USDA
Remote Sensing Programs, Priorities, and Partnerships

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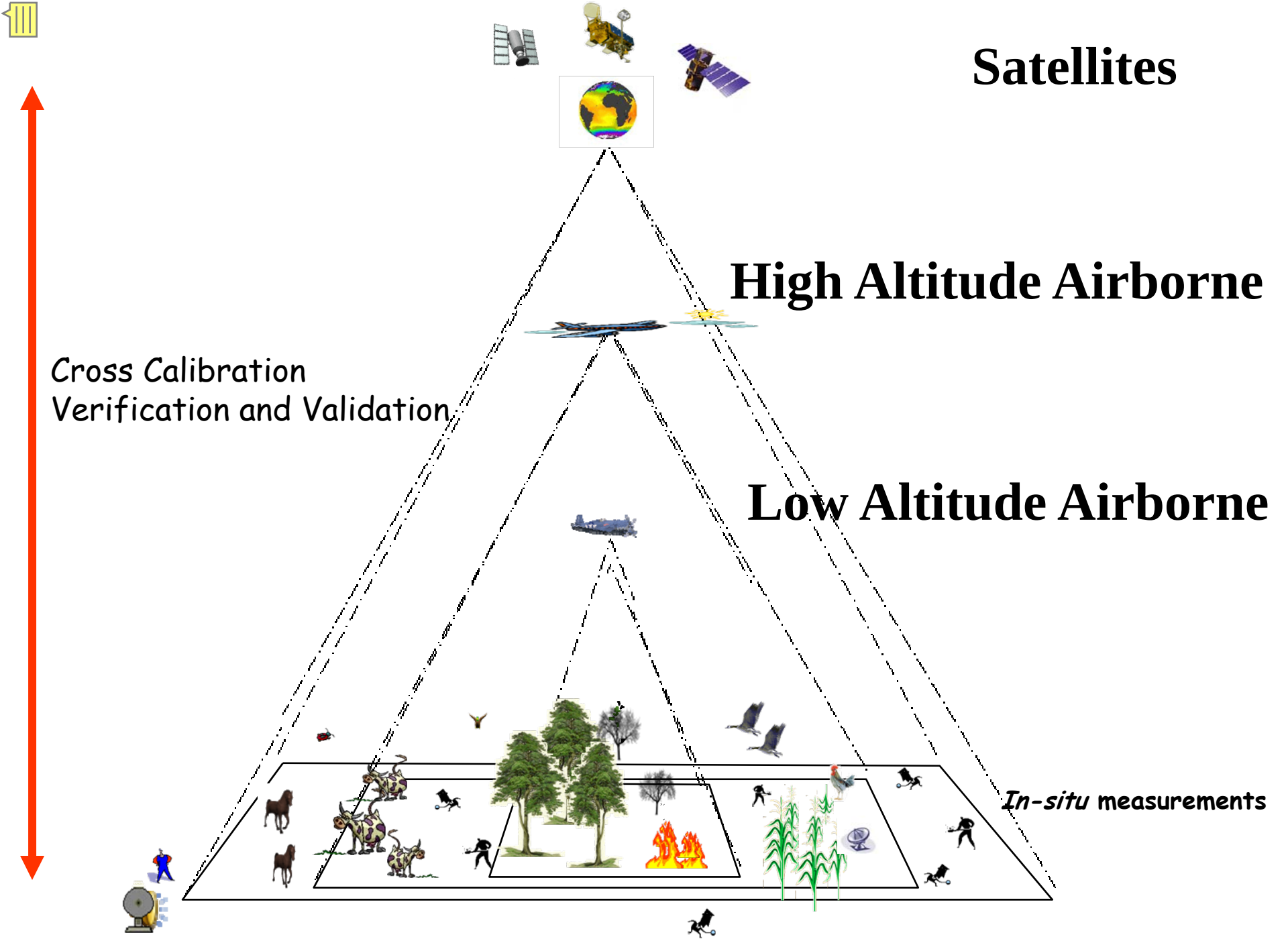
USDA Remote Sensing Advisor

Outline

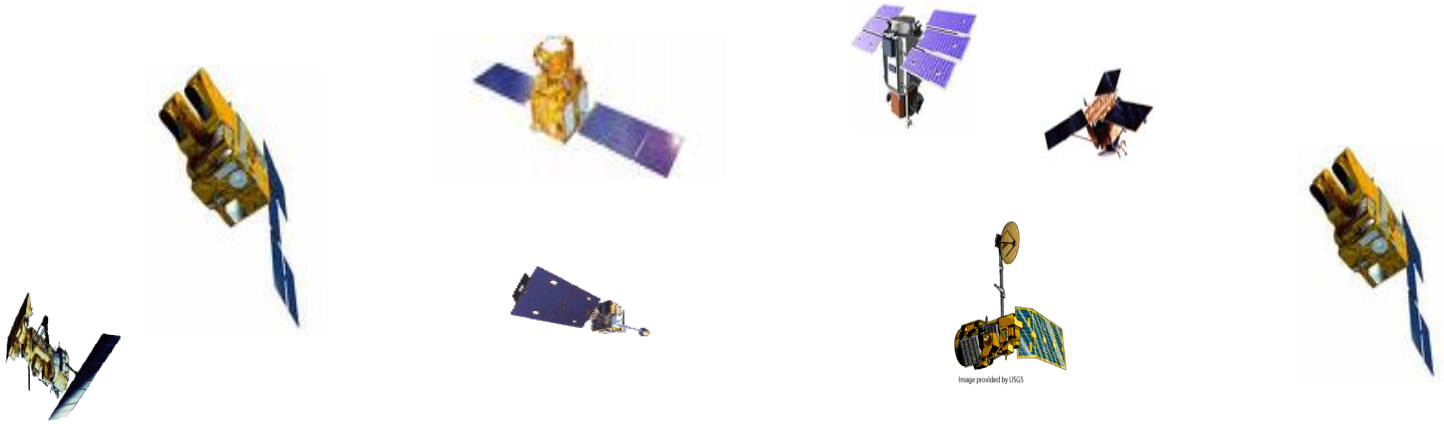
- National and Global Satellite Imagery Programs
  - USDA Satellite Image Archive
  - MODIS
- Applications
  - Disasters
  - Cropland data layer
  - Crop Insurance …
- USDA National Aerial Programs
- USGEO


Satellites
High Altitude Airborne
Low Altitude Airborne
Cross Calibration
Verification and Validation
In-situ measurements

Agriculture's Interrelated Policy and Program Considerations

- Commodity programs
- Conservation
- Agricultural trade
- U.S. Nutrition programs
- Rural development
- Agricultural research, education, and extension
- Forestry
- Biofuels
- Sustainable Agriculture
- Carbon Markets
- Disaster programs
- Wildland fire

- Environment
- Climate change
- Trade Policy
- Access to food by poorest consumers in poorest countries
- Dealing with longer-term scarcity concerns:
  - Land availability
  - Water
  - Food production inputs, especially energy
- Energy (total supply & demand)



Satellite Imagery

AWiFS

MODIS

SPOT

USDA Collection Strategy for ResourceSat

1. Background of USDA Satellite Imagery Archive

2. Who is doing the Purchasing? How and Why?
   - What is the Collection Strategy?

3. How is data distributed?
   - How much?
   - What is it used for?

Background on the USDA-Satellite Imagery Archive (USDA-SIA)

USDA-SIA is a program within the Foreign Agricultural Service that:

- Provides access to satellite imagery purchased by USDA for participating agencies.
- Cost-sharing program to maximize the cost effectiveness of Department expenditures on satellite imagery.
- Reduces the per-image price paid by USDA agencies.
- Takes advantage of contracts already in place.
- Benefits from leveraging the power of a single USDA purchasing body.

USDA purchases satellite imagery using the investment of the Commodity Credit Corporation and special imagery requests by the agencies.

USDA-SIA Roles

- Purchase satellite imagery from commercial vendors
  - USDA-SIA purchases satellite imagery from vendors who are on the prime vendor contract.
    - USDA standing order for US
    - USDA standing orders for foreign areas

- Process and store the satellite imagery
  - USDA-SIA processes the satellite imagery for the Foreign Agricultural Service, International Production Assessment Division.
  - No processing for the “archive” product.

- Distribute the satellite imagery to USDA agencies
  - USDA-SIA distributes the satellite imagery to the agencies who participate in the USDA archive.

USDA Standing Order
Coverage for the United States (lower 48)

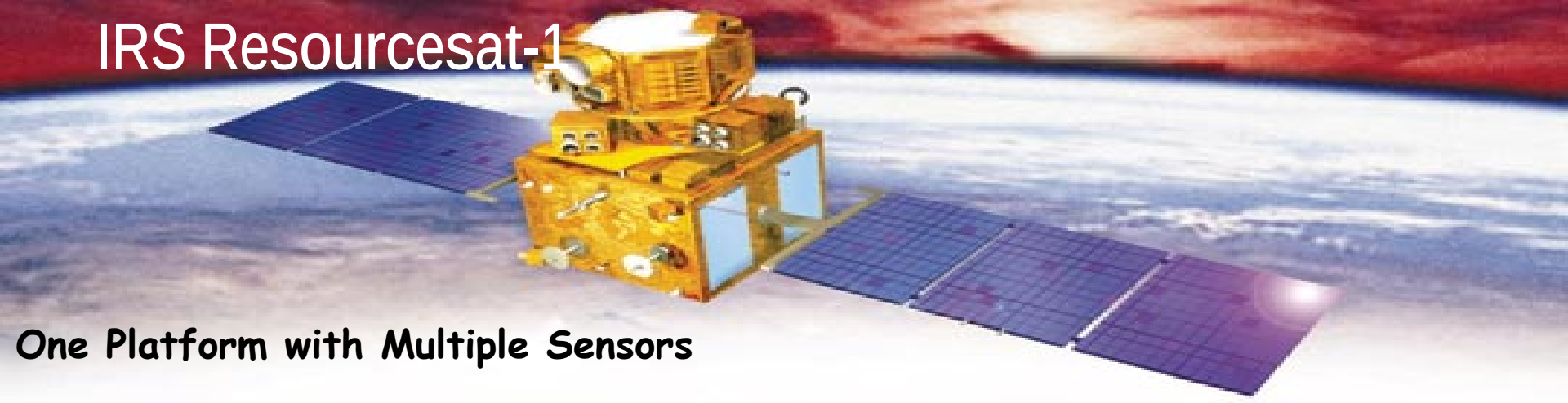
- The USDA is the largest commercial purchaser of ResourceSat-1 AWiFS data.
  - Largest in 2006, 2007 and probably 2008
- USDA purchases (and induces coverage) from April 1 to September 30
  - Commodity Credit Corporation funding
- Continued coverage, albeit less dense, from October 1 to March 31.
  - Pasture, rangeland and forage areas
  - Program Integrity funding, Risk Management Agency

USDA Can No Longer **Rely** on Landsat to Meet Operational Monitoring Needs

- USDA agencies are transitioning from Landsat to Resourcesat-1 AWiFS data.
  - **Global Coverage, Rapidly Delivered (other than India)**
  - **Excellent Revisit Cycle**
  - Excellent Value for USDA
  - Other Sensors Acquiring Data at Same Time
- USDA is no longer using Landsat imagery for operational monitoring applications because of the data gap.
  - No global coverage
  - No adequate revisit cycle
  - Not the best value for USDA

Not all applications have transitioned; 85% for P6-AWiFS, 14% for Landsat.

IRS Resourcesat-1



One Platform with Multiple Sensors

AWiFS:

- **56 m resolution at nadir**
- **737 km combined swath**

LISS-3:

- **23.5 m resolution**
- **141 km swath**

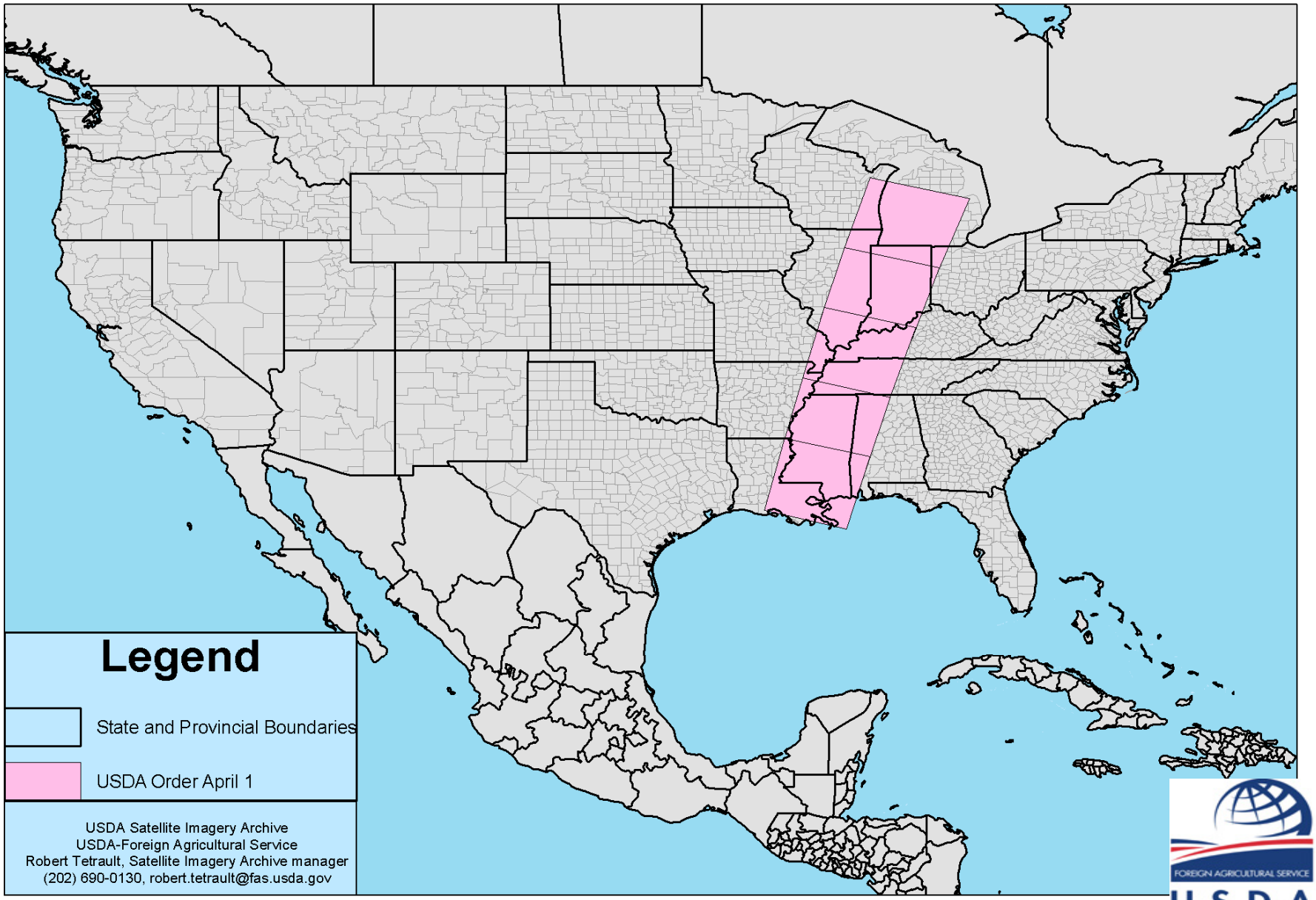
B2: 0.52 - 0.59
B3: 0.62 - 0.68
B4: 0.76 – 0.86
B5: 1.55 – 1.70

LISS-4:

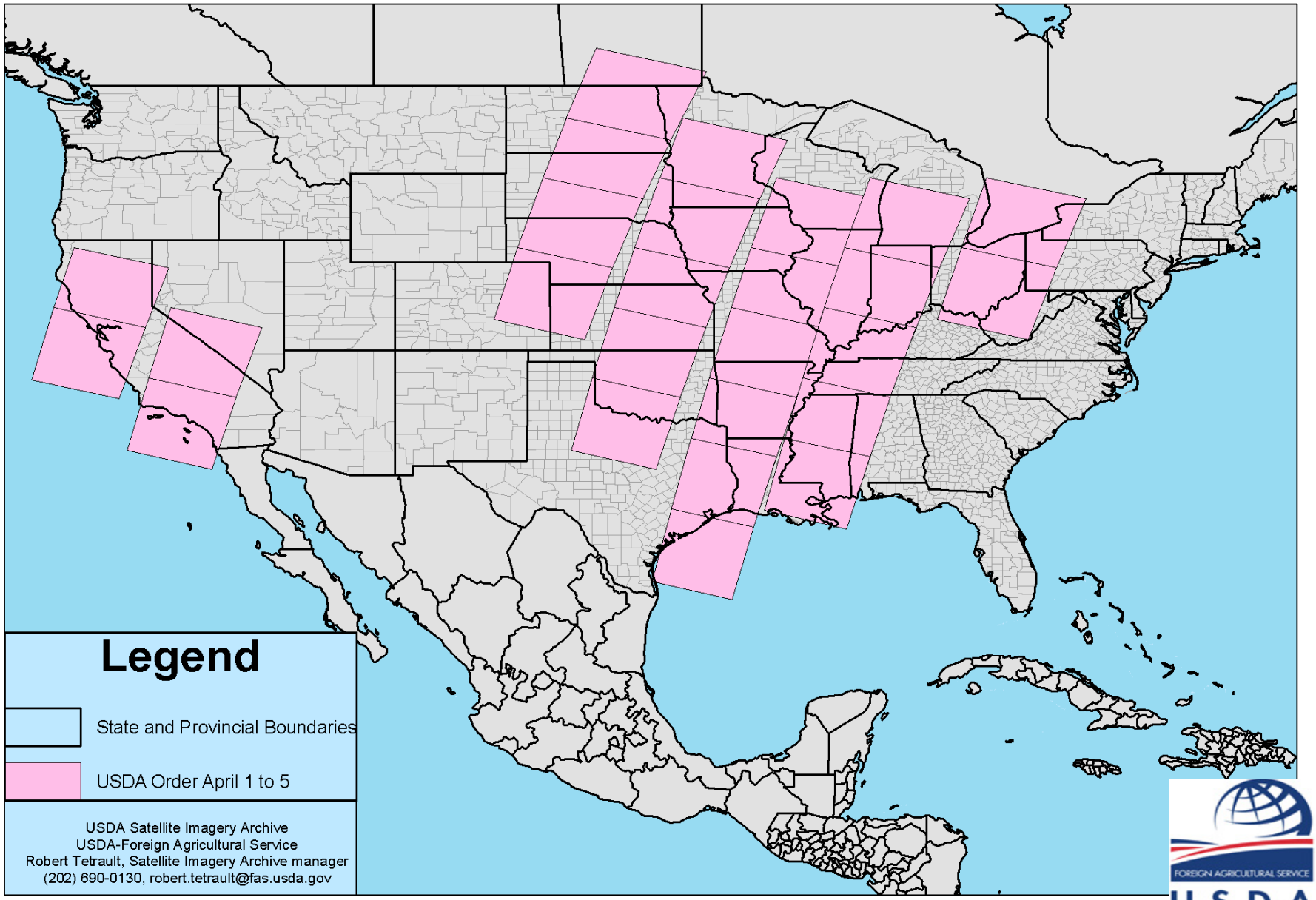
- **5.8 m resolution**
- **70.3 km (mono) swath**
- **Pointing**

B2: 0.52 - 0.59
B3: 0.62 - 0.68
B4: 0.76 – 0.86

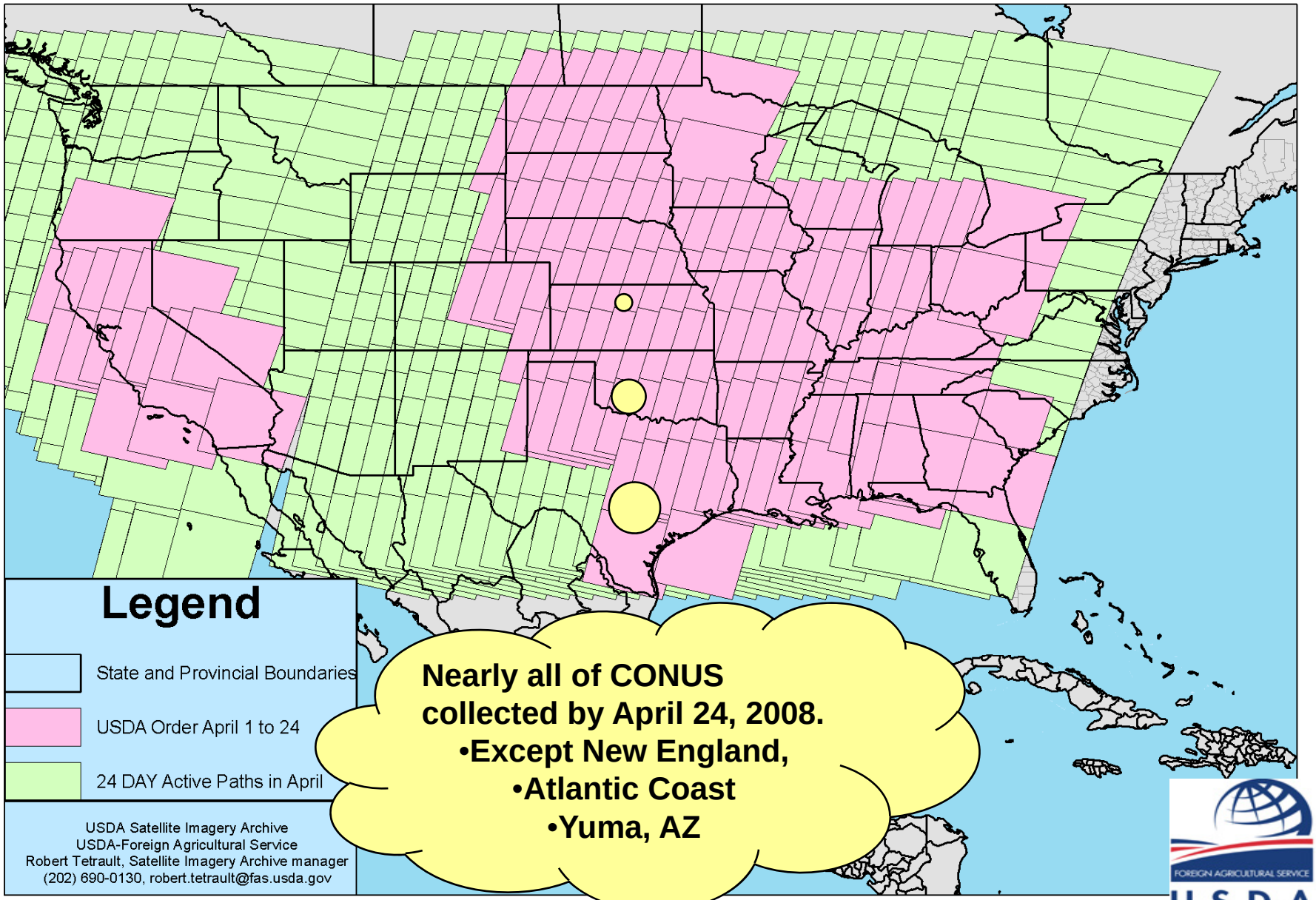
USDA Order for P6-AWiFS CONUS: April 1, 2008



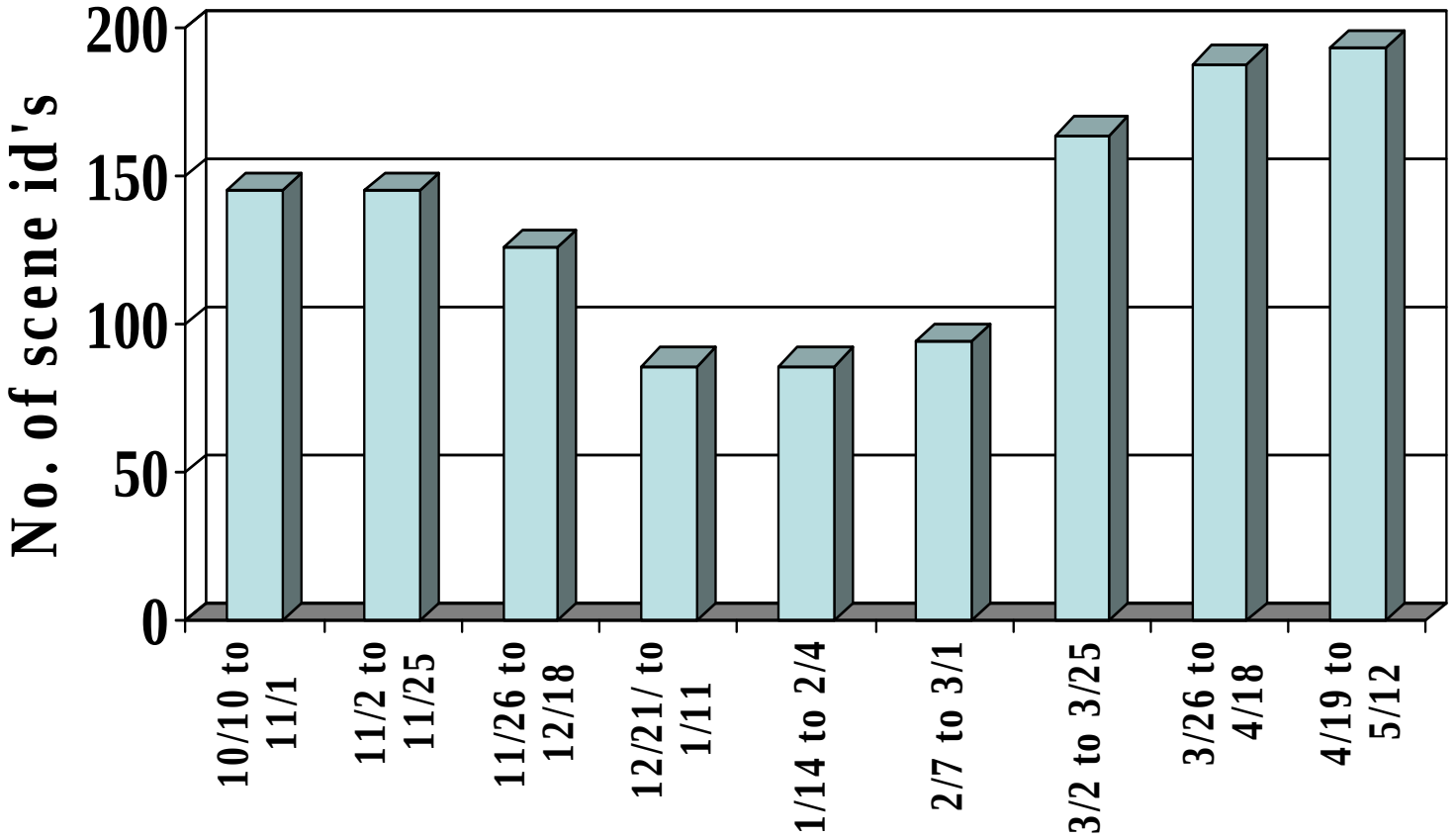
USDA Order for P6-AWiFS CONUS: April 1 to 5, 2008



