# Improving Agricultural Landcover Classification in the Cropland Data Layer Using the Disaster Monitoring Constellation

## Audra Zakzeski
## USDA NASS
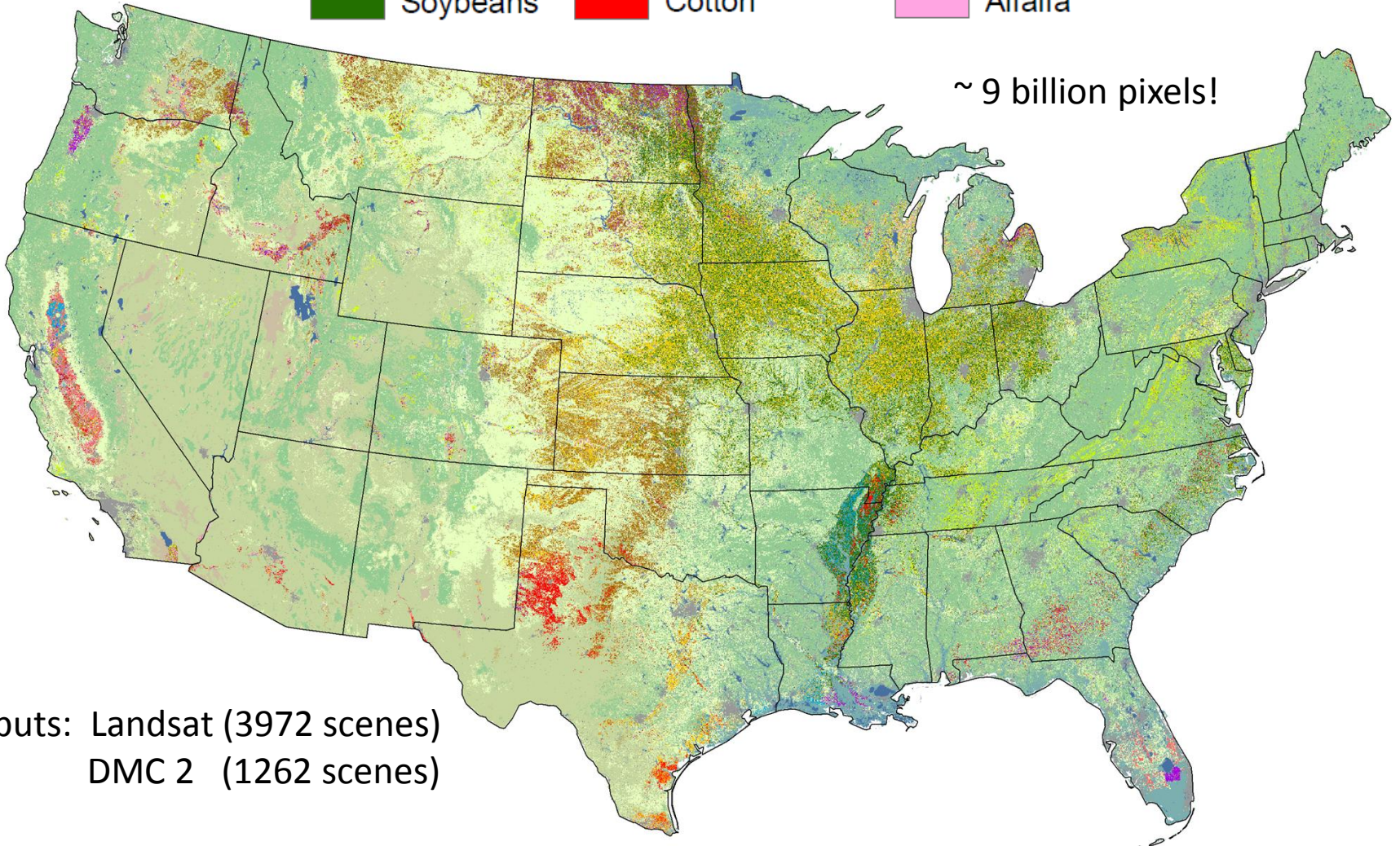
# 2011 Crop Land Data Layer

## Agriculture by crop type and location

Each pixel represents a type of crop or land cover

A sample:

- Corn
- Soybeans
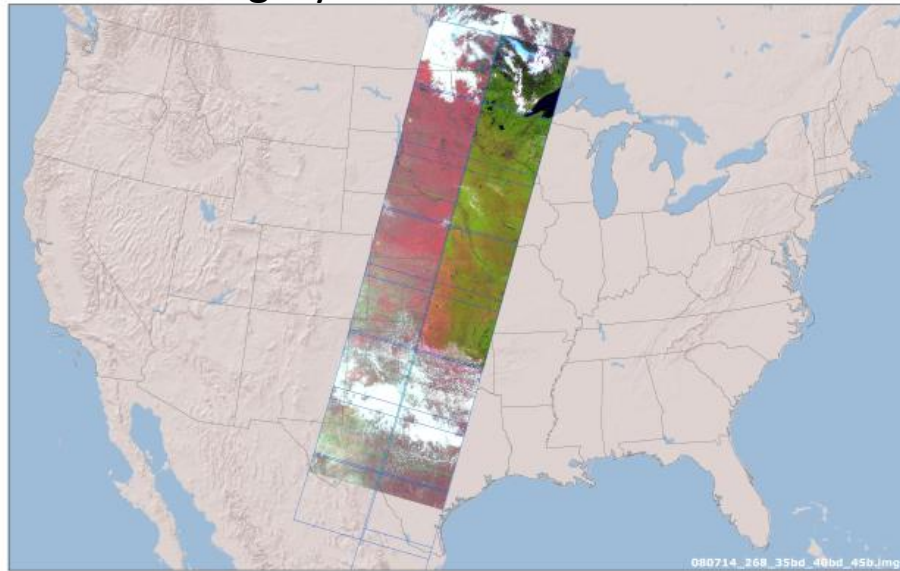- Winter Wheat
- Cotton
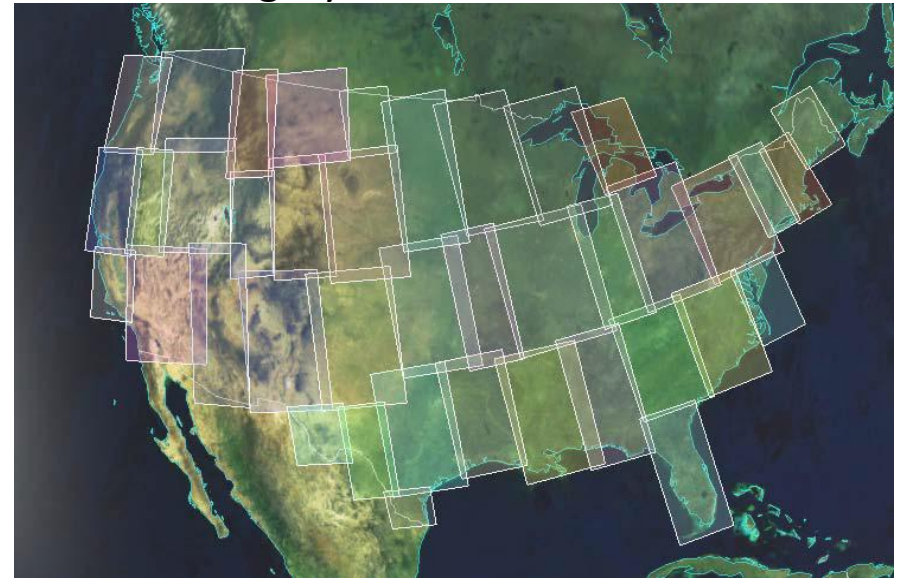- Rice
- Alfalfa

~ 9 billion pixels!



