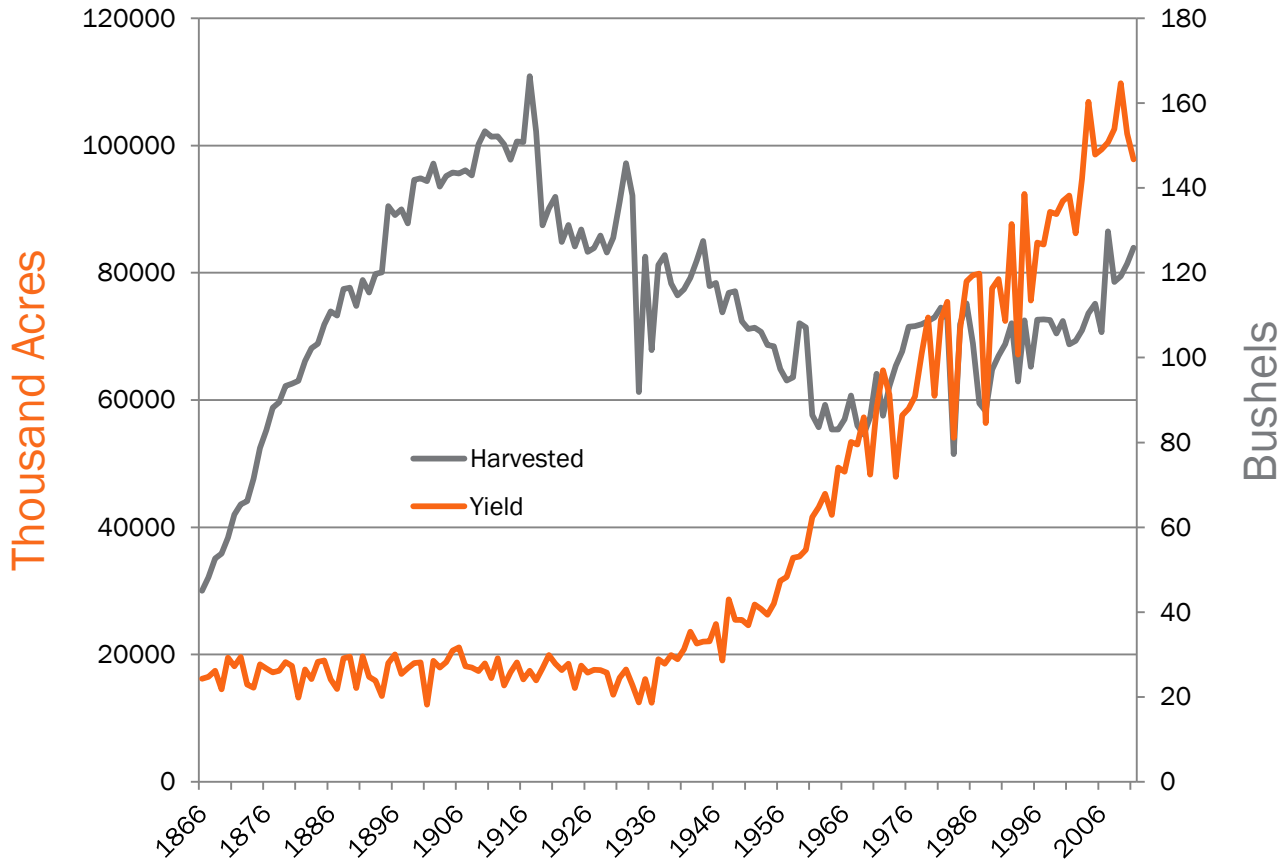


THE U.S. CROPLAND DATA LAYER

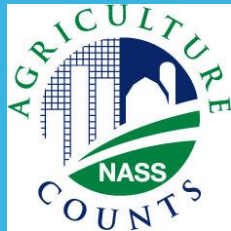
WINROCK INTERNATIONAL BIOENERGY WORKSHOP

