

# Change in California Farmland Using Cropland Data Layer

2007 vs. 2009

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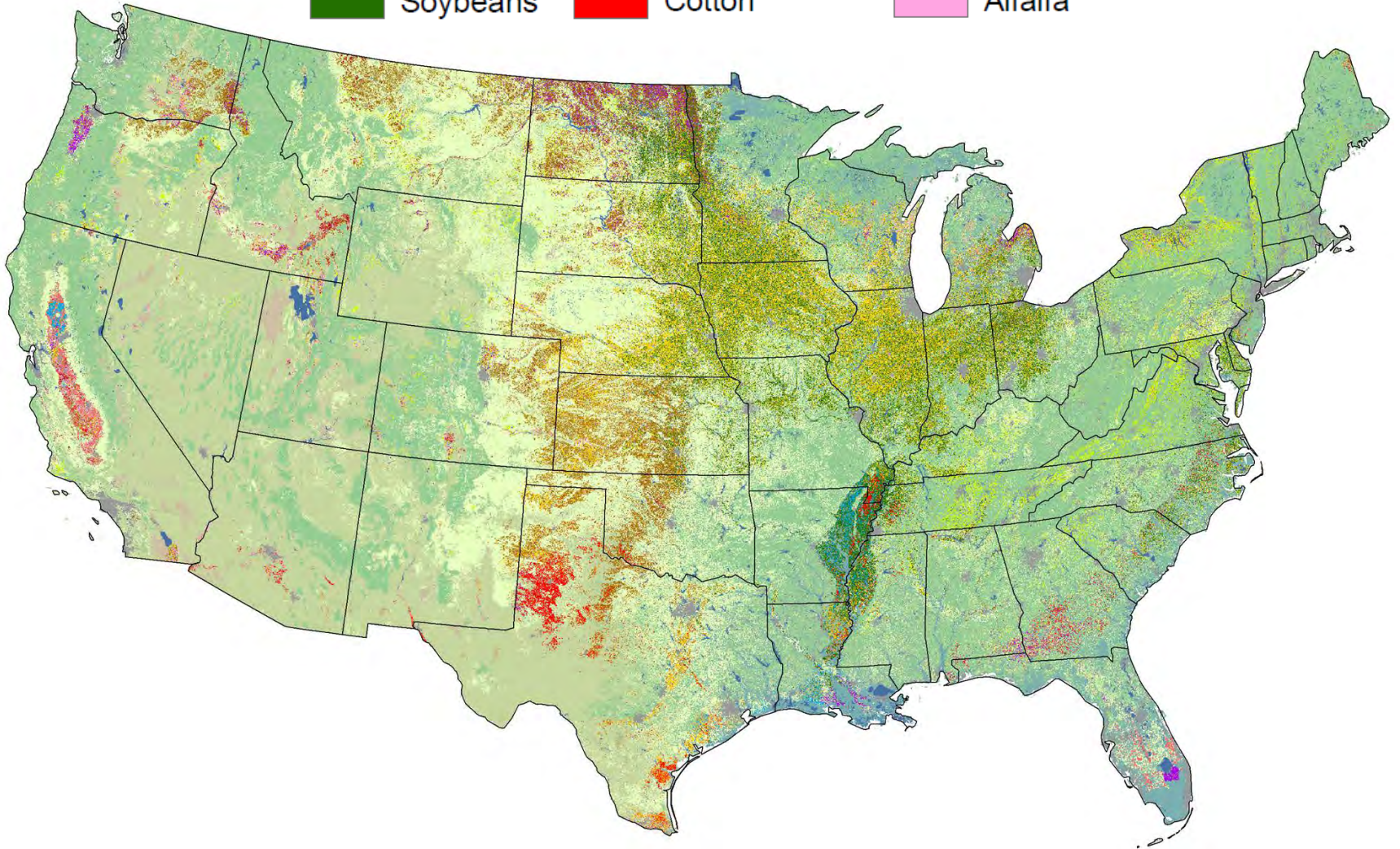
# What is a Crop Land Data Layer (CDL)?

A tool to identify agriculture type and location

Each pixel represents a type of crop or land cover

A sample:

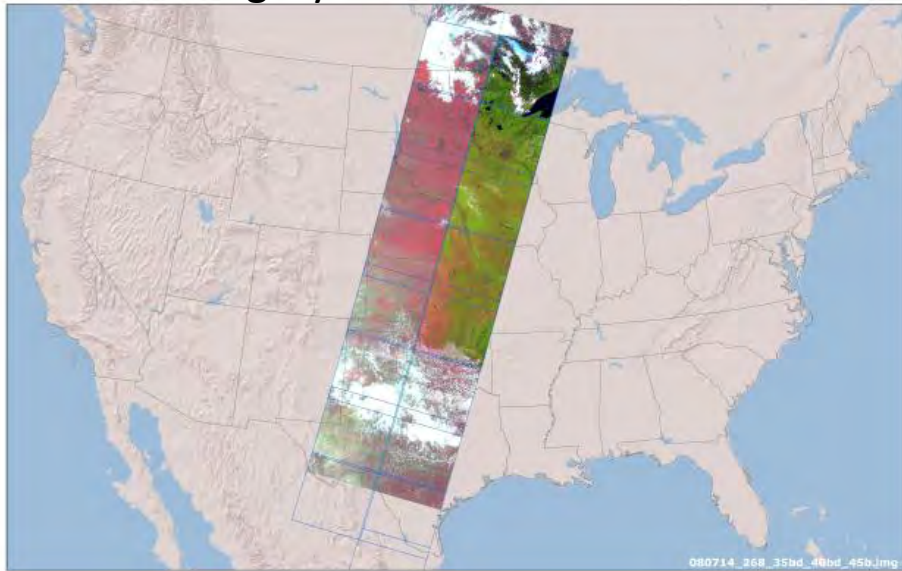
	Corn		Winter Wheat		Rice
	Soybeans		Cotton		Alfalfa