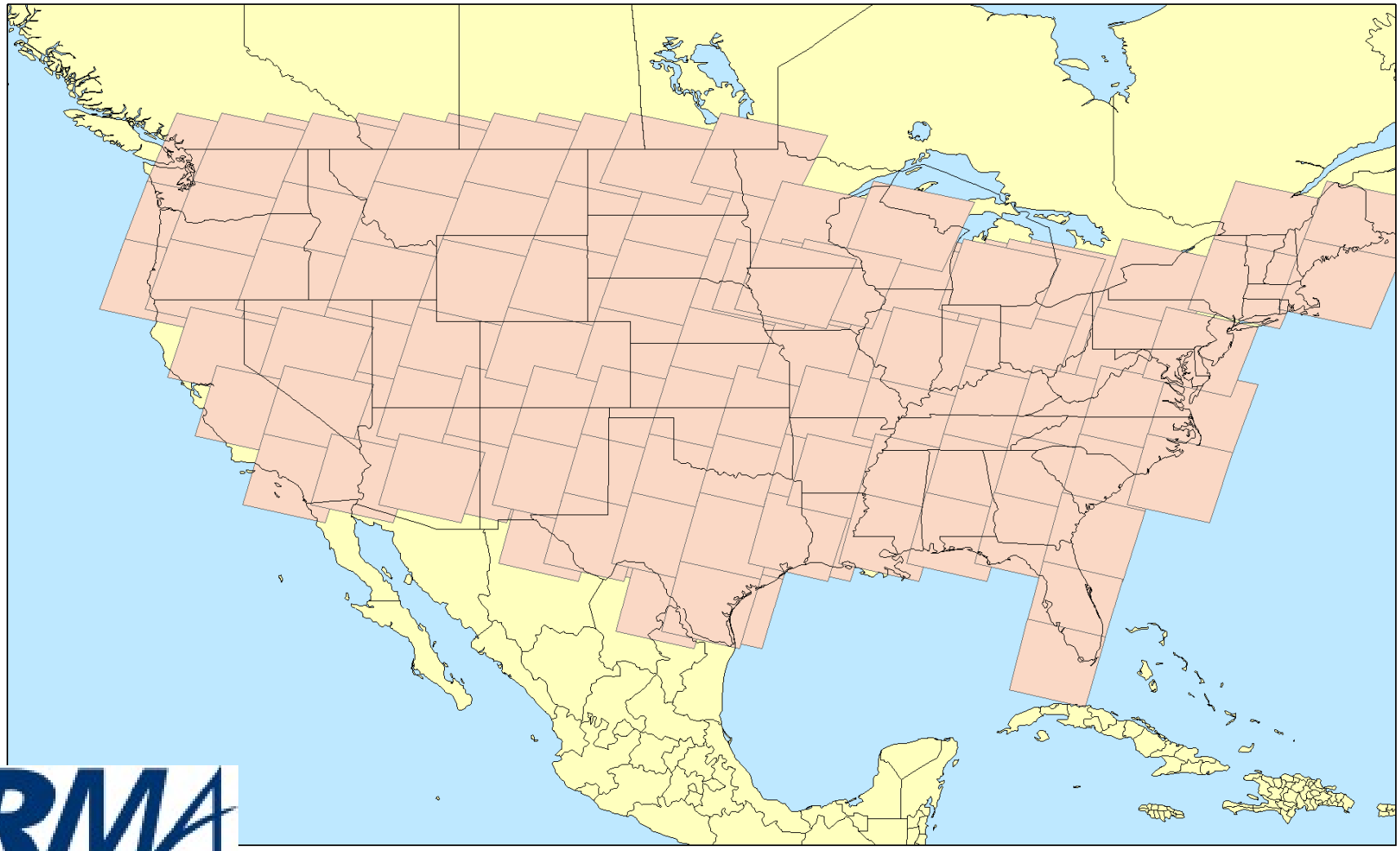
Active Paths for P6-AWiFS CONUS: April 1 to 24, 2008



Planned Collects for US for “leaf-off”



Pasture, Rangeland, and Forage for Crop Insurance Expansion
Collects for Date 3: Nov. 3 to Nov. 25, 2008

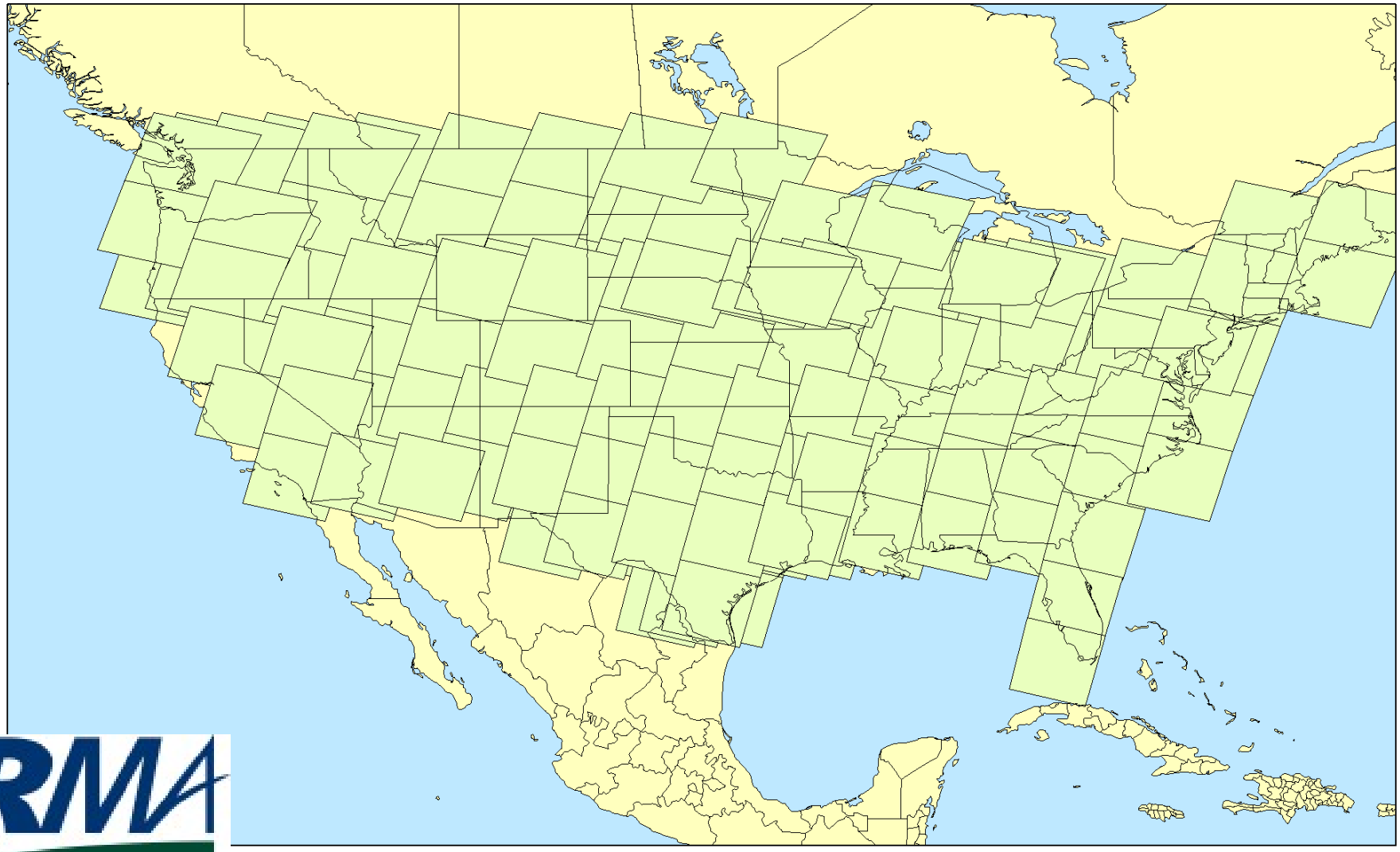


RMA

Pasture, Rangeland, and Forage for Crop Insurance Expansion
Collects for Date 5: Dec. 21 to Jan. 1, 2009

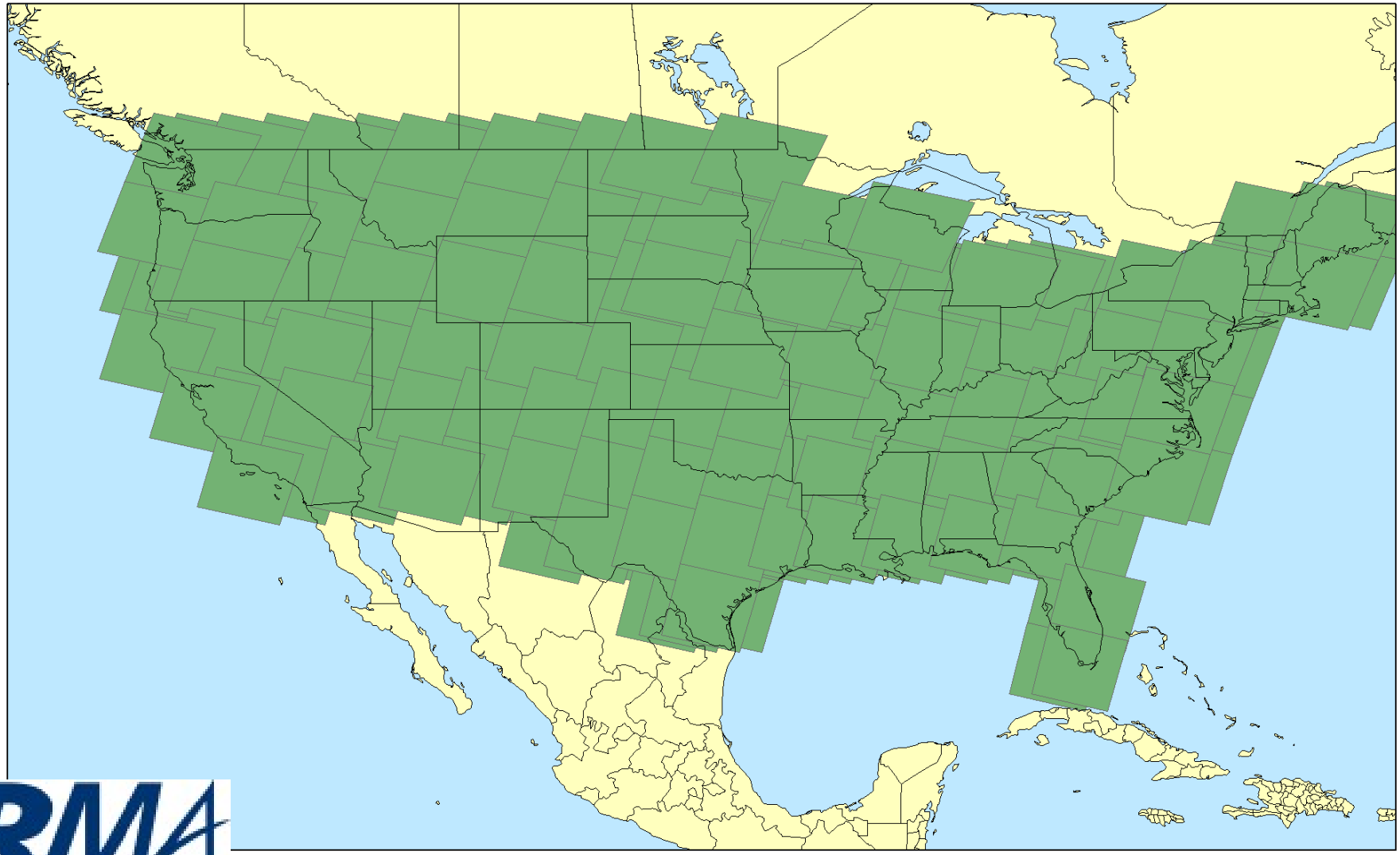
RMA

Pasture, Rangeland, and Forage for Crop Insurance Expansion
Collects for Date 8: Mar. 2 to Mar. 25, 2009



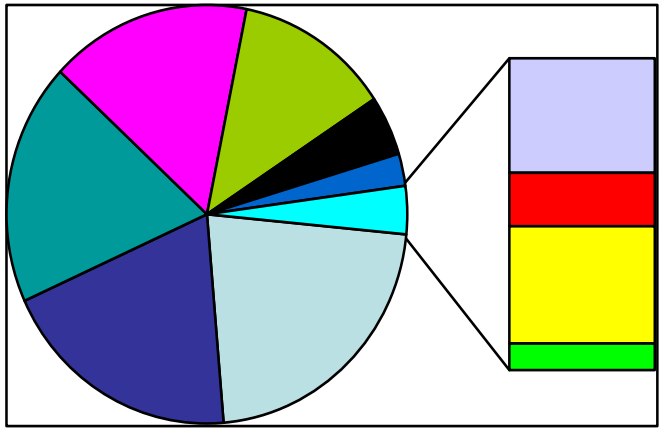
RMA

Pasture, Rangeland, and Forage for Crop Insurance Expansion
Collects for Date 10: Apr 19 to May. 12, 2009



RMA

Applications of Field-level* Satellite Data



- Compliance-22%
- Early Warning-19%
- Research-19%
- Cropland Data-16%
- Crop Assessment-12%
- Land Cover-5%
- Area Frame-2%
- Fire-1%
- Forest Pest-1%
- LDGS-1%
- Soil Modeling-1%

* Field-level satellite imagery allows users to distinguish fields or forest land parcels. It is typically defined by GSD of 5 to 100 meters.

Applications and Agency

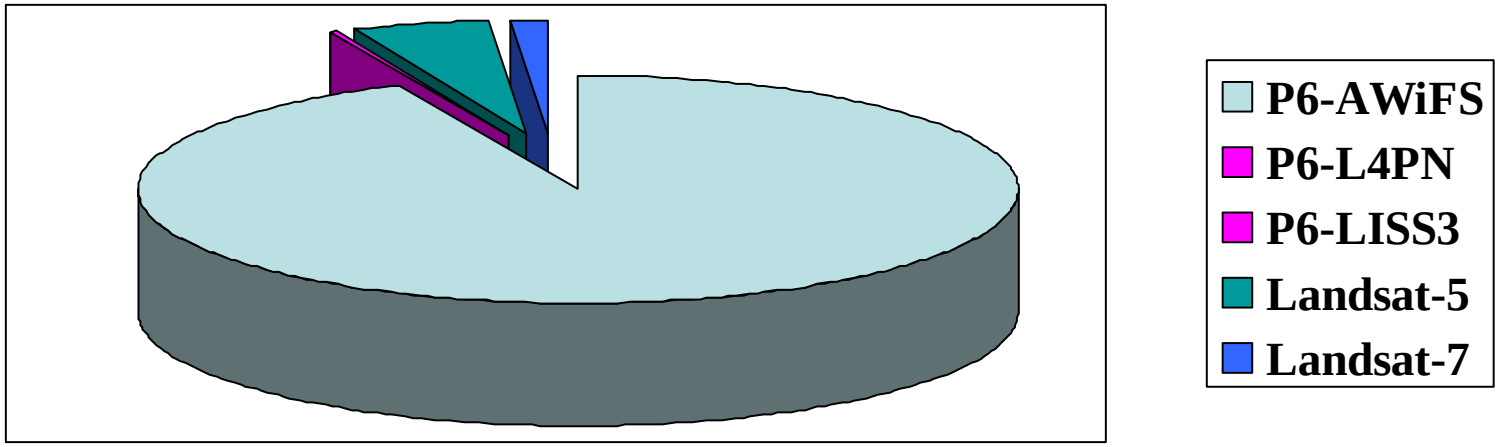
- Compliance/Regulatory Use (RMA)
- Early warning of potential food supply disruptions (FSA and FAS)
- Research (ARS and other agencies)
- Cropland data layer (NASS)
- Planted area of US corn and soybean (NASS)
- Foreign crop condition assessment (FAS)
- Land Cover (USGS and other agencies)
- Area Frame (NASS)
- Fire and Forest Pest (USFS)
- Soil Modeling (NRCS)
- Landsat Data Gap Study (USGS)

Who pays for the satellite imagery?

- Participating agencies pay an annual fee for access to the USDA Satellite Imagery Archive.
  - Fees do not cover the purchase of new imagery.
- USDA purchases satellite imagery using the investment of the Commodity Credit Corporation.
  - This is the USDA's standing order
- If agencies need additional imagery not in the standing order, the purchase needs to be funded separately.
  - RMA is funding the pasture, rangeland and forage collects
- The benefits to participating are high, if the area and time frame coincide with the USDA's standing order.

USDA-SIA Distributed 5,534 Field-level Satellite Scenes in FY2008 to USDA agencies

Distribution by Satellite Data Type



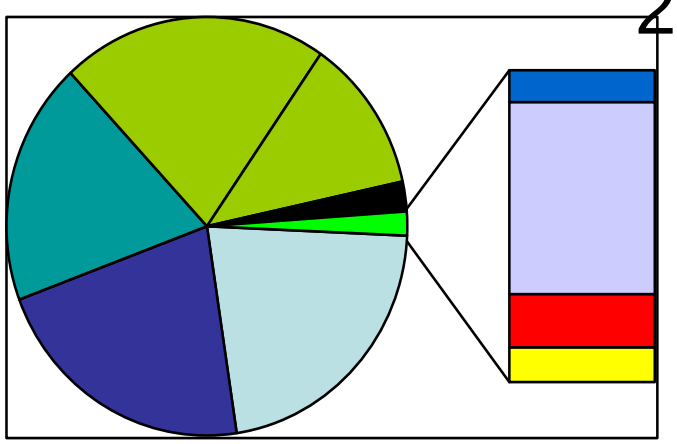
1. 24 % distributed through FAS-NAS network.
2. 31 % through hard drive (to NASS and RMA).
3. 45 % through Archive Explorer

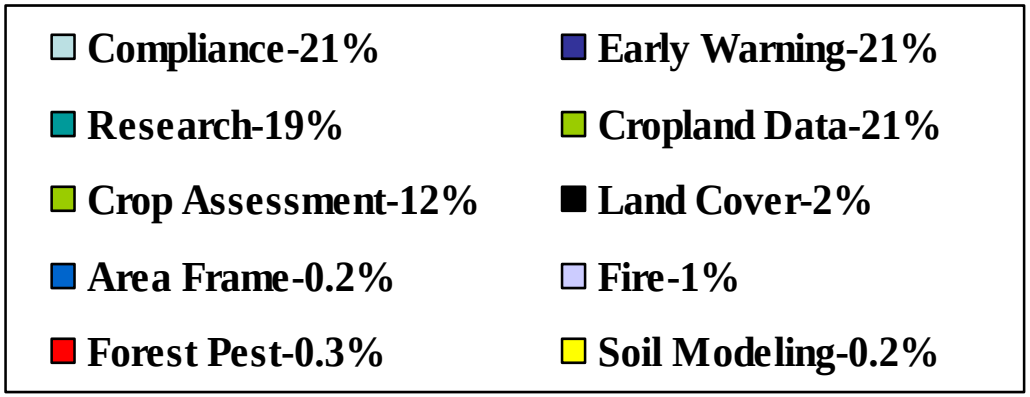
Archive Explorer can be found at: http://www.pecad.fas.usda.gov/remote.cfm

How to Access the ResourceSat-1 Data

- For participating agencies in the USDA-SIA, please use Archive Explorer.
  - Data is free. No per-scene transactional cost. Arrives on CD via common carrier.
- USDA-SIA operates on an “all you can eat” policy.
- Data is licensed to USDA and license restrictions apply.
  - Data cannot be redistributed. Data cannot be used commercially
  - Derived products such as the Cropland Data Layer have no license restrictions.
  - License can be “uplifted.”

Applications of Field-level* Satellite Data in FY 2008





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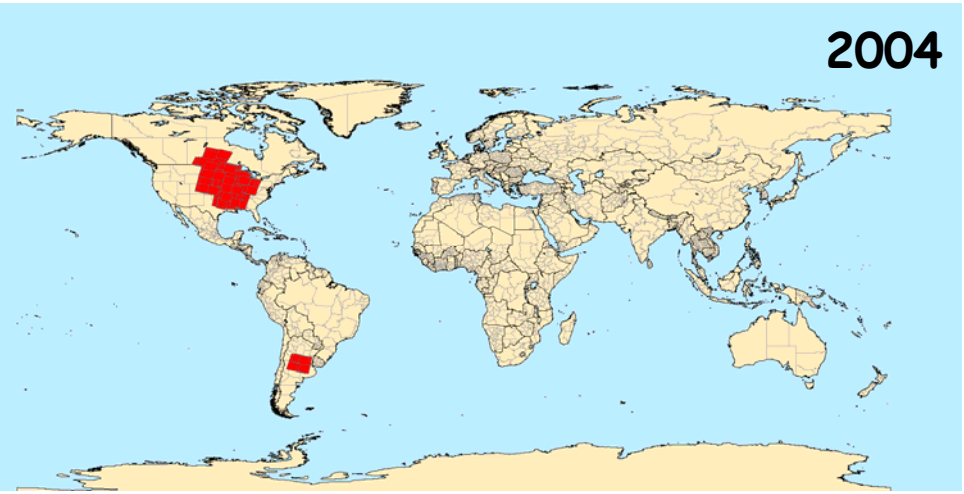
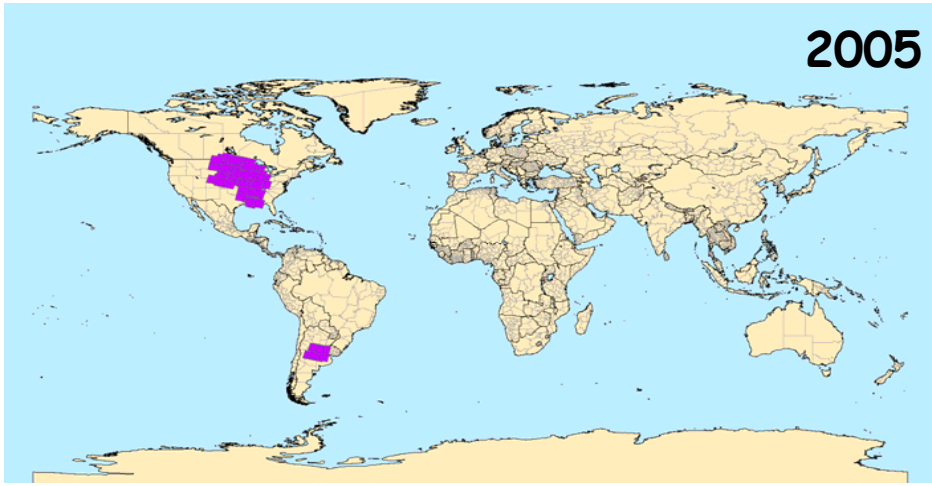
- Land Cover (USGS and other agencies)
- Area Frame (NASS)
- Fire and Forest Pest (USFS)
- Soil Modeling (NRCS)

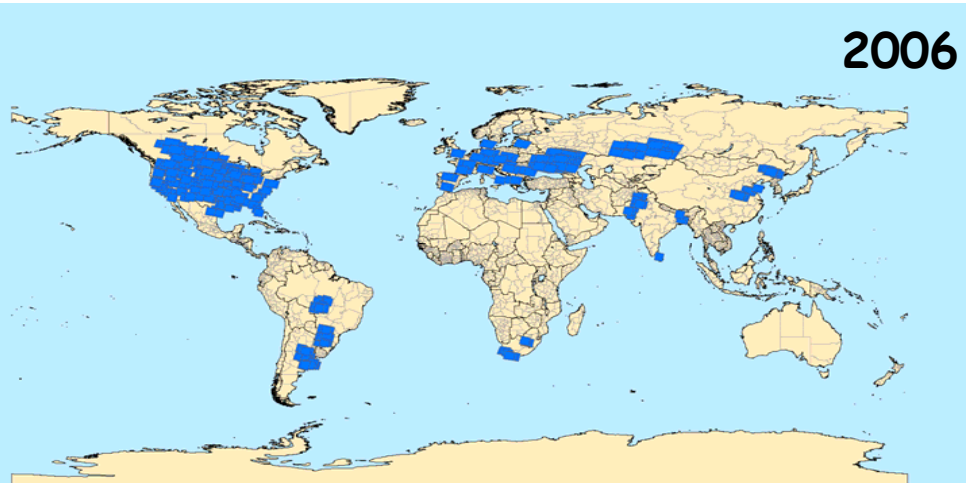
Summary

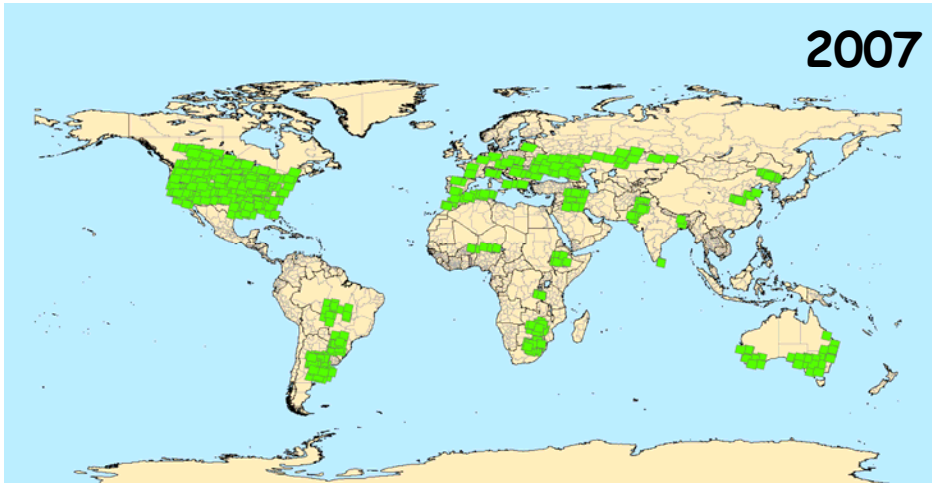
- USDA uses ResourceSat AWiFS imagery for operational agricultural programs
  - Third year of operational use
- ResourceSat data is
  - orthorectified, can be radiometrically corrected
  - Satellite is “always on” for the U.S.
- Agricultural applications are:
  - Compliance/Regulatory Use (RMA)
  - Early warning of potential food supply disruptions (FSA and FAS)
  - Research (ARS and other agencies)
  - Planted area of US corn and soybean & Cropland data layer (NASS)
  - Foreign crop condition assessment (FAS)
- USDA-SIA is a data-sharing partnership
  - Saved $3.5 million in cost avoidance for USDA