Inputs:  Landsat (3972 scenes)
DMC 2   (1262 scenes)
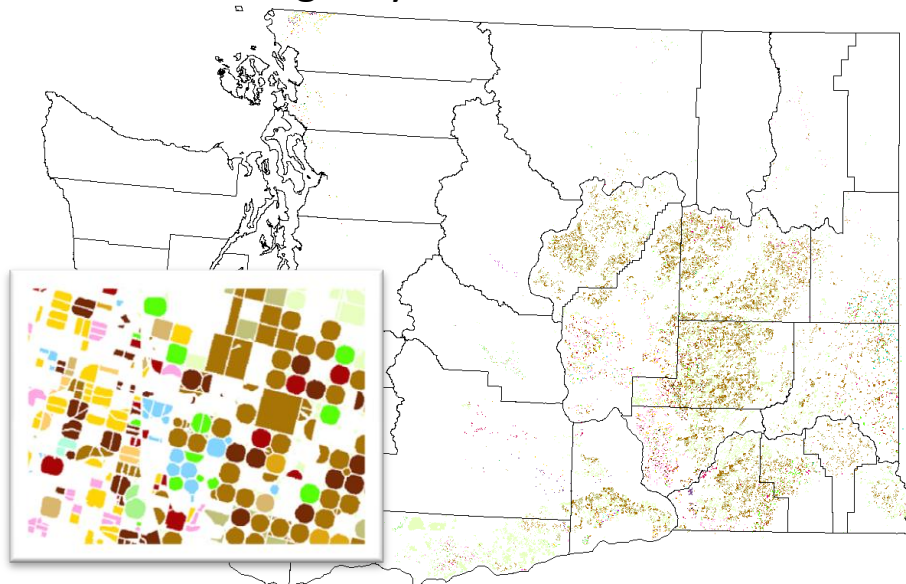
# 2011 Cropland Data Layer Inputs
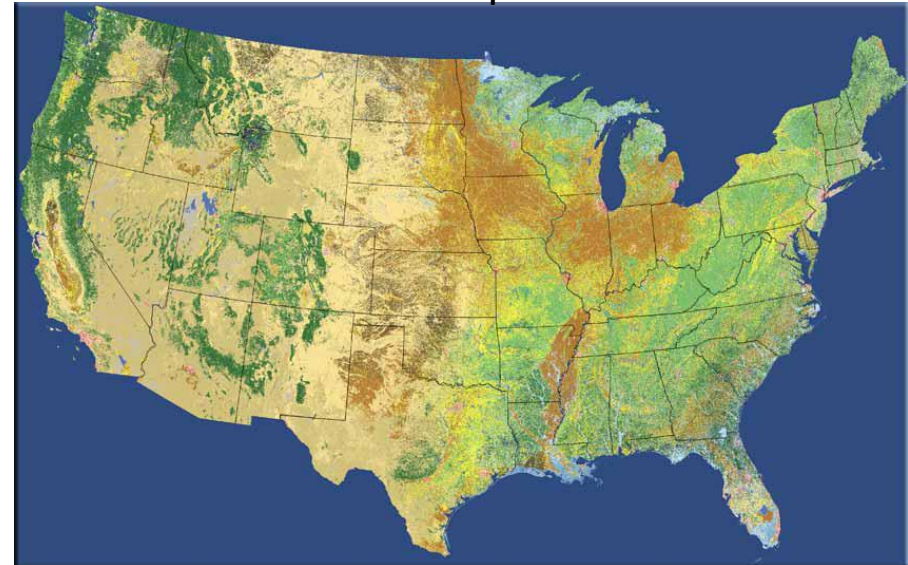
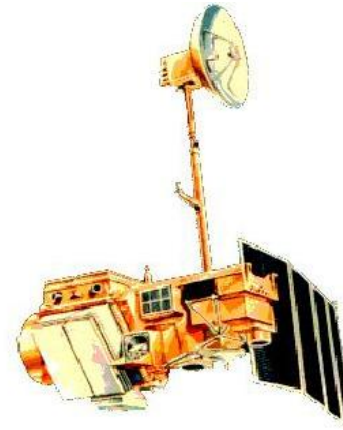Satellite Imagery – Landsat