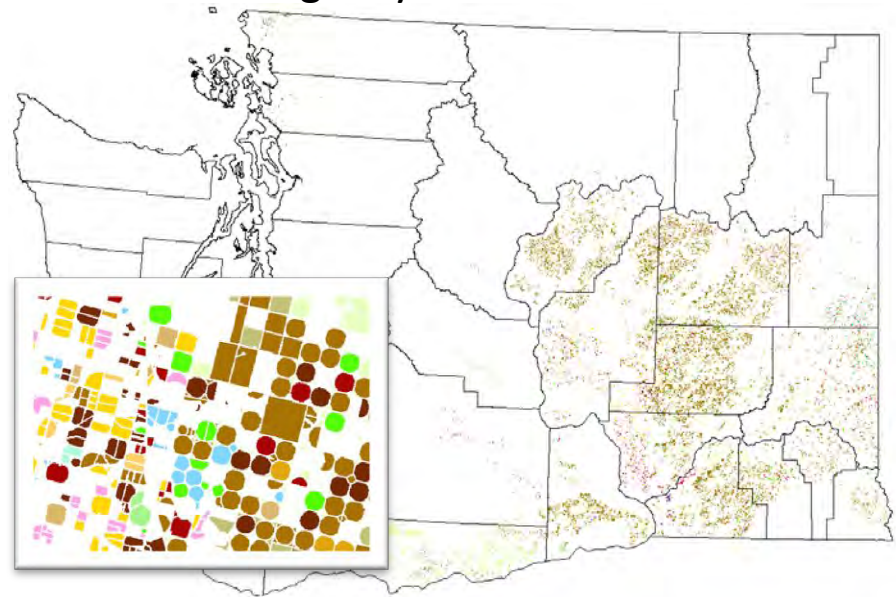


# Inputs

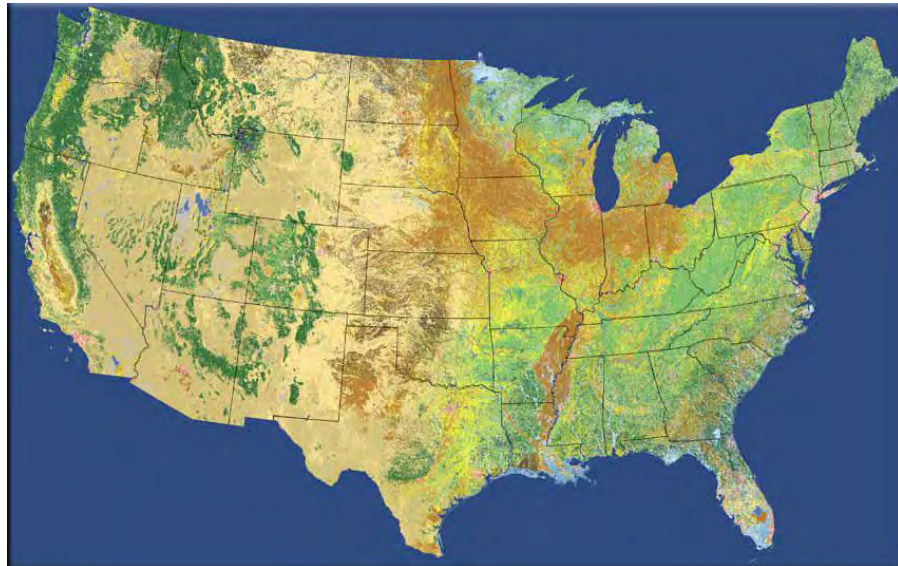
Satellite Imagery - AWiFS & Landsat TM



Farm Service Agency – Common Land Unit

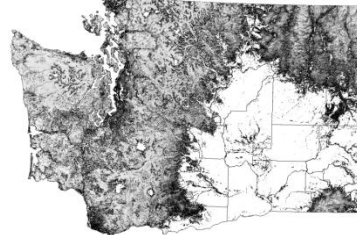


NLCD

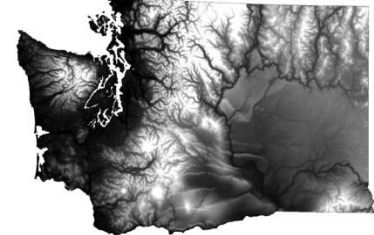


NLCD Derivative Products

Forest Canopy



Elevation



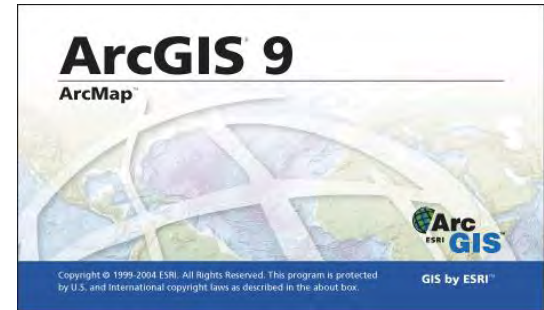
Impervious



# Software Suite

## Ground Truth Preparation

- ESRI ArcMap



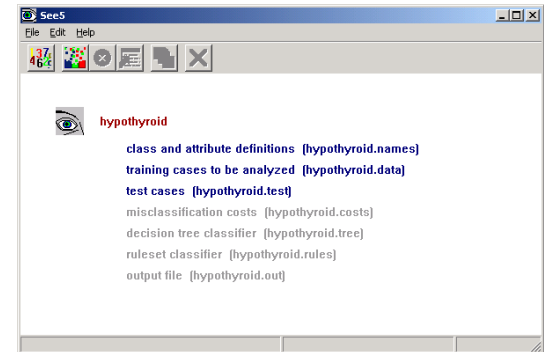
## Image Preparation

- Leica Geosystems ERDAS Imagine 9.1



## Image Classification

- See 5



## Acreage Estimates

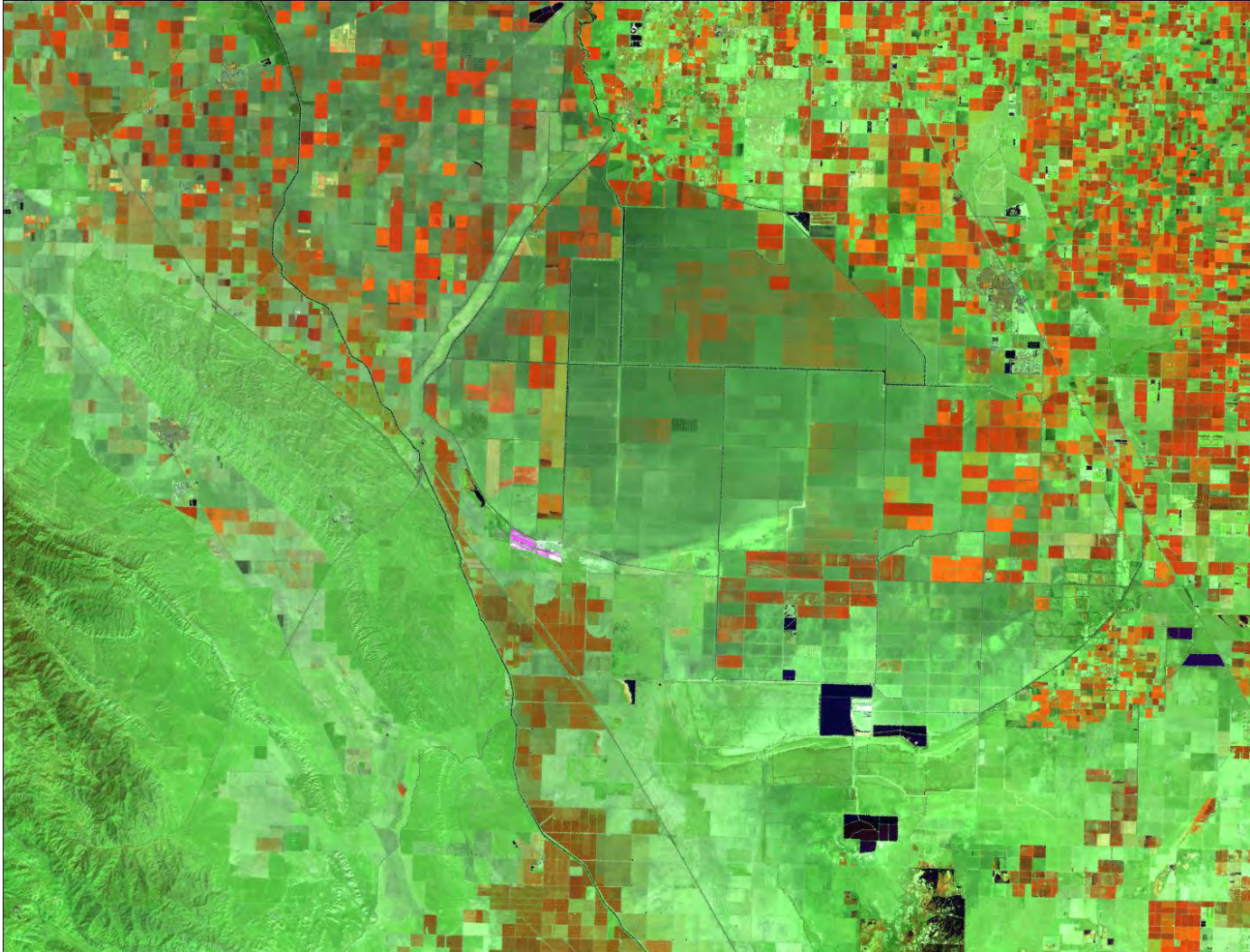
- SAS/IML Workshop





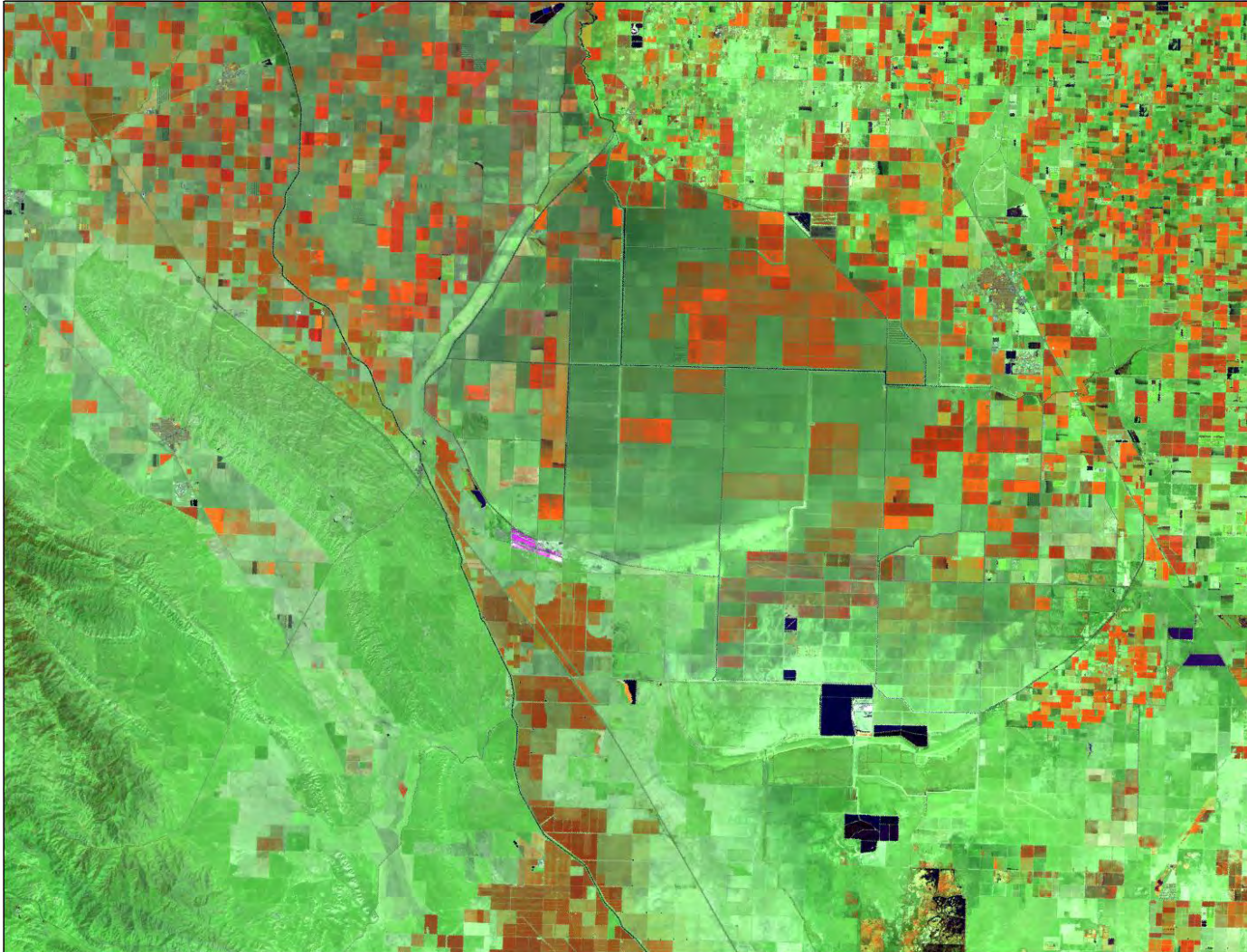
# Landsat TM

## April 23, 2009





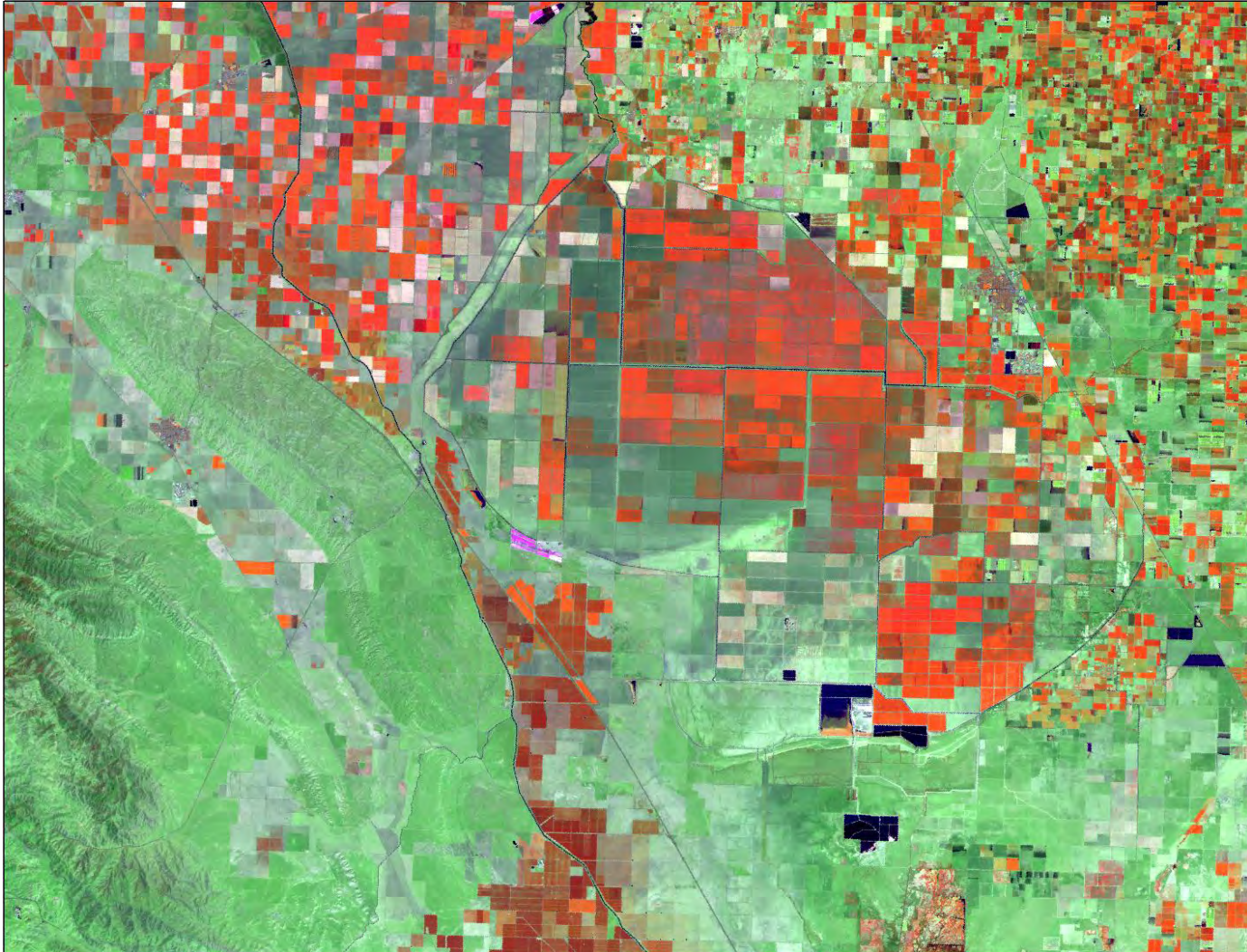
# Landsat TM May 9, 2009





# Landsat TM

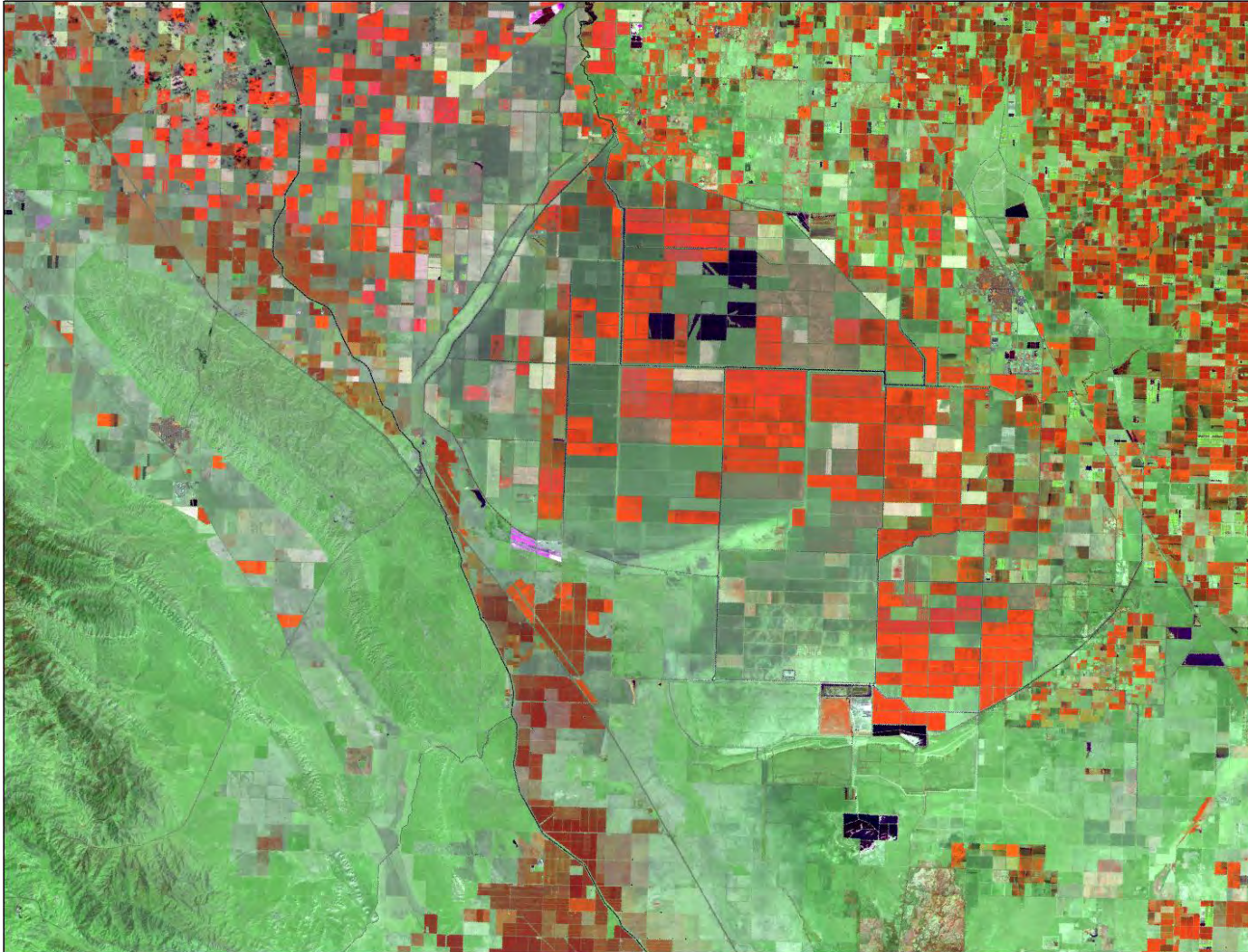
## June 26, 2009





# Landsat TM

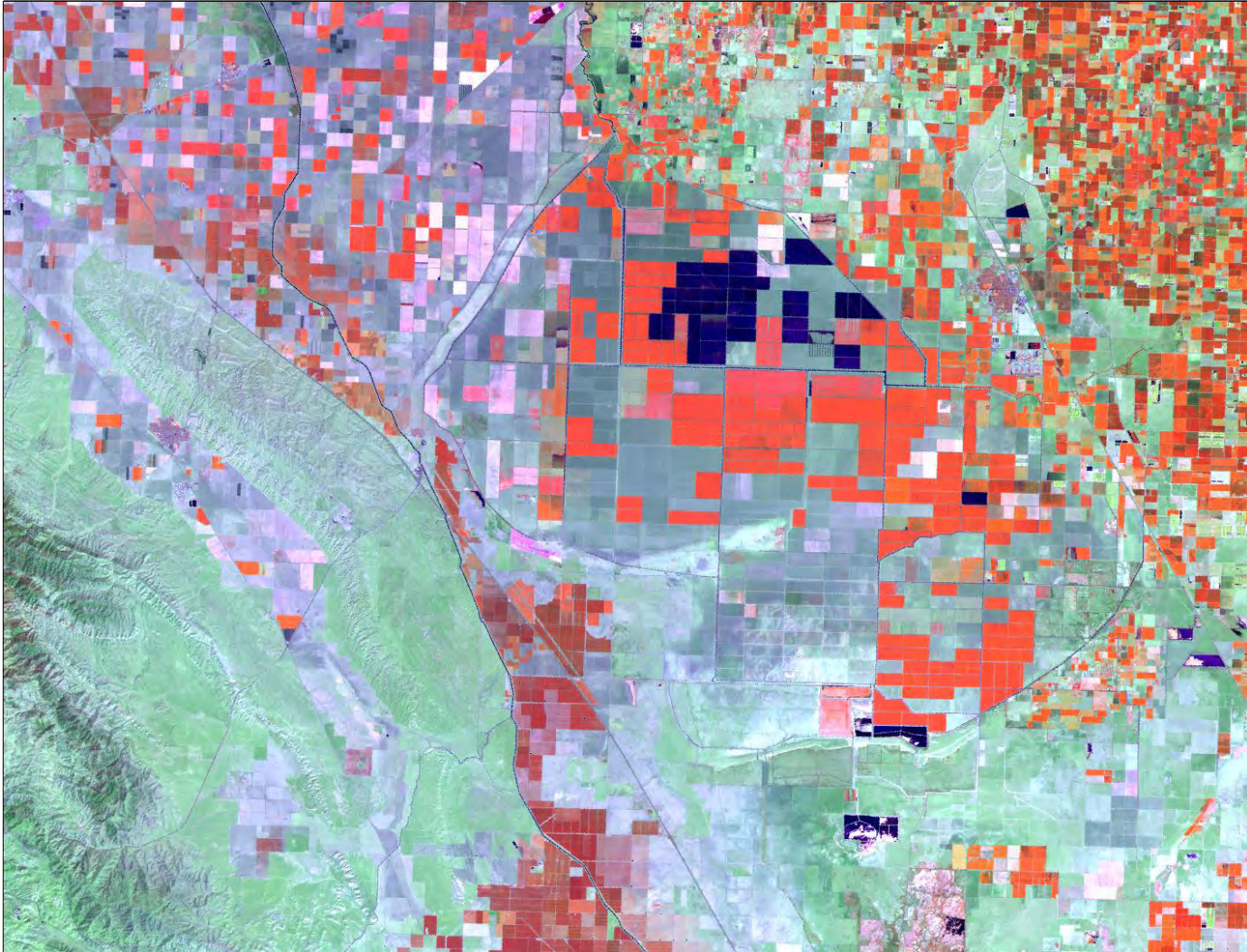
## July 28, 2009





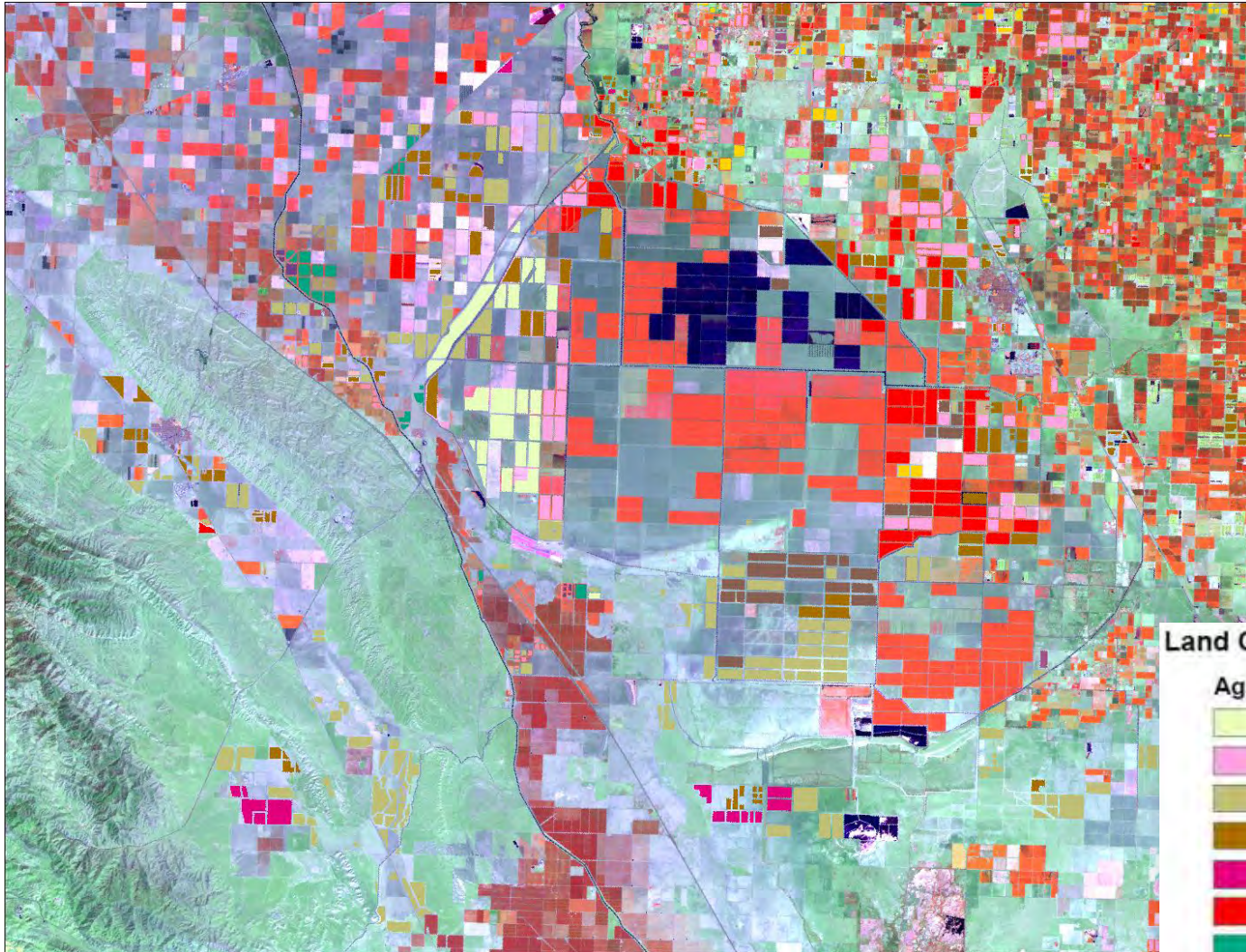