AWiFS Areas of Collection 2004-2007

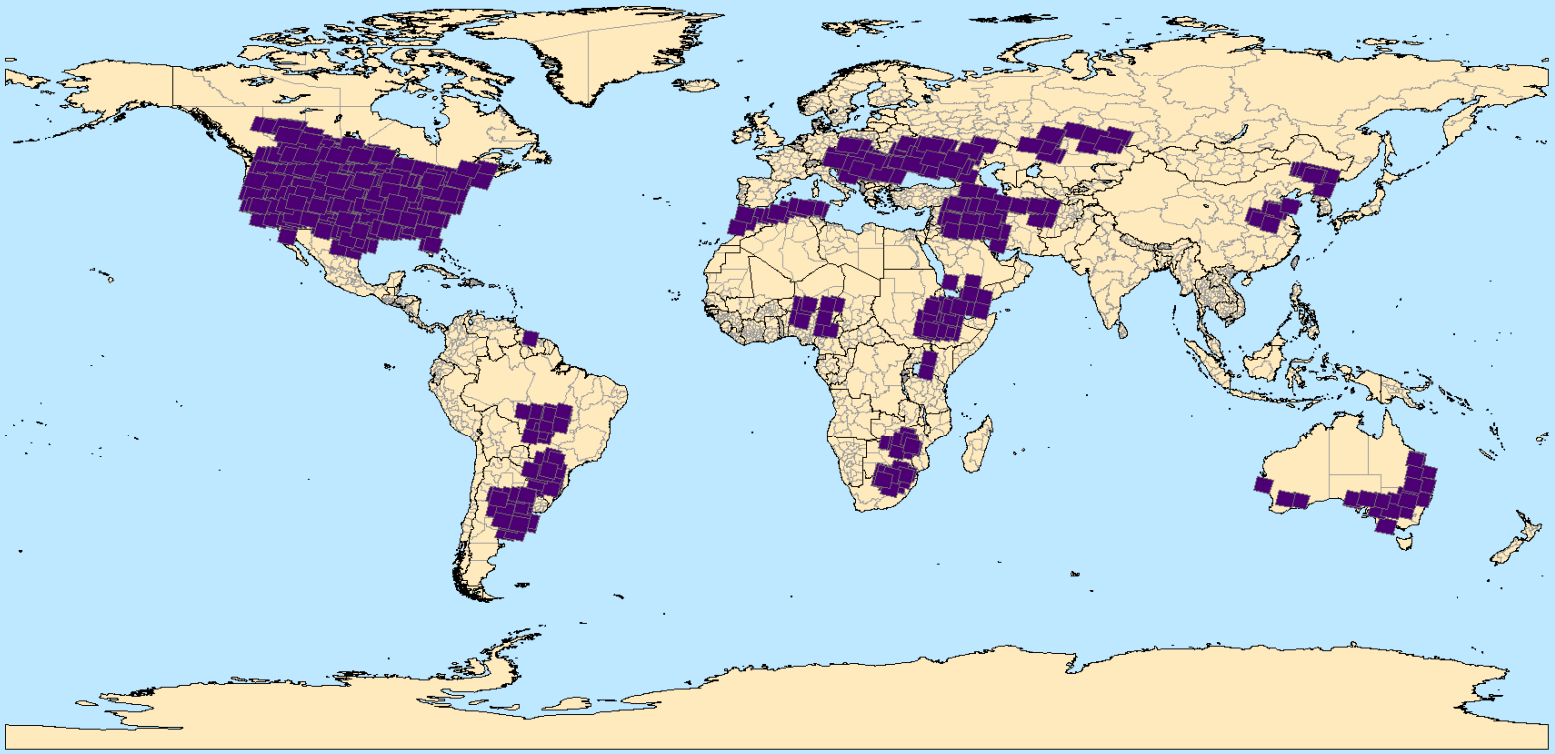








Resourcesat-1 AWiFS at USDA -- 2008



Legend

AWIFS_Collection_2008

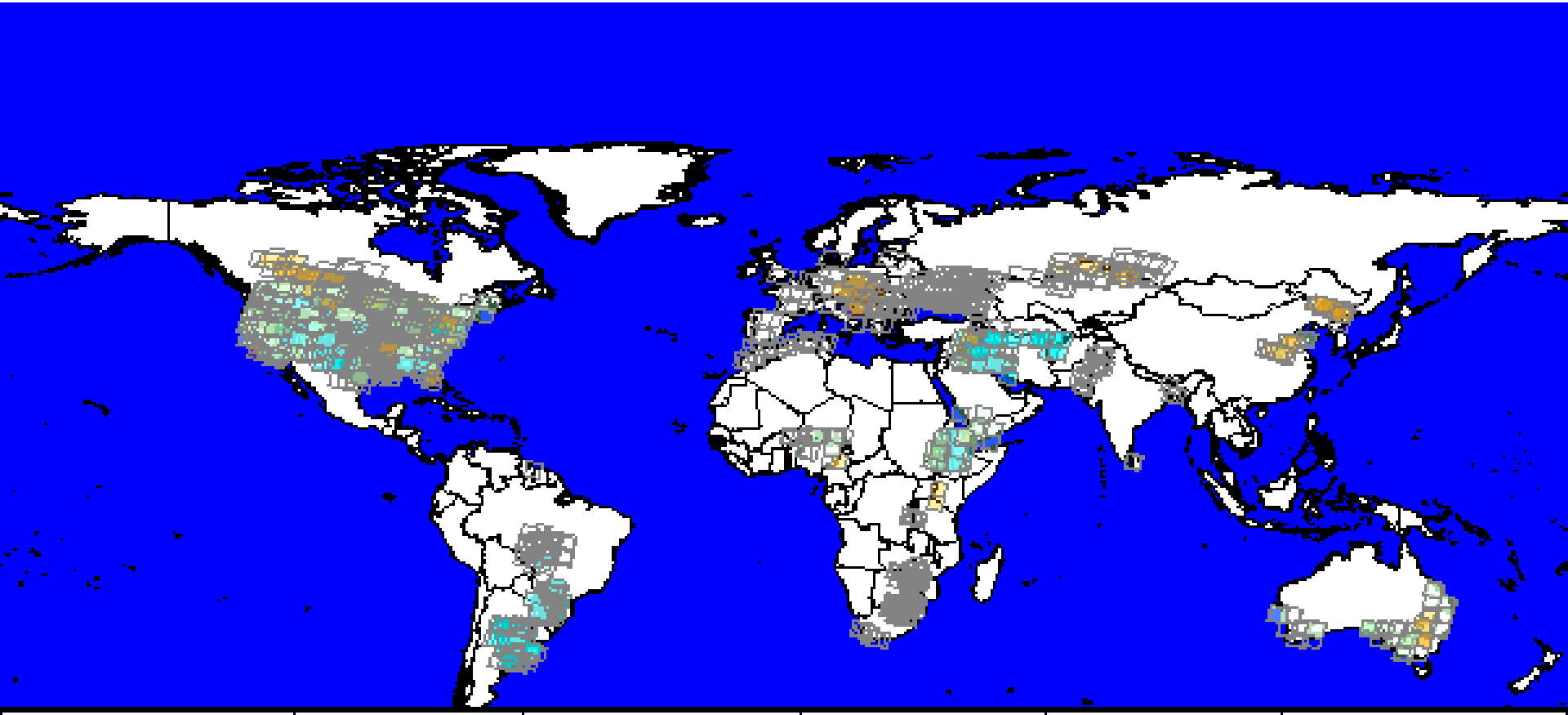
cntry00_with_lakes

Calendar Year	Total	US
2004	146	125
2005	100	84
2006	1415	888
2007	1408	798
2008	1654	1026

USDA Foreign Agricultural Service

For more information, please contact
Robert Tetrault (202) 720-1071 robert.tetrault@fas.usda.gov

USDA-SIA AWiFS Holdings



Afghanistan	Brazil	Hungary	Nigeria	Russia	Tunisia
Algeria	Bulgaria	Iraq	Pakistan	Serbia	Ukraine
Argentina	Canada	Iran	Paraguay	Slovakia	United States
Australia	China	Kazakhstan	Poland	South Africa	Zimbabwe
Bangladesh	Ethiopia	Morocco	Romania	Syria	

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Query | Results

SATELLITE

AWIFS (J)

United States

California

PATH & ROW

PATH: TO: ANY:

ROW: TO: ANY:

ACQUISITION DATE

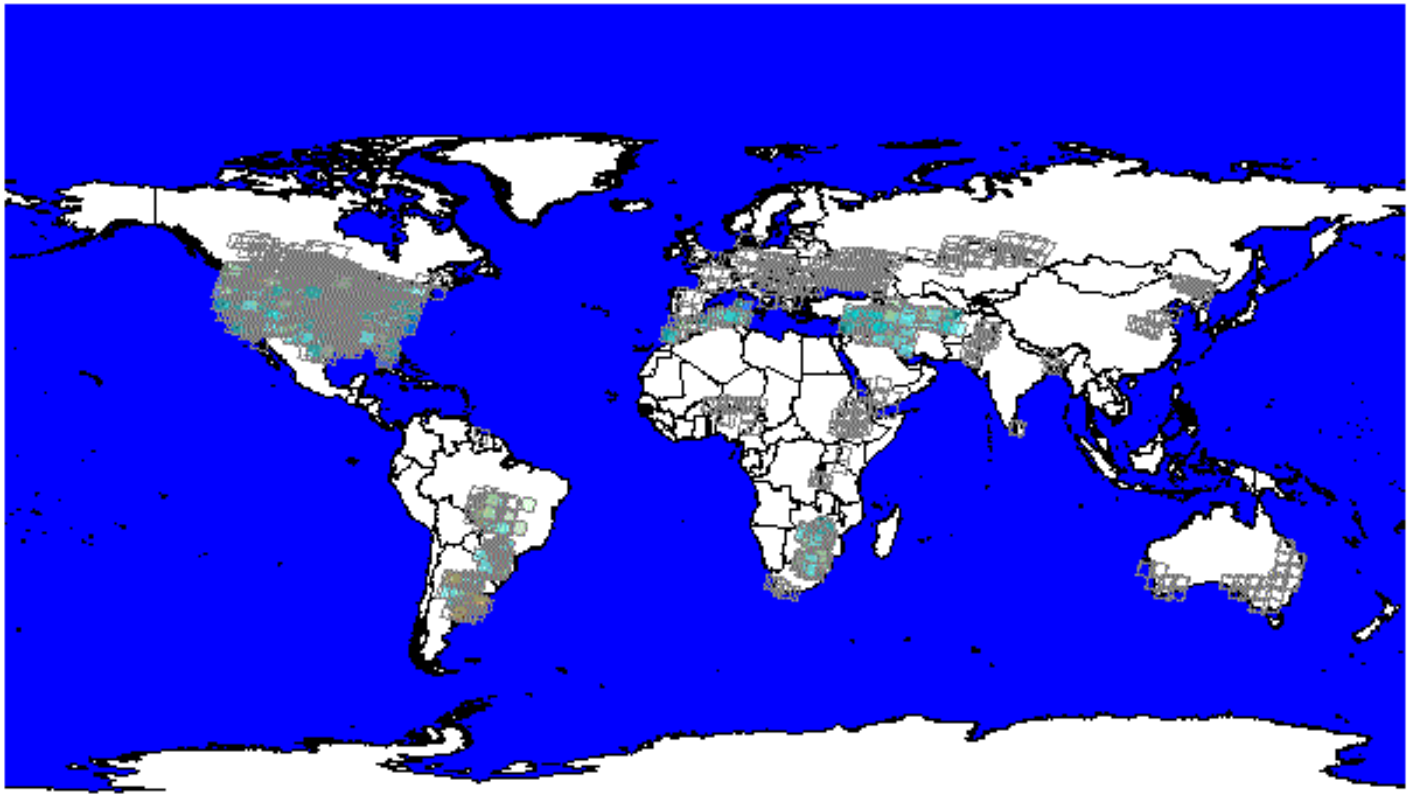
ALL | YEAR CYCLE > 2009 2008 2007

SEASONAL DATE RANGE > SEASON: April TO: April

YEARS: 1984 TO: 1984

SINGLE DATE RANGE > FROM: 04/28/09 TO: 04/28/09

Perform Query



AWiFS Swaths (by age)

1 to 30 days

31 to 60 days

61 to 90 days

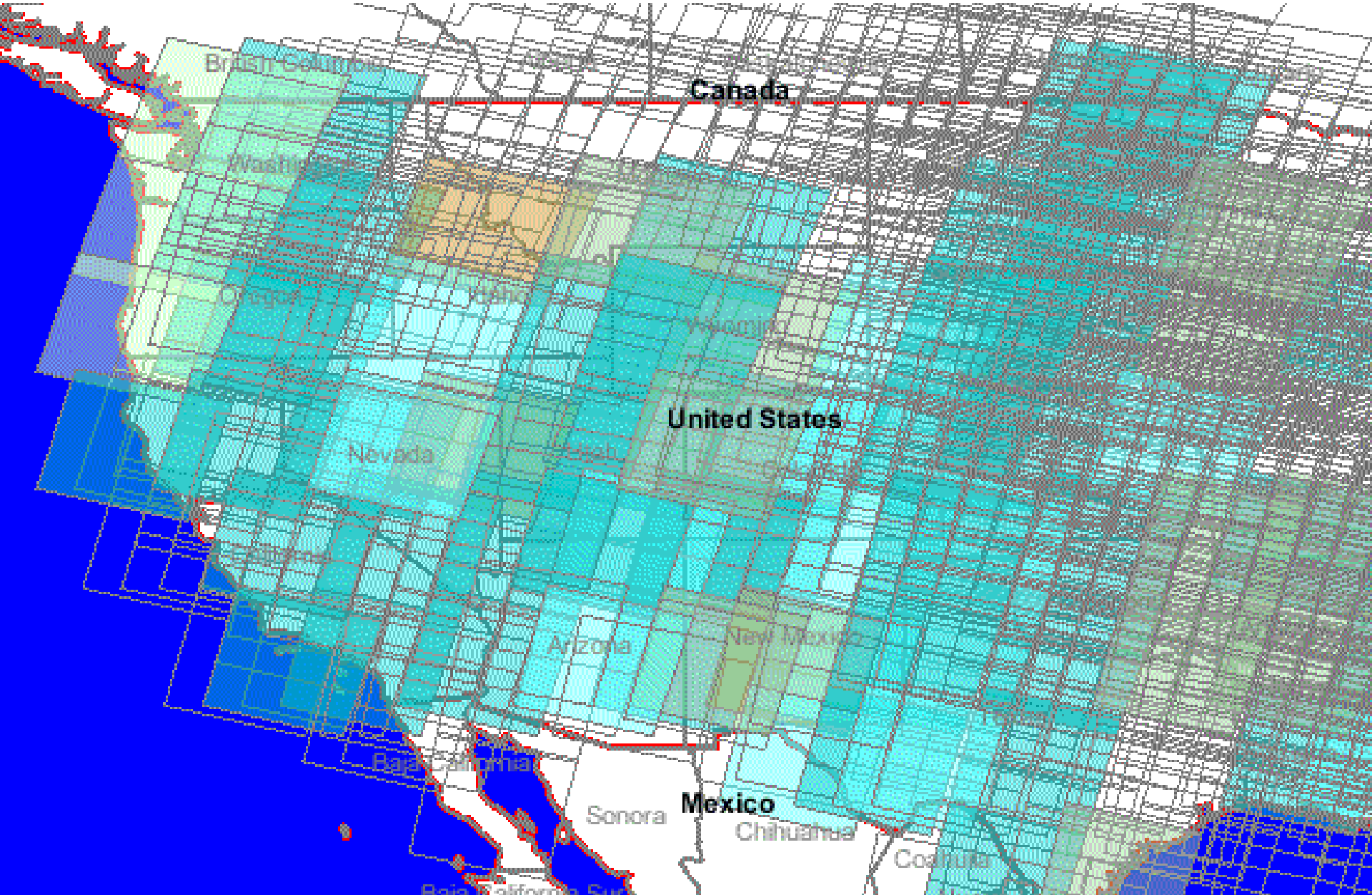
91 to 120 days

121 to 150 days

> 150 days

No Data

Country Boundaries


Canada
United States
Nevada
Arizona
Mexico
Sonora


United States

Selection


USDA Archive Explorer
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Query
Results
Your Search Returned 6 Results.
USDA Thumbnails
USDA Table
GeoEye Table
1. IRS_AWIFS, FULL,
04/14/09
Add To Cart
2. IRS_AWIFS, FULL,
04/05/09
Add To Cart
3. IRS_AWIFS, FULL,
04/04/09
Add To Cart
4. IRS_AWIFS, FULL,
03/12/09
Add To Cart
5. IRS_AWIFS, FULL,
03/11/09
Add To Cart
6. IRS_AWIFS, FULL,
02/01/09
Add To Cart

1 2 3 4 5 6 Next 30 >>

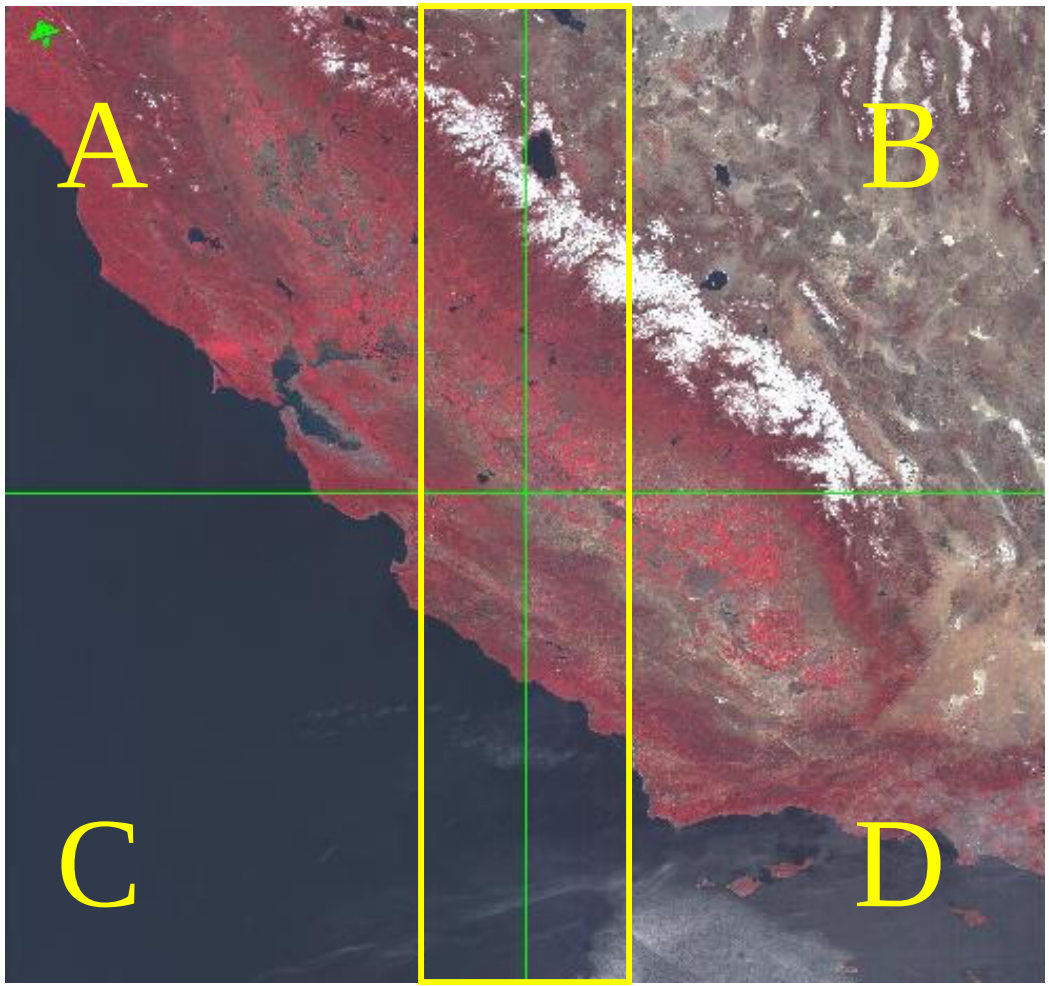
Your Search Returned 180 Results. [PRINT TABLE] [EXPORT TO EXCEL]

USDA Thumbnails		USDA Table			GeoEye Table		
Line	SceneID	Sensor	AcquisitionDate	Path	Row	Cloud Cover	
1	T24804020091143X0NOK	LIS3	20090424	248	40	98	Add To Cart
2	T24804120091143X0NOK	LIS3	20090424	248	41	99	Add To Cart
3	T24804220091143X0NOK	LIS3	20090424	248	42	81	Add To Cart
4	T24804320091143X0NOK	LIS3	20090424	248	43	81	Add To Cart
5	T2480442009114AX0NOK	AWIF	20090424	248	44	49	Add To Cart
6	T24804420091143X0NOK	LIS3	20090424	248	44	75	Add To Cart
7	T24804520091143X0NOK	LIS3	20090424	248	45	20	Add To Cart
8	T24304020091133X0NOK	LIS3	20090423	243	40	7	Add To Cart
9	T24304120091133X0NOK	LIS3	20090423	243	41	2	Add To Cart
10	T24304220091133X0NOK	LIS3	20090423	243	42	34	Add To Cart
11	T24304320091133X0NOK	LIS3	20090423	243	43	73	Add To Cart
12	T2430442009113AX0NOK	AWIF	20090423	243	44	54	Add To Cart
13	T24304420091133X0NOK	LIS3	20090423	243	44	73	Add To Cart
14	T24304520091133X0NOK	LIS3	20090423	243	45	99	Add To Cart
1	T25204020091103X0NOK	LIS3	20090420	252	40	26	Add To Cart
1	T25204120091103X0NOK	LIS3	20090420	252	41	26	Add To Cart
1	T25204220091103X0NOK	LIS3	20090420	252	42	17	Add To Cart
1	T25204320091103X0NOK	LIS3	20090420	252	43	8	Add To Cart
1	T2520442009110AX0NOK	AWIF	20090420	252	44	7	Add To Cart
2	T25204420091103X0NOK	LIS3	20090420	252	44	6	Add To Cart
2	T25204520091103X0NOK	LIS3	20090420	252	45	9	Add To Cart
22	T24704420091093X0NOK	LIS3	20090419	247	44	0	Add To Cart
23	T24704520091093X0NOK	LIS3	20090419	247	45	0	Add To Cart

One AWiFS Image to 6 LISS-3 Images

LISS 3

Each AWiFS Image has 4 Quads



LISS 3 @ Nadir

USDA Archive Explorer

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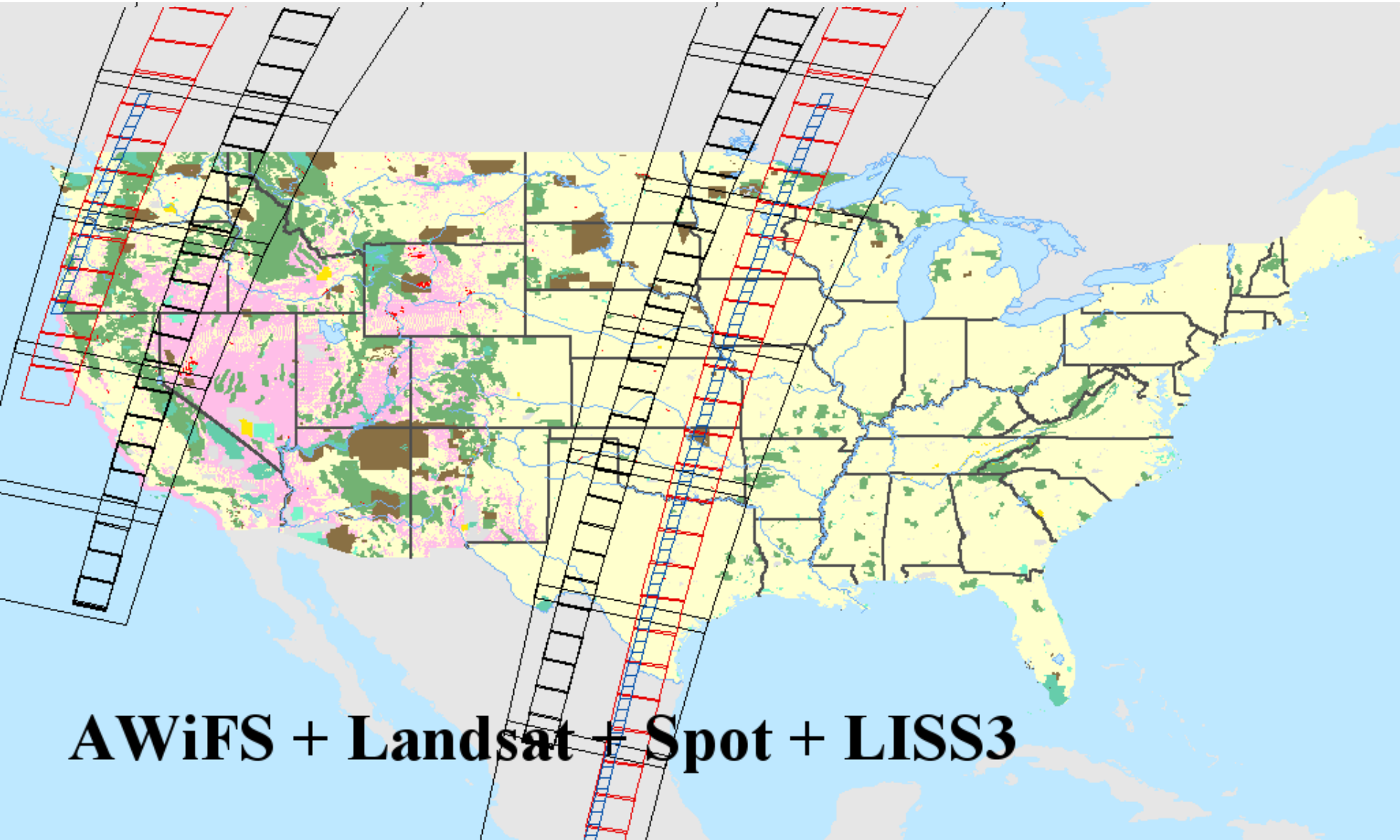
These selected scenes are NOT free but can be purchased by USDA-SIA through the ASRC-MS contract. The ASRC-MS contract includes several satellite imagery vendors. Vendor selection is based on best value to USDA. Please continue if you want to generate an ad-hoc order to be sent to the USDA-SIA manager for review.

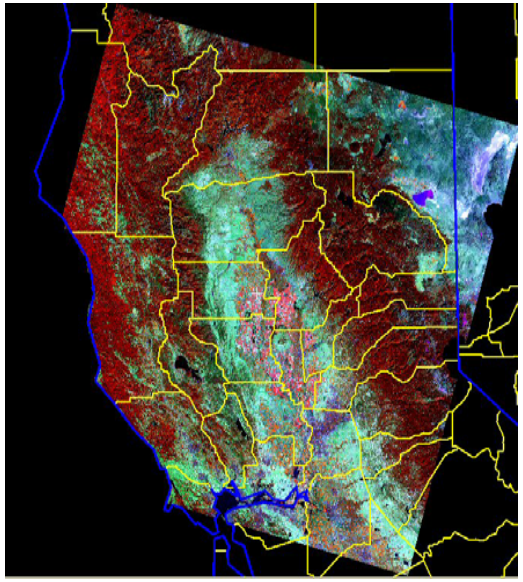
Line	Delete	Image	Quantity	Description	Quad	Acquistion Date	Path	Startrow	Endrow
1	Remove	autoscored-cb002470441Xp_nok_awip6T.109.jpg	1	AWIF	A B C D	04/19/2009	247	44	44
2	Remove	autoscored-cb002470421Xp_nok_lsip6T.109.jpg	1	LIS3		04/19/2009	247	42	42

Ability to use your funds to select and purchase LISS and AWIFS Imagery not in USDA SIA. Order AWIFs by Quad.