Satellite Imagery – Deimos & UK2



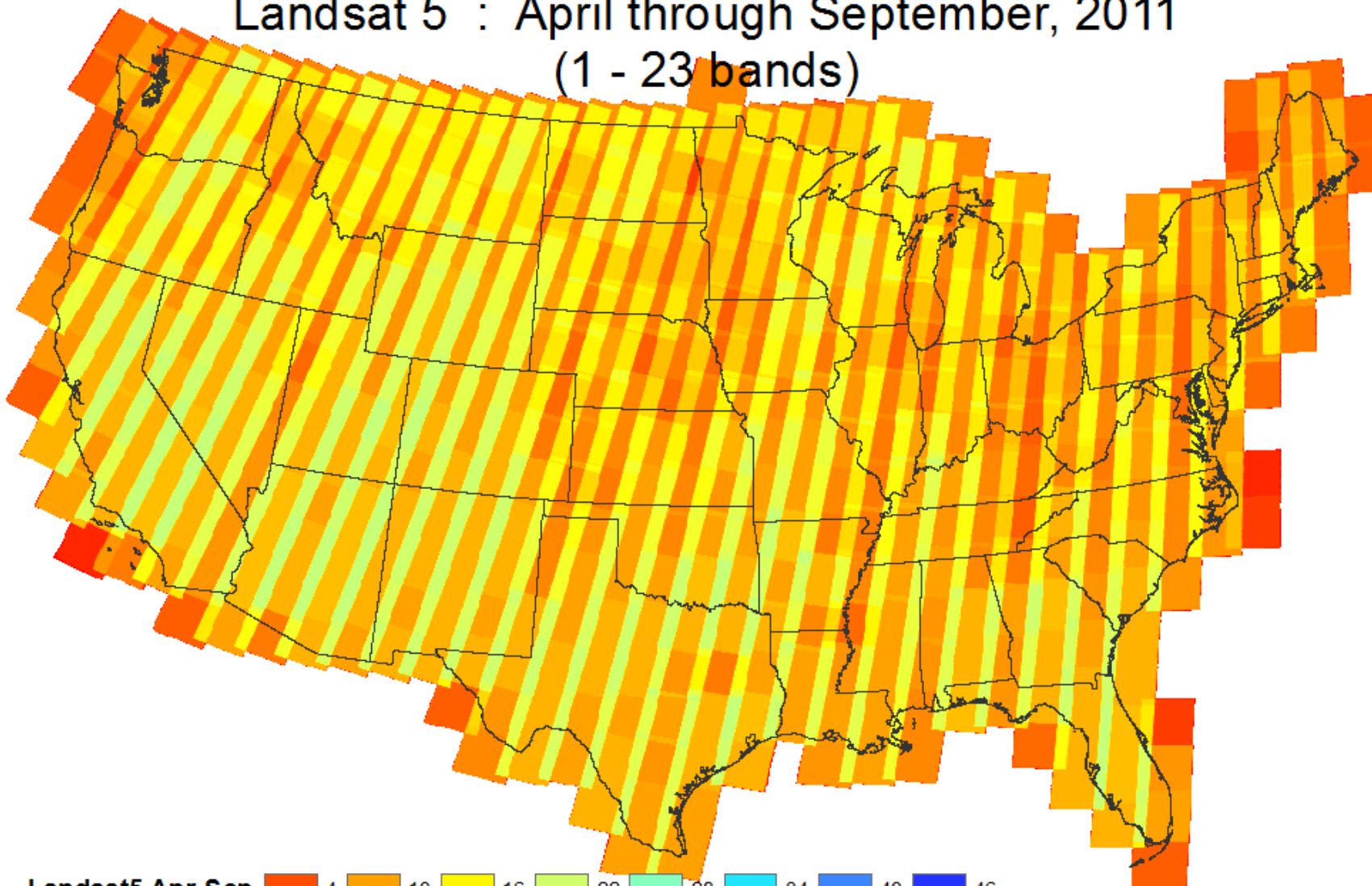Farm Service Agency: Common Land Unit


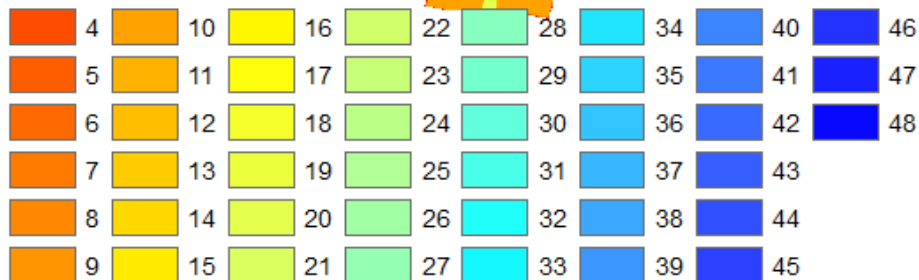
2006 NLCD & Derivative products

# Side by Side Comparison
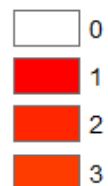


| | Deimos/UK2 | Landsat 5 |
|---|---|---|
| Launch Date | 2009 | 1984 |
| Resolution | 22 meters | 30 meters |
| Spectral Bands | B2: 0.52 – 0.60 (Green)<br>B3: 0.63 – 0.69 (Red)<br>B4: 0.77 – 0.90 (NIR)<br><br><br>3 bands total | B2: 0.52 – 0.60 (Green)<br>B3: 0.63 – 0.69 (Red)<br>B4: 0.75 – 0.90 (NIR)<br>B5: 1.55 – 1.75 (SWIR)<br><br>7 bands total |
| Swath Width | 600 kilometers | 185 kilometers |
| Revisit Rate | 4 Days | 16 Days |

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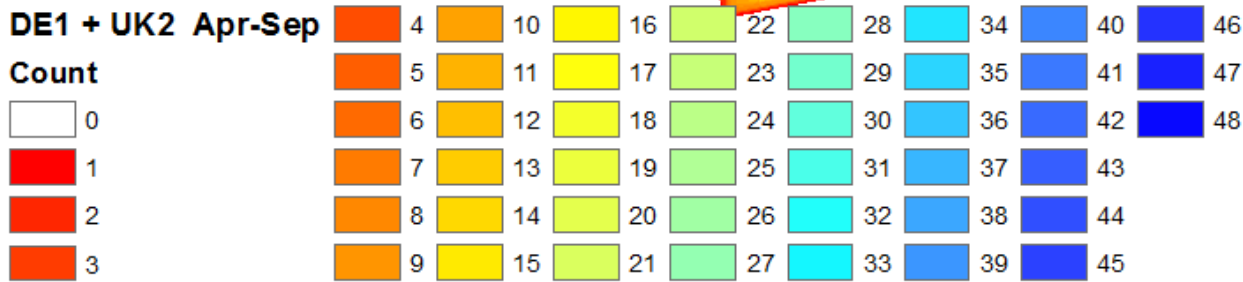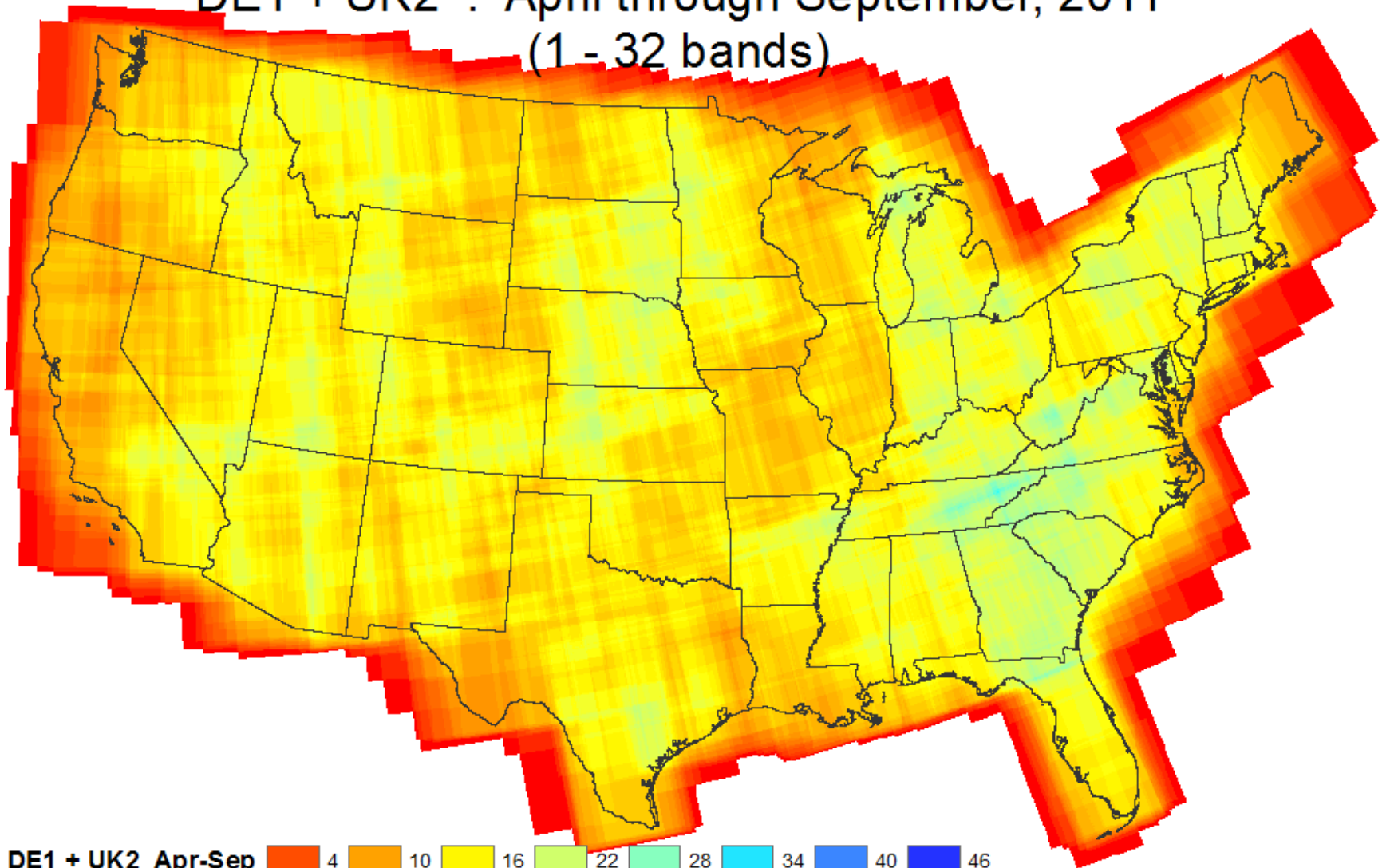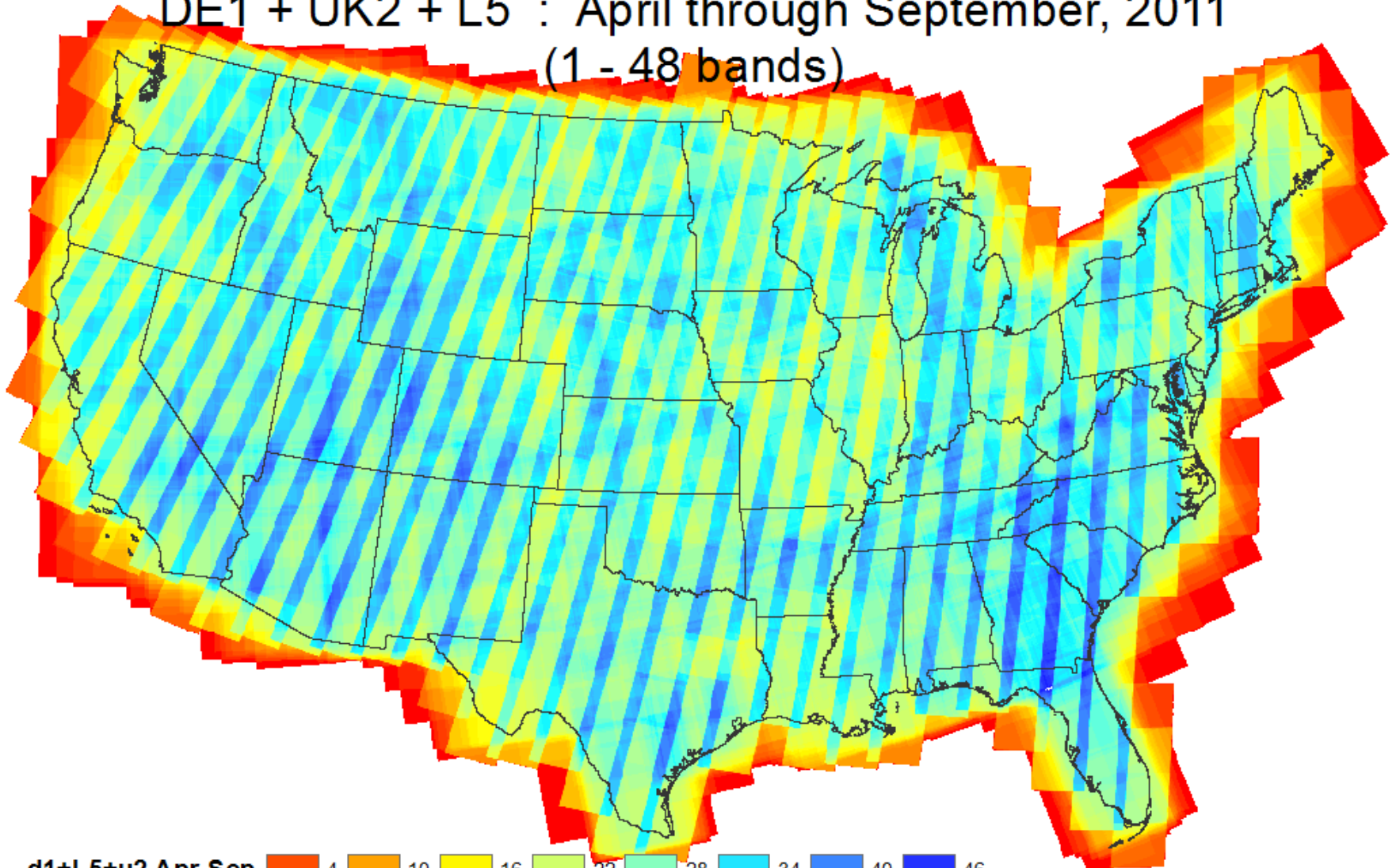(1 - 23 bands)