# Landsat TM

## August 29, 2009





# FSA Groundtruth Known Fields



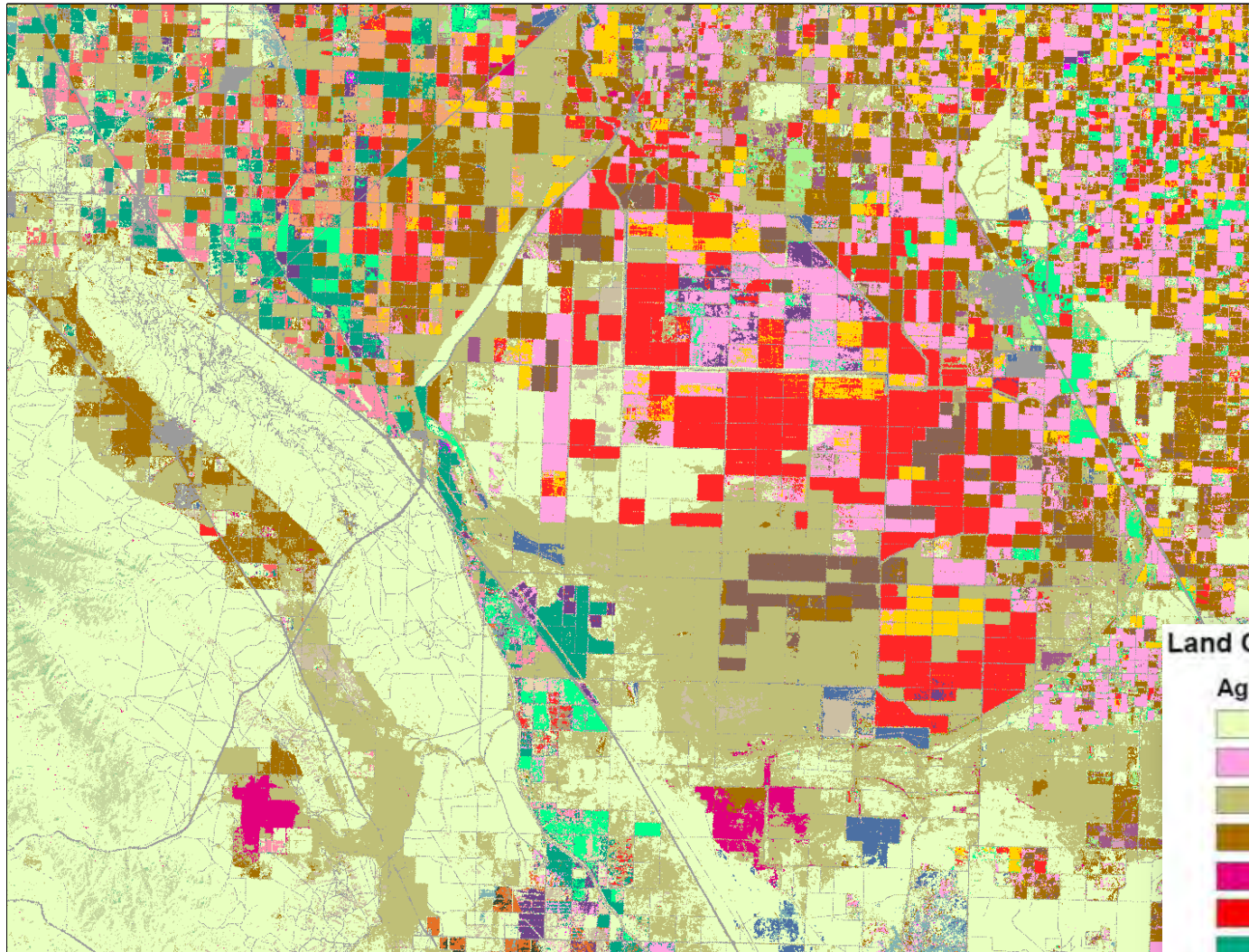
## Land Cover Categories

### Agriculture

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



# Crop Land Data Layer 2009

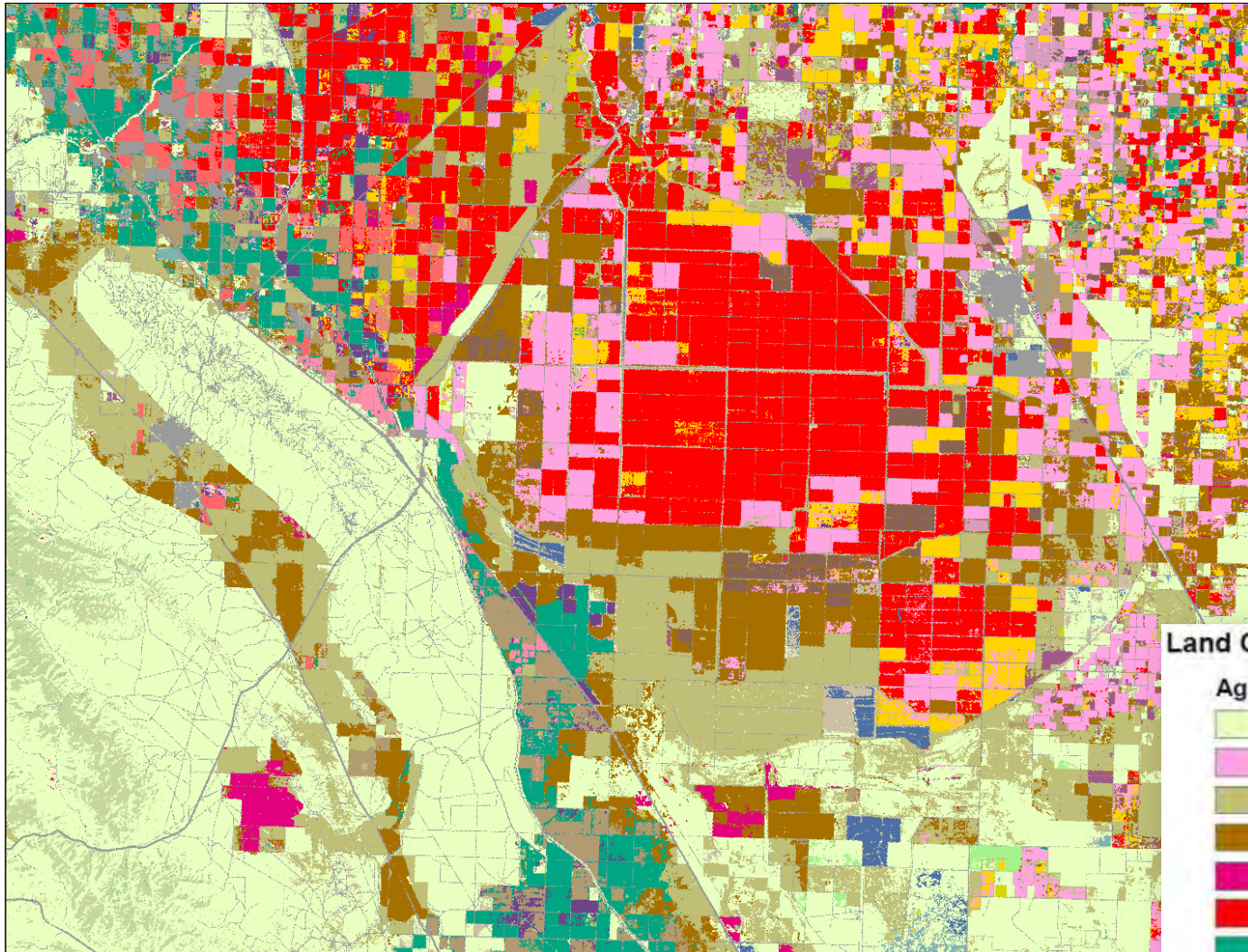


Land Cover Categories

**Agriculture**

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

# Crop Land Data Layer 2007



## Land Cover Categories

### Agriculture

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

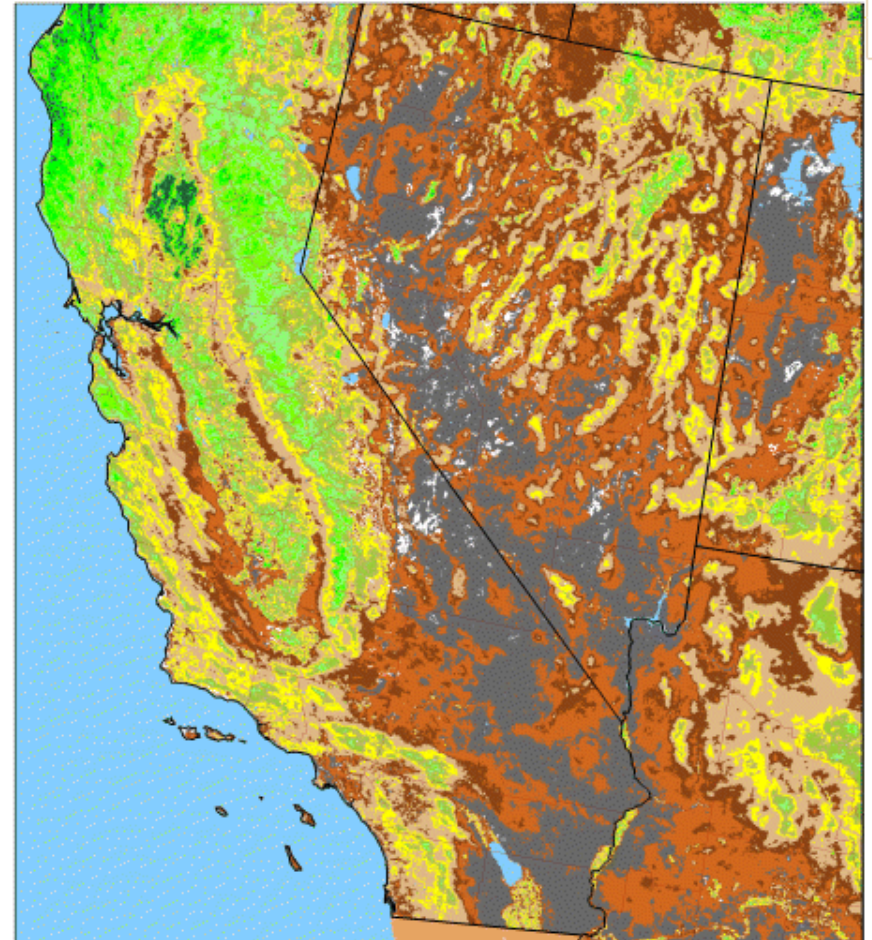
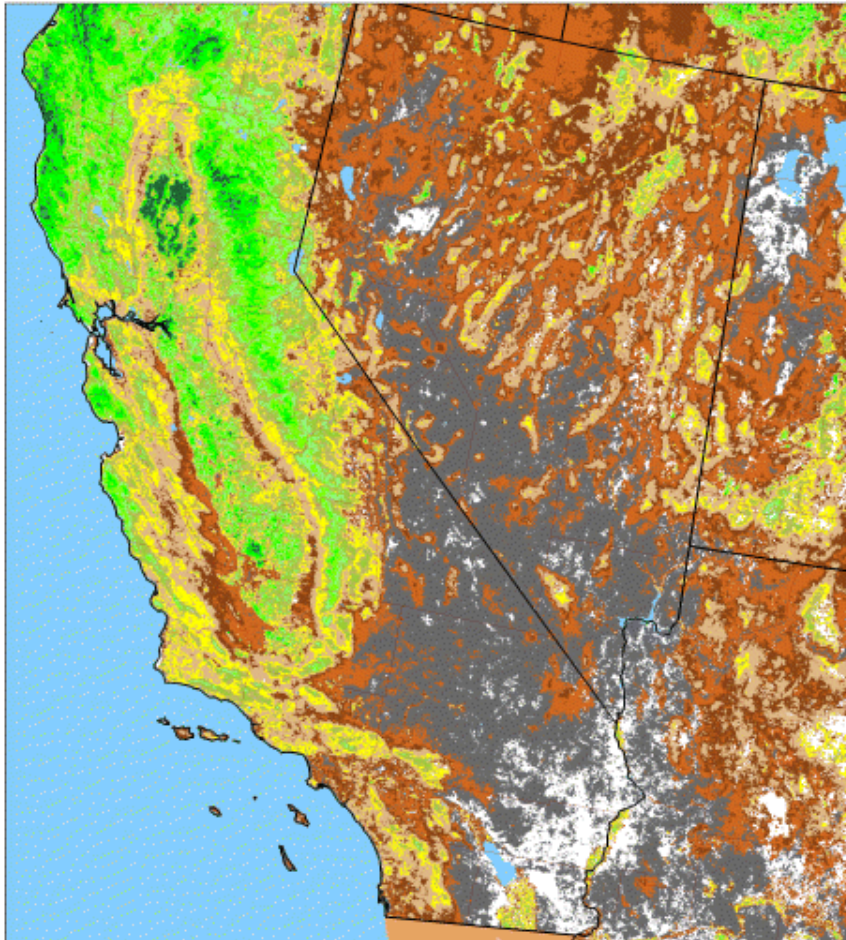


# California Drought Monitoring

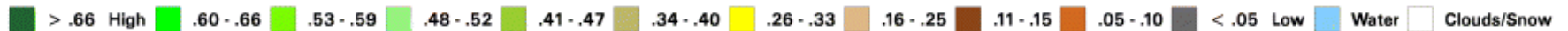
## Vegetation Condition

Period 32 (7/24 - 8/6) 2007

Period 32 (7/28 - 8/10) 2009



## Vegetation Index



No Water Vapor  
Correction Applied

Compiled BY: USDA/NASS & USDA/ARS, NOAA AVHRR 18, 1 KM Resolution  
Composite Imagery: USGS EROS Data Center, Image at <http://www.nass.usda.gov/research>



# Additional Water Restraints on Farmers

July 2009

Federal Bureau of Reclamation shut off water supply to farmers in central California to protect Delta Smelt population





# Assess change by comparing CDLs

2007  
Cropland Data Layer



## Land Cover Categories (by decreasing acreage)

### AGRICULTURE

- |                      |                            |
|----------------------|----------------------------|
| Pasture/Grass        | Oranges                    |
| Alfalfa              | Tomatoes                   |
| Fallow/Idle Cropland | Other Tree Nuts & Fruits   |
| Almonds              | Olives                     |
| Winter Wheat         | Peaches/Plums/Apricots     |
| Rice                 | Barley                     |
| Other Hays           | Clover/Wildflowers         |
| Corn                 | Misc. Veggies & Fruits     |
| Grapes               | Other Crops/Seed/Sod Grass |
| Walnuts              | Sunflowers                 |
| Cats                 | Safflower                  |
| Cotton               | Triticale                  |
| Durum Wheat          | Spring Wheat               |