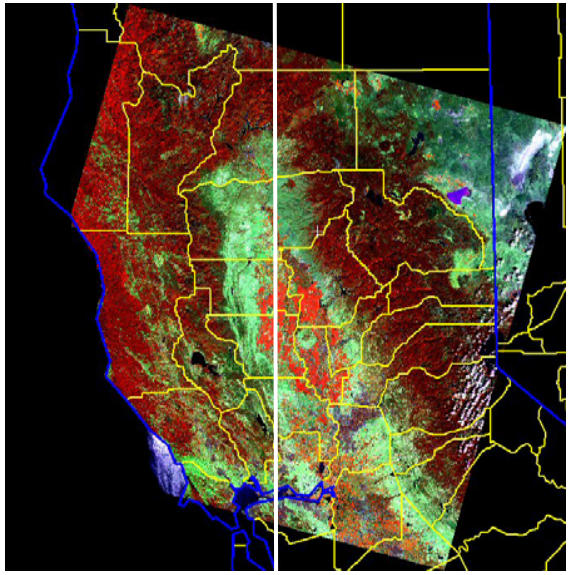
Comparing Single Pass Collection Capability



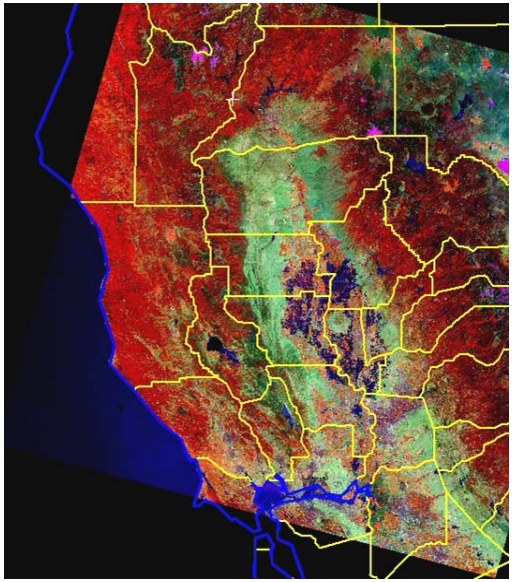
Northern California - AWiFs



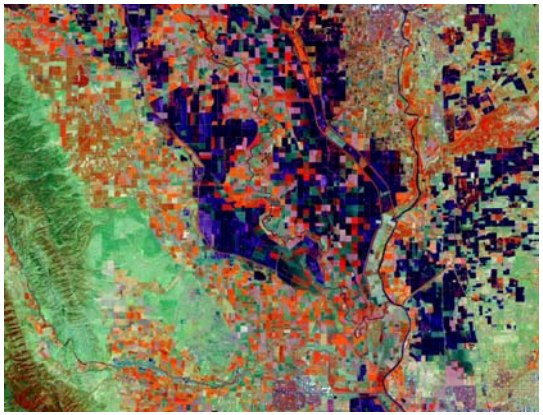
May 28, 2007

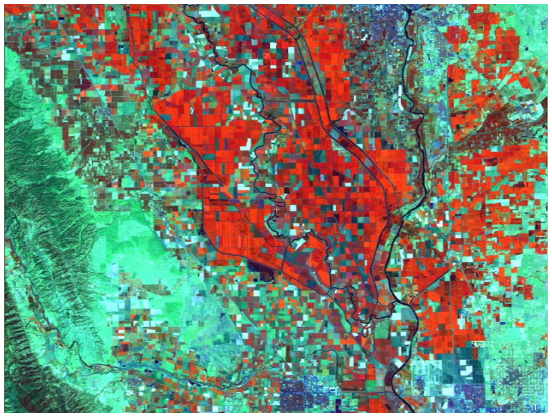


September 1, 2007

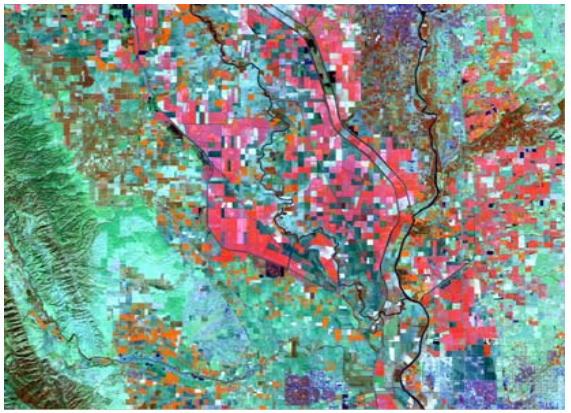


September 25, 2007





NE Yolo Co., California

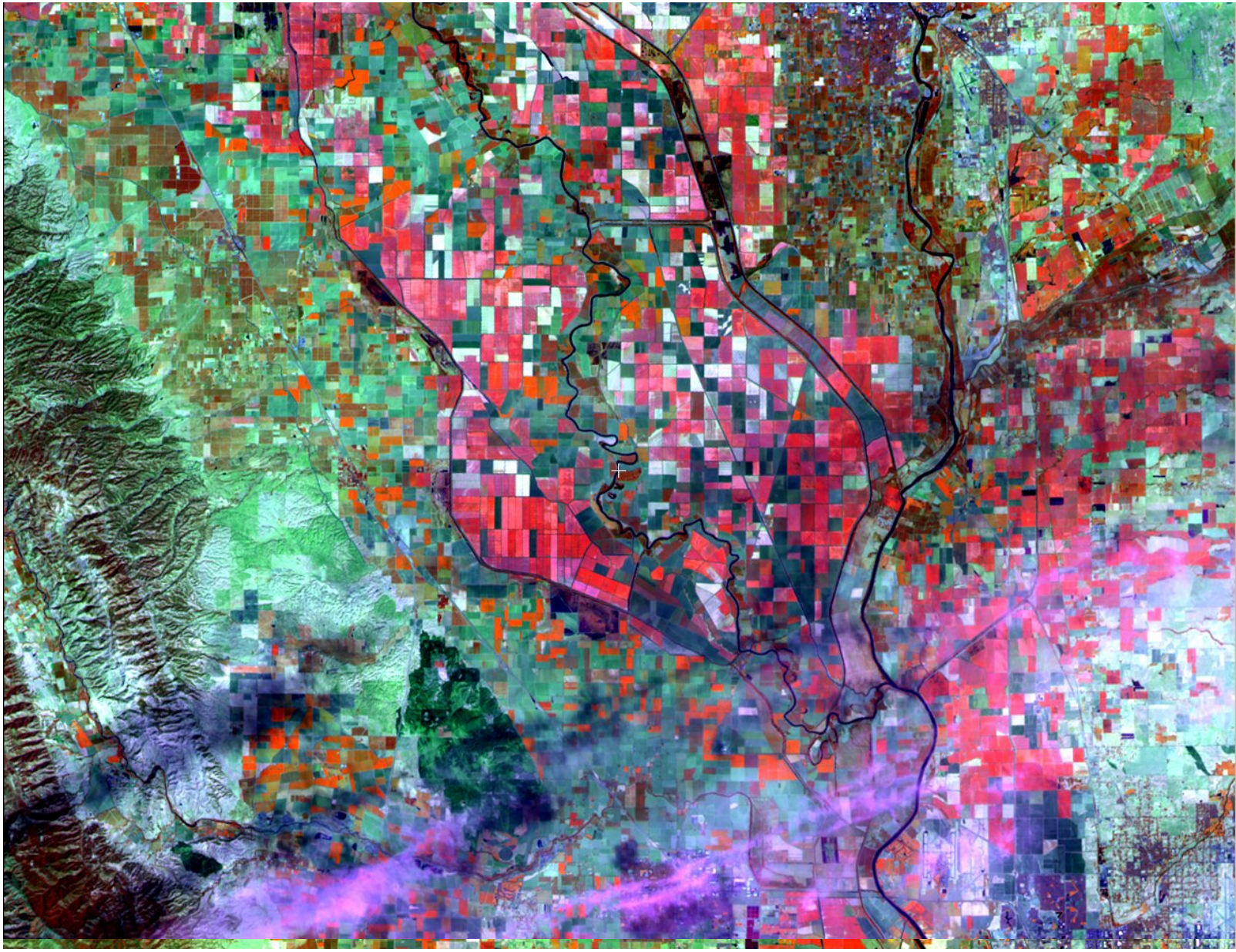


AWiFs Ch. 4,5,3

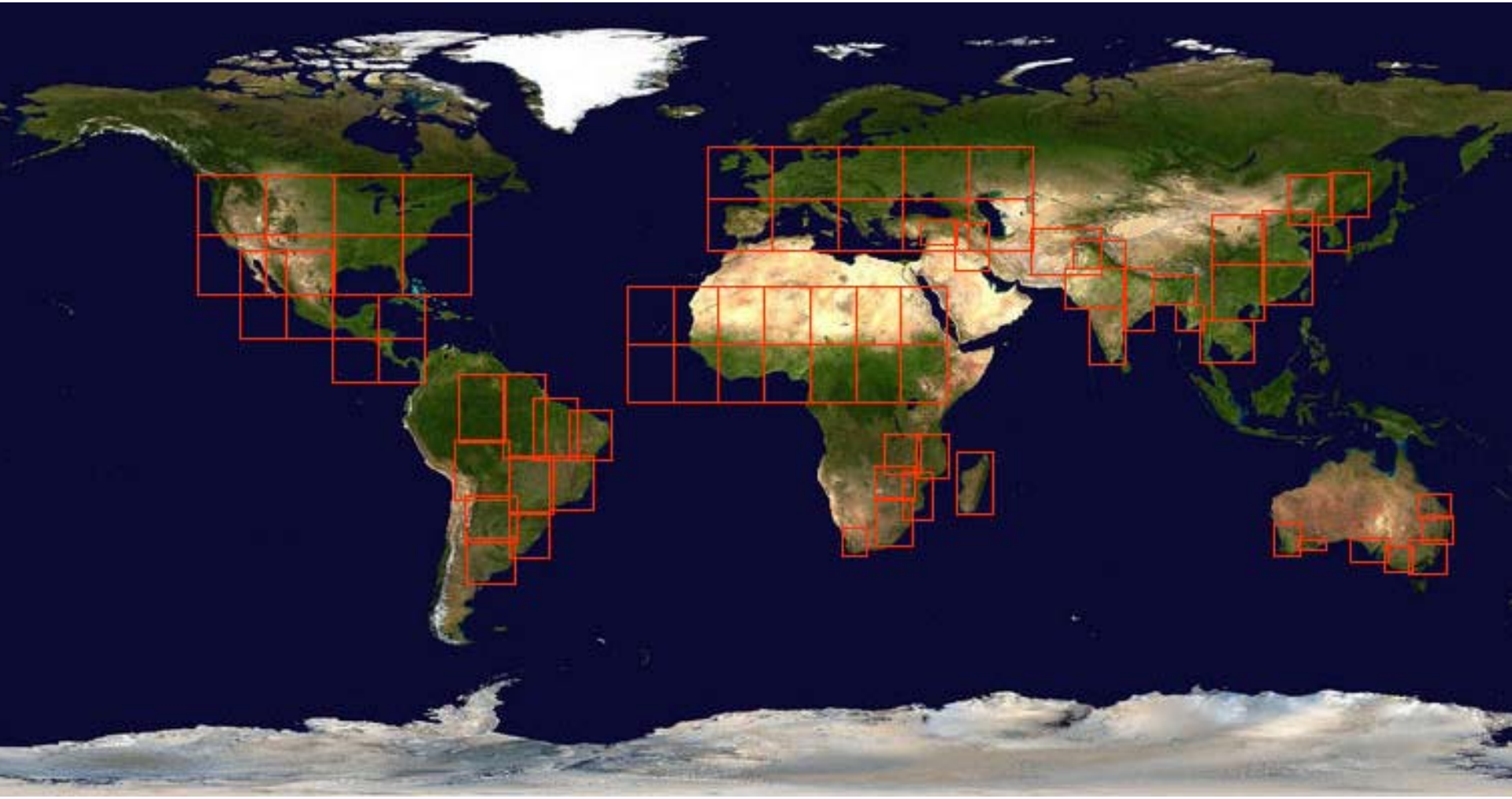
FFAS Center for Remote Sensing Analysis

USDA

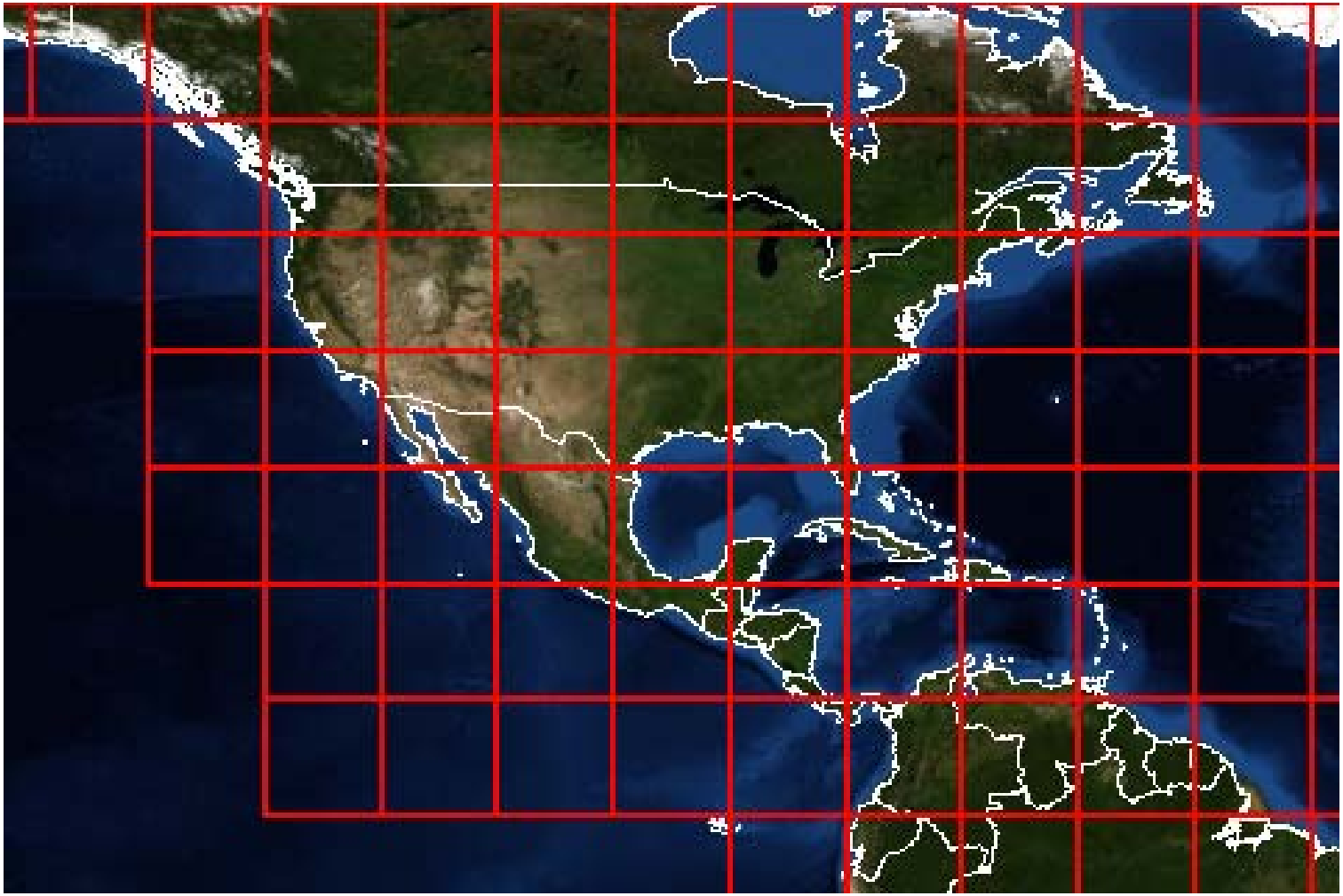
NE Yolo Co., California May 28– September 30, 2007



Foreign Agriculture Service MODIS Subsets for Crop Monitoring

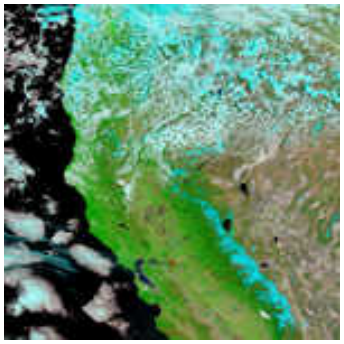


Foreign Agriculture Service MODIS Subsets for Crop Monitoring



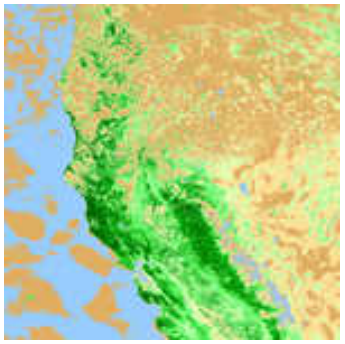
View Current MODIS

04/29/09 (Day 119 of 2009)



721

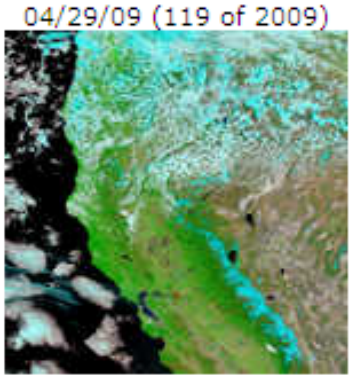
True Color

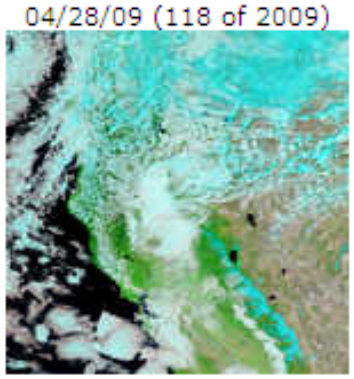


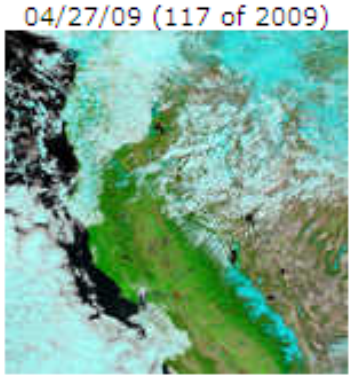
NDVI Images

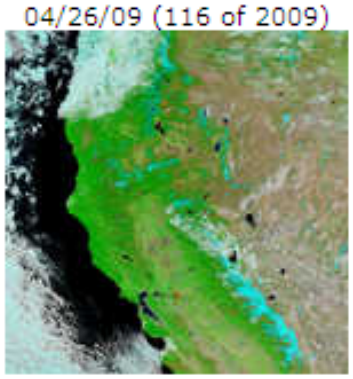
Terra (AM)
Pixel size:
250m | 1km | 2km

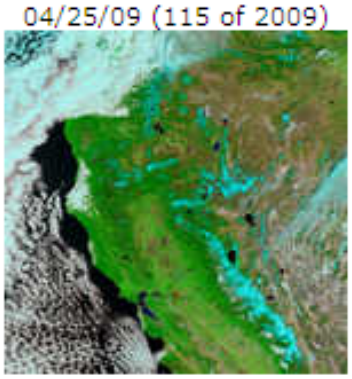
View Last 30 days

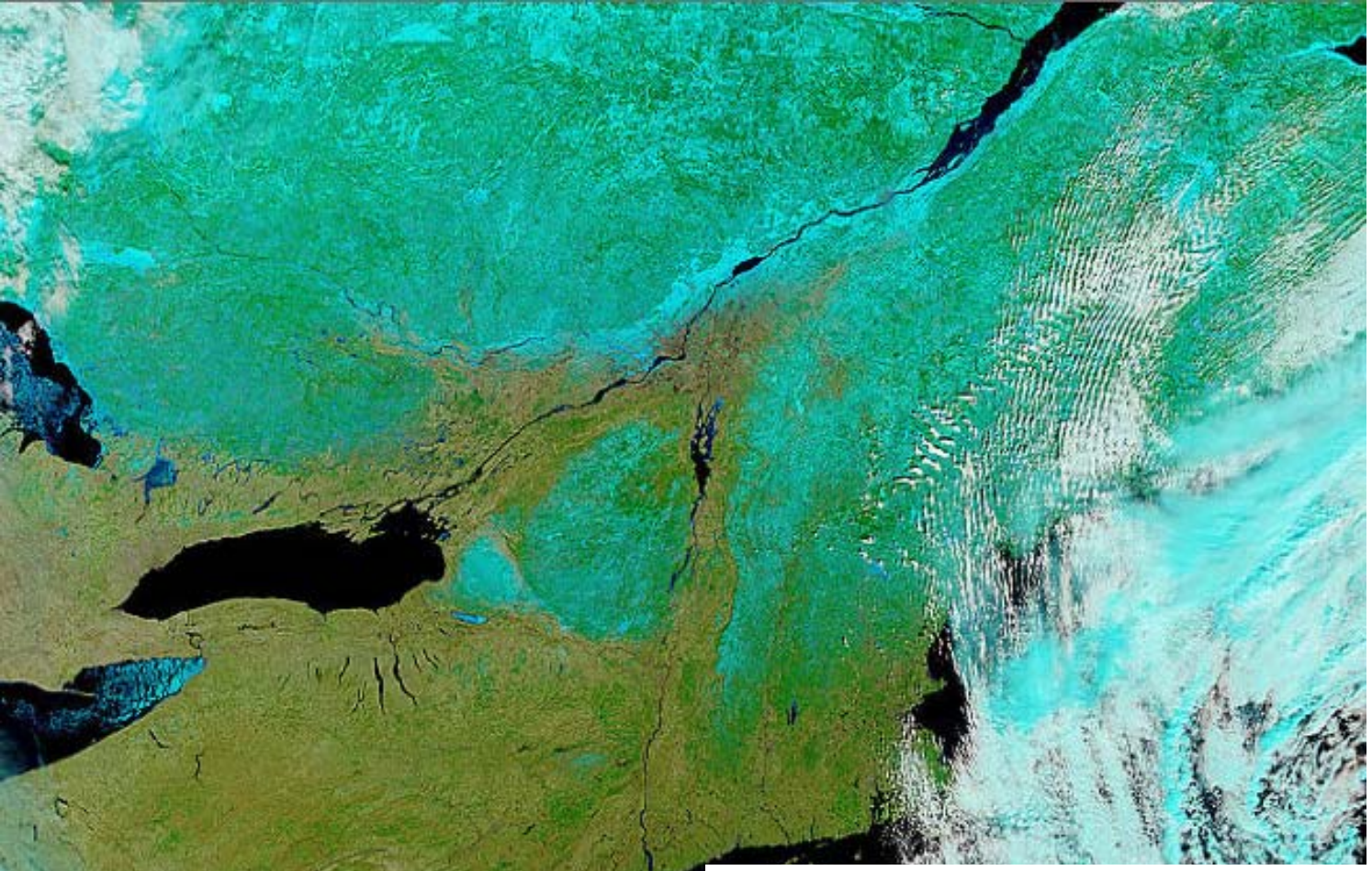












USA4 Subset - Terra 2km Bands 7-2-1 image for 2009/083 (03/24/09)

Vectors selected: none

Change vector options: none submit

View alternate pixel size: **1km** | **500m** | **250m** |

View alternate band combination: **True Color** | **NDVI** |

View Aqua image | **See all images available for this area this day** |

Display metadata (including time of input data)

Display worldfile | **Display projection file**

Download JPG image with ancillary files (.zip)

Download KMZ file for GoogleEarth

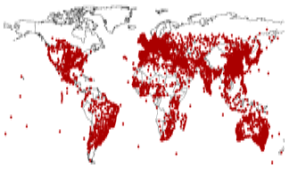
Download GeoTIFF file

Global Monitoring Data Sources for Estimating Crop Production

FAS/Office of Global Analysis

United States Department of Agriculture
Foreign Agricultural Service

WMO STATION Data



- Daily station data for rainfall, & min/max temperatures
- Archive from1979

COARSE-RESOLUTION Imagery

METEOSAT GMS GOES

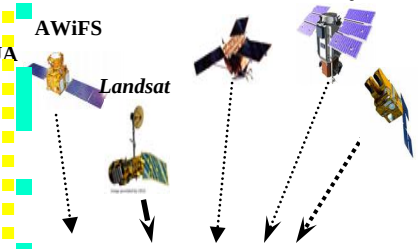
SSMI

LOW-RESOLUTION Imagery

SPOT Veg TERRA/AQUA

MEDIUM to HIGH-RESOLUTION

Resourcesat 1 IKONOS QuickBird AWiFS Landsat SPOT



ECONOMIC INFORMATION

Attaché reports (from USDA/FAS) for area harvested, yield, & production.

75 offices monitoring 110 countries

GRID (RASTER)

Rainfall images (8-km)

AVHRR

LAC

GAC (from NASA)

USDA Satellite Imagery Library

AGRMET

- Daily polygrid data (25-51-km) for rainfall, snow, solar radiation, min/max temperatures, potential ET, and actual ET
- Archive from 1981

Image analysis

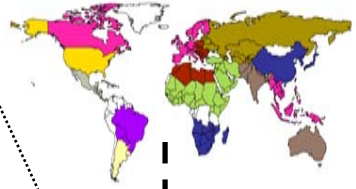
- Vegetation classification
- Vegetation stress
- Area planted estimates

Monitor Vegetation conditions.

- OGA Agricultural Economists for Grains, Cotton, and Oilseeds
- National production data & News Wires
- Regional experts + crop assessment travel

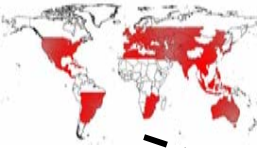
OGA REGIONAL CROP ASSESSMENT ANALYSTS

10 regional analysts monitoring 100 countries



Automated Product Generation (WWW)

Convergence of Evidence Analysis



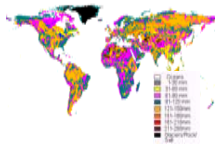
Station & polygrid data utilized to generate rainfall, temperature, & soil moisture images.

GIS Analysis/Integration (Multi-year comparisons)

SOIL MOISTURE Models

BASELINE REFERENCE Data

Historical crop area, yield, production,& trends connected to regional weather anomalies



ALARM Models

- Act as meteorological data filters by providing early warning to adverse weather conditions that affect crop growth.
- Models crop stages for corn, wheat, and sorghum.
- Flags regional weather anomalies that exceed temperature and soil moisture thresholds for the particular crop.

CROP Models

- Wheat (CERES, AGRISTARS, Maas, URCROP),
- Corn (AGRISTARS, URCROP)
- Soybean (Sinclair)
- Sorghum (AGRISTARS)
- Barley (URCROP).