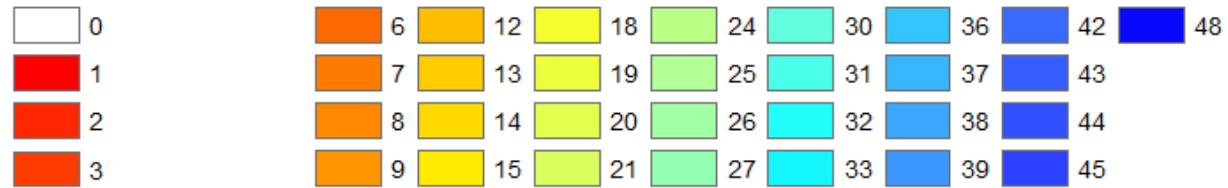| Landsat5 Apr-Sep | | 4 | | 10 | | 16 | | 22 | | 28 | | 34 | | 40 | | 46 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Count** | | 5 | | 11 | | 17 | | 23 | | 29 | | 35 | | 41 | | 47 |
| | 0 | | 6 | | 12 | | 18 | | 24 | | 30 | | 36 | | 42 | | 48 |
| | 1 | | 7 | | 13 | | 19 | | 25 | | 31 | | 37 | | 43 | | |
| | 2 | | 8 | | 14 | | 20 | | 26 | | 32 | | 38 | | 44 | | |
| | 3 | | 9 | | 15 | | 21 | | 27 | | 33 | | 39 | | 45 | | |

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

| DE1 + UK2 Apr-Sep | | 4 | | 10 | | 16 | | 22 | | 28 | | 34 | | 40 | | 46 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Count** | | 5 | | 11 | | 17 | | 23 | | 29 | | 35 | | 41 | | 47 |
| | 0 | | 6 | | 12 | | 18 | | 24 | | 30 | | 36 | | 42 | | 48 |
| | 1 | | 7 | | 13 | | 19 | | 25 | | 31 | | 37 | | 43 | | |
| | 2 | | 8 | | 14 | | 20 | | 26 | | 32 | | 38 | | 44 | | |
| | 3 | | 9 | | 15 | | 21 | | 27 | | 33 | | 39 | | 45 | | |

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

| d1+L5+u2 Apr-Sep | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Count | 4 | 10 | 16 | 22 | 28 | 34 | 40 | 46 |
| 0 | 5 | 11 | 17 | 23 | 29 | 35 | 41 | 47 |
| | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 |
| 1 | 7 | 13 | 19 | 25 | 31 | 37 | 43 | |
| 2 | 8 | 14 | 20 | 26 | 32 | 38 | 44 | |
| 3 | 9 | 15 | 21 | 27 | 33 | 39 | 45 | |

# National Cropland Data Layer Legend

**Land Cover Categories (by decreasing acreage)**

## Agriculture

Pasture/Grass
Corn
Soybeans
Winter Wheat
Fallow/Idle Cropland
Other Hay/Non Alfalfa
Alfalfa
Cotton
Spring Wheat
Sorghum
Dbl Crop WinWht/Soybeans
Rice
Barley
Oranges
Oats
Sunflower
Dry Beans
Peanuts
Durum Wheat
Sugarbeets
Potatoes
Canola
Sugarcane
Almonds
Sod/Grass Seed
Grapes
Apples

Rye
Peas
Millet
Walnuts
Lentils
Pecans
Dbl Crop WinWht/Cotton
Dbl Crop WinWht/Sorghum
Sweet Corn
Aquaculture
Clover/Wildflowers
Other Crops
Dbl Crop WinWht/Corn
Cherries
Triticale
Citrus
Safflower
Pistachios
Blueberries
Christmas Trees
Dbl Crop Barley/Soybeans
Tomatoes
Onions
Flaxseed
Dbl Crop Oats/Corn
Pop or Orn Corn
Herbs

Misc Vegs & Fruits
Olives
Other Tree Crops
Dbl Crop Corn/Soybeans
Sweet Potatoes
Peaches
Cranberries
Tobacco
Cantaloupes
Prunes
Dbl Crop Barley/Corn
Dbl Crop Soybeans/Cotton
Pears
Lettuce
Dbl Crop Lettuce/Durum Wht
Watermelons
Switchgrass
Asparagus
Carrots
Strawberries
Pumpkins
Squash
Cabbage
Peppers
Dbl Crop Soybeans/Oats
Hops
Mint

Pomegranates
Dbl Crop Lettuce/Cotton
Mustard
Plums
Dbl Crop Barley/Sorghum
Broccoli
Radishes
Garlic
Speltz
Vetch
Apricots
Caneberries
Greens
Nectarines
Cucumbers
Other Small Grains
Turnips
Dbl Crop Lettuce/Cantaloupe
Camelina
Cauliflower
Rape Seed
Honeydew Melons
Celery
Dbl Crop Durum Wht/Sorghum
Eggplants
Gourds
Dbl Crop Lettuce/Barley