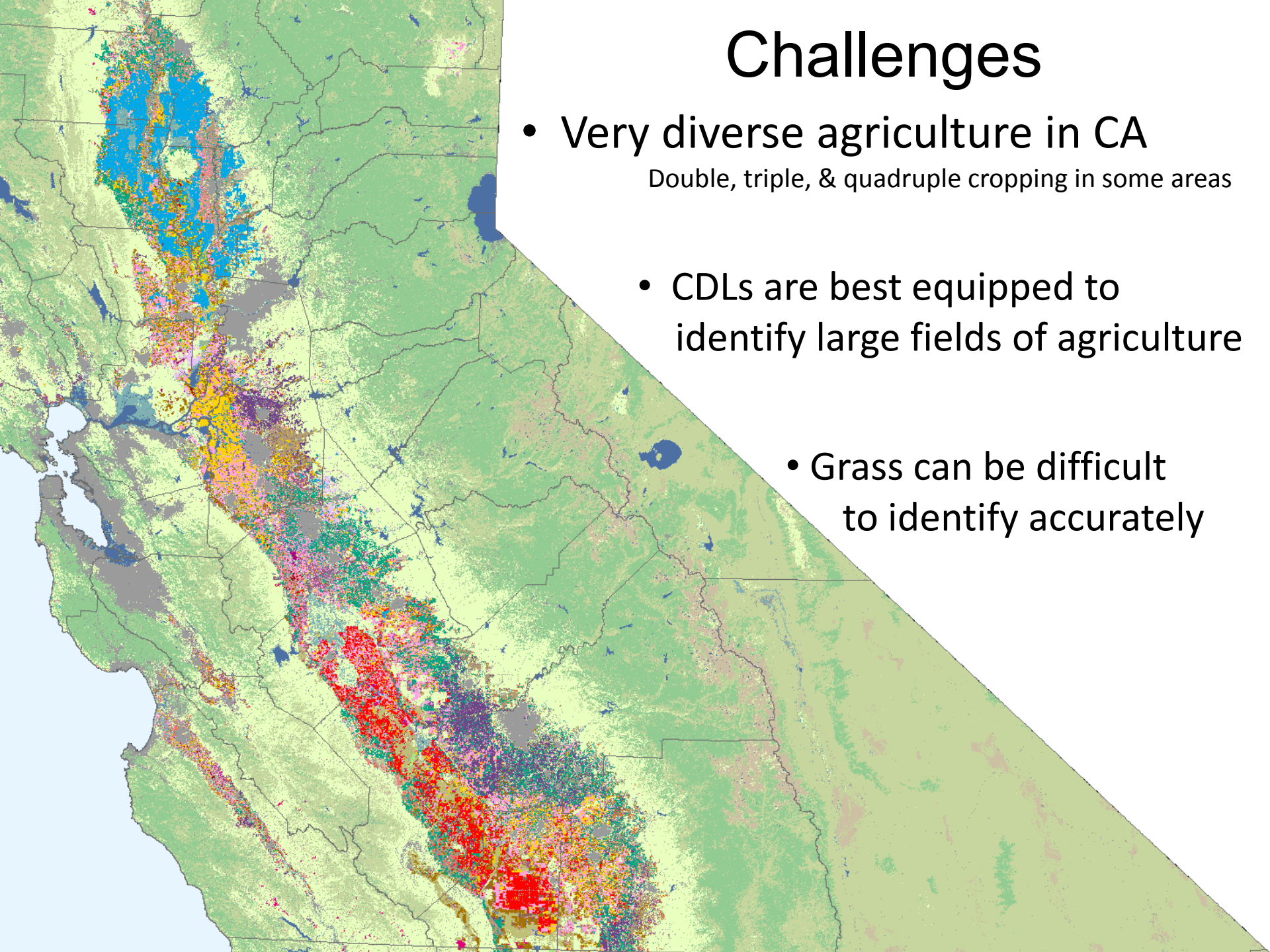
2009  
Cropland Data Layer





# Challenges

- Very diverse agriculture in CA  
Double, triple, & quadruple cropping in some areas
- CDLs are best equipped to identify large fields of agriculture
- Grass can be difficult to identify accurately





# Accuracy Assessments

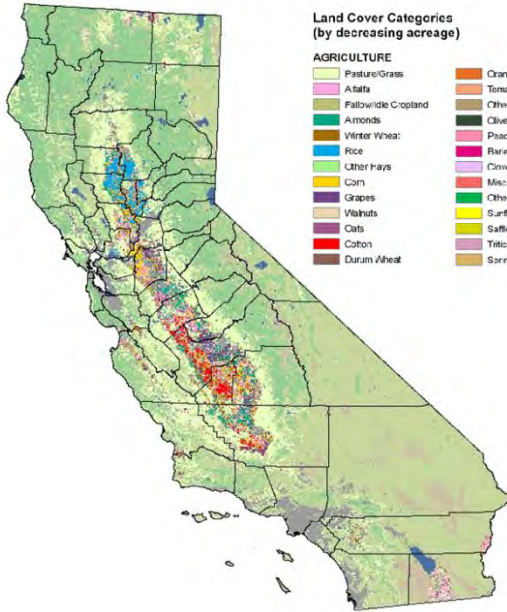
- Producers Accuracy – a measurement of omission
  - The percent of pixels in category that are over classified
- User Accuracy – a measurement of commission
  - The percent of pixels in a category that are under classified

2009	FSA CROPS		IDLE/GRASS	
	Producer	User	Producer	User
District 51	77.50%	81.74%	54.97%	85.72%
San Joaquin	84.06%	85.78%	53.37%	75.94%
Stanislaus	74.19%	99.33%	60.99%	65.32%
Merced	73.92%	77.92%	37.95%	75.92%
Madera	72.13%	81.11%	48.49%	95.37%
Fresno	75.52%	74.74%	20.36%	56.02%
Kings	79.11%	83.85%	84.41%	79.13%
Tulare	64.00%	87.64%	45.40%	50.61%
Kern	81.76%	91.89%	77.11%	93.41%



# Method

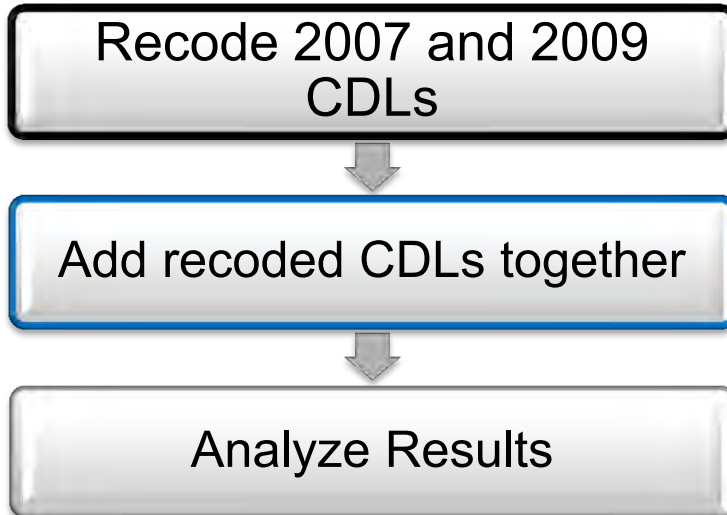
2007  
Cropland Data Layer



2009  
Cropland Data Layer



2007		2009	
Value	Category	Value	Category
1	Agriculture	4	Agriculture
2	Grass	8	Grass
3	Idle	12	Idle



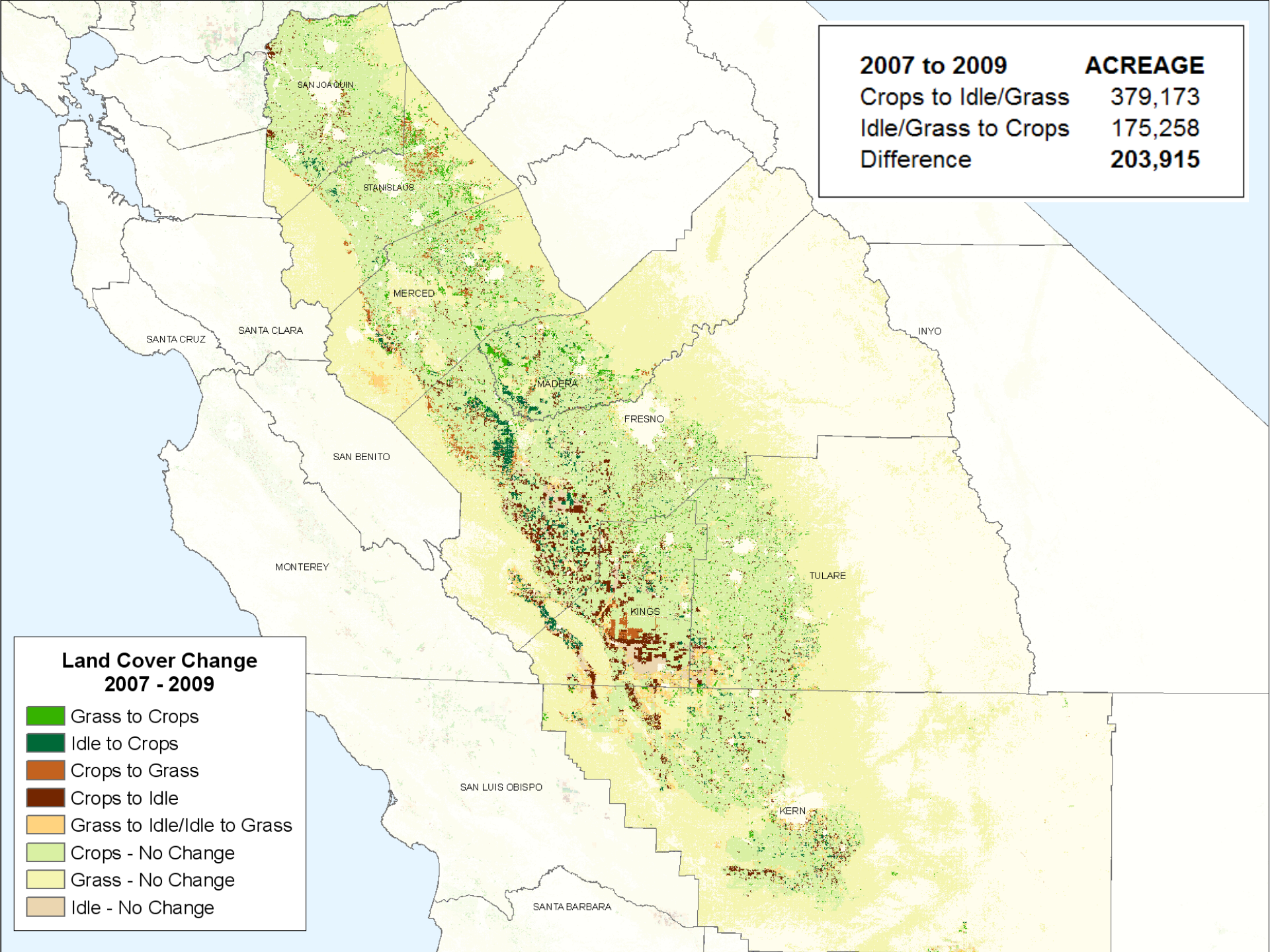
2007 + 2009	
Value	Category
1	Ag 07
2	Grass 07
3	Idle 07
4	Ag 09
5	Ag 07 + Ag 09
6	Grass 07 + Ag 09
7	Idle 07 + Ag 09
8	Grass 09
9	Ag 07 + Grass 09
10	Grass 07 + Grass 09
11	Idle 07 + Grass 09
12	Idle 09
13	Ag 07 + Idle 09
14	Grass 07 + Idle 09
15	Idle 07 + Idle 09



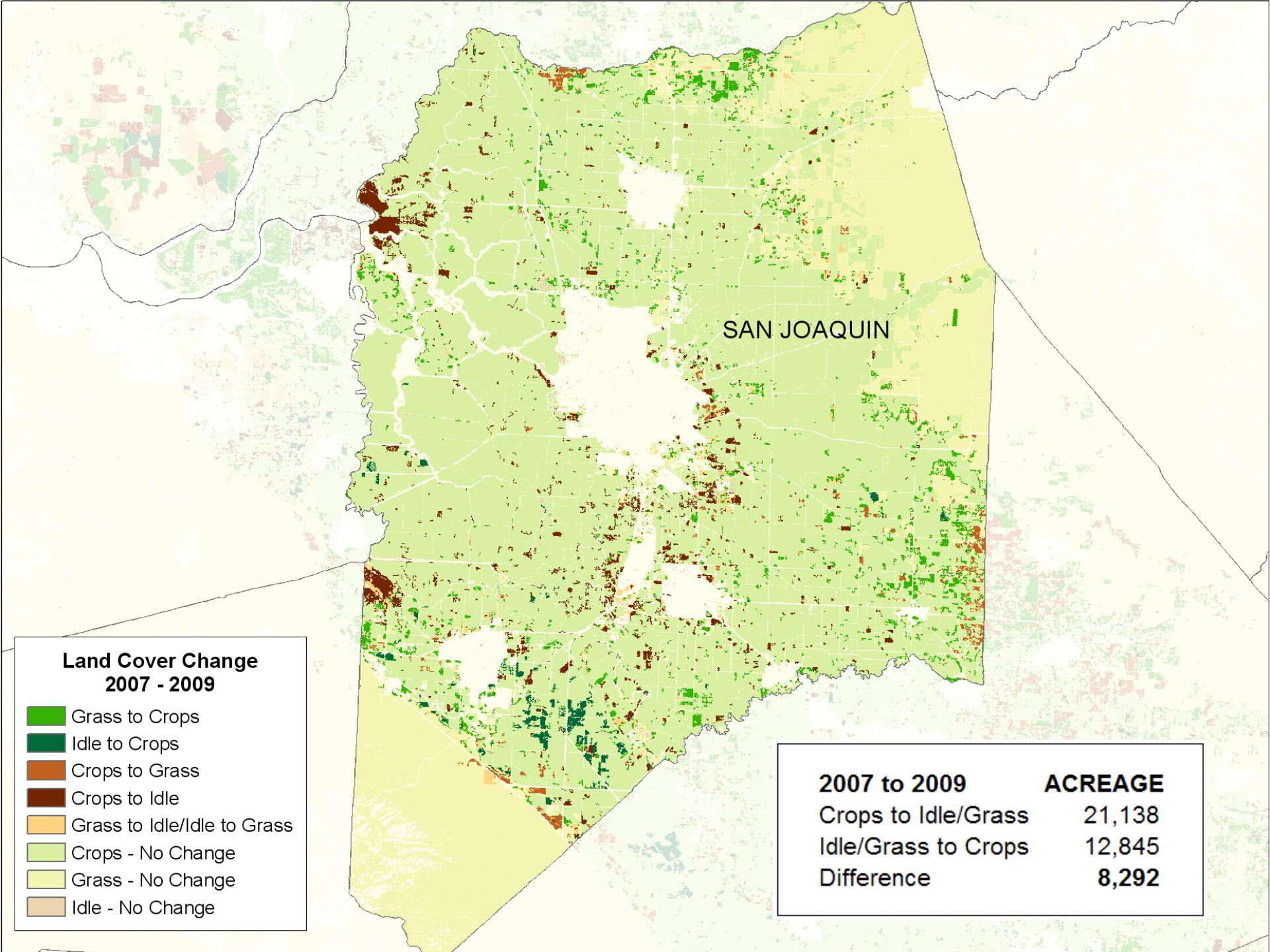
2007 to 2009	ACREAGE
Crops to Idle/Grass	379,173
Idle/Grass to Crops	175,258
Difference	203,915