- Historical crop production databases
- Administrative boundaries
- Average temperature & rainfall spatial data
- Soil texture & water-holding capacity

CROP PRODUCTION ESTIMATES

- Preliminary production estimates
- "Lockup" with USDA's World Outlook Board
- *USDA official production estimates released on the second week of each month*

Crop Explorer Portal

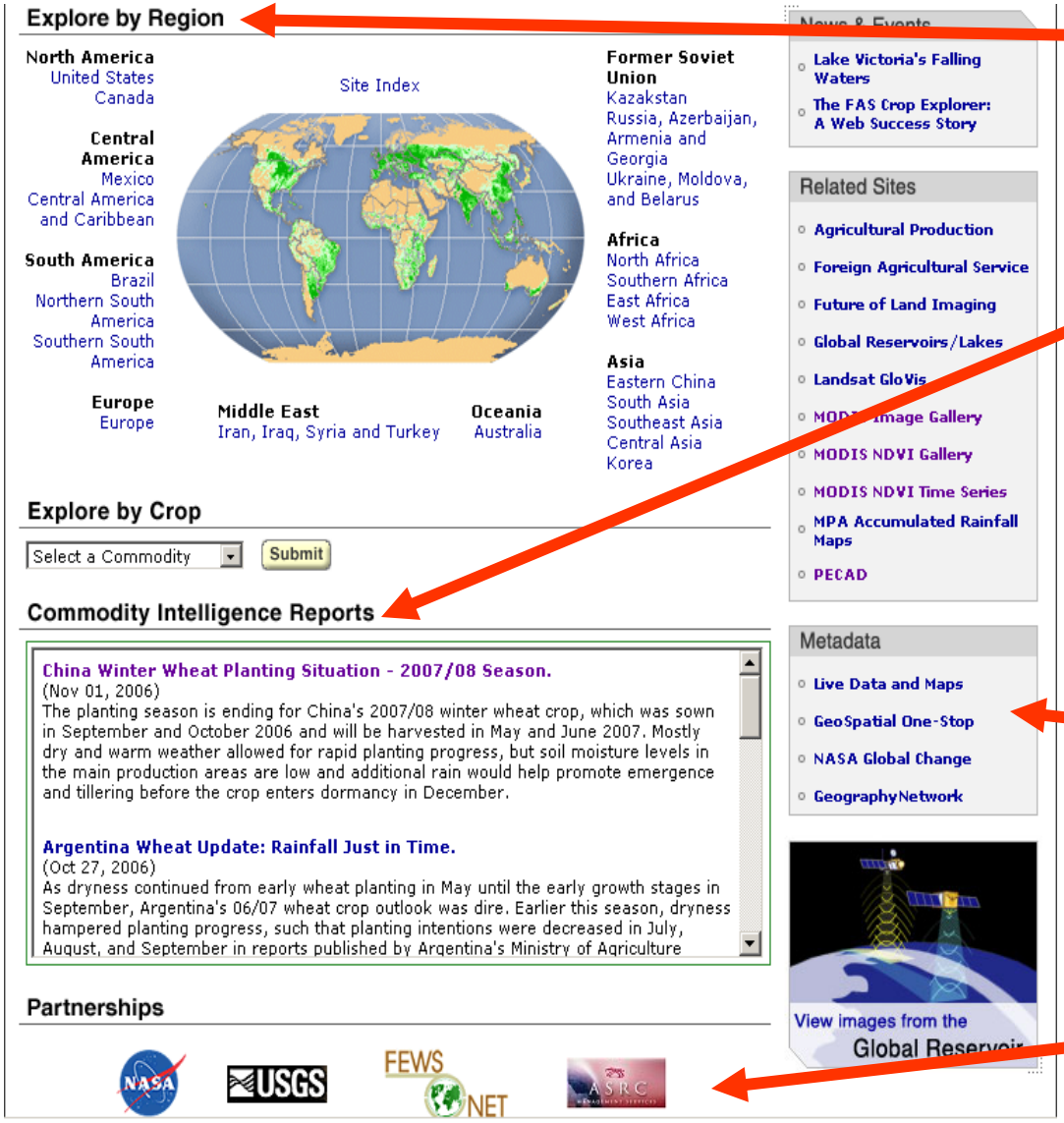
Portal to near-real time global agriculture conditions

www.pecad.fas.usda.gov/cropexplorer

or

Google “crop explorer”

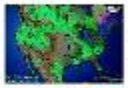
Crop Explorer Overview

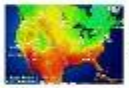


- Click on map to explore by region
- Review latest Commodity Intelligence Reports
- Connect to portal data from technology transfer partners
- Visit partners

Wireless Quotes
CBOT Advantage
CBOT DataExchange
Real-Time Quotes & Charts
Commodity News for Tomorrow
Delayed Quotes & Charts
Time & Sales
Settlement Prices
Volume & OI
Reports
Historical Data
Historical Volatility
Commentaries
Delivery Reports
Liquidity Analyzer
Weather
Data Vendors
Market Data Online Billing

Weather as of October 5, 2006 6:05 PM


Four-Panel rainfall distribution map


Latest hour's temperatures


Yesterday's high temperatures


Latest month-to-date rainfall totals


Latest windchill temperature values


Forec next

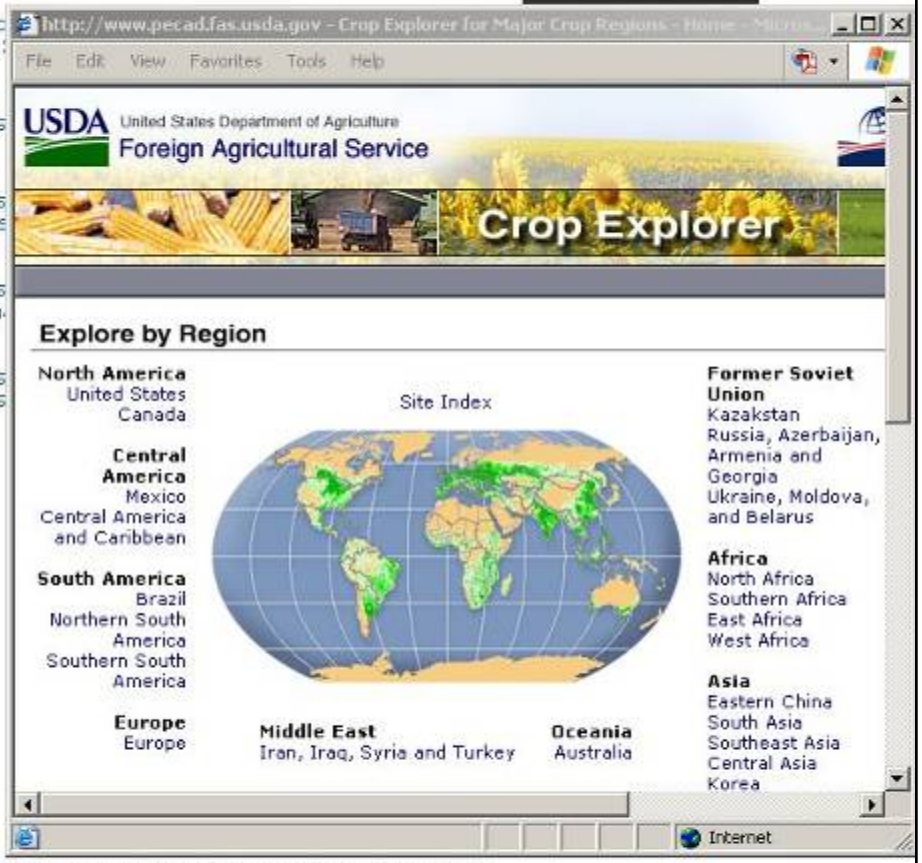

Lates


Lates totals


Lates norm


Lates knots

US Regional Radar Maps



The Crop Explorer Web Site features near-real-time global crop condition information based on satellite imagery and weather data. Thematic maps of major crop growing regions depict vegetative vigor, precipitation, temperature, and soil moisture. Time-series charts depict growing season data for specific agro-meteorological zones. Regional crop calendars and crop area maps are also available for selected regions.

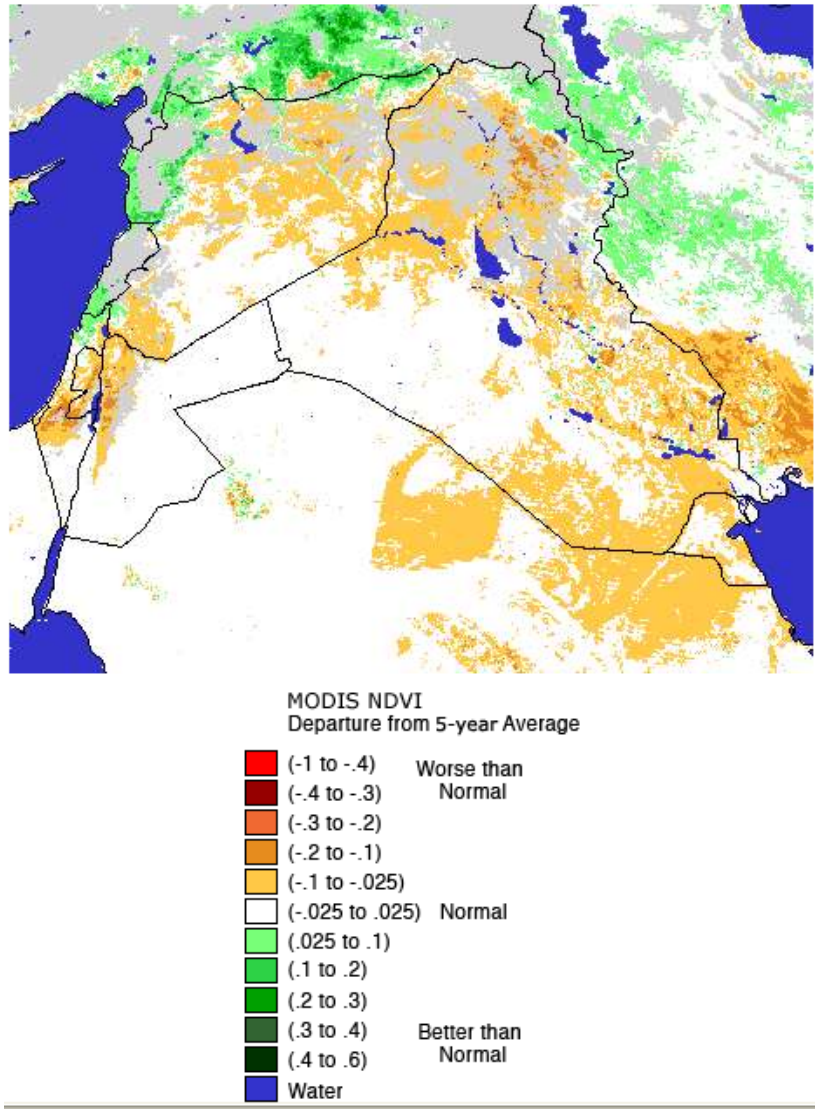
http://www.pecad.fas.usda.gov/cropexplorer/index.cfm

USDA United States Department of Agriculture
Foreign Agricultural Service

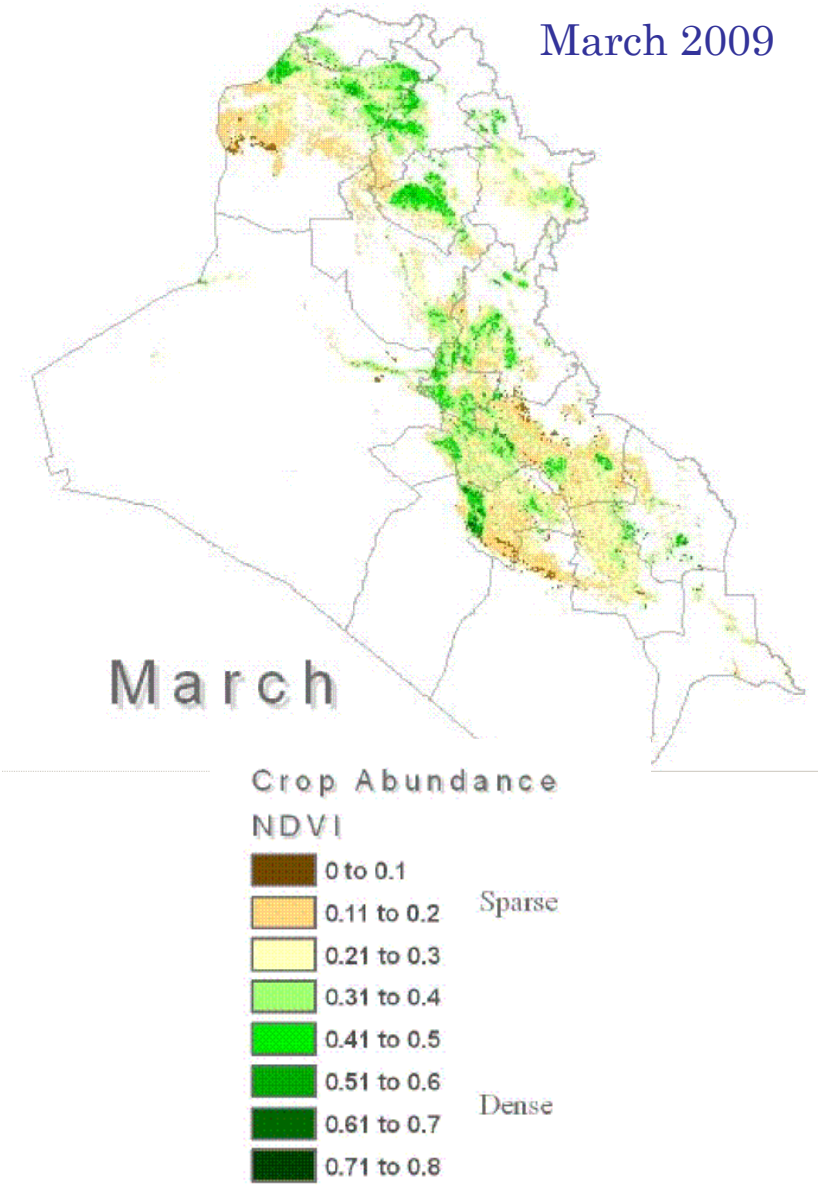
Production Estimates and Crop Assessment Division

MODIS Processed Data

NDVIs related to 5-Year Average

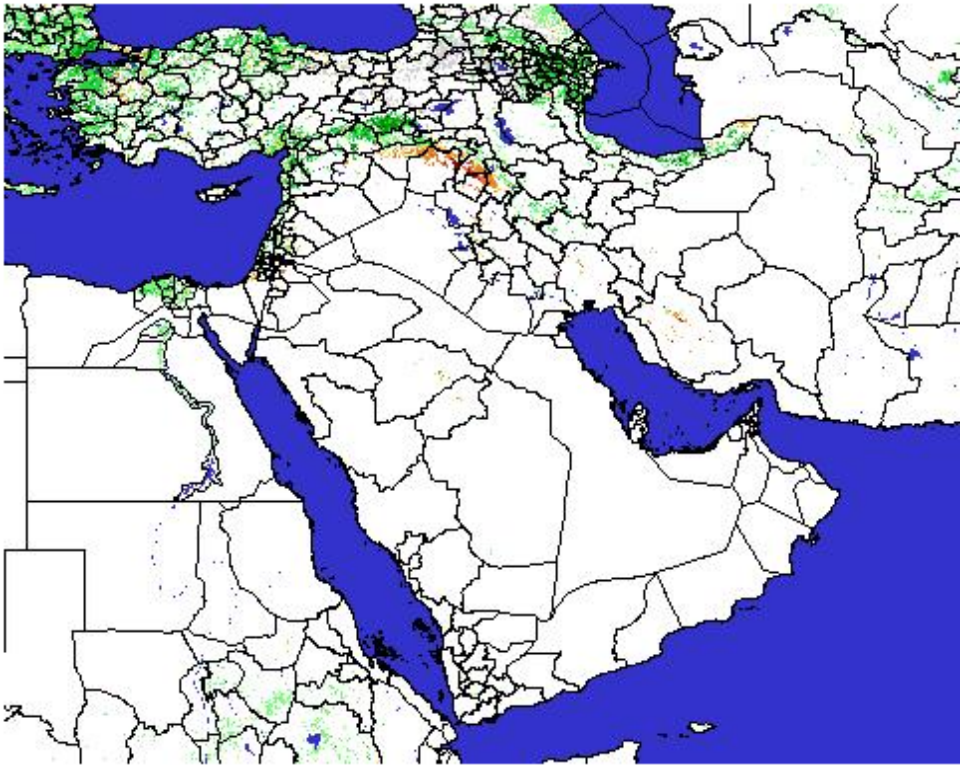


NDVIs related to Cropland

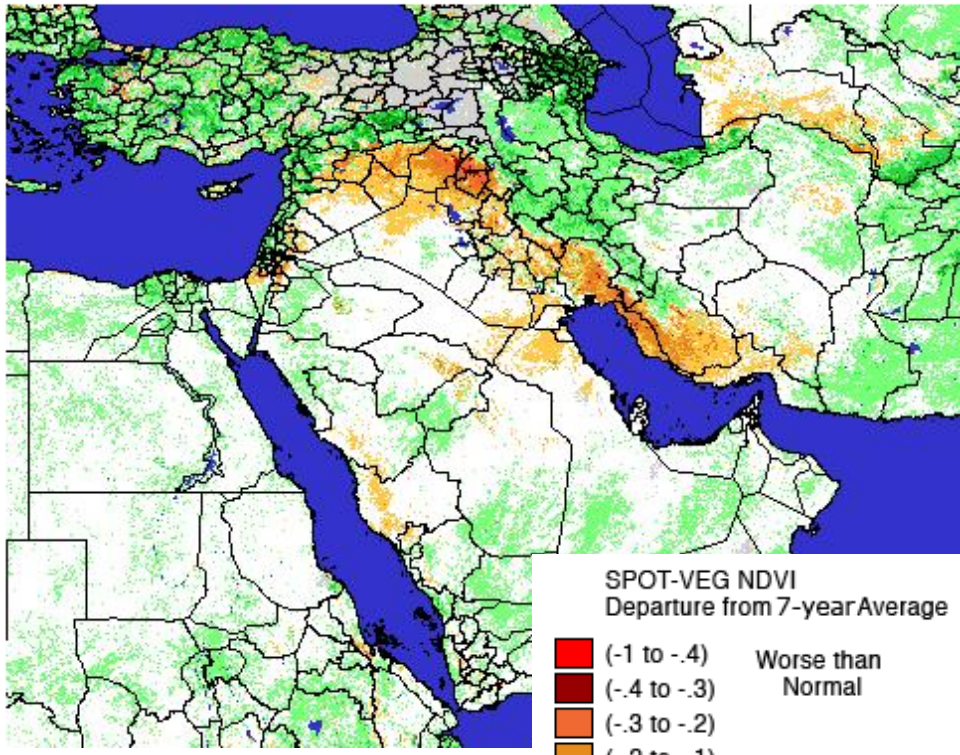


Processing Global SPOT Vegetation NDVI

Crop-masked SPOT-VEG Departure from Short-term Average
03/11/09 - 03/20/09



SPOT-VEG Departure from Short-term Average
03/11/09 - 03/20/09



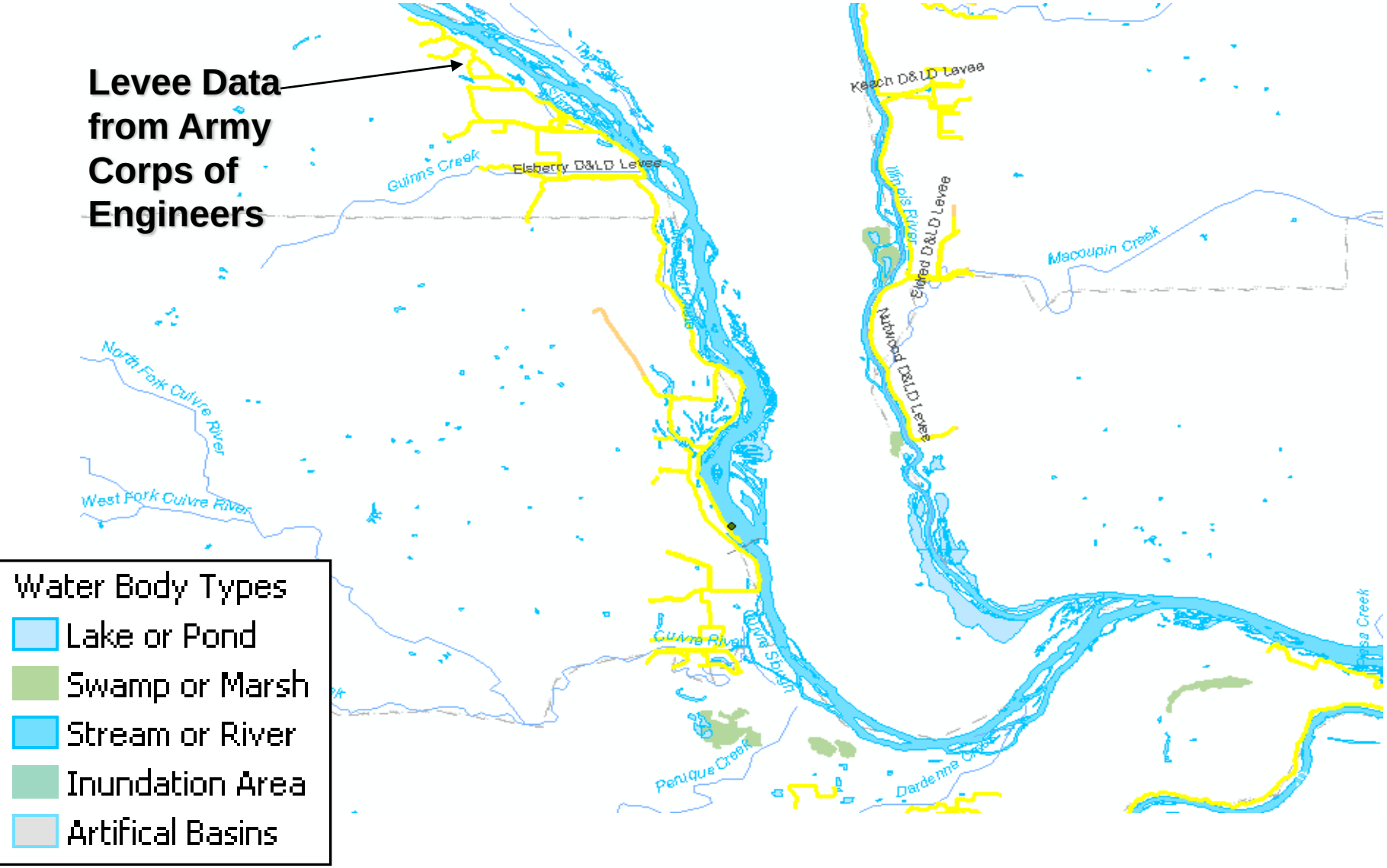
SPOT-VEG NDVI
Departure from 7-year Average

- (-1 to -.4) — Worse than Normal
- (-.4 to -.3)
- (-.3 to -.2)
- (-.2 to -.1)
- (-.1 to -.025)
- (-.025 to .025) — Normal
- (.025 to .1)
- (.1 to .2)
- (.2 to .3)
- (.3 to .4) — Better than Normal
- (.4 to .6)
- Water
- No Data

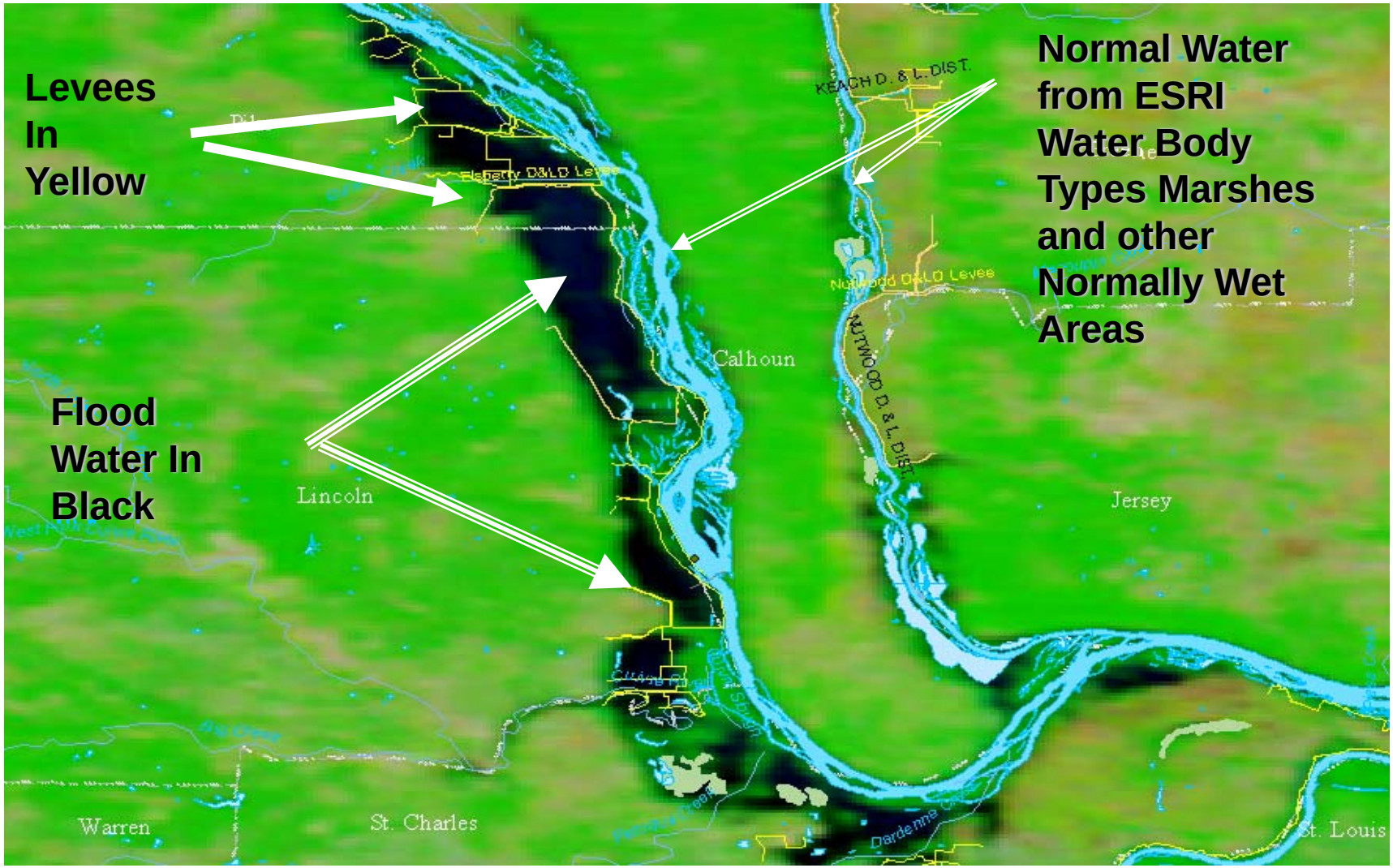
Time Series of Mississippi Flooding June 2008 MODIS Imagery from MODIS Rapid Response System

Imagery downloaded from:
http://rapidfire.sci.gsfc.nasa.gov/subsets/?subset=USA3.2008080

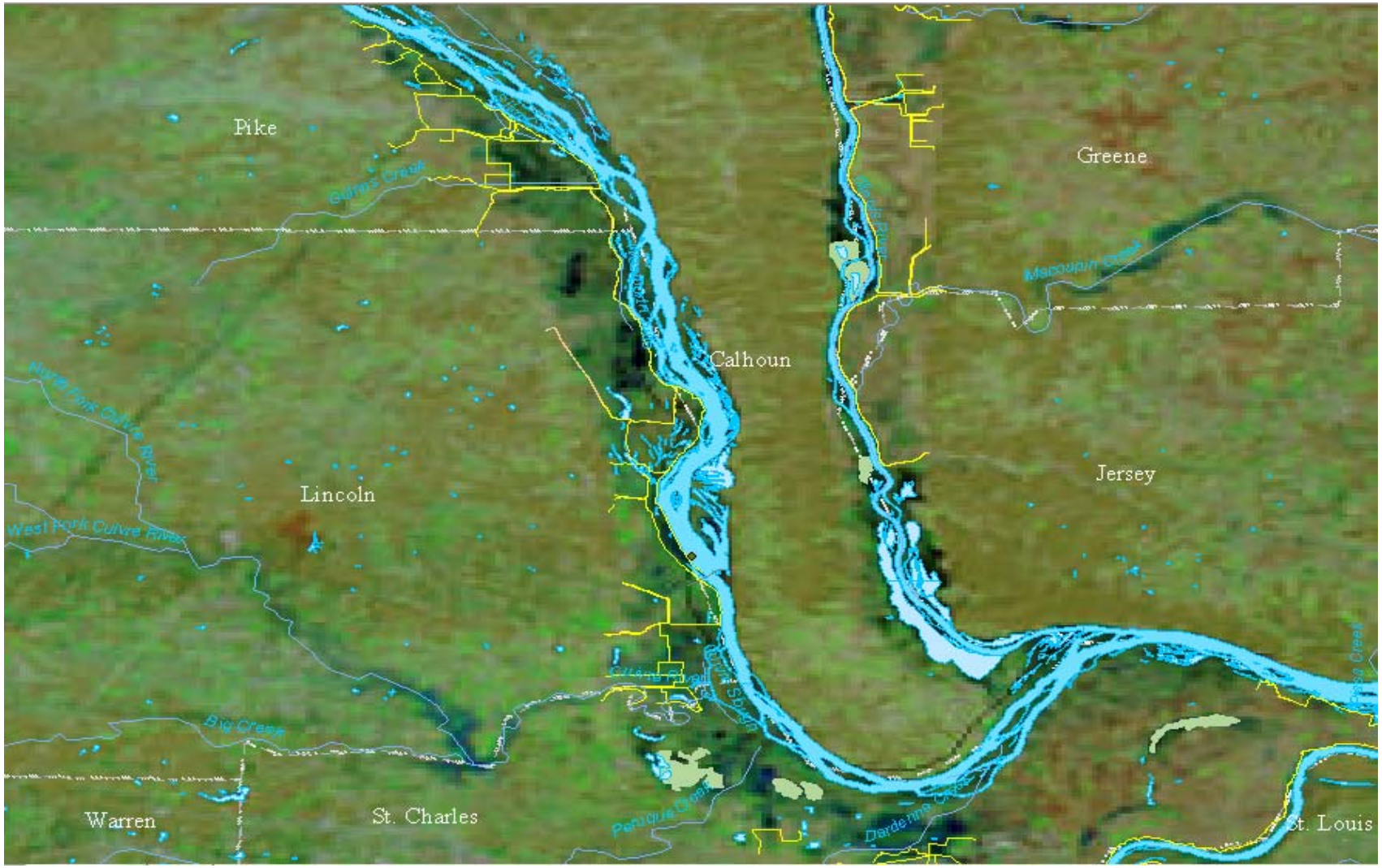
ESRI Water Body Types Used to Display Normal Water and Swaps…