## Non-Agriculture

Forest
Shrubland
Developed
Wetlands
Water
Barren
Perennial Ice/Snow

# States to Analyze

# California



**Legend:**
- Cotton (red)
- Corn (yellow)
- Almonds (teal)
- Grapes (purple)
- Alfalfa (pink)
- Pistachios (bright green)
- Winter Wheat (brown)
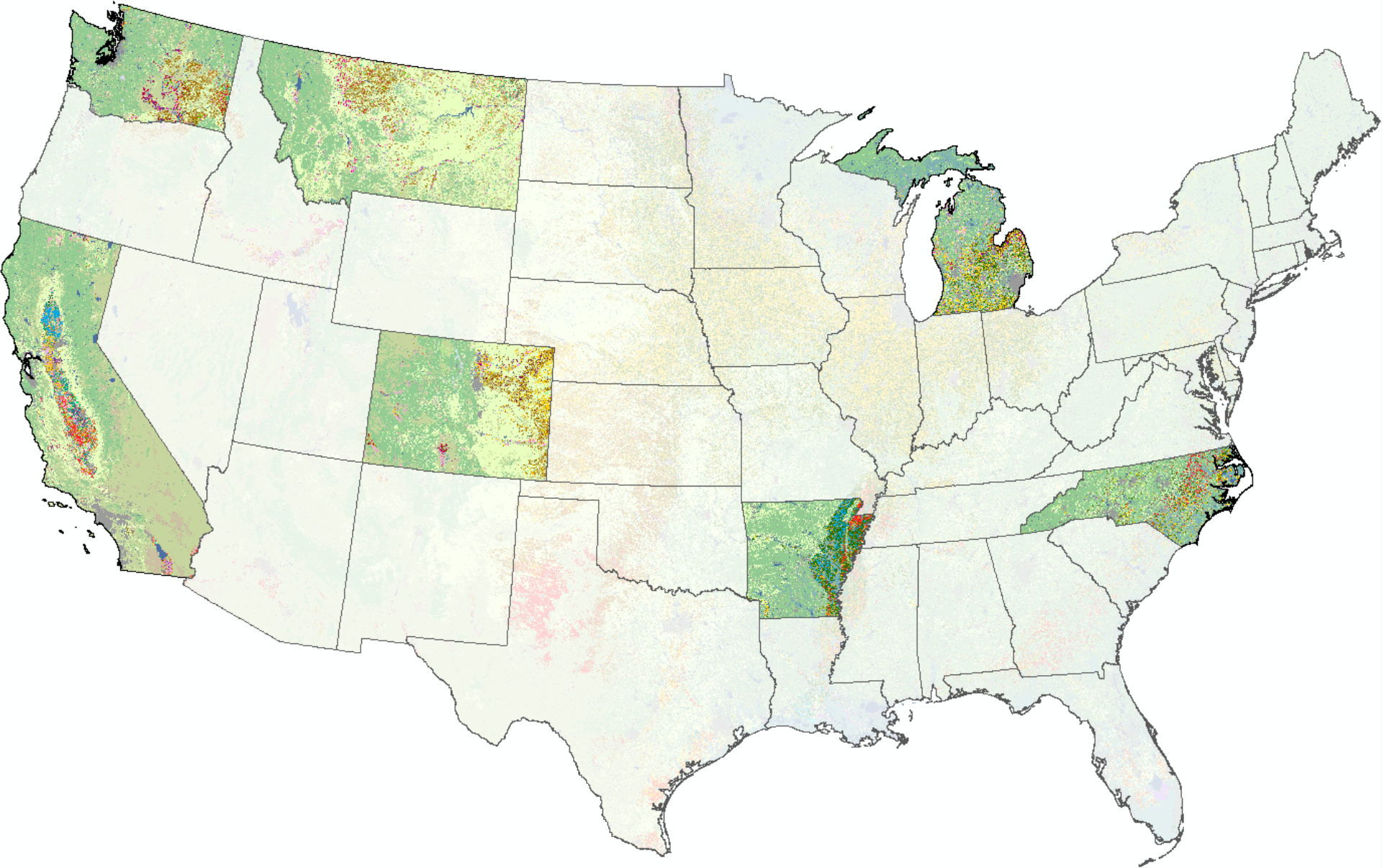
## Landsat & DMC
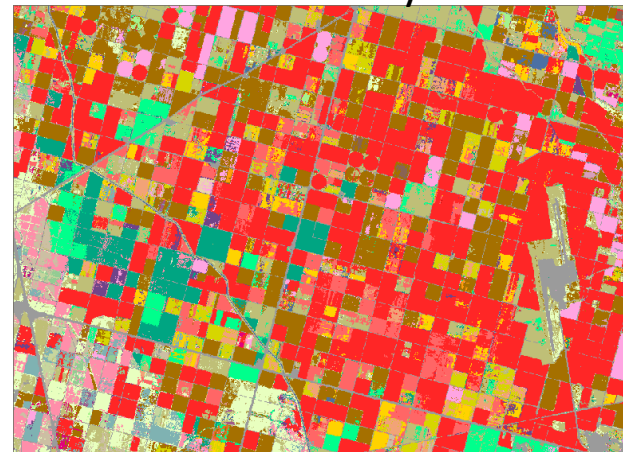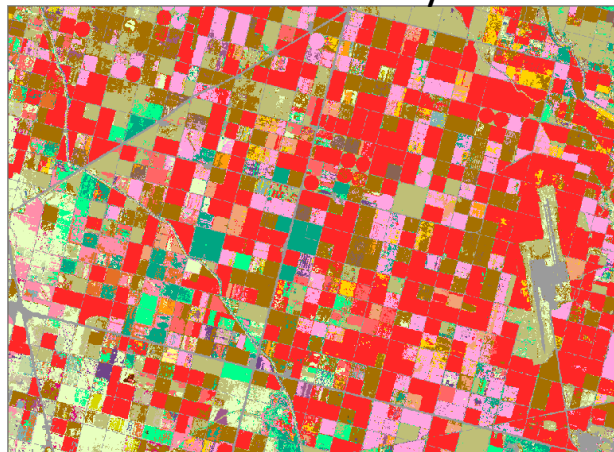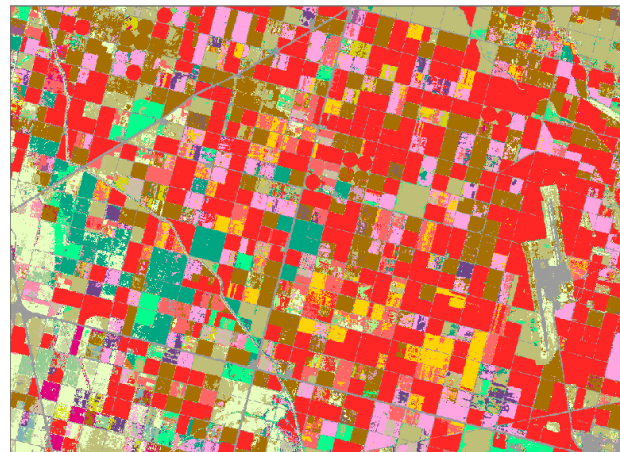
| | | Producer | User |
|---|---|---|---|
| ALL CROPS | ★ | 85% | |
| Corn | ★ | 91% | 90% |
| Rice | ★ | 99% | 99% |
| Cotton | ★ | 97% | 95% |
| W. Wheat | ★ | 85% | 88% |
| Alfalfa | ★ | 93% | 90% |
| Fallow/Idle | ★ | 79% | 73% |

211 bands – North
215 bands – South

## Landsat Only

| | | Producer | User |
|---|---|---|---|
| ALL CROPS | | 83% | |
| Corn | | 89% | 89% |
| Rice | ★ | 99% | 99% |
| Cotton | | 96% | 91% |
| W. Wheat | | 83% | 86% |
| Alfalfa | | 92% | 89% |
| Fallow/Idle | | 76% | 68% |

151 bands – North
135 bands – South

## DMC Only

| | | Producer | User |
|---|---|---|---|
| ALL CROPS | | 76% | |
| Corn | ★ | 91% | 90% |
| Rice | ★ | 99% | 99% |
| Cotton | ★ | 97% | 95% |
| W. Wheat | | 84% | 80% |
| Alfalfa | | 93% | 82% |
| Fallow/Idle | | 79% | 45% |