Rick Mueller
USDA/National Agricultural Statistics Service
26 Jan. 2012

CORN HARVESTED ACRES & YIELD

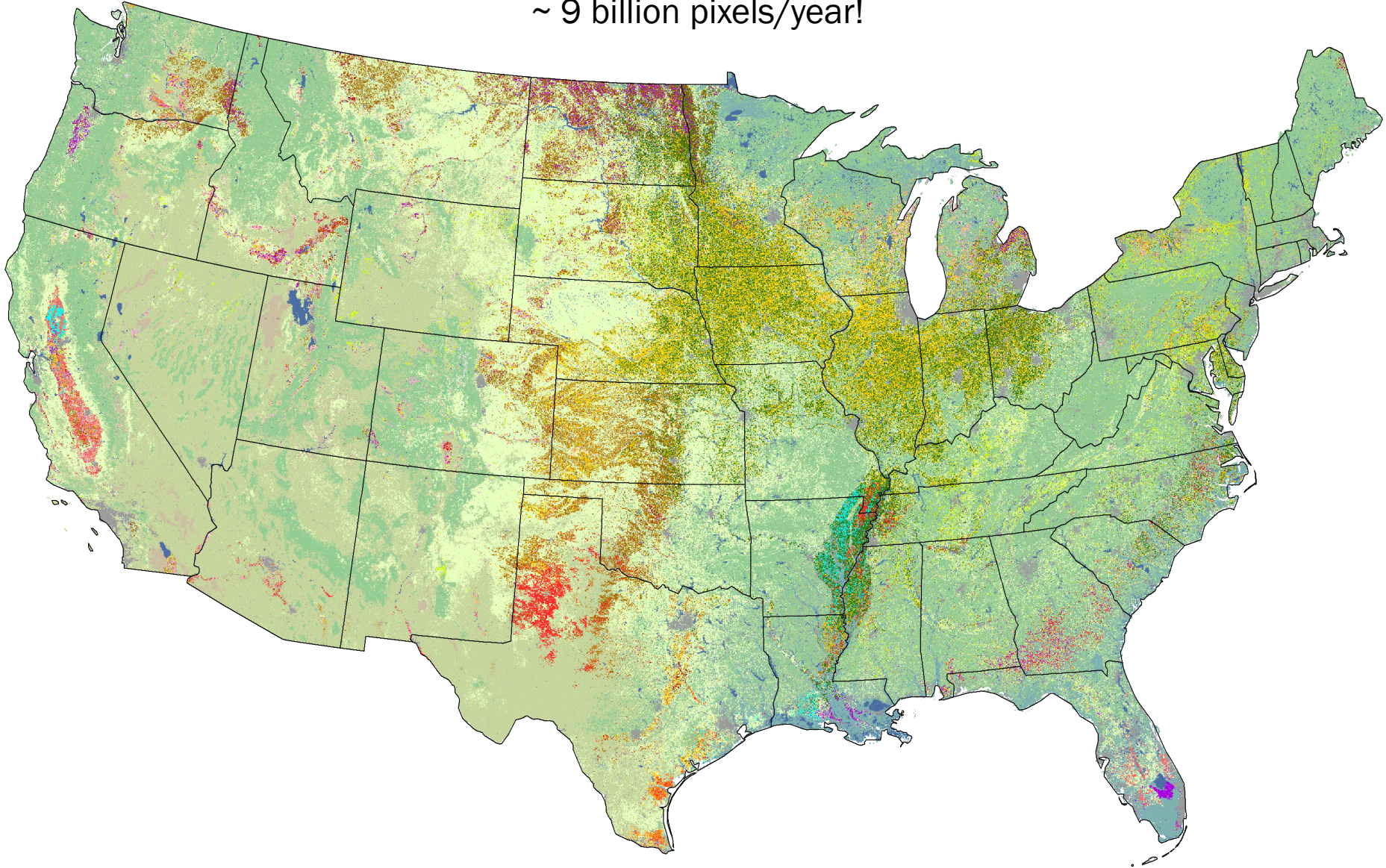


Official NASS statistics - www.nass.usda.gov/quickstats

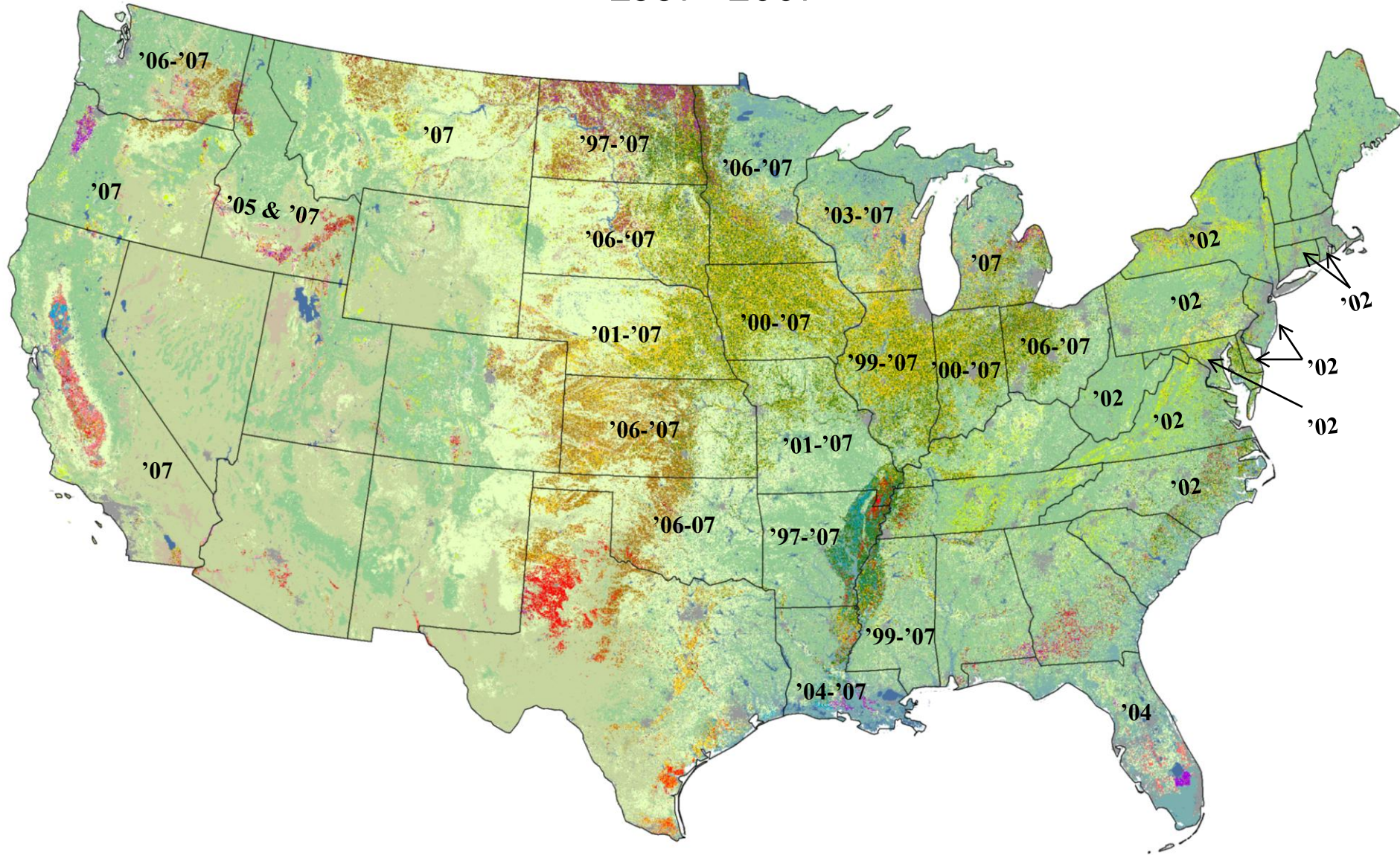


2008 – 2011 National Cropland Data Layers

~ 9 billion pixels/year!



Cropland Data Layers 1997 - 2007

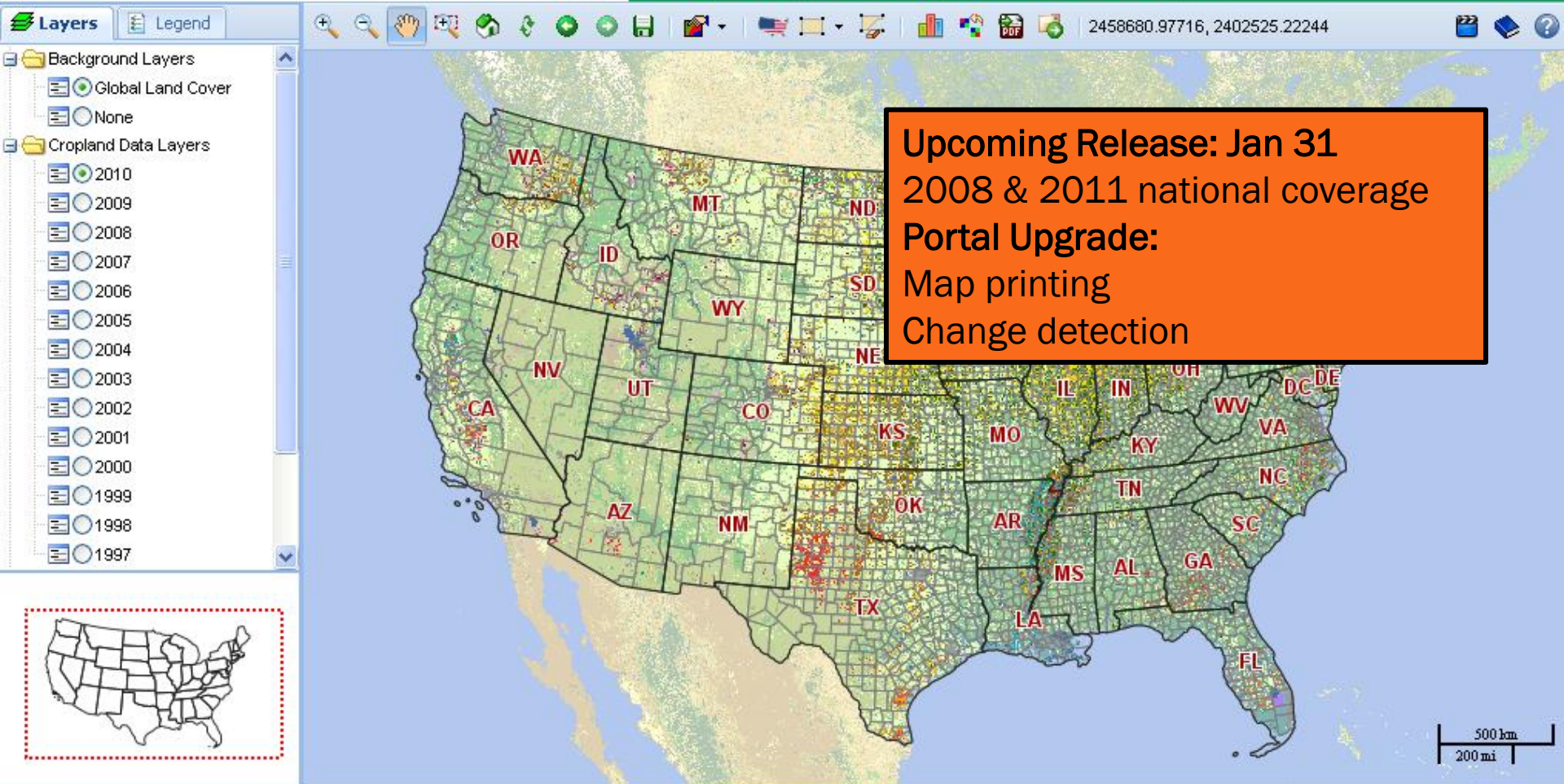


CROPLAND DATA LAYER (CDL) OBJECTIVES

- *Annually* cover major crops for conterminous United States
- 30m pixels @.22 acre/.09 hectares
- **Deliver in-season remote sensing acreage estimates**
 - For June, August, September, and October Official Production Reports
 - Update planted area/survey variance reduction
 - Reduce respondent burden
 - Basis for crop progress/condition/yield program monitoring
- **Provide timely, accurate, useful estimates**
 - Measurable error
 - Unbiased/independent estimator
 - State, District, County
- **CropScape dissemination portal**
 - Visualize, query, interactive web service