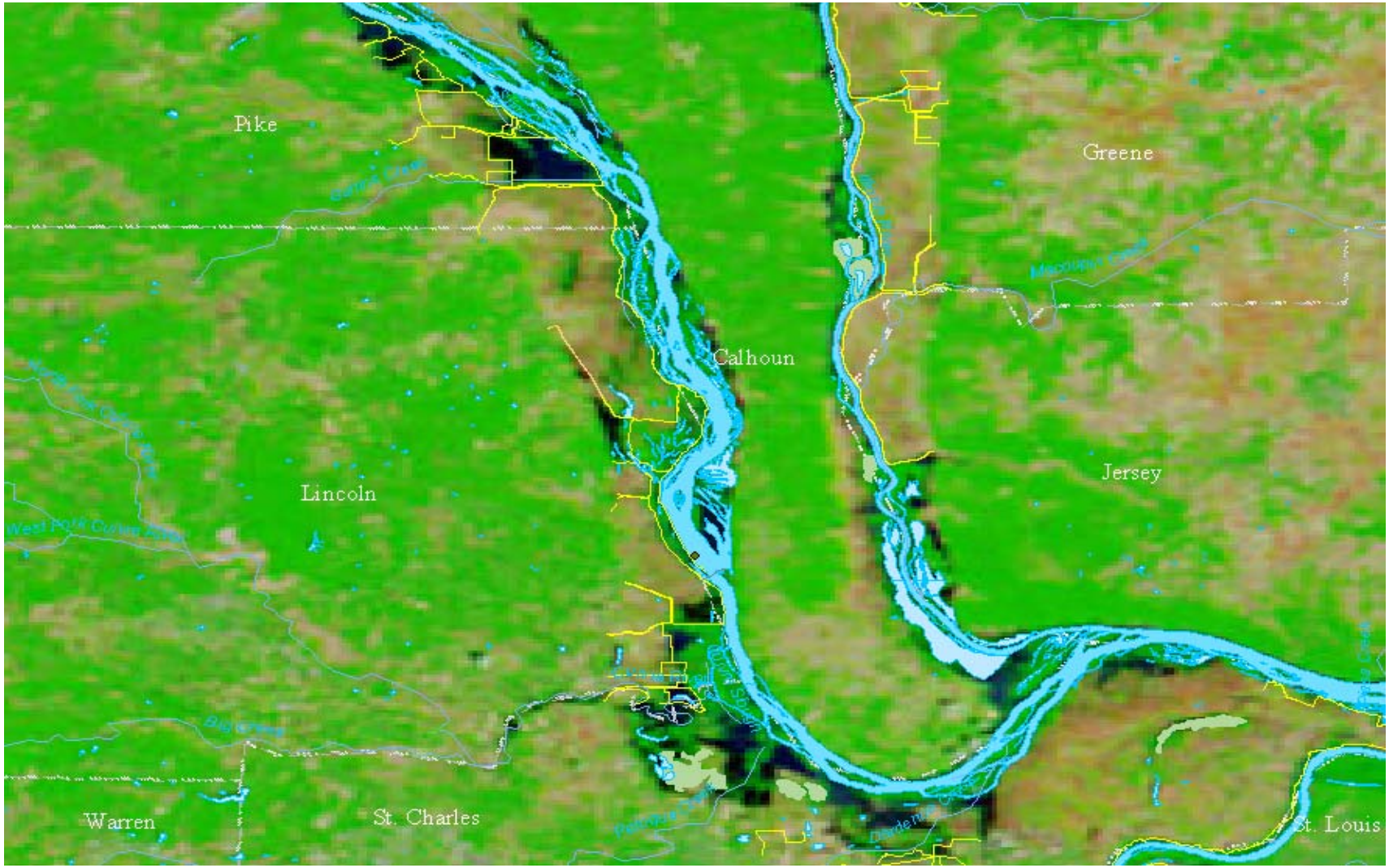
About the Slides



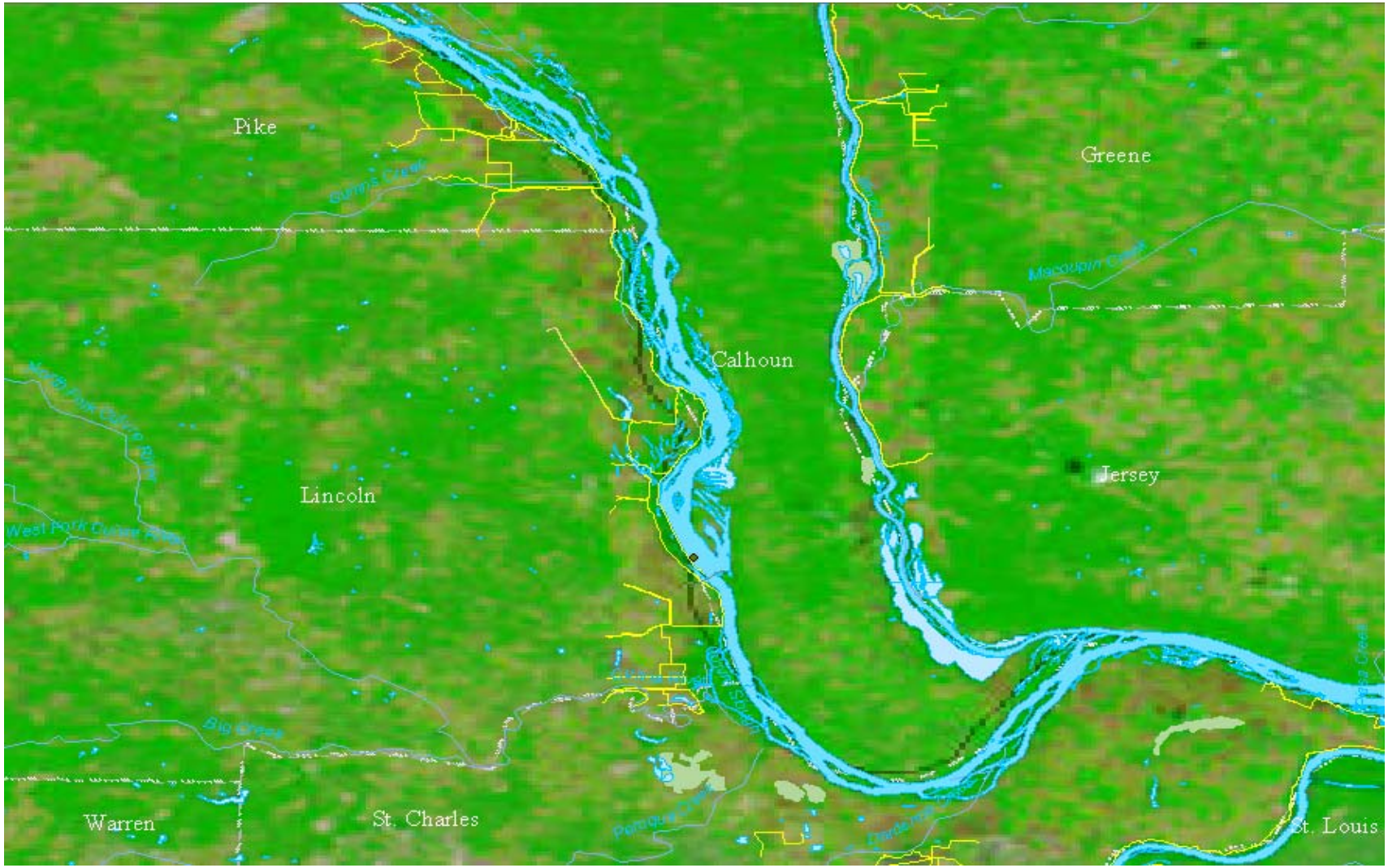
March 20, 2008



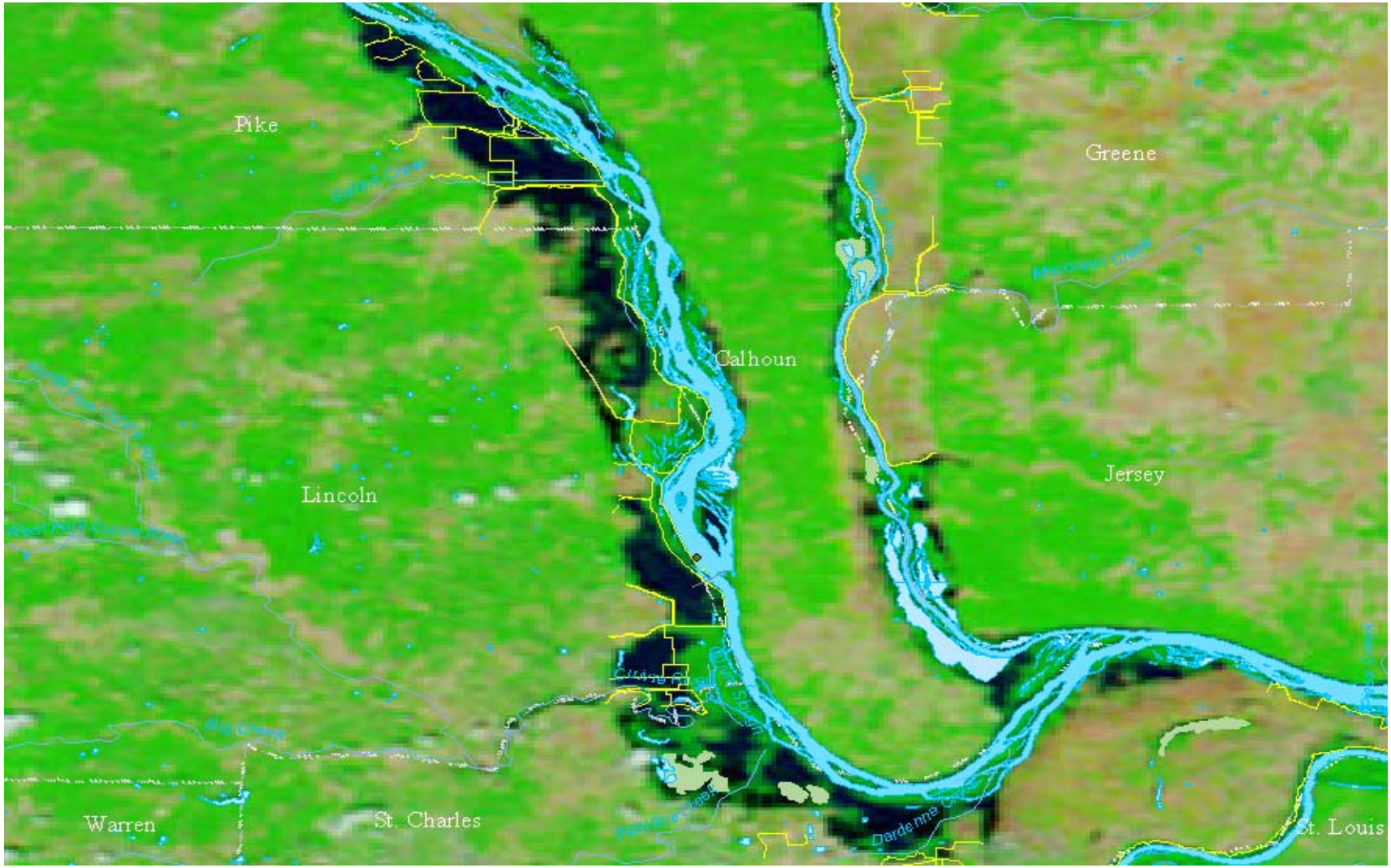
June 17, 2008


Pike
Greene
Calhoun
Lincoln
Jersey
Warren
St. Charles
St. Louis

June 12, 2007


Pike
Greene
Calhoun
Lincoln
Jersey
Warren
St. Charles
St. Louis

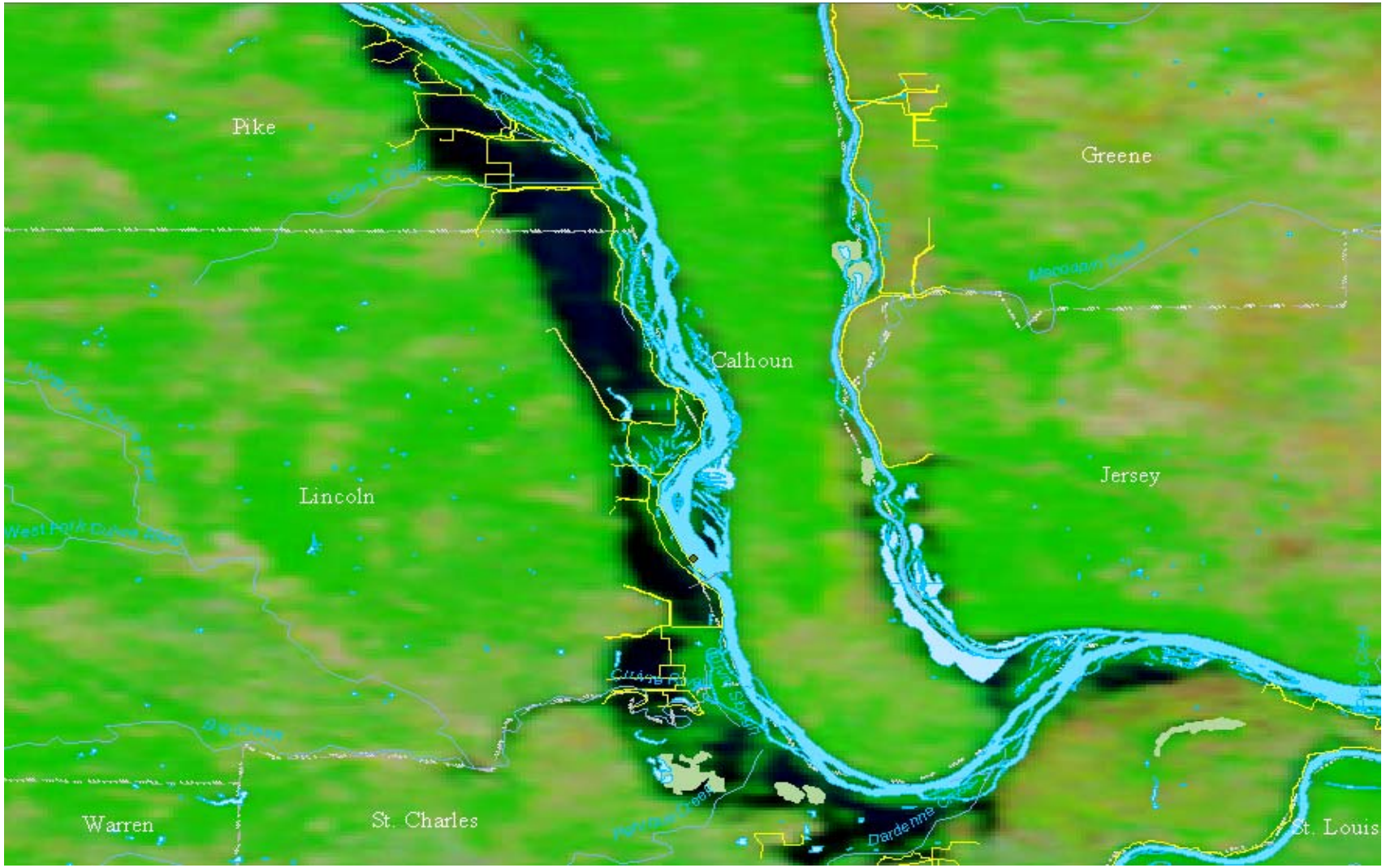
June 19, 2008



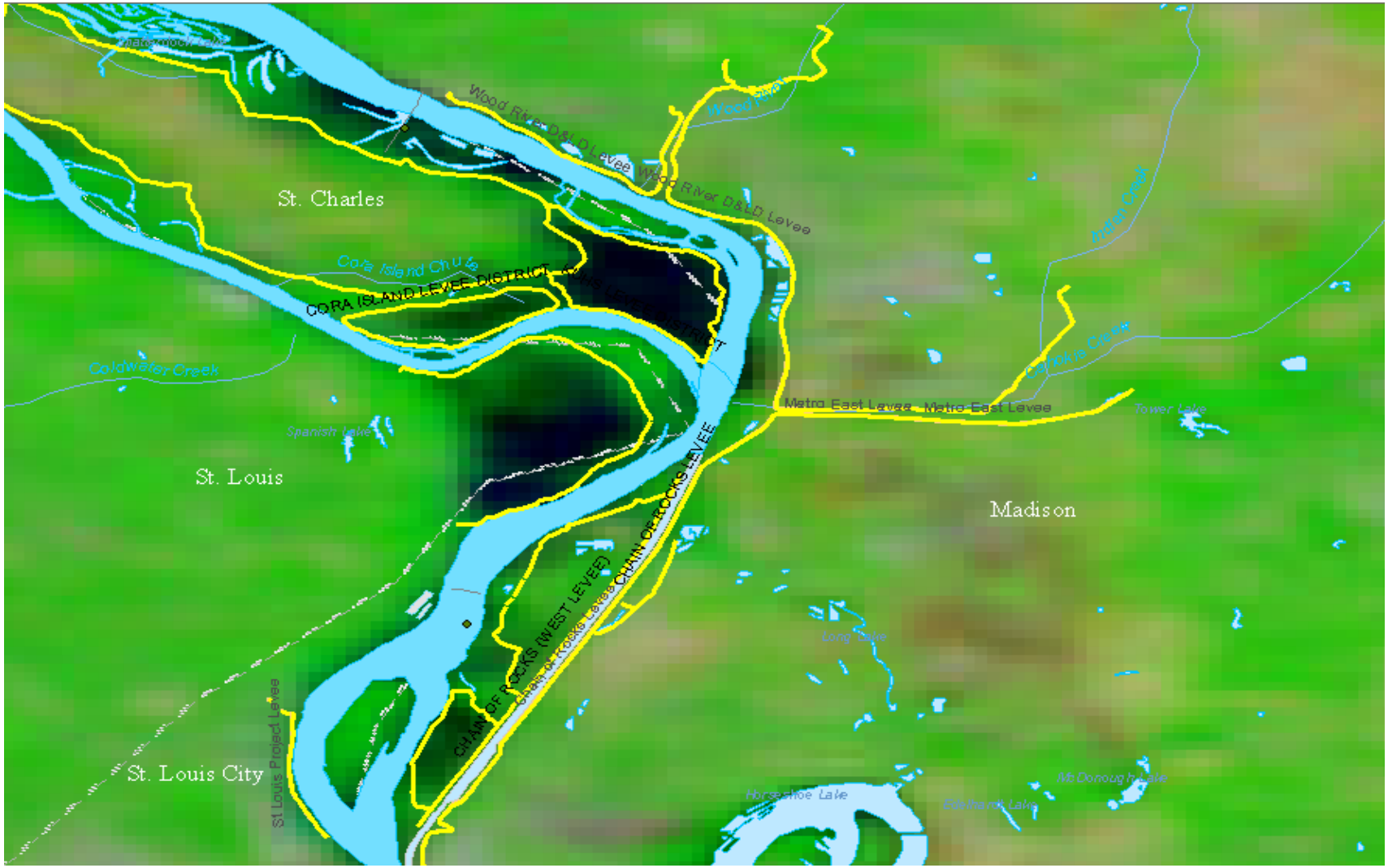
MODIS Rapid Response Team

June 21, 2008

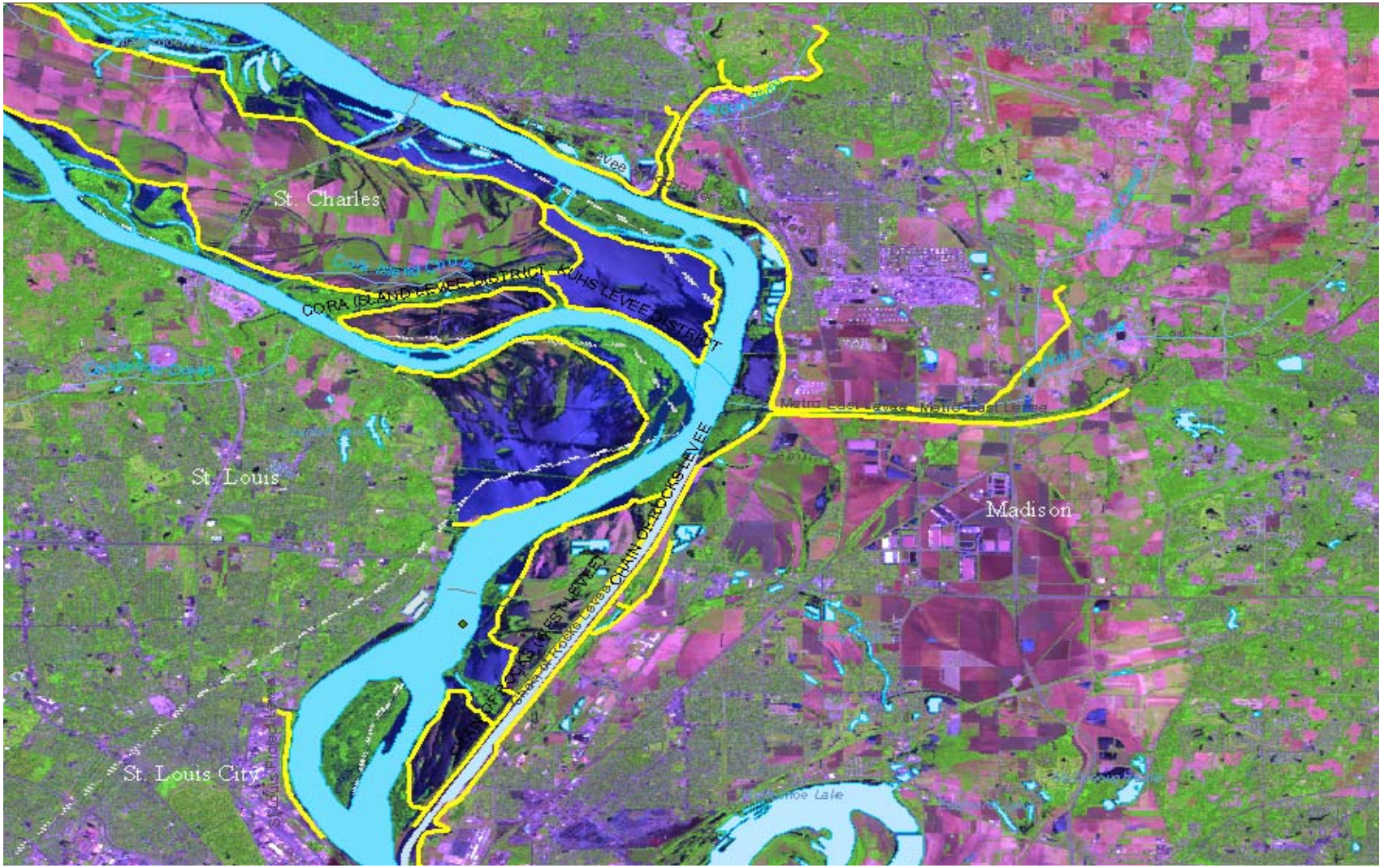
June 23, 2008


Pike
Greene
Calhoun
Lincoln
Jersey
Warren
St. Charles
St. Louis

June 23, 2008 MODIS



June 23, 2008 SPOT

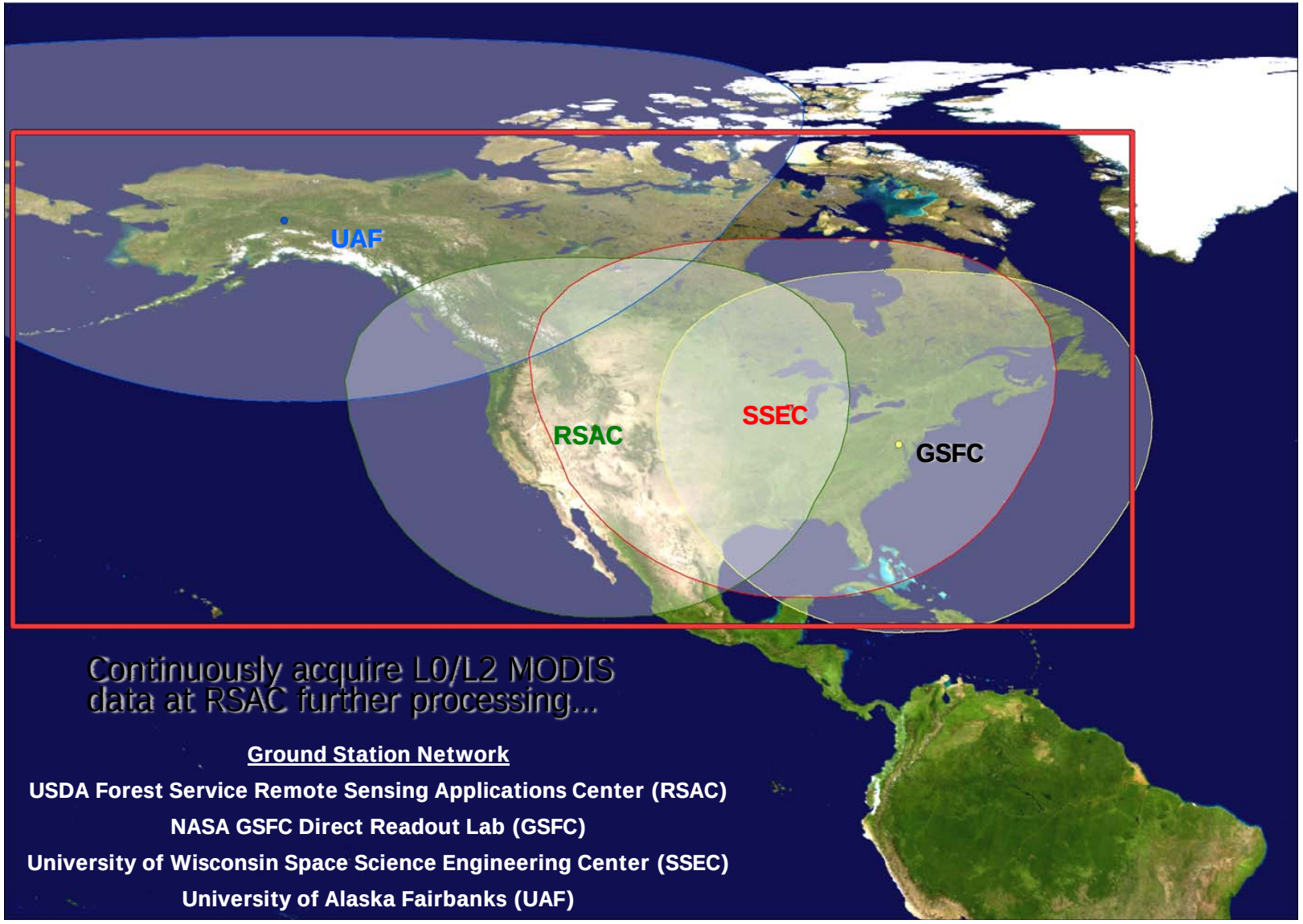


The additional Spatial Resolution of Spot 5.