99 bands – North
93 bands – South

★ Highest Accuracy

# Washington

Legend:
- Winter Wheat
- Fallow/Idle Cropland
- Sod/Grass Seed
- Barley
- Lentils
- Peas
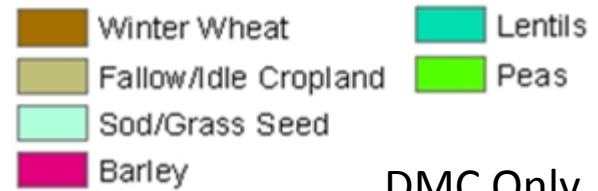
## Landsat & DMC
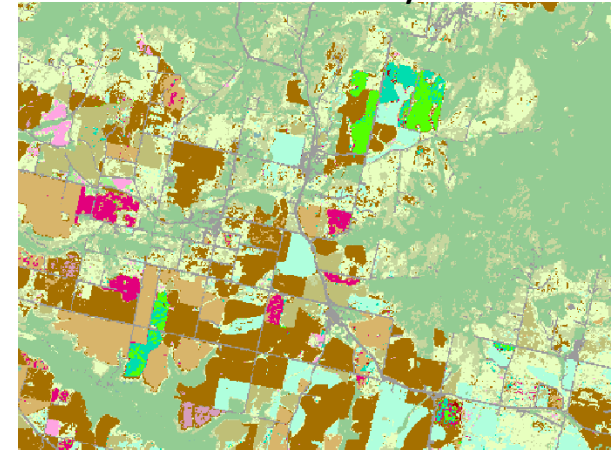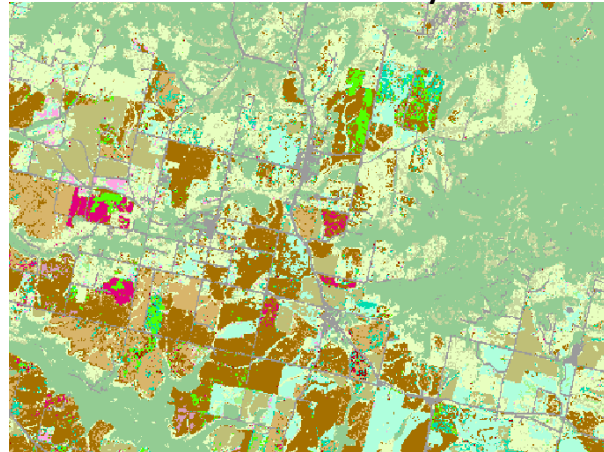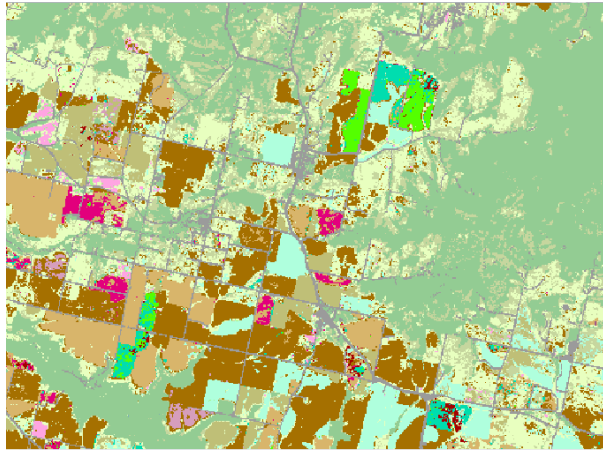
|  | | Producer | User |
|---|---|---|---|
| ALL CROPS | ★ | 92% | |
| Corn | | 89% | 94% |
| W. Wheat | ★ | 98% | 97% |
| S. Wheat | | 92% | 93% |
| Alfalfa | | 84% | 88% |
| Peas | ★ | 88% | 87% |
| Fallow/Idle | ★ | 97% | 97% |

179 bands

## Landsat Only

|  | | Producer | User |
|---|---|---|---|
| ALL CROPS | | 89% | |
| Corn | | 80% | 89% |
| W. Wheat | | 97% | 94% |
| S. Wheat | | 84% | 88% |
| Alfalfa | | 82% | 87% |
| Peas | | 79% | 82% |
| Fallow/Idle | ★ | 97% | 97% |

136 bands

## DMC Only

|  | | Producer | User |
|---|---|---|---|
| ALL CROPS | ★ | 92% | |
| Corn | ★ | 92% | 93% |
| W. Wheat | | 98% | 97% |
| S. Wheat | ★ | 93% | 93% |
| Alfalfa | ★ | 85% | 89% |
| Peas | | 87% | 86% |
| Fallow/Idle | ★ | 97% | 97% |

81 bands

★ Highest Accuracy

# Montana

**Legend:**
- Barley
- Winter Wheat
- Fallow/Idle Cropland
- Alfalfa
- Peas



### Landsat & DMC
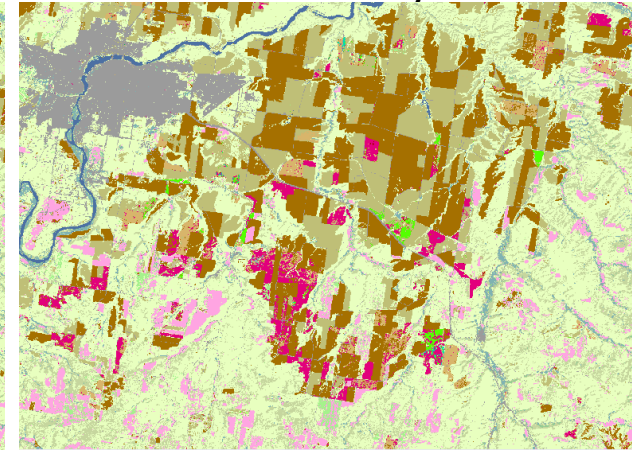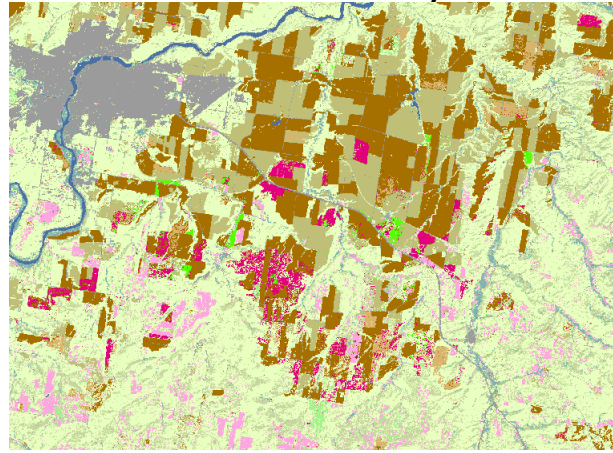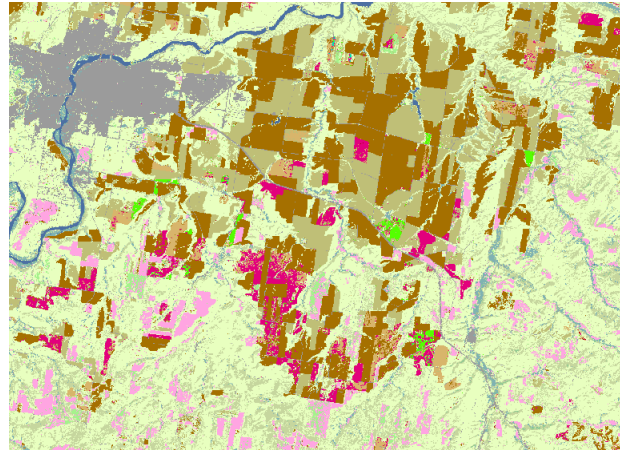
| | Producer | User |
|---|---|---|
| ALL CROPS | ★ 72% | |
| Fallow/Idle | ★ 90% | 90% |
| W. Wheat | ★ 90% | 92% |
| S. Wheat | ★ 86% | 83% |
| Alfalfa | ★ 60% | 63% |
| Other Hay | 21% | 38% |
| Barley | ★ 66% | 77% |