CROPSCAPE PORTAL



2010 Craighead County, Arkansas

Land Cover Categories

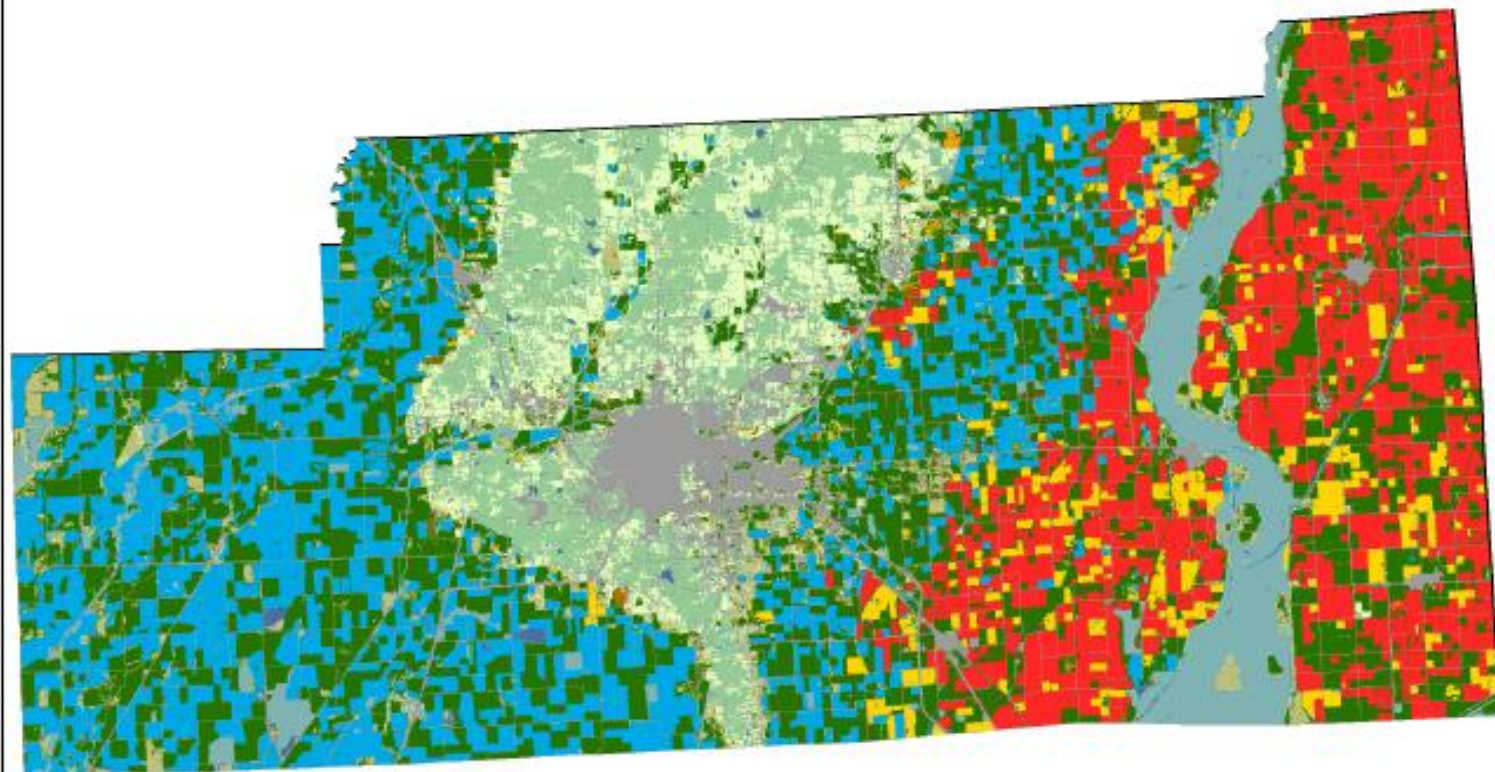
(by decreasing acreage)

AGRICULTURE*

- Soybeans
- Rice
- Cotton
- Corn
- Fallow/Idle Cropland
- Winter Wheat/Soybeans Dbl. Crop
- Sorghum
- Winter Wheat
- Oats
- Alfalfa
- Dbl. Crop Soybeans/Cotton
- Dbl. Crop Soybeans/Oats
- Other Crops
- Pecans
- Peaches
- Millet

NON-AGRICULTURE**

- Deciduous Forest
- Woody Wetlands
- Pasture/Hay
- Developed/Open Space
- Developed/Low Intensity
- Open Water

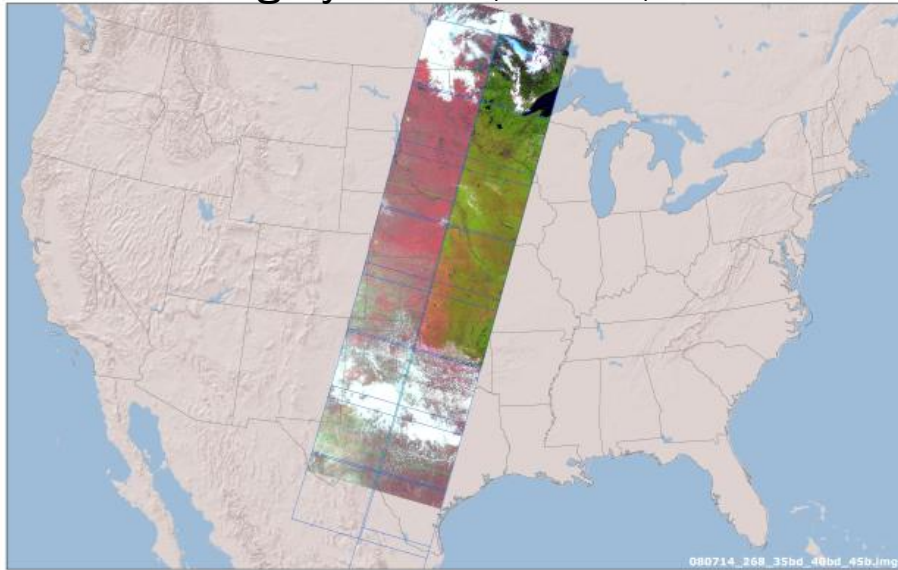


0 1.98 3.95 5.93
miles

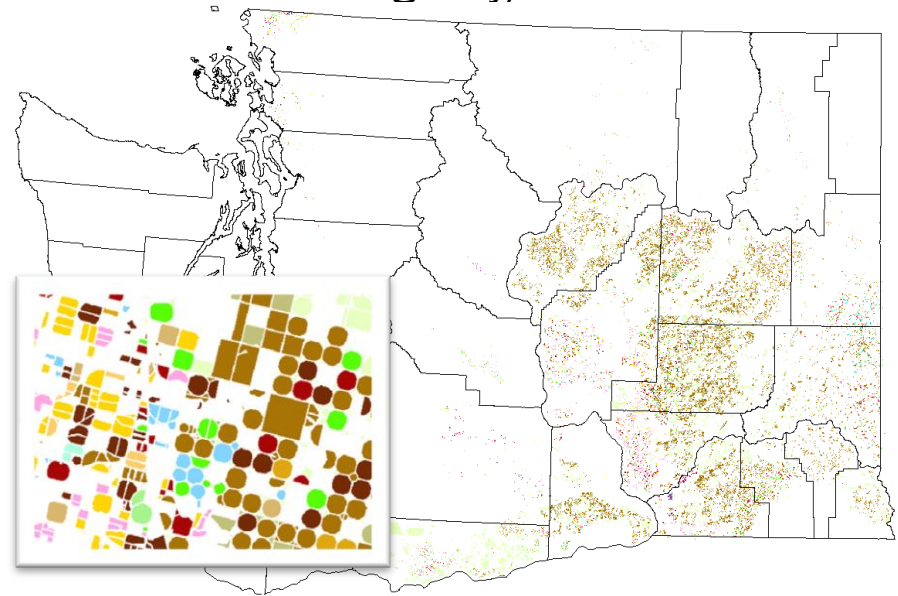


CROPLAND DATA LAYER INPUTS

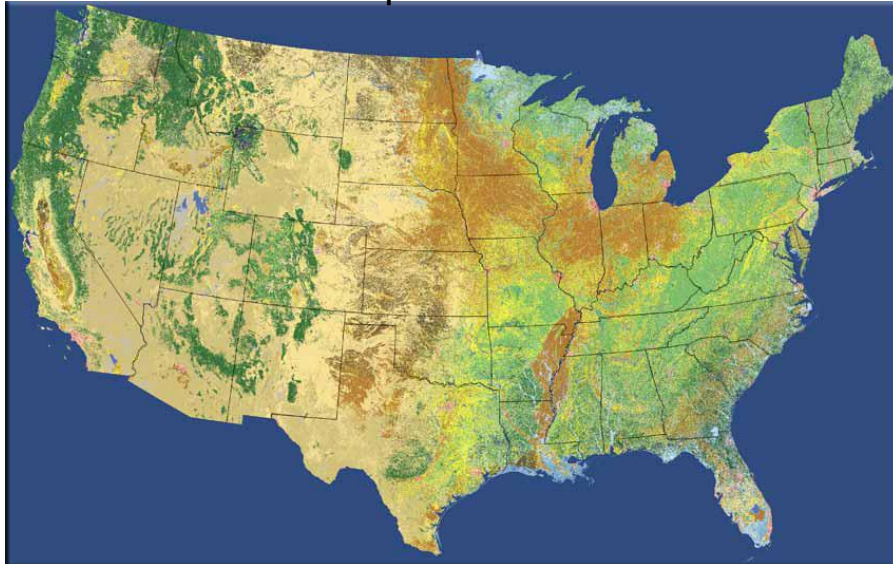
Satellite Imagery – DMC, AWiFS, & Landsat



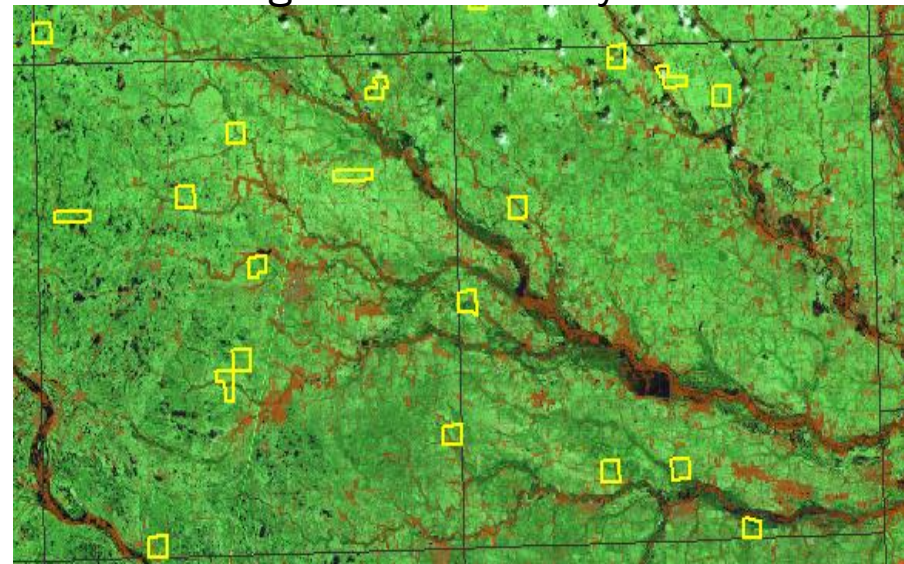
USDA Farm Service Agency/Common Land Unit