### Land Cover Change 2007 - 2009

- Grass to Crops
- Idle to Crops
- Crops to Grass
- Crops to Idle
- Grass to Idle/Idle to Grass
- Crops - No Change
- Grass - No Change
- Idle - No Change







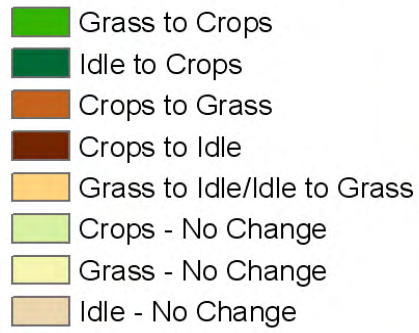
**Land Cover Change  
2007 - 2009**

- Grass to Crops
- Idle to Crops
- Crops to Grass
- Crops to Idle
- Grass to Idle/Idle to Grass
- Crops - No Change
- Grass - No Change
- Idle - No Change

2007 to 2009	ACREAGE
Crops to Idle/Grass	21,138
Idle/Grass to Crops	12,845
Difference	8,292



### Land Cover Change 2007 - 2009



STANISLAUS

2007 to 2009	ACREAGE
Crops to Idle/Grass	23,555
Idle/Grass to Crops	8,614
Difference	<b>14,941</b>



**Land Cover Change  
2007 - 2009**

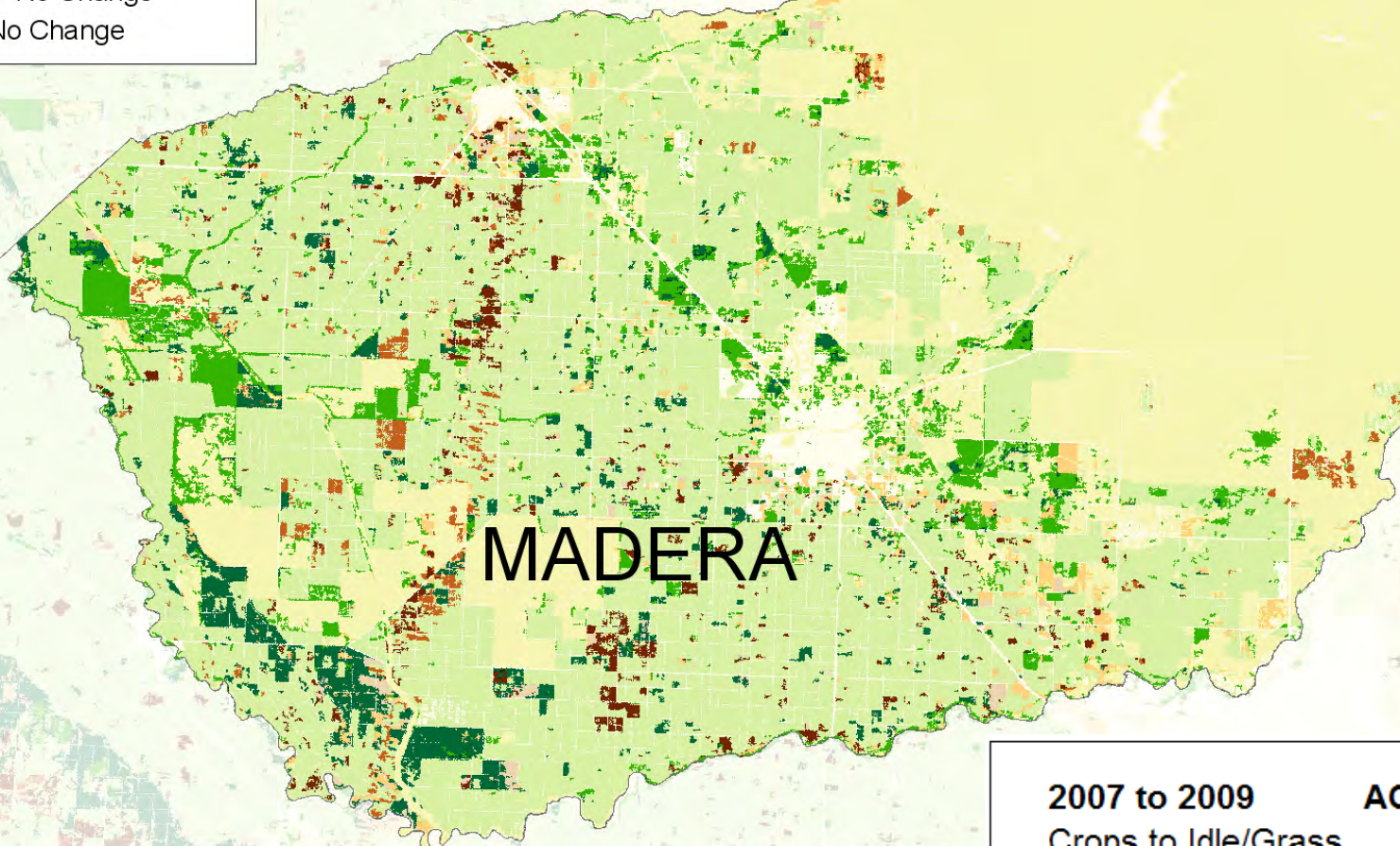
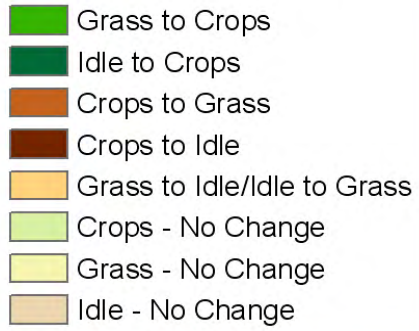
- Grass to Crops
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- Crops to Grass
- Crops to Idle
- Grass to Idle/Idle to Grass
- Crops - No Change
- Grass - No Change
- Idle - No Change

MERCED

<b>2007 to 2009</b>	<b>ACREAGE</b>
Crops to Idle/Grass	32,081
Idle/Grass to Crops	20,468
<b>Difference</b>	<b>11,613</b>

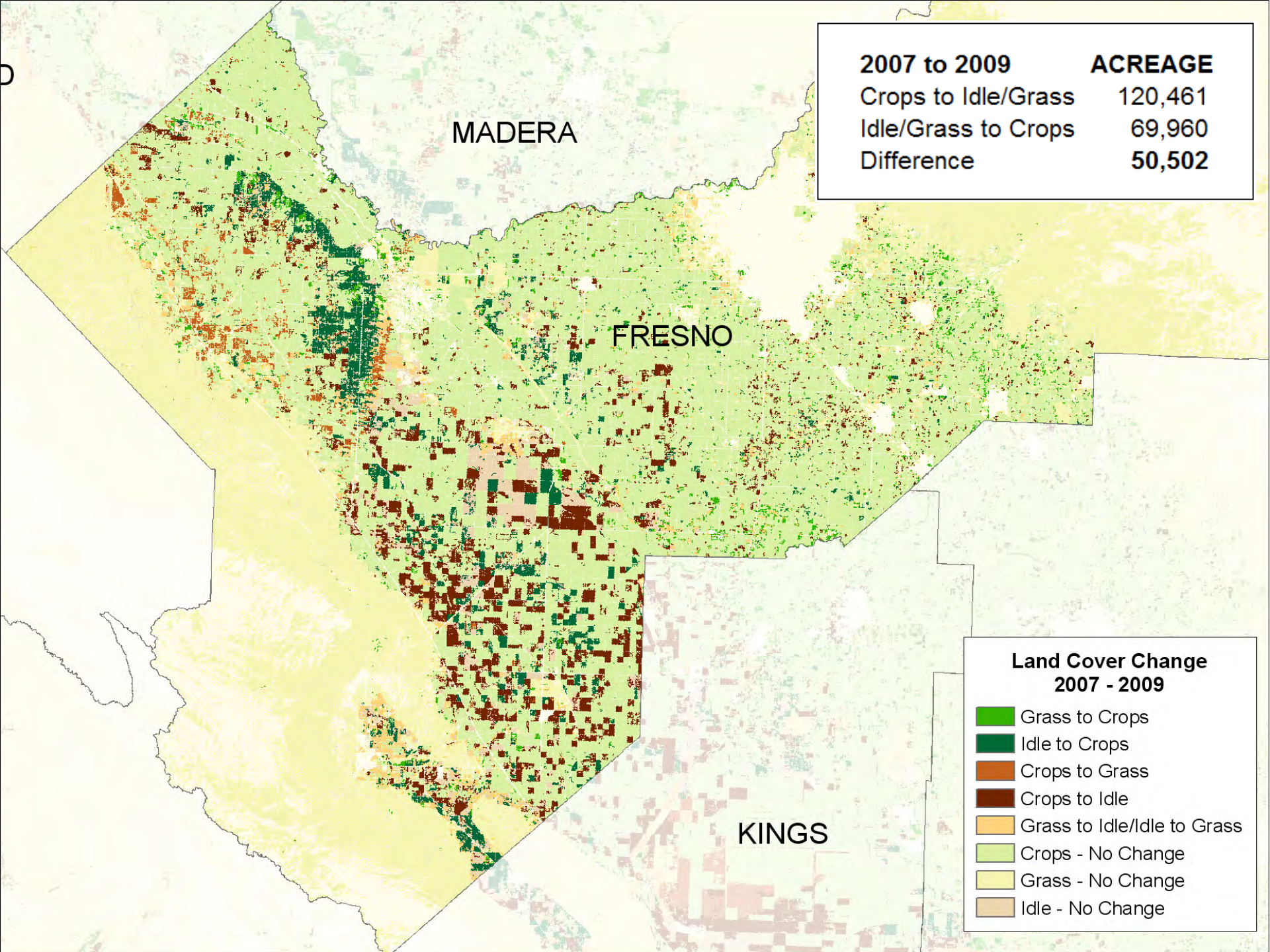


**Land Cover Change  
2007 - 2009**



<b>2007 to 2009</b>	<b>ACREAGE</b>
Crops to Idle/Grass	13,016
Idle/Grass to Crops	20,735
Difference	<b>(7,719)</b>





MADERA

FRESNO

KINGS



**Land Cover Change  
2007 - 2009**

- Grass to Crops
- Idle to Crops
- Crops to Grass
- Crops to Idle
- Grass to Idle/Idle to Grass
- Crops - No Change
- Grass - No Change
- Idle - No Change