**181 bands**

### Landsat Only

| | Producer | User |
|---|---|---|
| ALL CROPS | 67% | |
| Fallow/Idle | 89% | 88% |
| W. Wheat | 87% | 87% |
| S. Wheat | 81% | 78% |
| Alfalfa | 56% | 58% |
| Other Hay | 19% | 35% |
| Barley | 57% | 70% |

**133 bands**

### DMC Only

| | Producer | User |
|---|---|---|
| ALL CROPS | 69% | |
| Fallow/Idle | 89% | 88% |
| W. Wheat | 89% | 91% |
| S. Wheat | 84% | 81% |
| Alfalfa | 58% | 60% |
| Other Hay | 19% | 34% |
| Barley | 64% | 74% |

**48 bands**

★ Highest Accuracy

# Colorado

Legend:
- Millet
- Winter Wheat
- Fallow/Idle Cropland
- Corn

## Landsat & DMC



| | | Producer | User |
|---|---|---|---|
| ALL CROPS | ★ | 81% | |
| Corn | | 91% | 93% |
| W. Wheat | ★ | 90% | 95% |
| Potatoes | ★ | 87% | 93% |
| Fallow/Idle | ★ | 83% | 89% |
| Barley | ★ | 78% | 74% |
| Millet | ★ | 80% | 72% |

140 bands

## Landsat Only
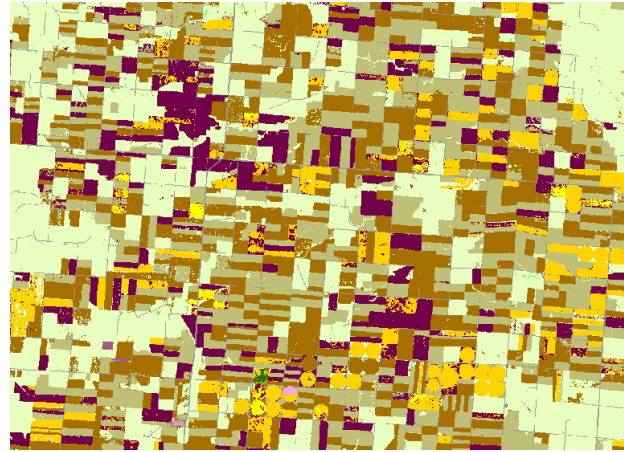
Not enough bands available

| | Producer | User |
|---|---|---|
| ALL CROPS | | |
| Corn | | |
| W. Wheat | | |
| Potatoes | | |
| Fallow/Idle | | |
| Barley | | |
| Millet | | |

## DMC Only



| | | Producer | User |
|---|---|---|---|
| ALL CROPS | ★ | 81% | |
| Corn | ★ | 92% | 92% |
| W. Wheat | | 90% | 93% |
| Potatoes | | 82% | 98% |
| Fallow/Idle | | 83% | 88% |
| Barley | | 73% | 78% |
| Millet | | 71% | 79% |

66 bands

★ Highest Accuracy

# Arkansas



**Legend:** Soybeans · Corn · Dbl Crop WinWht/Soybeans · Cotton · Sorghum · Rice
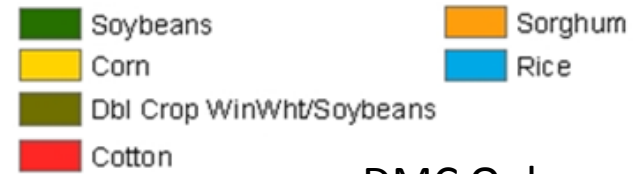
## Landsat & DMC
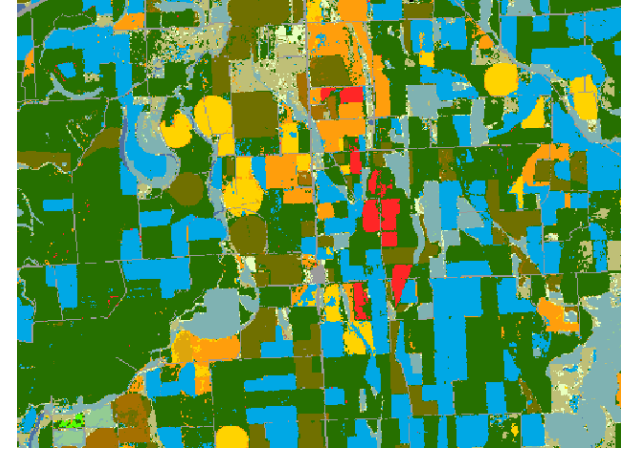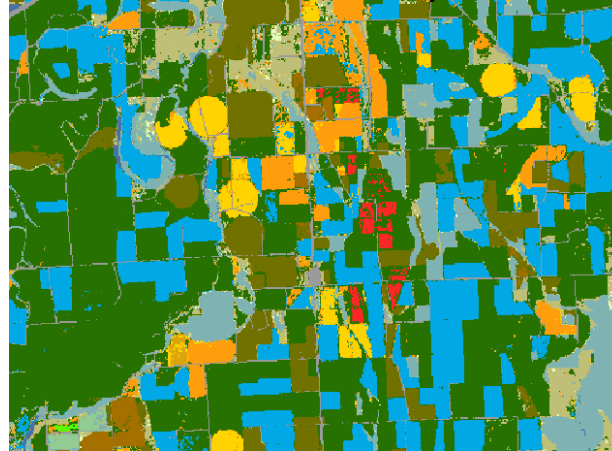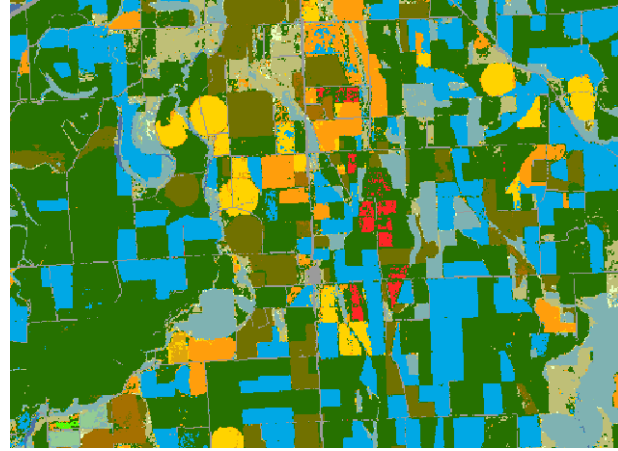
| | | Producer | User |
|---|---|---|---|
| ALL CROPS | ★ | 92% | |
| Corn | ★ | 92% | 95% |
| Rice | ★ | 97% | 98% |
| Cotton | | 94% | 94% |
| Soybeans | ★ | 95% | 94% |
| WW & Soy | ★ | 90% | 84% |
| Sorghum | | 65% | 90% |

217 bands

## Landsat Only

| | | Producer | User |
|---|---|---|---|
| ALL CROPS | | 89% | |
| Corn | | 91% | 94% |
| Rice | ★ | 97% | 98% |
| Cotton | | 94% | 93% |
| Soybeans | | 94% | 93% |
| WW & Soy | | 68% | 82% |
| Sorghum | | 62% | 82% |

178 bands

## DMC Only

| | | Producer | User |
|---|---|---|---|
| ALL CROPS | | 90% | |
| Corn | ★ | 92% | 94% |
| Rice | | 96% | 97% |
| Cotton | ★ | 95% | 96% |
| Soybeans | | 94% | 93% |
| WW & Soy | | 71% | 77% |
| Sorghum | ★ | 68% | 90% |

102 bands

★ Highest Accuracy

# Michigan



| | | Corn |
|---|---|---|
| | | Winter Wheat |
| | | Soybeans |
| | | Dry Beans |
| | | Sugarbeets |