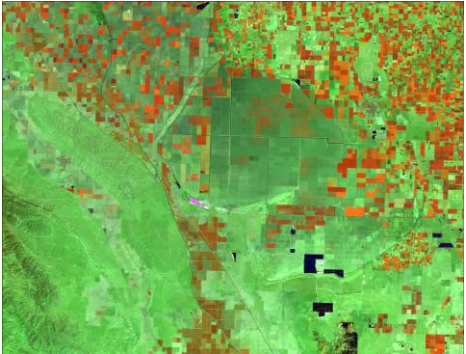
NLCD & Derivative products



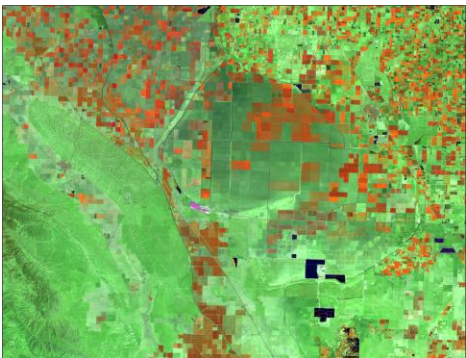
NASS June Agricultural Survey



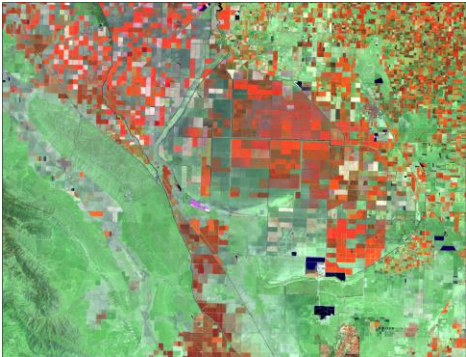
April



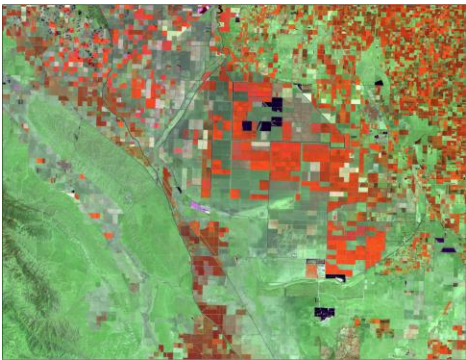
May



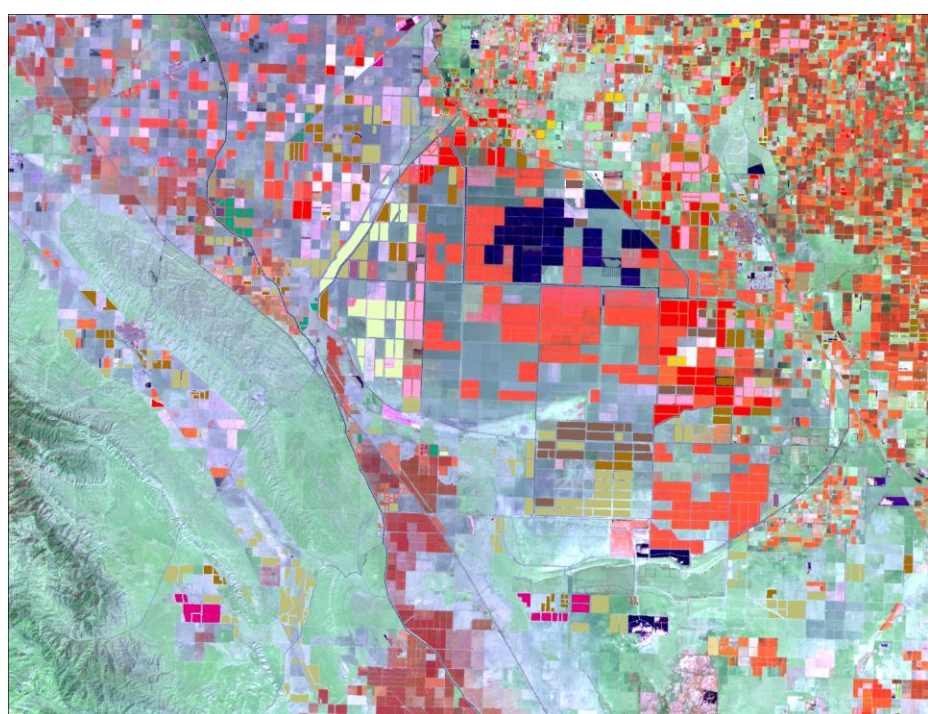
June



July



August

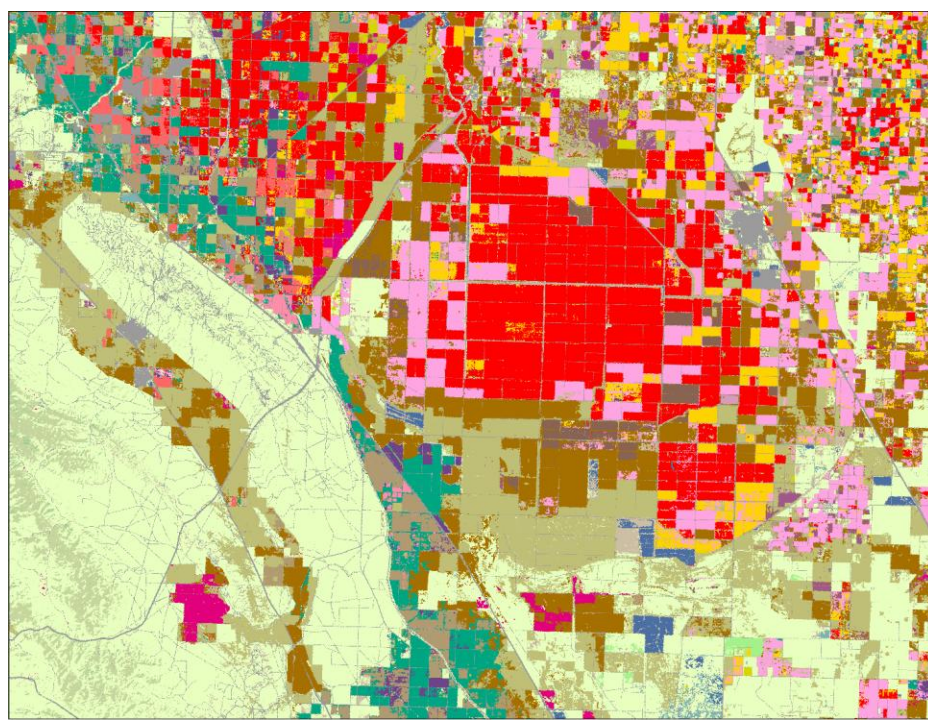


Land Cover Categories

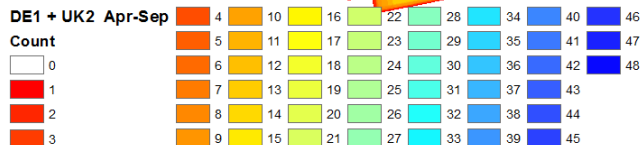
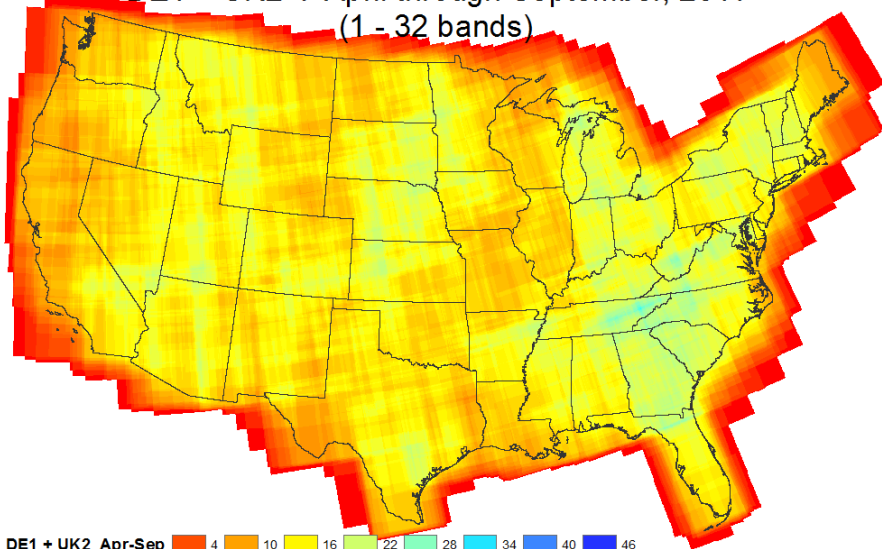
Agriculture