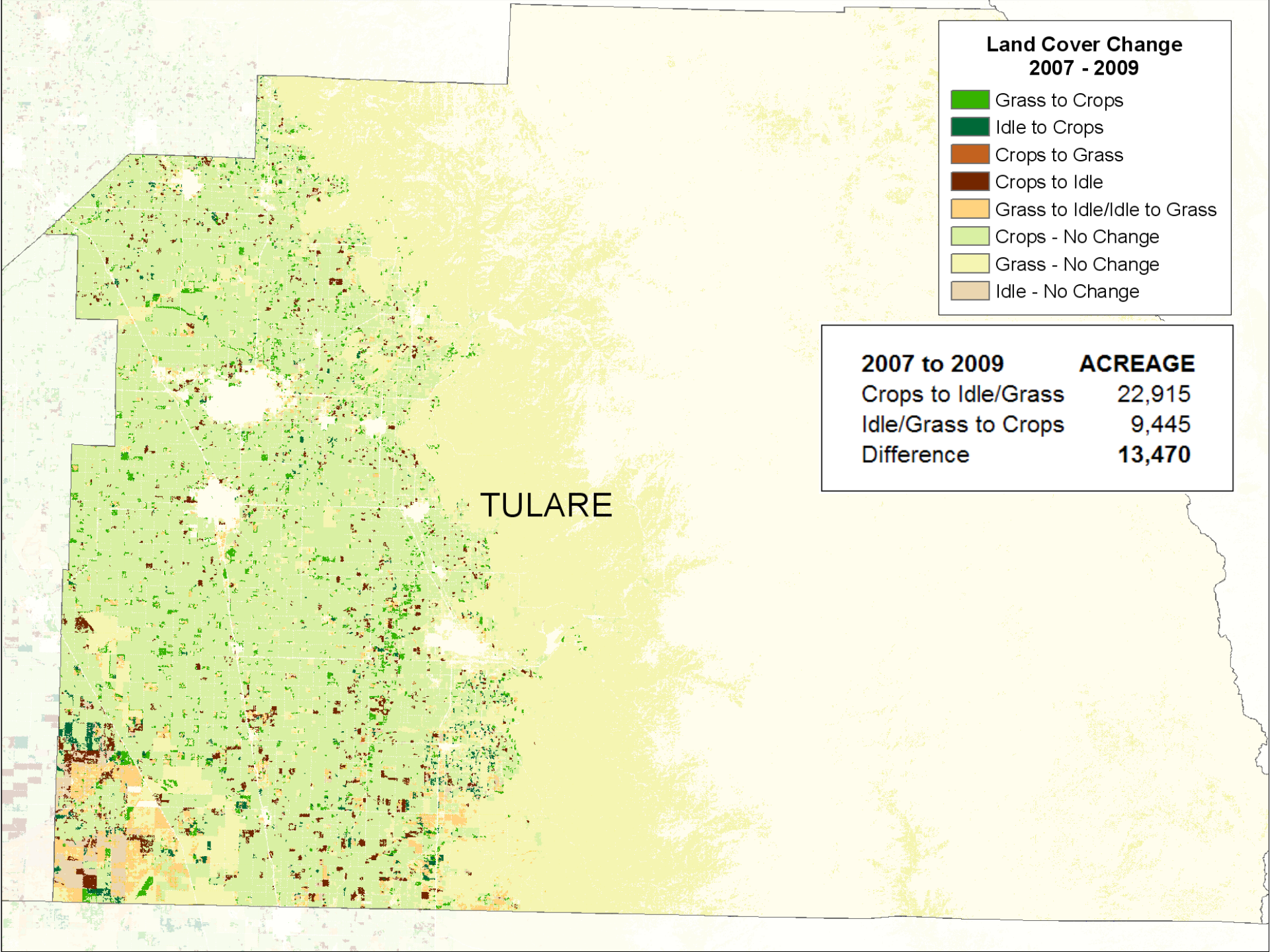
**2007 to 2009**

**ACREAGE**

Crops to Idle/Grass	99,289
Idle/Grass to Crops	16,243
<b>Difference</b>	<b>83,046</b>

**KINGS**





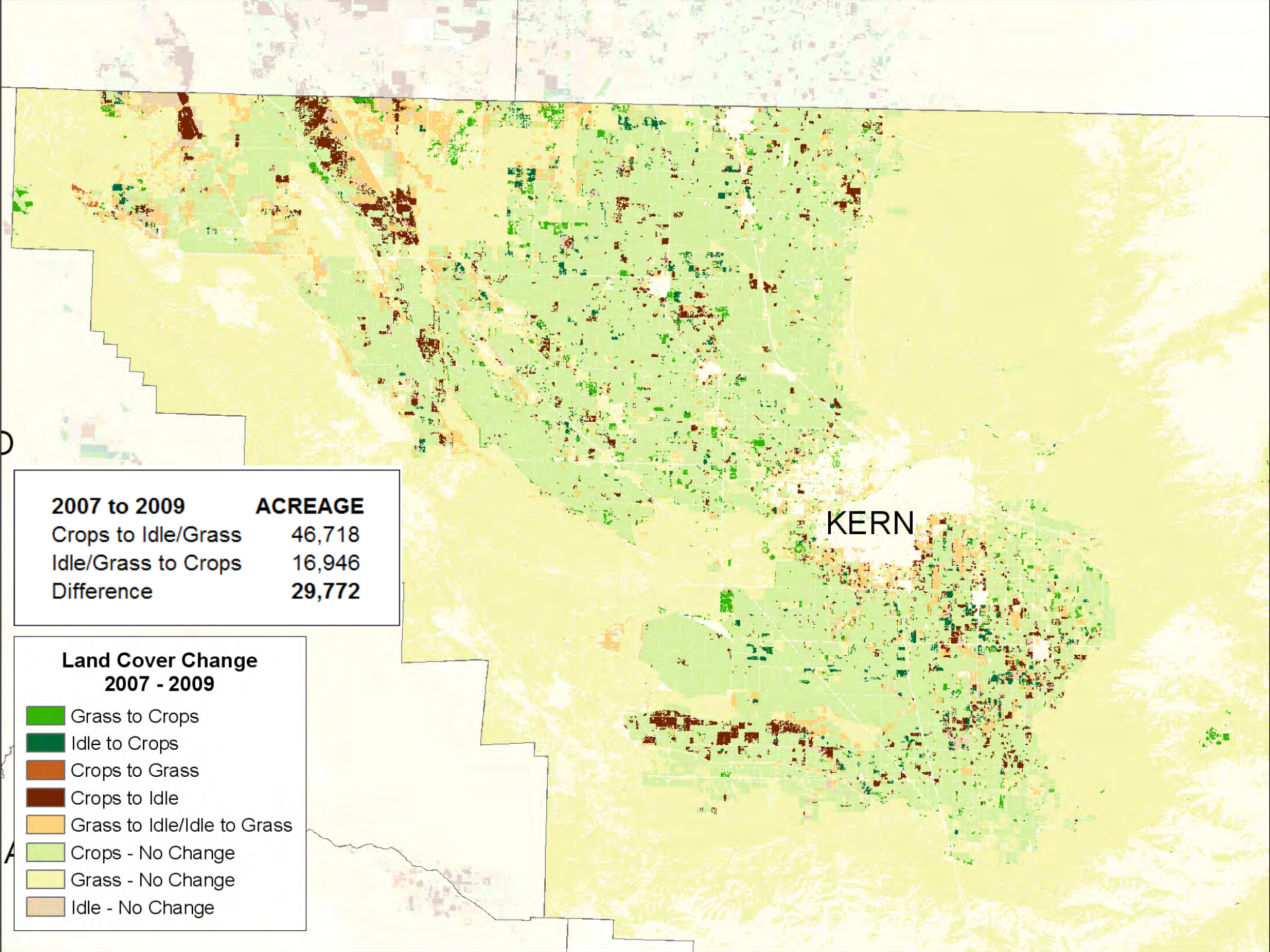
**Land Cover Change  
2007 - 2009**

- Grass to Crops
- Idle to Crops
- Crops to Grass
- Crops to Idle
- Grass to Idle/Idle to Grass
- Crops - No Change
- Grass - No Change
- Idle - No Change

<b>2007 to 2009</b>	<b>ACREAGE</b>
Crops to Idle/Grass	22,915
Idle/Grass to Crops	9,445
<b>Difference</b>	<b>13,470</b>

TULARE





2007 to 2009	ACREAGE
Crops to Idle/Grass	46,718
Idle/Grass to Crops	16,946
Difference	29,772

**Land Cover Change  
2007 - 2009**

- Grass to Crops
- Idle to Crops
- Crops to Grass
- Crops to Idle
- Grass to Idle/Idle to Grass
- Crops - No Change
- Grass - No Change
- Idle - No Change



# Summary

2007 - 2009

	Crops to Idle/Grass	Idle/Grass to Crops	Difference
District 51	379,173	174,076	205,097
San Joaquin	21,138	12,759	8,379
Stanislaus	23,555	8,556	14,999
Merced	32,081	20,330	11,751
Madera	13,016	20,595	-7,579
Fresno	120,461	69,488	50,973
Kings	99,289	16,134	83,155
Tulare	22,915	9,381	13,534
Kern	46,718	16,831	29,887

- Remote sensing confirms agricultural land in District 51 affected by water resource issues.

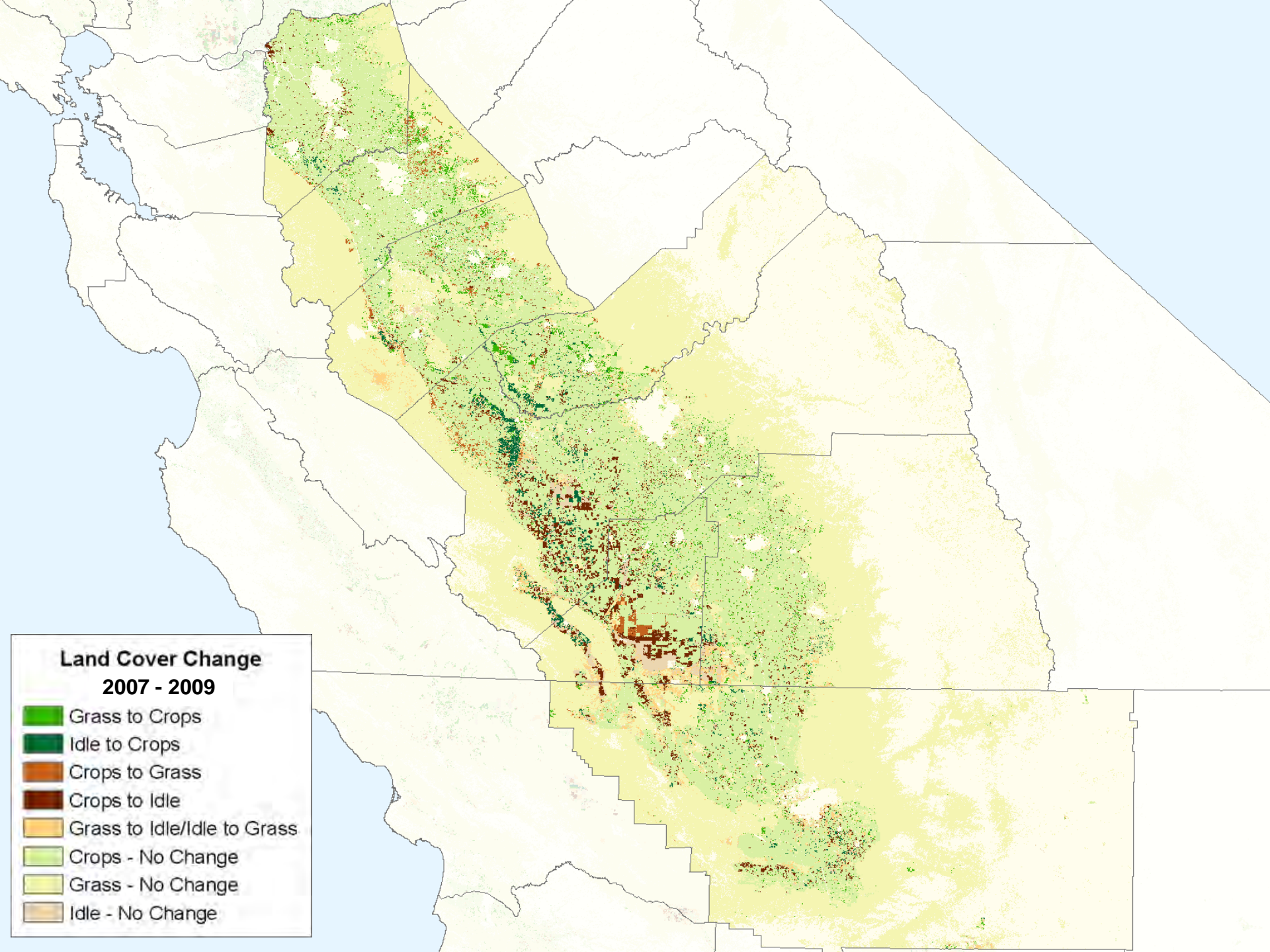
- Three counties most affected in District 51 are