### Landsat & DMC
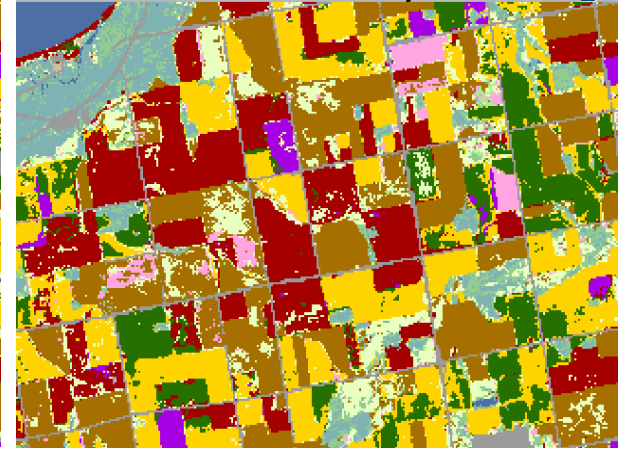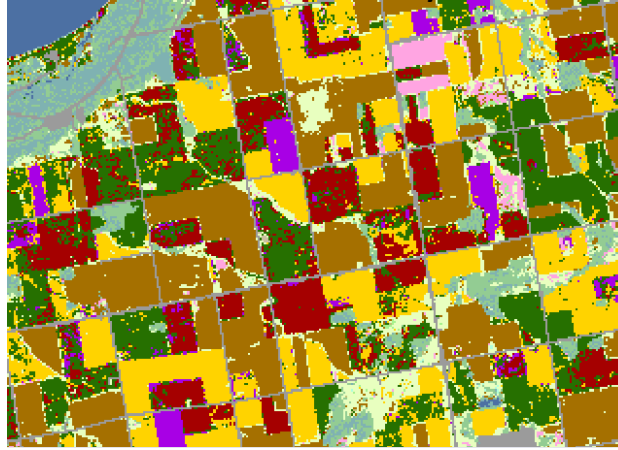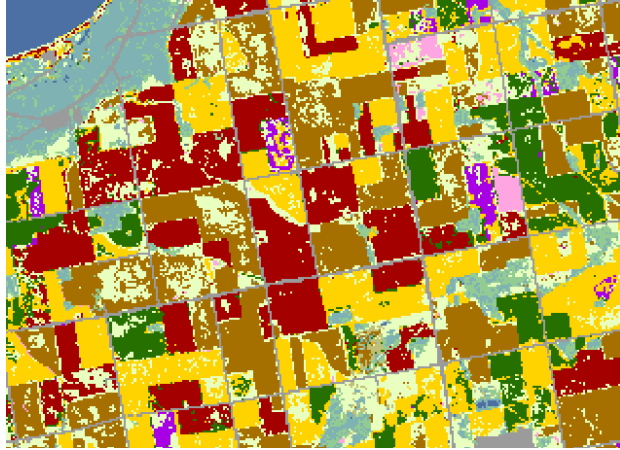
| | | Producer | User |
|---|---|---|---|
| ALL CROPS | ★ | 91% | |
| Corn | ★ | 96% | 96% |
| Soybeans | | 96% | 96% |
| Win. Wheat | ★ | 97% | 95% |
| Dry Beans | ★ | 81% | 95% |
| Sugarbeets | ★ | 94% | 93% |
| Potatoes | ★ | 84% | 93% |

**174 bands**

### Landsat Only

| | Producer | User |
|---|---|---|
| ALL CROPS | 87% | |
| Corn | 93% | 94% |
| Soybeans | 94% | 93% |
| Win. Wheat | 96% | 92% |
| Dry Beans | 80% | 77% |
| Sugarbeets | 86% | 88% |
| Potatoes | 76% | 85% |

**115 bands**

### DMC Only

| | | Producer | User |
|---|---|---|---|
| ALL CROPS | | 88% | |
| Corn | | 94% | 93% |
| Soybeans | ★ | 97% | 93% |
| Win. Wheat | | 96% | 92% |
| Dry Beans | | 79% | 79% |
| Sugarbeets | | 85% | 89% |
| Potatoes | | 77% | 86% |

**75 bands**

★ Highest Accuracy

# North Carolina



| Legend | |
|---|---|
| Corn | (yellow) |
| Dbl Crop WinWht/Soybeans | (olive) |
| Cotton | (red) |
| Soybeans | (dark green) |

## Landsat & DMC
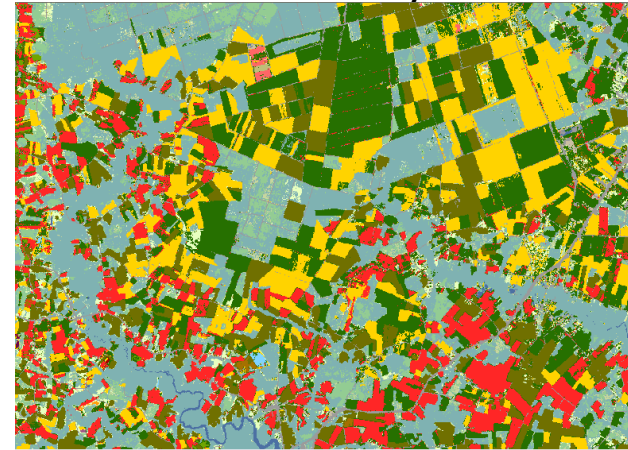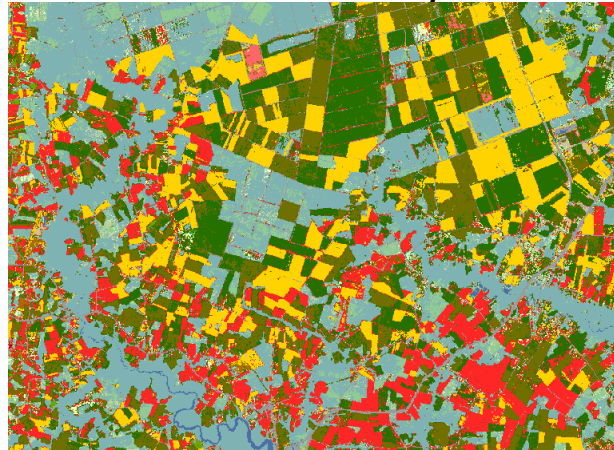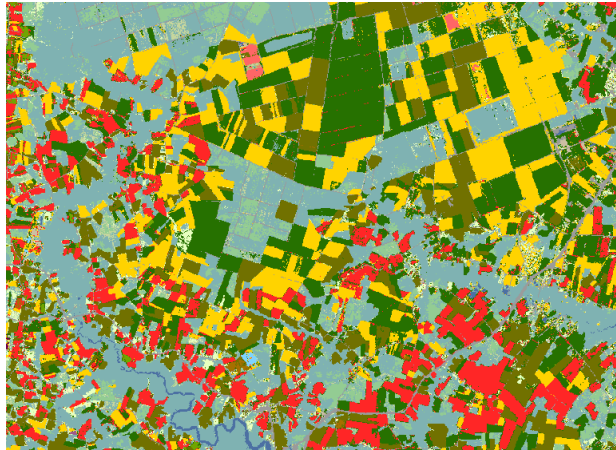
| | | Producer | User |
|---|---|---|---|
| ALL CROPS | ★ | 82% | |
| Corn | | 94% | 92% |
| Cotton | ★ | 96% | 94% |
| Soybeans | ★ | 85% | 84% |
| WW/Soy | ★ | 94% | 88% |
| Pasture | | 67% | 68% |
| Peanuts | ★ | 87% | 93% |

**118 bands**

## Landsat Only

| | Producer | User |
|---|---|---|
| ALL CROPS | 69% | |
| Corn | 83% | 82% |
| Cotton | 91% | 85% |
| Soybeans | 63% | 71% |
| WW/Soy | 80% | 82% |
| Pasture | 59% | 44% |
| Peanuts | 71% | 90% |

**73 bands**

## DMC Only

| | | Producer | User |
|---|---|---|---|
| ALL CROPS | ★ | 82% | |
| Corn | ★ | 95% | 92% |
| Cotton | ★ | 96% | 94% |
| Soybeans | | 84% | 83% |
| WW/Soy | ★ | 94% | 88% |
| Pasture | ★ | 67% | 69% |
| Peanuts | | 82% | 91% |

**66 bands**

★ Highest Accuracy

# Questions?

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