-  Pasture/Grass
-  Alfalfa
-  Fallow/Idle Cropland
-  Winter Wheat
-  Barley
-  Cotton
-  Almonds
-  Corn
-  Durum Wheat

Final
CDL



DE1 + UK2 : April through September, 2011
(1 - 32 bands)

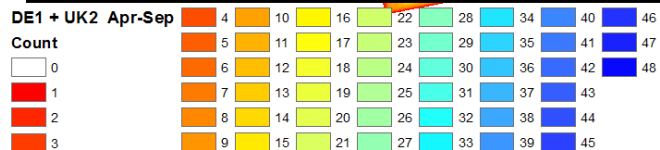
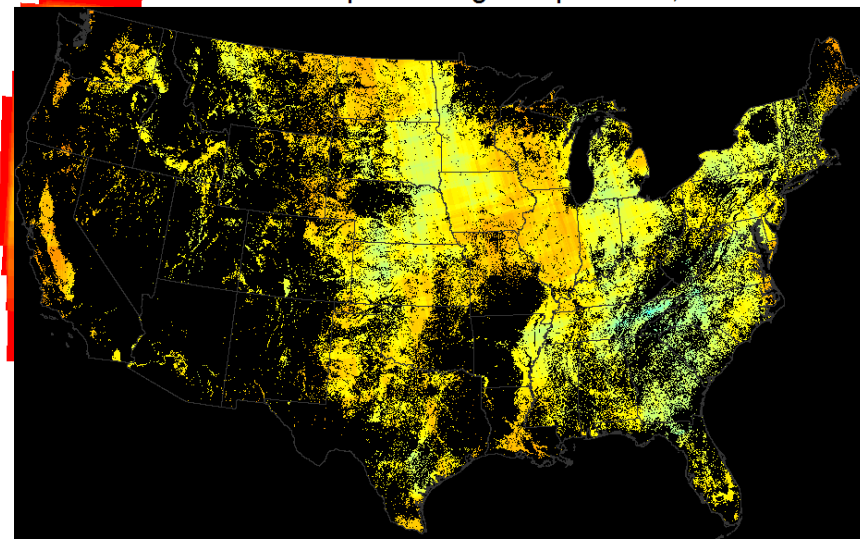


Unmasked

DISASTER MONITORING CONSTELLATION 2011 COVERAGE

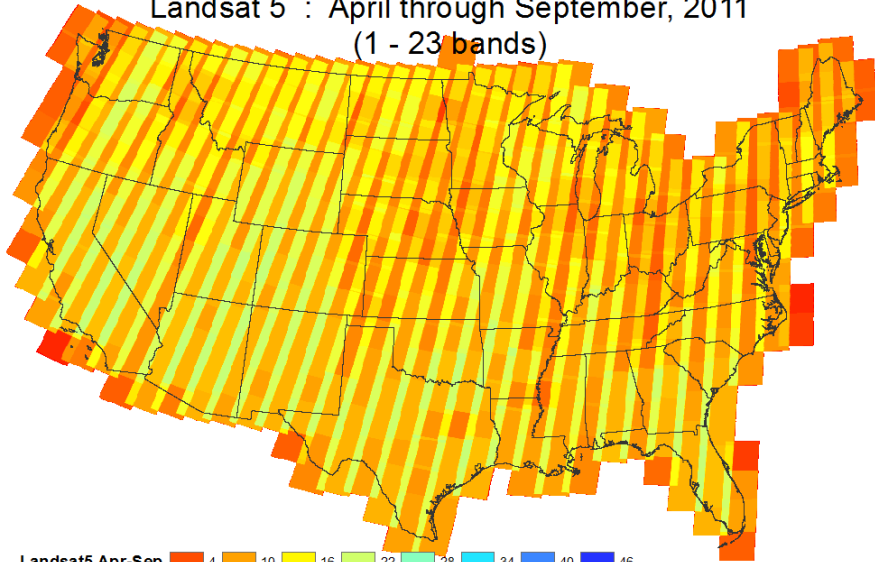
Deimos-1 & UK2

DE1 + UK2 : April through September, 2011



Ag Mask

Landsat 5 : April through September, 2011
(1 - 23 bands)

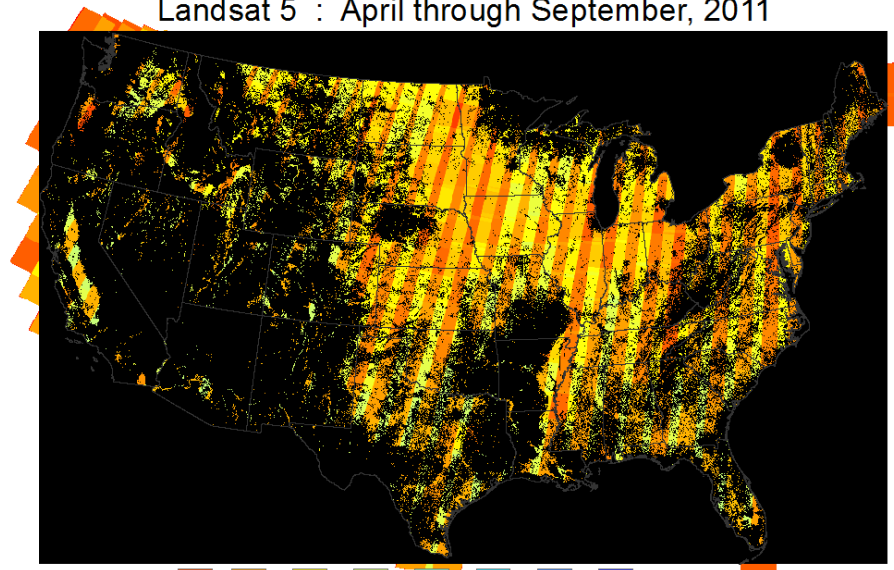


Landsat5 Apr-Sep	4	10	16	22	28	34	40	46
Count	5	11	17	23	29	35	41	47
	6	12	18	24	30	36	42	48
	7	13	19	25	31	37	43	
	8	14	20	26	32	38	44	
	9	15	21	27	33	39	45	

Unmasked

LANDSAT 5 2011 COVERAGE

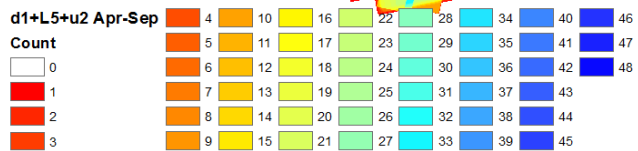
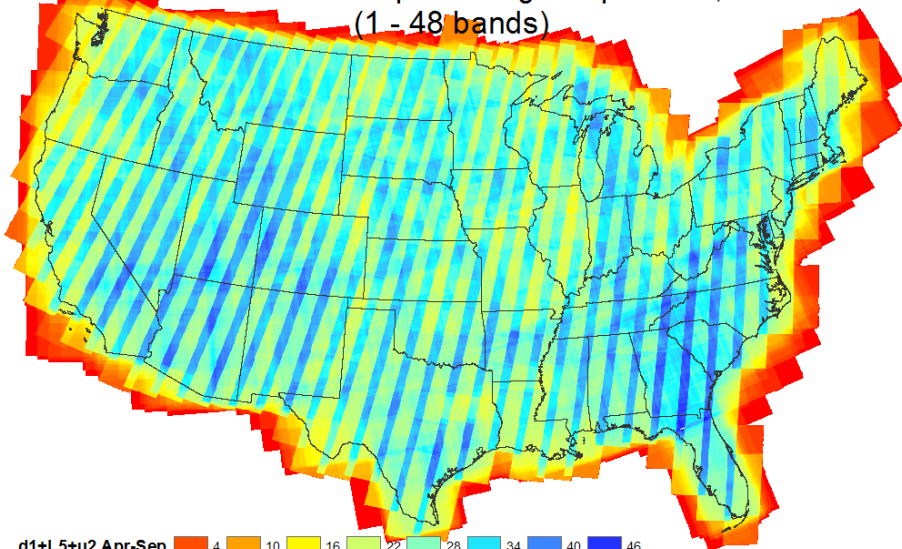
Landsat 5 : April through September, 2011



Landsat5 Apr-Sep	4	10	16	22	28	34	40	46
Count	5	11	17	23	29	35	41	47
	6	12	18	24	30	36	42	48
	7	13	19	25	31	37	43	
	8	14	20	26	32	38	44	
	9	15	21	27	33	39	45	