MODIS Active Fire Mapping Program

- Generate “value added” geospatial fire products
  - Current, synoptic view of the wildfire situation in a geospatial context
  - Accurate and current information on fire locations, fire intensity, burned area extent and smoke
  - Aid strategic planning and asset allocation at regional/national level
    - Prioritize allocation of suppression assets
    - Focus tactical airborne reconnaissance assets
  - Monitor fire activity in remote areas

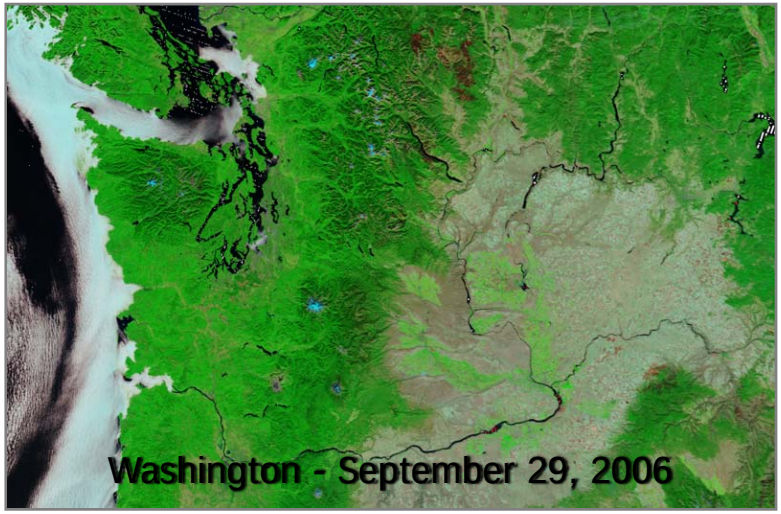
MODIS Direct Readout Ground Station Network

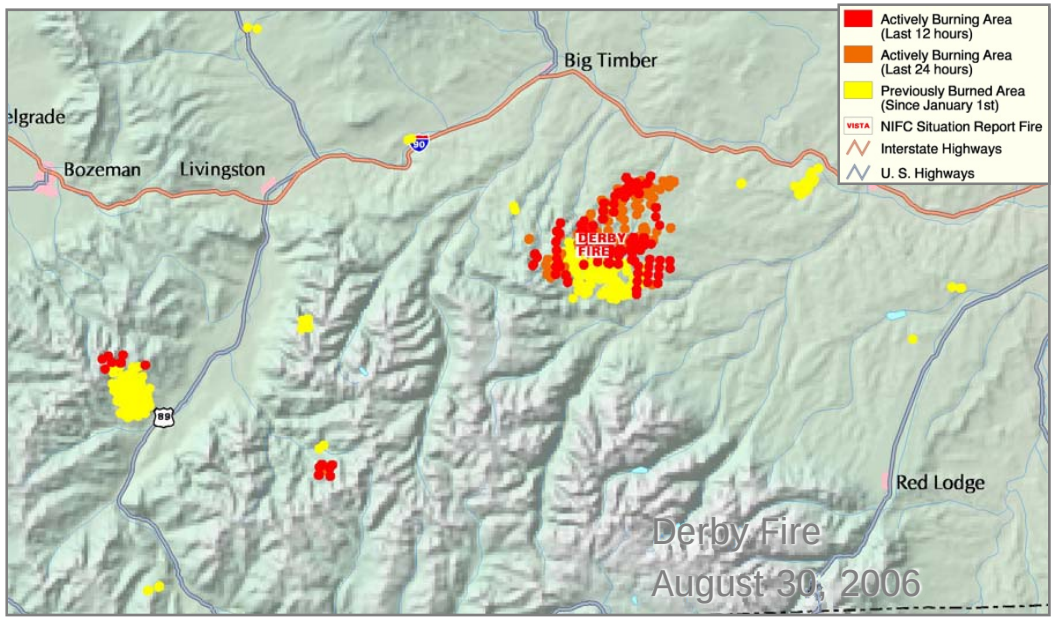


NASA MODIS Rapid Response System provides global coverage; backs up ground station network

MODIS Active-Fire Products

- Products to assist strategic planning
  - Fire detection maps, imagery and geospatial data
  - Not a replacement for airborne thermal infrared mapping systems
- Available for United States & Canada





Forest Service MODIS Active Fire Mapping Program

Currently and Planned Sensor Assets

Sensor	Platform Type	Spatial Resolution (Reflectance/TIR Bands)	Temporal Resolution (per instrument)	Fire Algorithm	Data Source
MODIS	Polar orbiting	250m, 500m, 1km/1km	2 times daily	MOD14/MYD14	Direct Readout; NASA Rapid Response System
AVHRR	Polar orbiting	1km/1km	2 times daily	FIMMA	NOAA NESDIS
GOES	Geostationary	1km/4km	4 times hourly	WF-ABBA	NOAA NESDIS
VIIRS*	Polar orbiting	375m/750m	2 times daily	TBD	Direct Readout; Rapid Response
GOES-R#	Geostationary	500m, 1km/2km	4 times hourly	TBD	Direct Readout; NOAA NESDIS

* VIIRS launch on NPOESS Preparatory Project (NPP) mission in June 2010 and subsequent NPOESS missions

GOES-R launch in 2015 and subsequent missions

NIROPS Aircraft

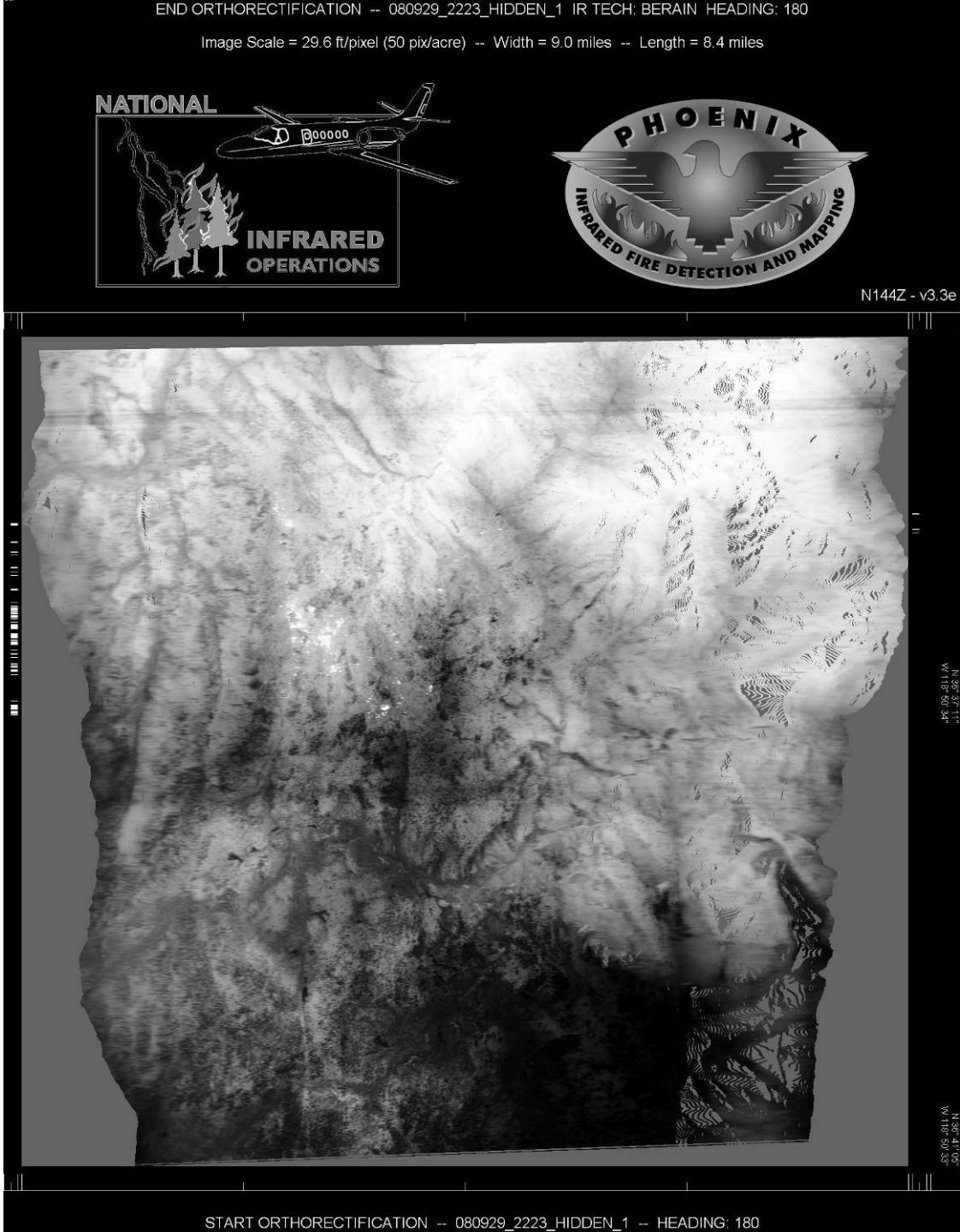
Main function: Wildfire mapping from April-November

144Z: Cessna Citation Bravo

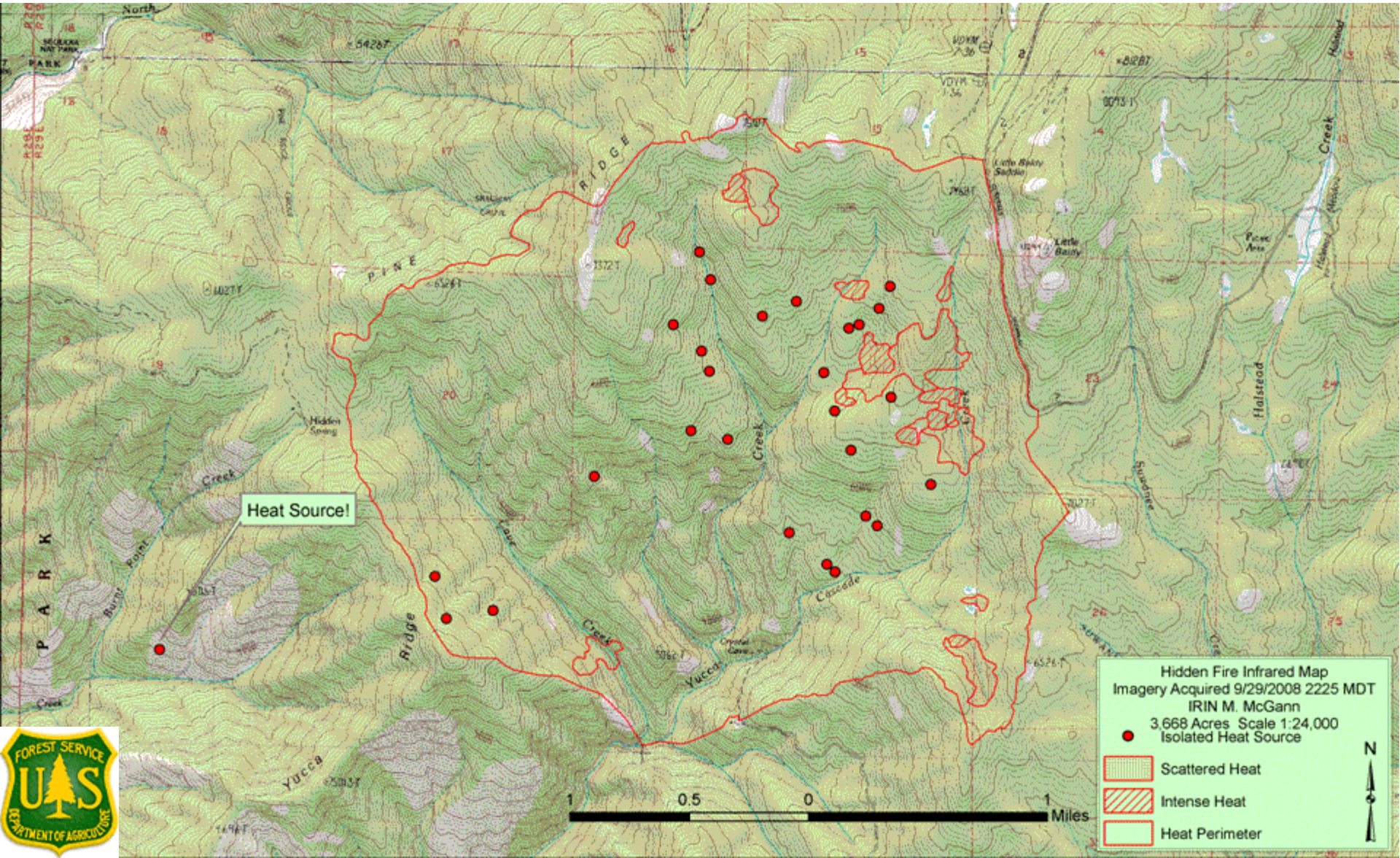
149Z Beechcraft 200 Super King Air

PHOENIX

- FS Phoenix sensor is the primary tactical fire sensor.
- IR Analysts Interpret Orthorectified Imagery to create Fire Boundary Shapefiles.



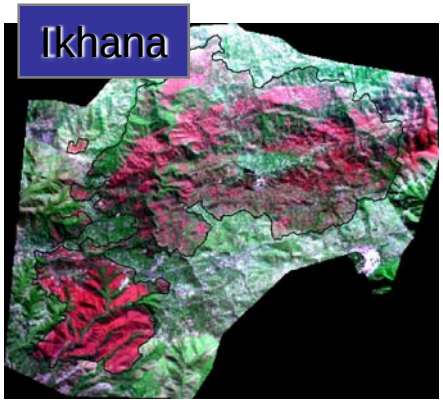
Heat Sources and Fire Boundary



RSAC Operations Program Support

<u>Currently Leveraged Sensor Assets</u>

Landsat 5 and Landsat 7 (SLC-Off)
ASTER
SPOT 4 and 5
AWiFS
NASA Ikhana AMS
Disaster Monitoring Constellation
MASTER
IKONOS
Quickbird
MODIS
AVHRR
GOES



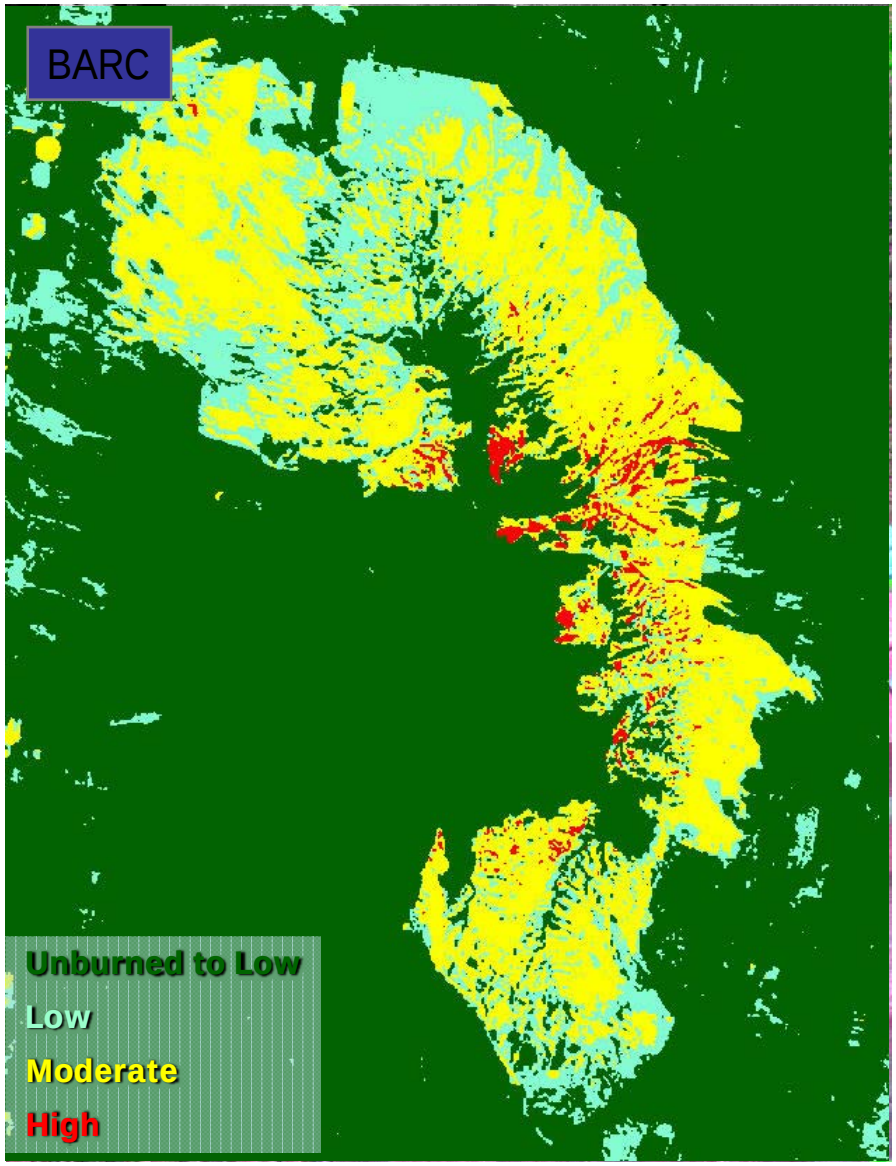
Burned Area Emergency Response Imagery Support

Frequently Leveraged Sensor Assets

Sensor	Platform Type	Spatial Resolution (Reflectance Bands)	Temporal Resolution (per instrument)	Data Source
Landsat 5	Polar orbiting	30m	16 days	USGS EROS
Landsat 7 (SLC-off)	Polar orbiting	30m	16 days	USGS EROS
AWiFS	Polar orbiting	56m	5 days	USDA-FAS-SIA
SPOT 4	Polar orbiting	20m	2-3 days (pointable)	SPOT Image
SPOT 5	Polar orbiting	10m/20m	2-3 days (pointable)	SPOT Image
ASTER[1]	Polar orbiting	15m/30m	4-16 days (pointable)	NASA/USGS EROS
NASA AMS	Airborne (UAV)	~ 21m	--	NASA
LDCM[2]	Polar orbiting	30m	16 days	USGS EROS

1 – Anomalous SWIR band issues since April 2008; 2 - LDCM launch currently scheduled for July 2011

Creation of the BARC



Black Pine 2 Fire
Sawtooth NF
73,000 Acres

Normalized Burn Ratio (NBR)
Differenced Normalized Burn Ratio (dNBR)

NBR = (NIR – SWIR) / (NIR + SWIR)

dNBR = Pre NBR – Post NBR

Normalized Difference Vegetation Index (NDVI)
Differenced NDVI (dNDVI)

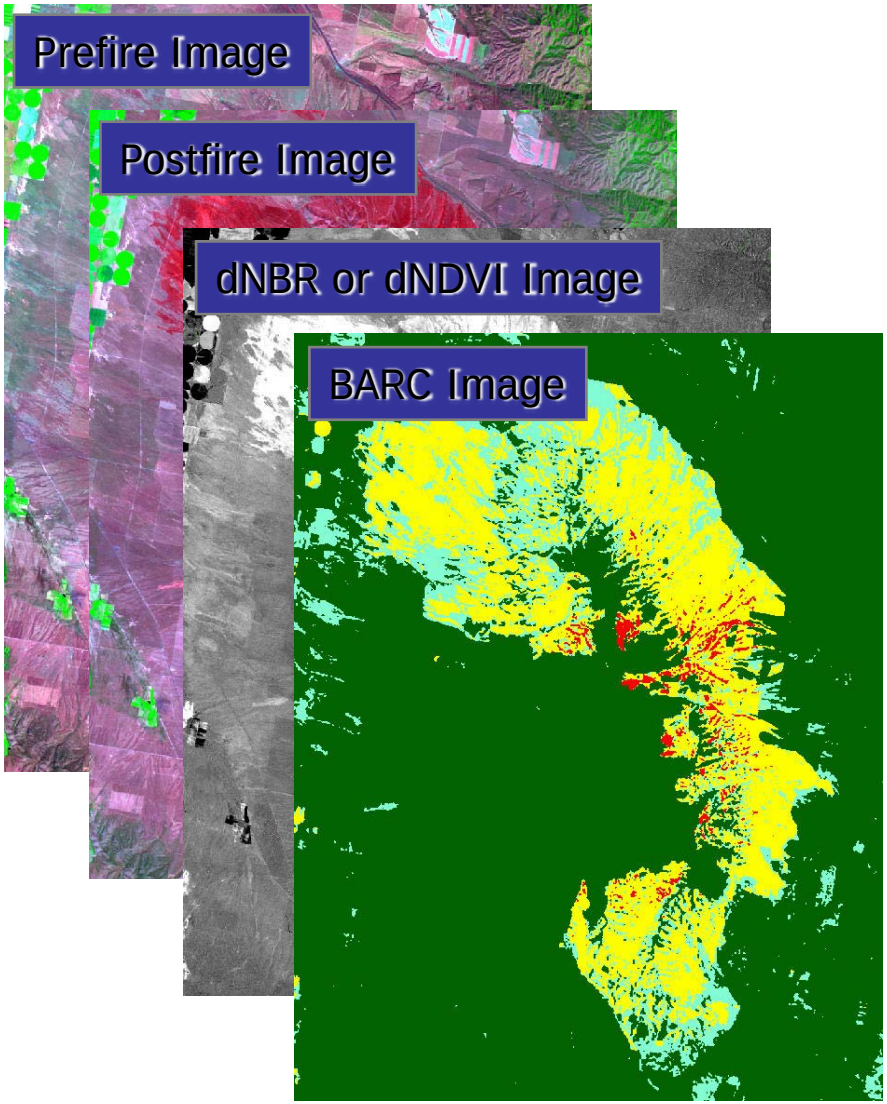
NDVI = (NIR – Red) / (NIR + Red)

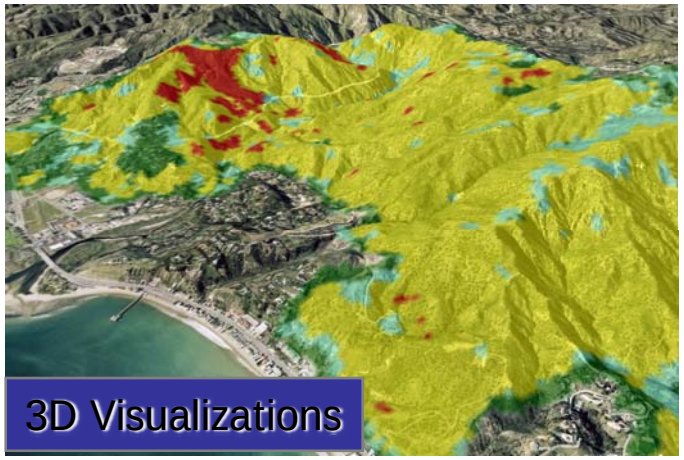
dNDVI = Pre NDVI – Post NDVI

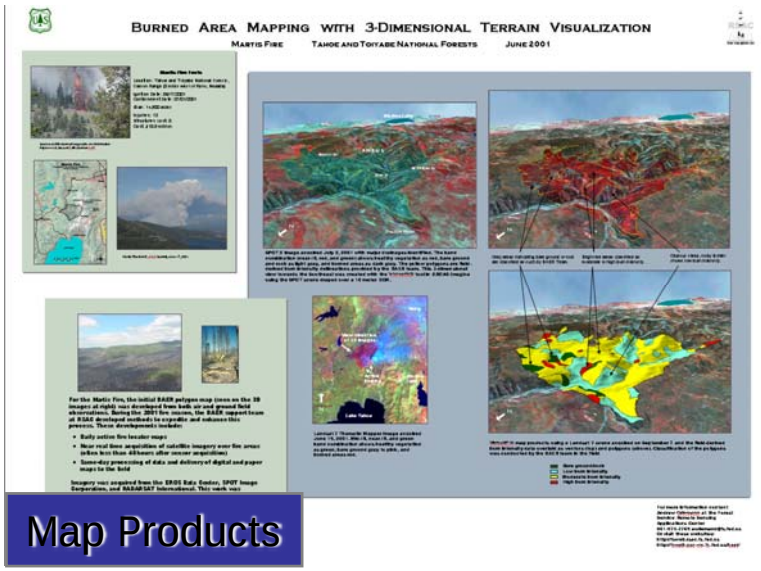
dNDVI is utilized when appropriate SWIR band is not available