Kings

Fresno

Kern

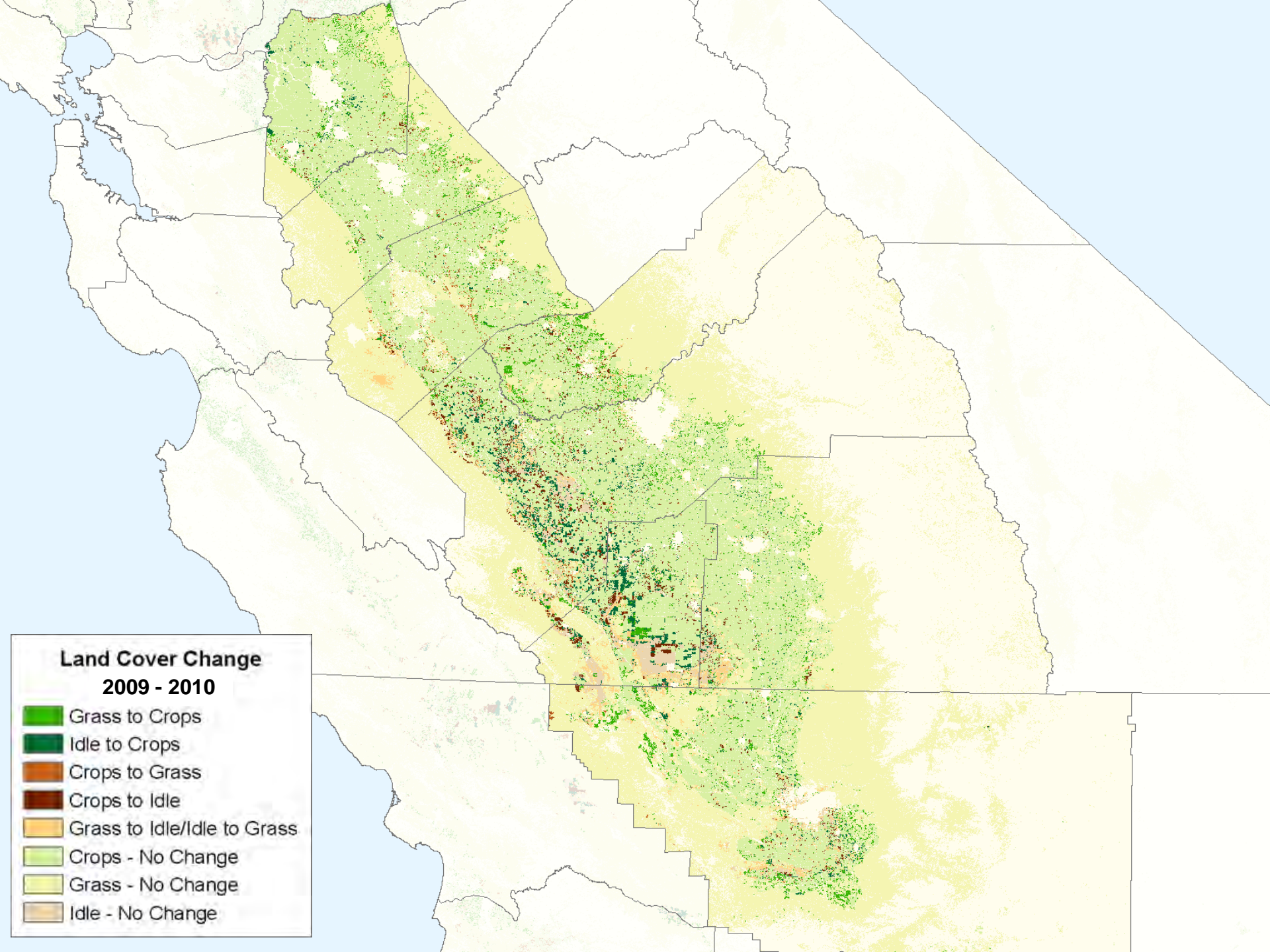




**Land Cover Change  
2007 - 2009**

- Grass to Crops
- Idle to Crops
- Crops to Grass
- Crops to Idle
- Grass to Idle/Idle to Grass
- Crops - No Change
- Grass - No Change
- Idle - No Change



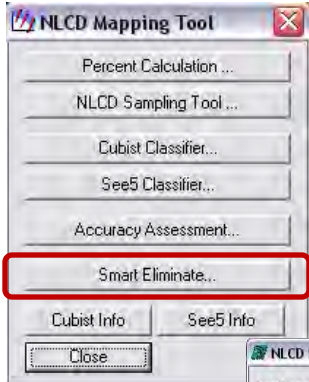


**Land Cover Change  
2009 - 2010**

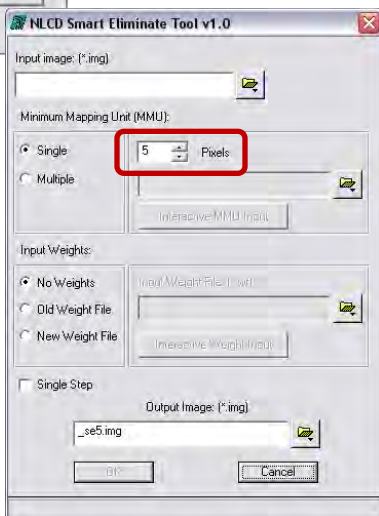
- Grass to Crops
- Idle to Crops
- Crops to Grass
- Crops to Idle
- Grass to Idle/Idle to Grass
- Crops - No Change
- Grass - No Change
- Idle - No Change



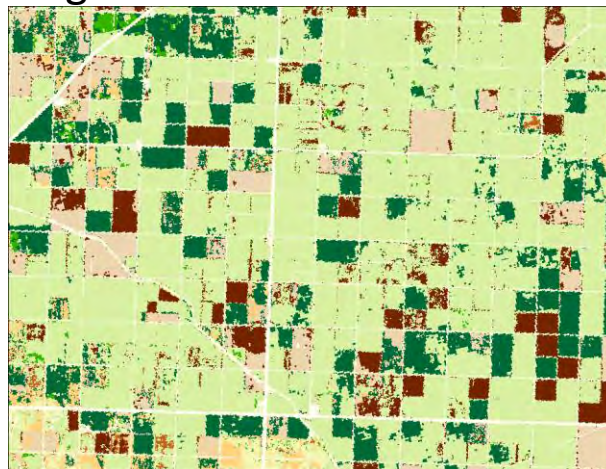
# Smart Eliminate



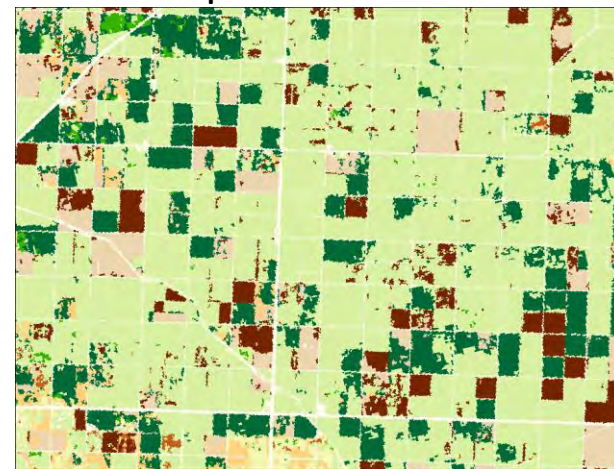
MMU =  
Minimum  
Mapping  
Unit



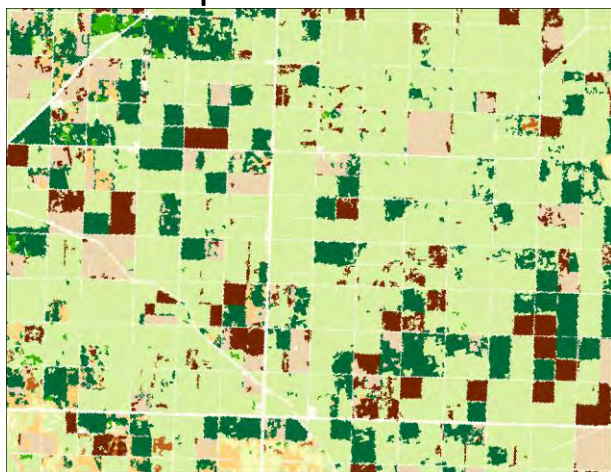
Original File



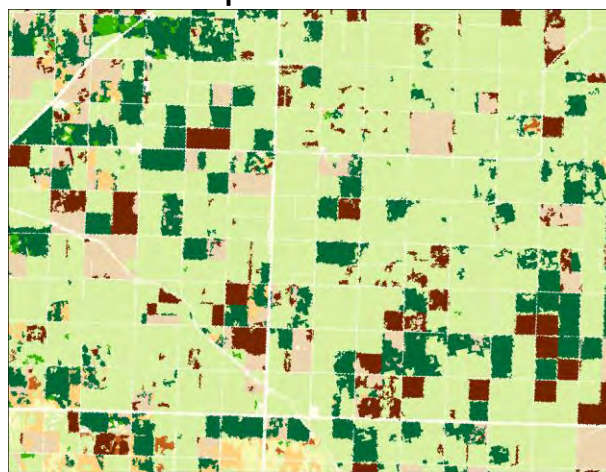
MMU = 5 pixels



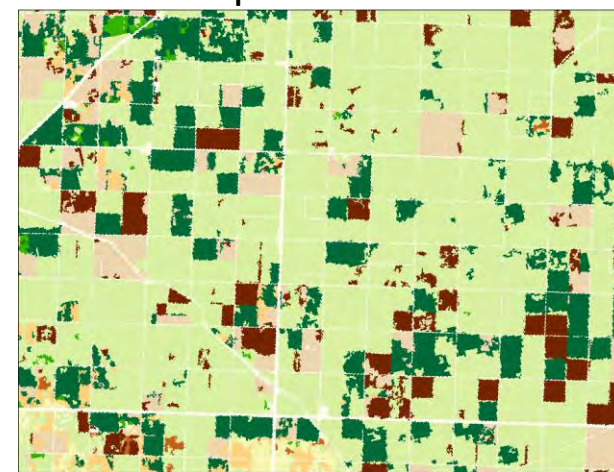
MMU = 8 pixels



MMU = 13 pixels



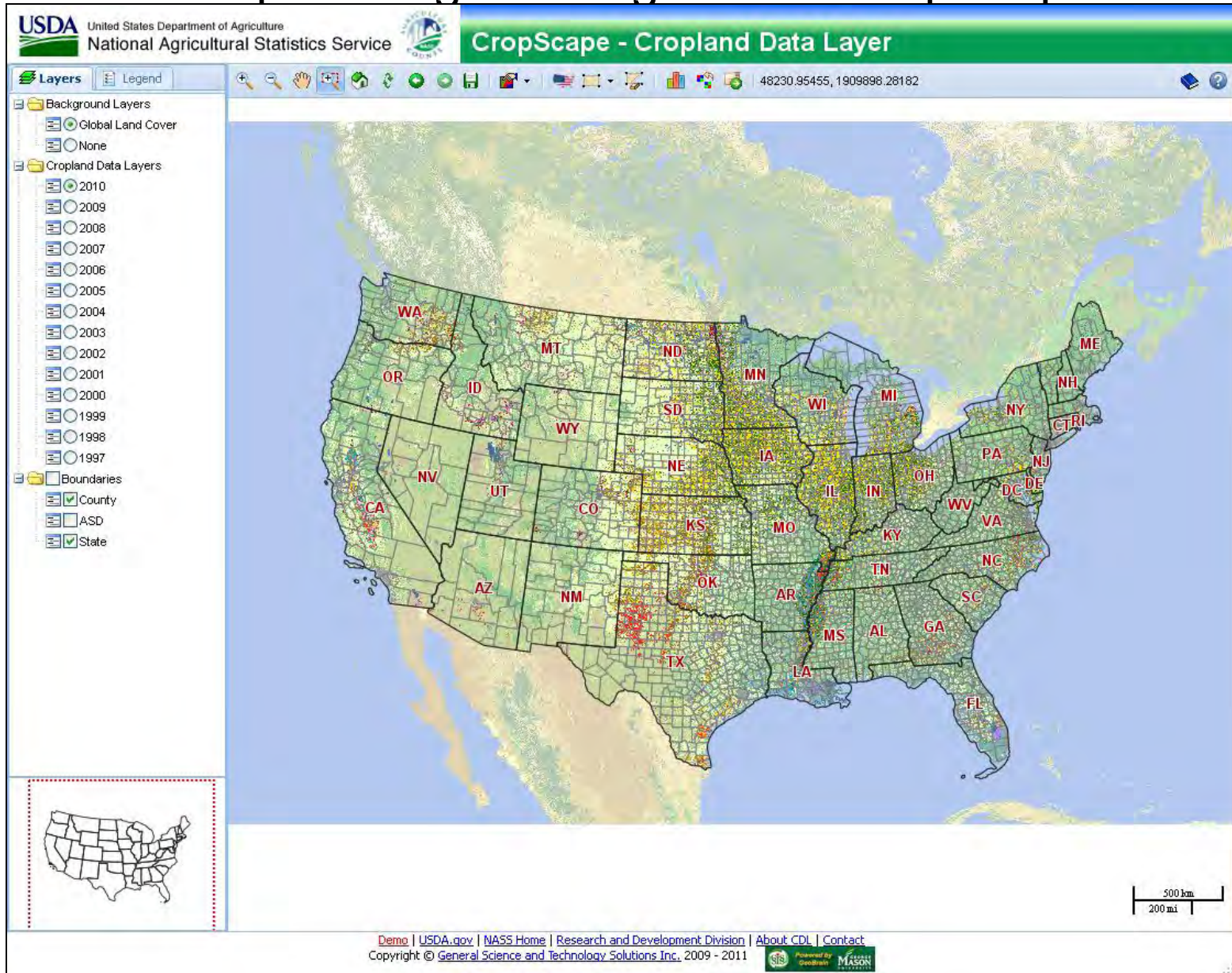
MMU = 18 pixels






# CropScape

<http://nassgeodata.gmu.edu/CropScape>







Thank you!  
Questions?

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