Ag Mask

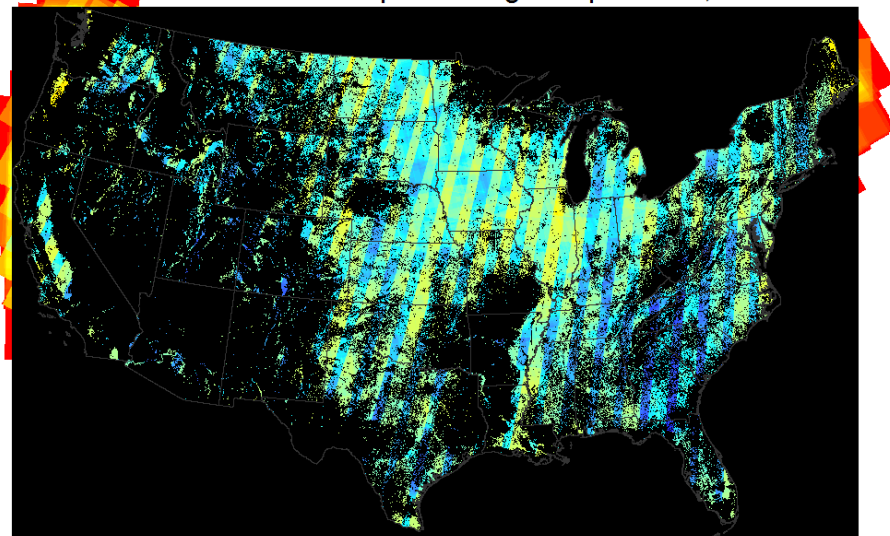
DE1 + UK2 + L5 : April through September, 2011
(1 - 48 bands)



Unmasked

DMC & LANDSAT 5 2011 COVERAGE

DE1 + UK2 + L5 : April through September, 2011



Ag Mask

GROUND TRUTH – LAND COVER

AGRICULTURE GROUND TRUTH

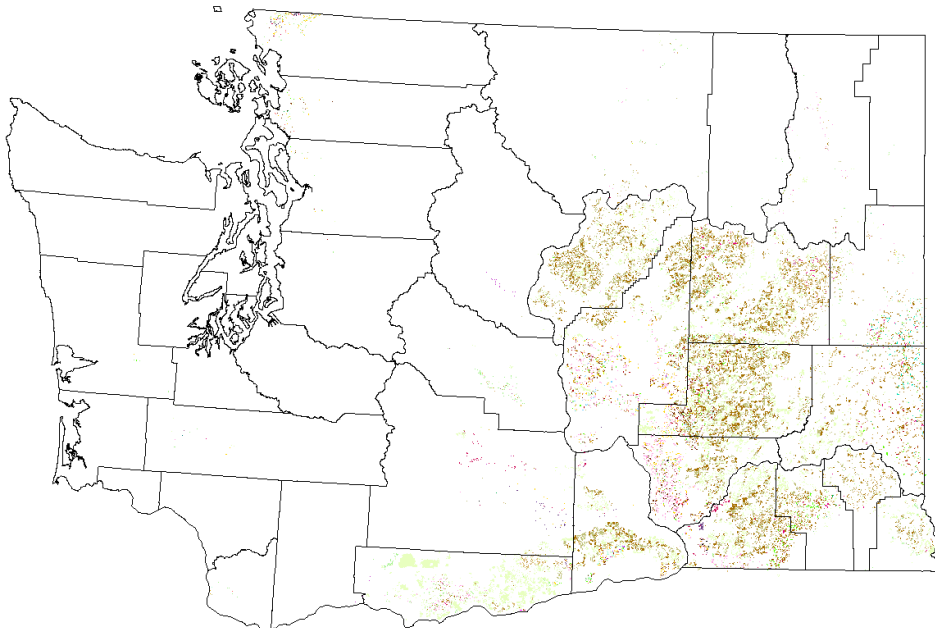
Provided by Farm Service Agency

Identifies known fields and crops

Divide known fields into 2 sets

70% used for training software

30% used for validating results



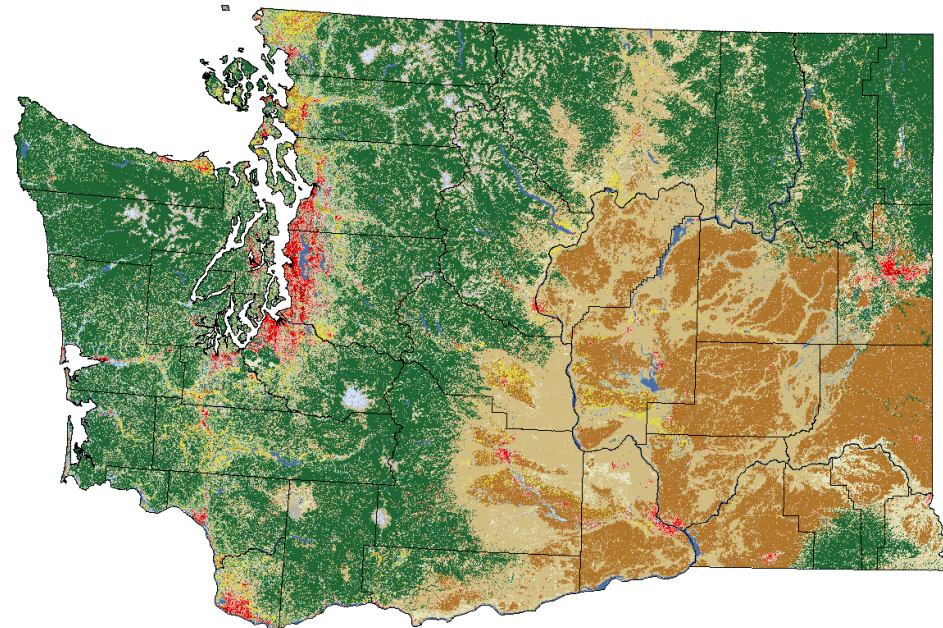
NON-AGRICULTURE GROUND TRUTH

U.S. Geological Survey

National Land Cover Dataset

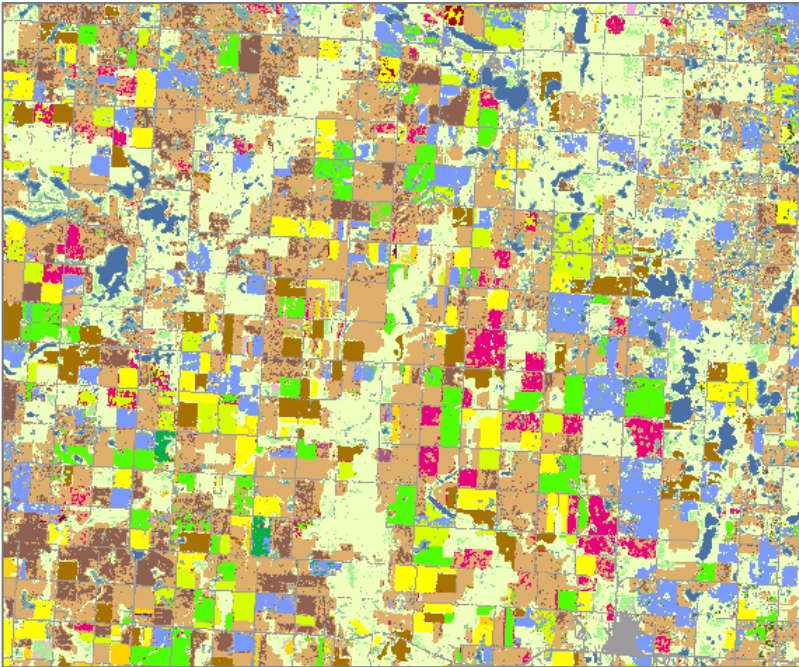
**Identifies urban infrastructure
and non-agriculture land cover**

Forest, grass, water, cities

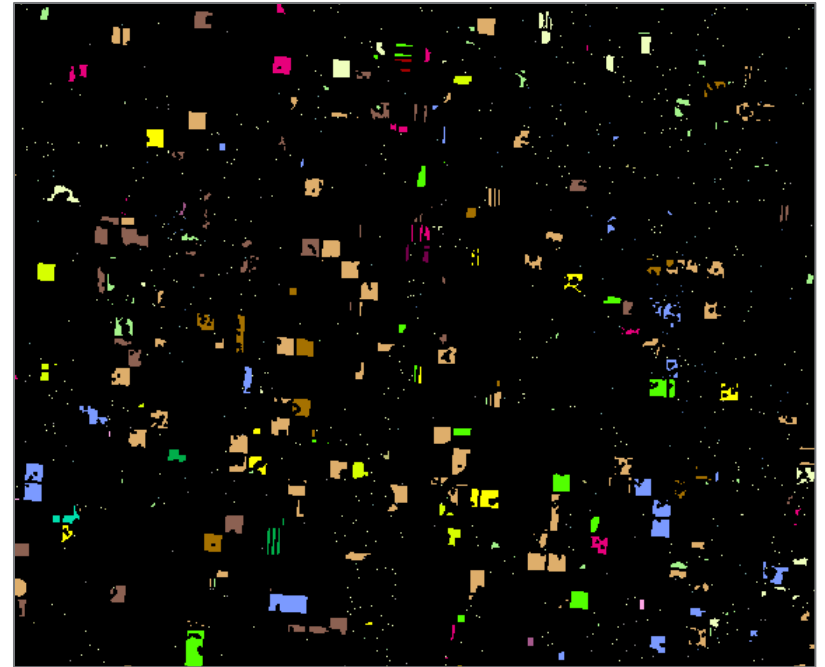


CDL ACCURACY ASSESSMENT

Each classification tested against independent set of ground truth data to determine overall and within class accuracies



Example classification subset



Example validation subset

ACCURACY STATISTICS

Crop-specific covers only	*Correct	Accuracy	Error	Kappa
OVERALL ACCURACY**	2368649	83.10%	16.90%	0.7891

Cover Type	Attribute Code	*Correct Pixels	Producer's Accuracy	Omission Error	Kappa	User's Accuracy	Commission Error	Cond'l Kappa
Corn	1	460221	93.78%	6.22%	0.9272	94.47%	5.53%	0.9351
Sorghum	4	63253	57.82%	42.18%	0.5677	77.37%	22.63%	0.7660
Soybeans	5	1870	48.85%	51.15%	0.4882	94.02%	5.98%	0.9401
Sunflower	6	26389	61.28%	38.72%	0.6087	74.09%	25.91%	0.7375
Sweet Corn	12	905	54.75%	45.25%	0.5474	92.73%	7.27%	0.9272
Barley	21	7877	66.47%	33.53%	0.6636	71.55%	28.45%	0.7145
Durum Wheat	22	0	n/a	n/a	n/a	0.00%	100.00%	0.0000
Spring Wheat	23	2286	48.46%	51.54%	0.4839	49.02%	50.98%	0.4895
Winter Wheat	24	817165	92.79%	7.21%	0.9030	95.50%	4.50%	0.9389
Rye	27	285	14.57%	85.43%	0.1455	31.39%	68.61%	0.3135
Oats	28	4483	33.63%	66.37%	0.3344	47.41%	52.59%	0.4720
Millet	29	70479	79.66%	20.34%	0.7900	66.96%	33.04%	0.6606
Speltz	30	85	85.00%	15.00%	0.8500	49.13%	50.87%	0.4913
Canola	31	0	n/a	n/a	n/a	0.00%	100.00%	0.0000
Flaxseed	32	0	n/a	n/a	n/a	0.00%	100.00%	0.0000
Safflower	33	577	31.26%	68.74%	0.3120	19.97%	80.03%	0.1992
Alfalfa	36	174154	72.85%	27.15%	0.7109	85.82%	14.18%	0.8472
Other Hay	37	54825	39.87%	60.13%	0.3862	80.78%	19.22%	0.7995
Sugarbeets	41	4381	80.64%	19.36%	0.8061	83.04%	16.96%	0.8301
Dry Beans	42	12029	68.64%	31.36%	0.6844	54.83%	45.17%	0.5459
Potatoes	43	12742	85.17%	14.83%	0.8511	91.00%	9.00%	0.9096
Other Crops	44	0	0.00%	100.00%	0.0000	n/a	n/a	n/a
Misc. Veggies. & Fruits	47	0	n/a	n/a	n/a	0.00%	100.00%	0.0000
Watermelons	48	25	6.35%	93.65%	0.0634	39.68%	60.32%	0.3968

Producer's Accuracy: relates to the probability that a ground truth pixel will be correctly mapped and measures errors of omission

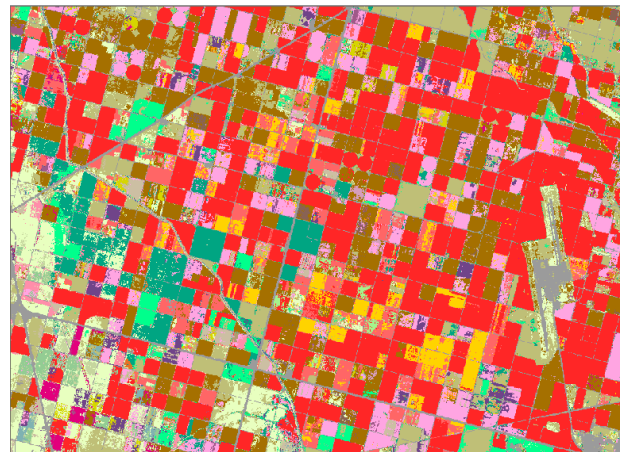
Errors of Omission: occur when a pixel is excluded from the correct category

User's Accuracy: indicates the probability that a pixel from classification actually matches the ground truth data and measures errors of commission

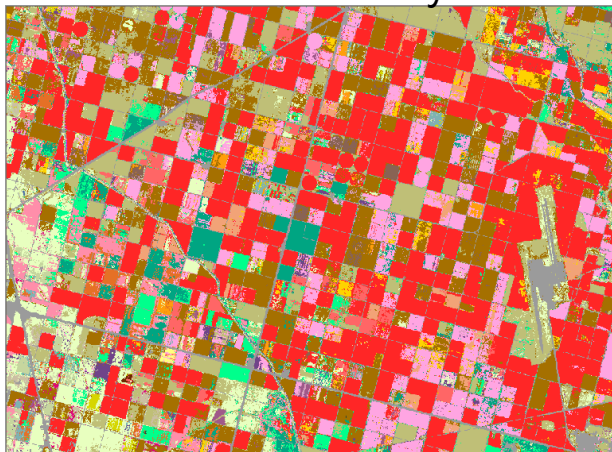
Errors of Commission: occur when a pixel is included in an incorrect category

CALIFORNIA

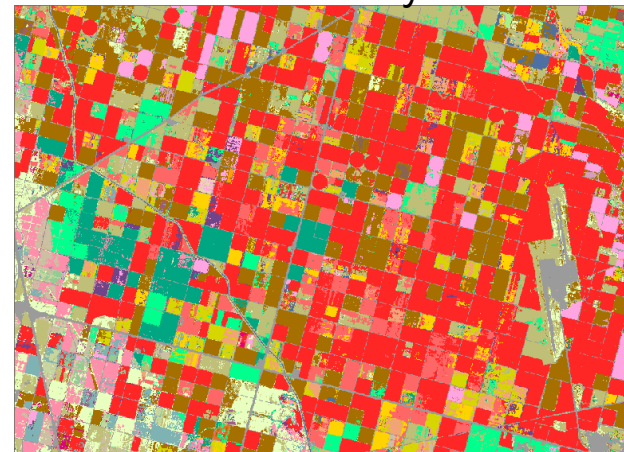
Landsat & DMC



Landsat Only



DMC Only



Producer User

	Producer	User
ALL CROPS	85.1%	
Corn	91.4%	90.1%
Rice	99.1%	99.7%
Cotton	97.4%	94.9%
W. Wheat	84.9%	88.0%
Alfalfa	92.7%	90.4%
Fallow/Idle	79.2%	73.1%

Producer User

	Producer	User
ALL CROPS	82.5%	
Corn	88.5%	89.0%
Rice	99.0%	99.8%
Cotton	95.8%	90.8%
W. Wheat	82.8%	85.5%
Alfalfa	91.7%	88.5%
Fallow/Idle	76.3%	67.6%

Producer User

	Producer	User
ALL CROPS	76.4%	
Corn	90.6%	89.9%
Rice	98.9%	99.1%
Cotton	97.3%	94.5%
W. Wheat	83.6%	79.5%
Alfalfa	92.8%	82.4%
Fallow/Idle	79.0%	45.4%

211 bands – North
215 bands – South

151 bands – North
135 bands – South

99 bands – North
93 bands – South

SWITCHGRASS IN SOUTH DAKOTA

State switchgrass proportions

State	% of 2011
SD	24.82%
TX	18.21%
IA	12.65%
MI	12.33%
MO	8.05%
OK	5.23%
MN	4.06%
NY	2.93%
MS	1.89%
PA	1.77%
OH	1.71%
IL	1.50%
CO	1.07%
TN	0.78%
WI	0.67%
LA	0.42%
IN	0.38%
AL	0.36%
KS	0.26%
NC	0.21%
VA	0.19%
NY	0.19%
MD	0.10%
WA	0.06%
ND	0.06%
KY	0.05%
MT	0.04%

2010 South Dakota Land Cover Categories (by decreasing acreage)

- AGRICULTURE**
- Pasture/Grass
- Corn
- Soybeans
- Other Hay/Non Alfalfa
- Spring Wheat
- Winter Wheat
- Alfalfa
- Sunflower
- Fallow/Idle Cropland
- Sorghum
- Millet
- Oats
- Barley
- Safflower
- Durum Wheat
- Peas
- Flaxseed
- Dry Beans
- Sod/Grass Seed
- Rye
- Herbs
- Pop or Orn Corn
- Triticale
- Canola
- Lentils
- Dbl Crop WinWht/Corn
- Switchgrass
- Other Crops
- Dbl Crop WinWht/Sorghum
- Dbl Crop Corn/Soybeans
- Clover/Wildflowers
- Camelina
- Dbl Crop WinWht/Soybeans
- Apples
- Sweet Corn
- Potatoes
- Pumpkins
- NON-AGRICULTURE**
- Forest
- Developed
- Water
- Wetlands
- Barren
- Shrubland

2010 CDL Pixel Counts

2010 Cropland Data Layer Statistics for South Dakota

Note: Pixel and acreage counts are not official estimates.

Value	Category	Pixel Counts	Acreage
60	Switchgrass	1908	424.3

CDL Conversion to Switchgrass '10 vs. '09

2010	2009	Pixel Counts	Acreage
Switchgrass	Corn	34	26.3
Switchgrass	Sorghum	1	0.8
Switchgrass	Soybeans	11	8.5
Switchgrass	Spring Wheat	1	0.8
Switchgrass	Winter Wheat	7	5.4
Switchgrass	Alfalfa	2	1.5
Switchgrass	Other Hays	15	11.6
Switchgrass	Wetlands	1	0.8
Switchgrass	NLCD - Open Water	1	0.8
Switchgrass	NLCD - Developed/Open Space	7	5.4
Switchgrass	NLCD - Grassland Herbaceous	167	129.4
Switchgrass	NLCD - Pasture/Hay	288	223.2
Switchgrass	NLCD - Woody Wetlands	1	0.8
Switchgrass	NLCD - Herbaceous Wetlands	8	6.2

South Dakota 2010 CDL

Regression-based Acreage Estimator

Acreage not just about counting pixels

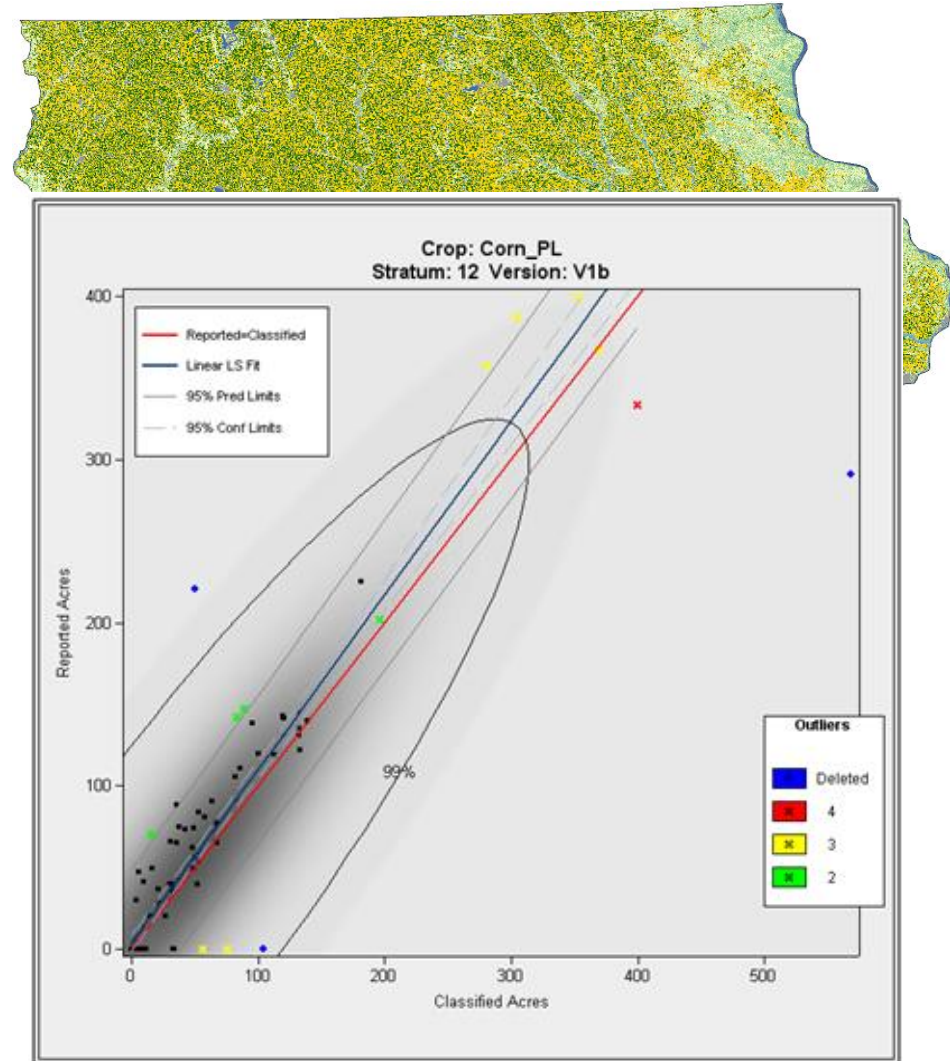
Simple Linear Regression

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

Outlier segment detection - removal from regression analysis

Using regression results in estimates reduces error rates over using JAS alone

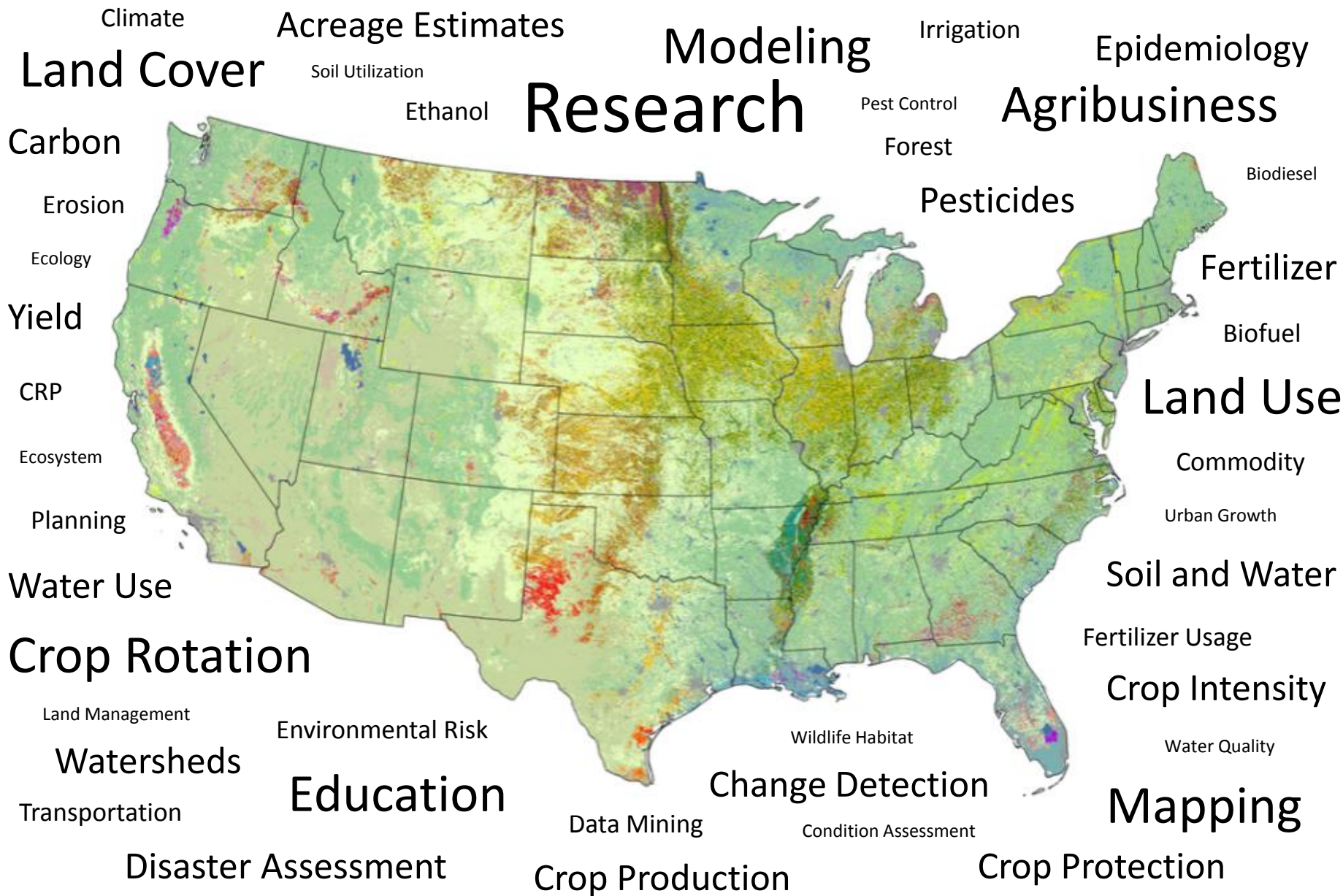


Estimate 17 crops in 39 states

HOW COMPETITIVE ARE THE REMOTE SENSING INDICATIONS FOR PLANTED ACRES?

Highly Competitive	Moderately Competitive	Not in the Game
Corn	Alfalfa	Other Hay
Soybeans	Sorghum	Fruits
Winter Wheat	Sugarcane	Vegetables
All Cotton	Barley	Small Area Crops
Spring Wheat	Oats	
Fall Potatoes	Tobacco	
All Rice		
Sugarbeets		
Peanuts		
Durum Wheat		
All Dry Beans		
Sunflower		
Canola		

NASS Cropland Data Layer Applications



CROPLAND DATA LAYER SUMMARY

Operational Program

- Timely estimate delivery
- Measureable statistical error
- Set national/regional/county acreage estimates

Components

- DMC/AWiFS/Landsat imagery
- Farm Service Agency/Common Land Unit
- USGS NLCD/ancillary layers
- June Agricultural Survey

Leverage

- CDL program paramount to other NASS geospatial activities
- Partnerships with cooperating agencies critical for success
- Heavy reliance on satellites and information technology

Distribution

- CropScape Portal
- NRCS Data Gateway