Burned Area Emergency Response Imagery Support

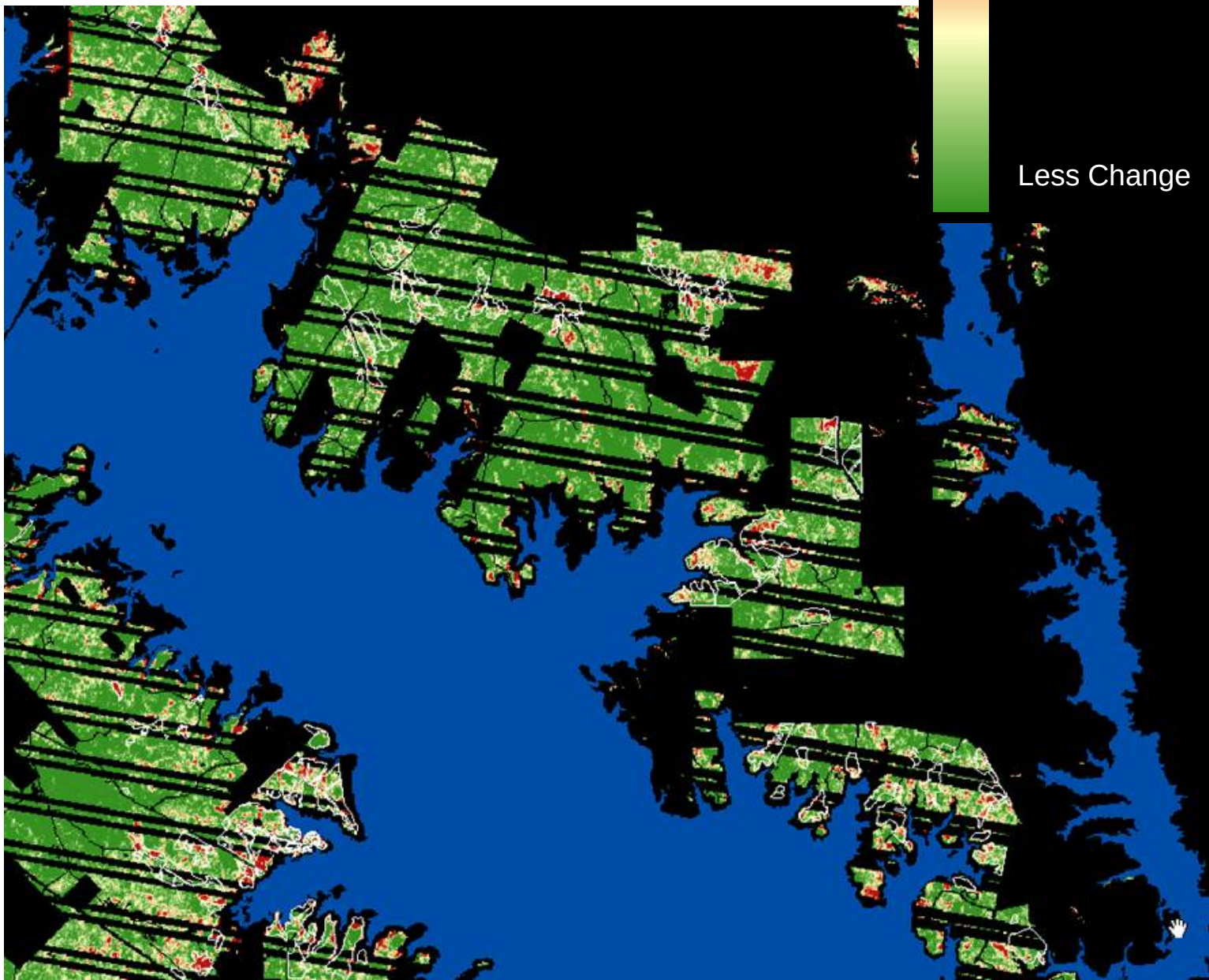
BAER Support Rapid Delivery Products







Problems creating products with Landsat 7



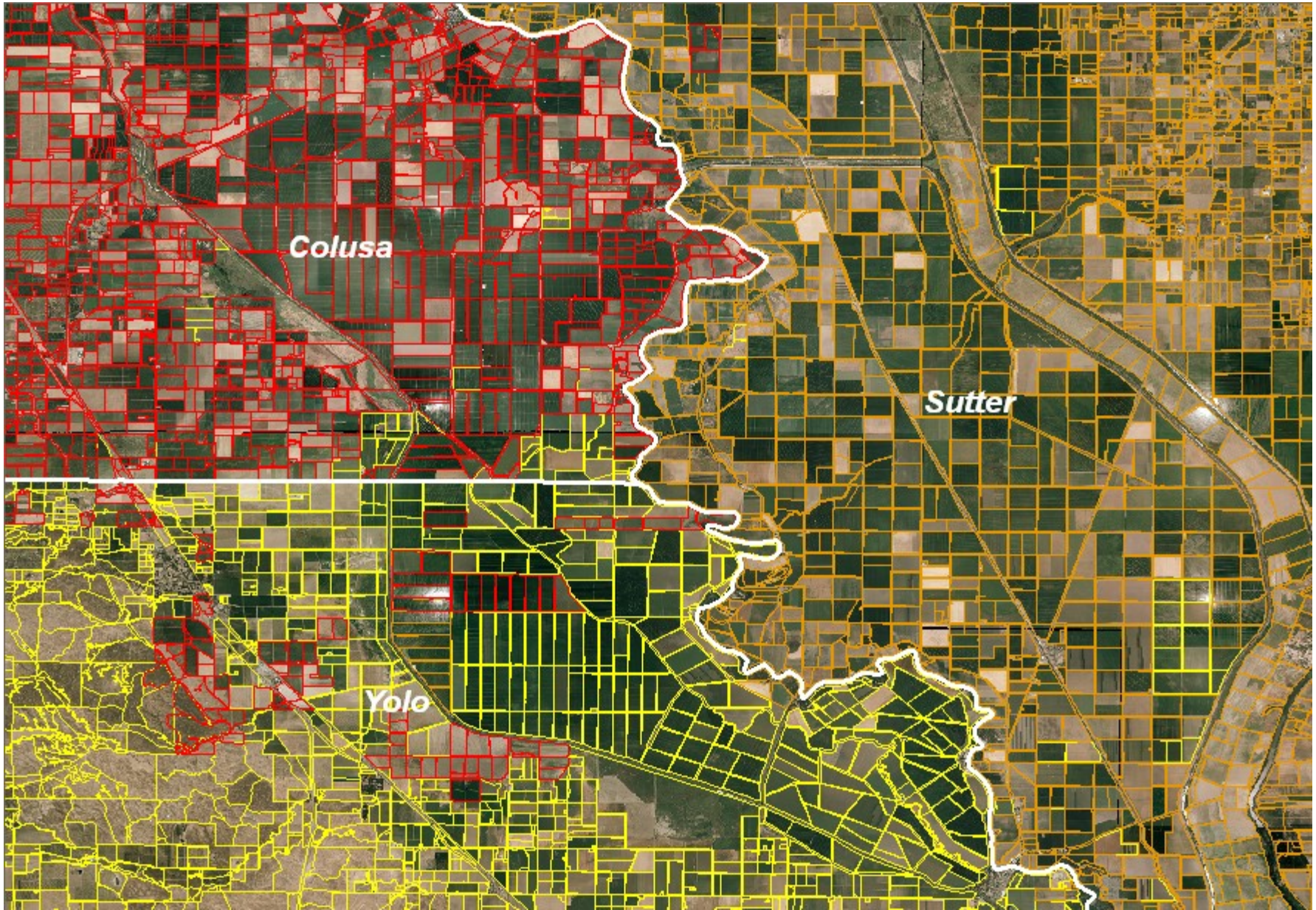
Salvage Areas

LANDSAT
10/22/05-9/4/05
Average Change in NDFI:
NDFI = (NDVI + NDMI) / 2

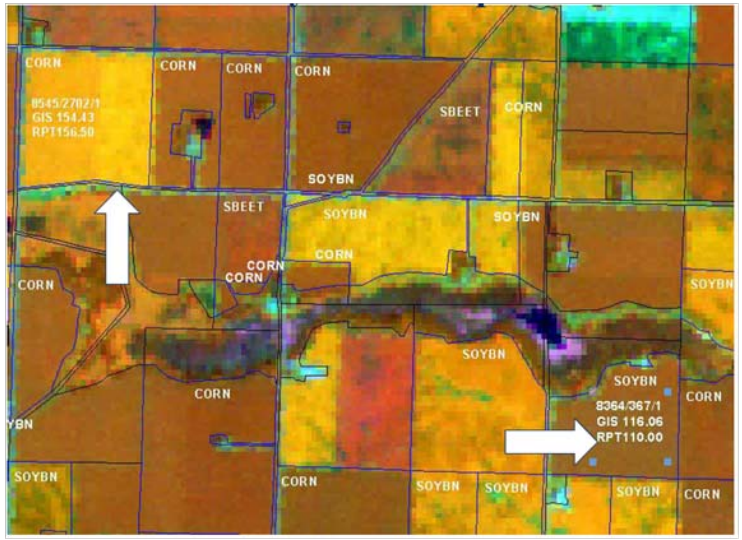
Image Processing / Information Extraction

Common Land Units Over NAIP

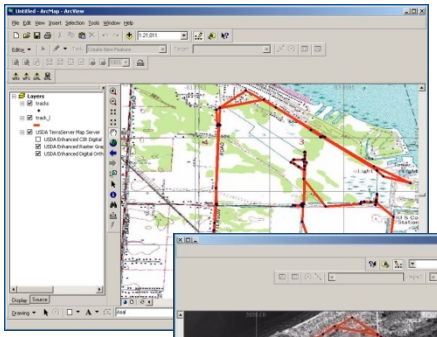
Colusa County + Sutter County + Yolo County CA

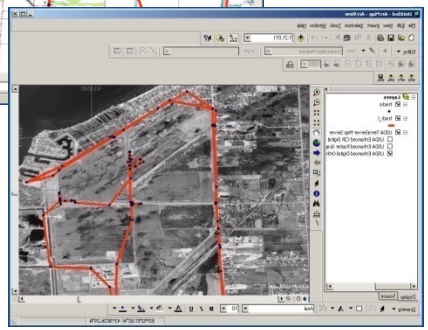


Cropped Area Certified by Property Owner

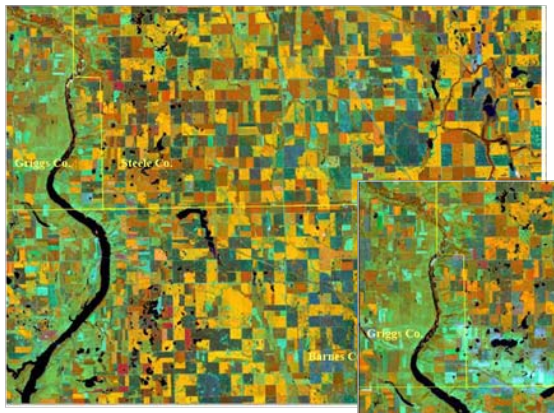


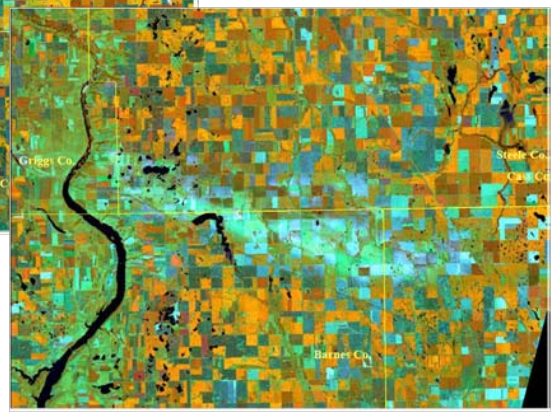
Tracking Reported Crops & Monitoring for Discrepancies



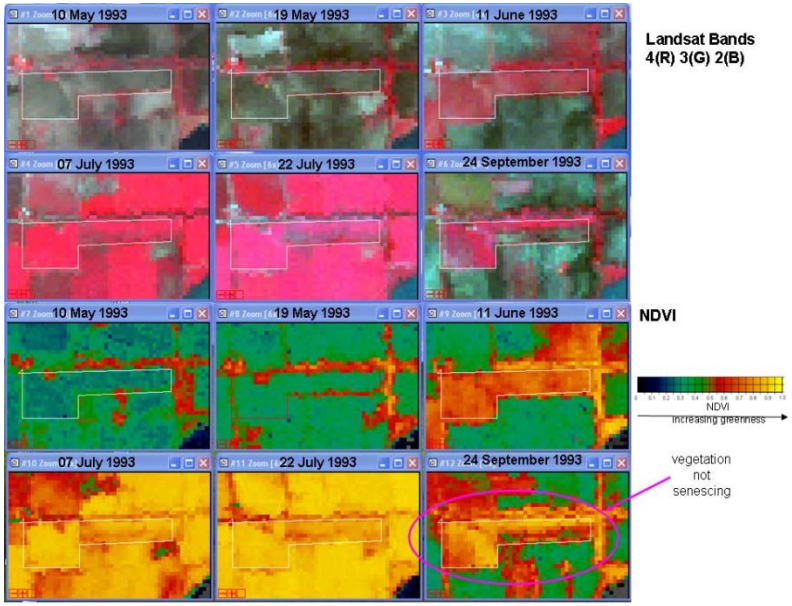


Integrating Remote Sensing, Geographic Information Systems (GIS), and Global Positioning Systems (GPS)





Determining Disaster Extent and Monitoring for Fraud

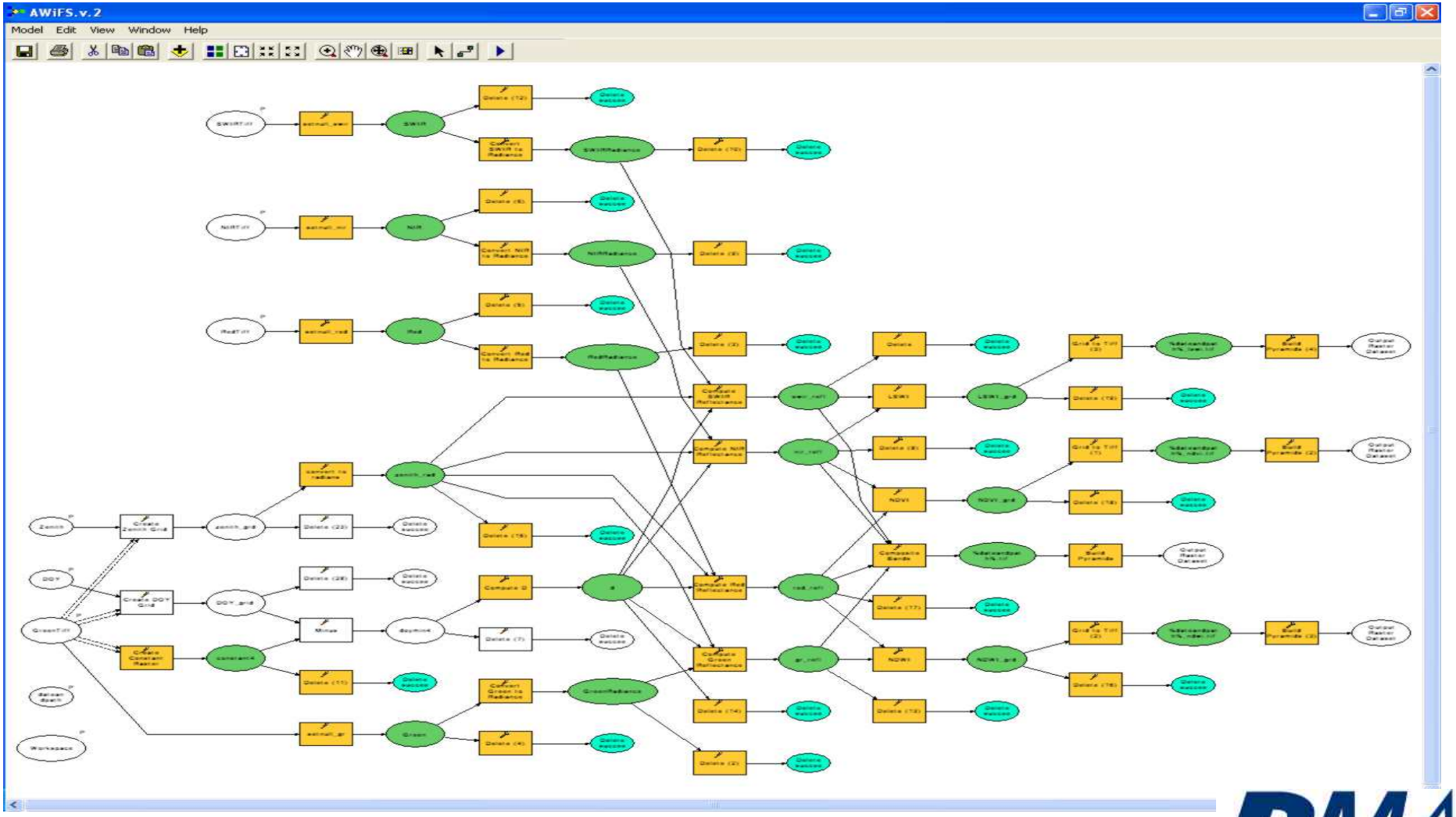


Forensic Reconstruction and Analysis of Crop Histories

RMA

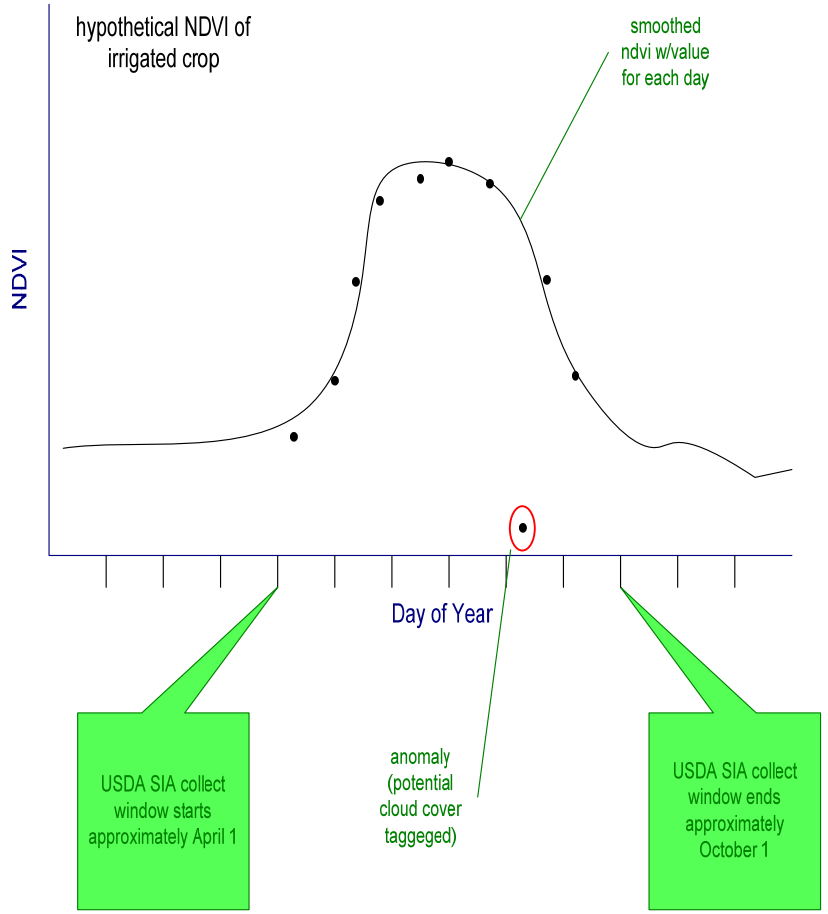
Remote Sensing within USDA Risk Management Agency

Model Builder Preprocessing ToolBox

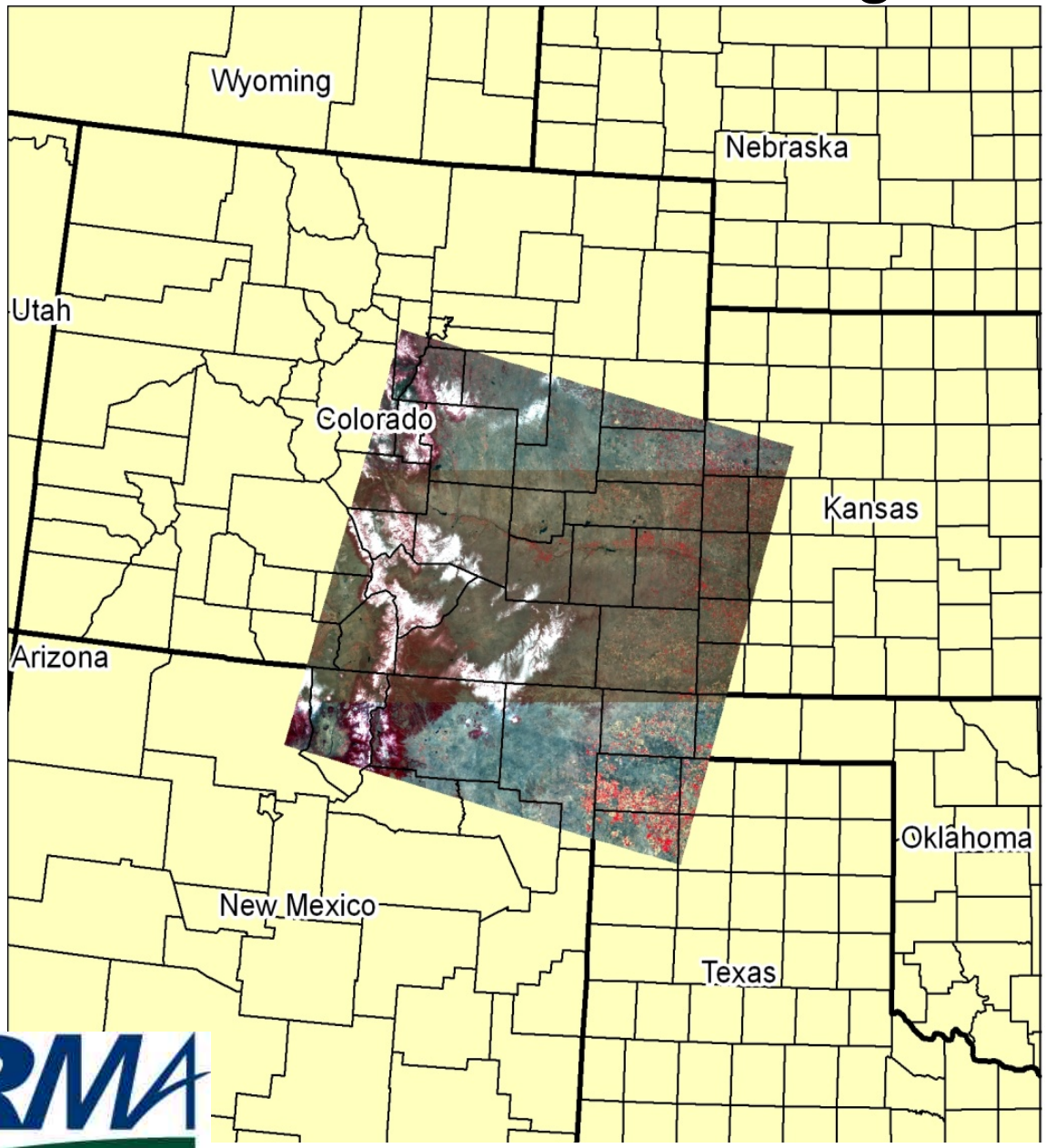


Indices Generated

- vegetation index
  - ND**V**I (Normalized Difference Vegetative Index)
    - NDVI = (nir – red)/ (nir + red)
- water index
  - ND**W**I (Normalized Difference Water Index)
    - NDWI = (red – green) / (red + green)
- land surface water index (irrigated / non-irrigated differentiator)
  - LSWI (Land Surface Water Index)
    - LSWI = (nir – swir)/ (nir + swir)



Data Processing Examples



AWiFS Overview

Acquisition Date: 04/18/2008
Path: 265 Row: 045 Quad: A
Bands: 3 (ir) / 2 (red) / 1 (green)

% Reflectance Image

0 20 40 80 120 160
Miles

% Reflectance Image

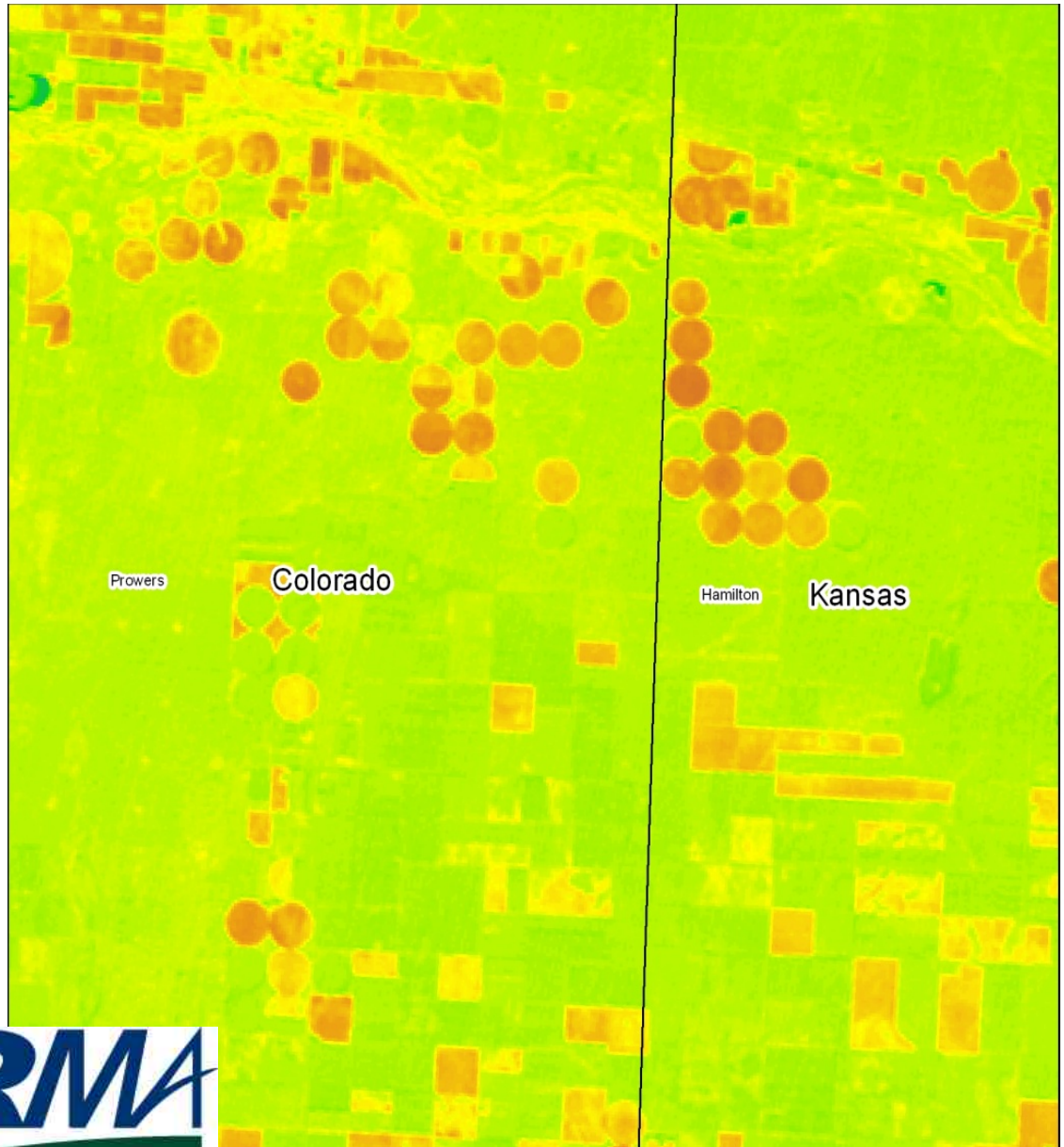
AWiFS Overview

Acquisition Date: 04/18/2008
Path: 265 Row: 045 Quad: A
Bands: 3 (ir) / 2 (red) / 1 (green)

% Reflectance Image

0 0.5 1 2 3 4
Miles

Normalized Difference Vegetation Index



AWiFS Overview

Acquisition Date: 04/18/2008
Path: 265 Row: 045 Quad: A

NDVI Image

NDVI

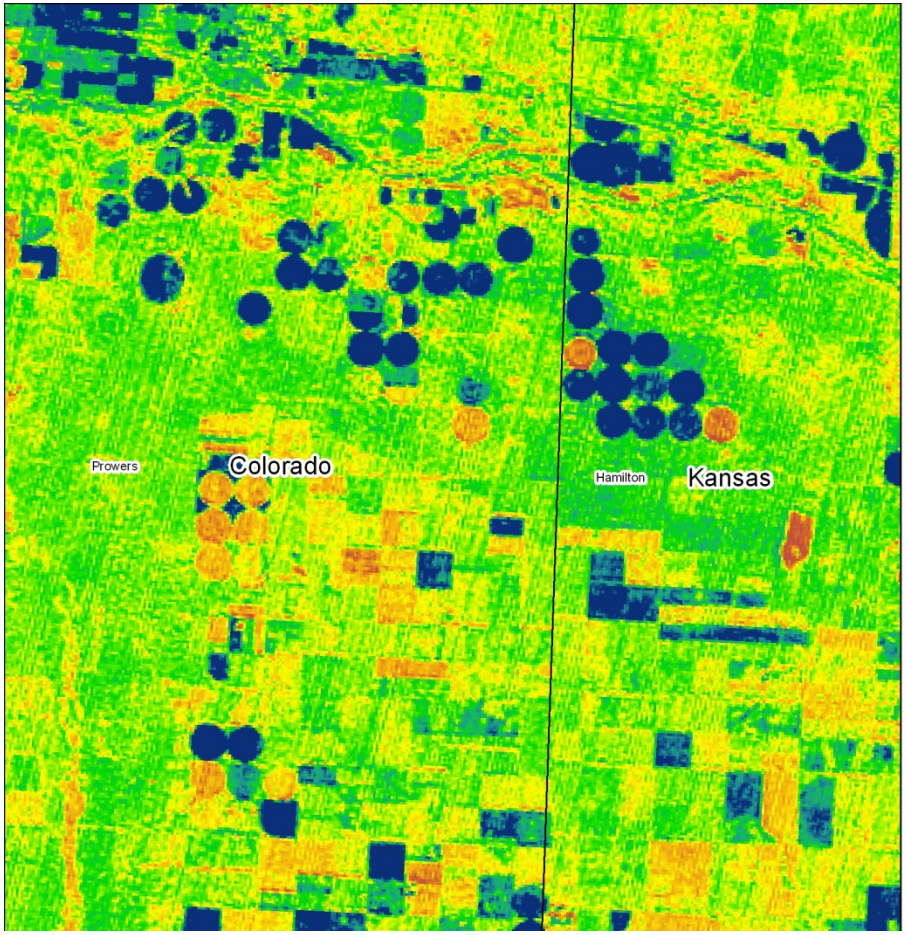
Value

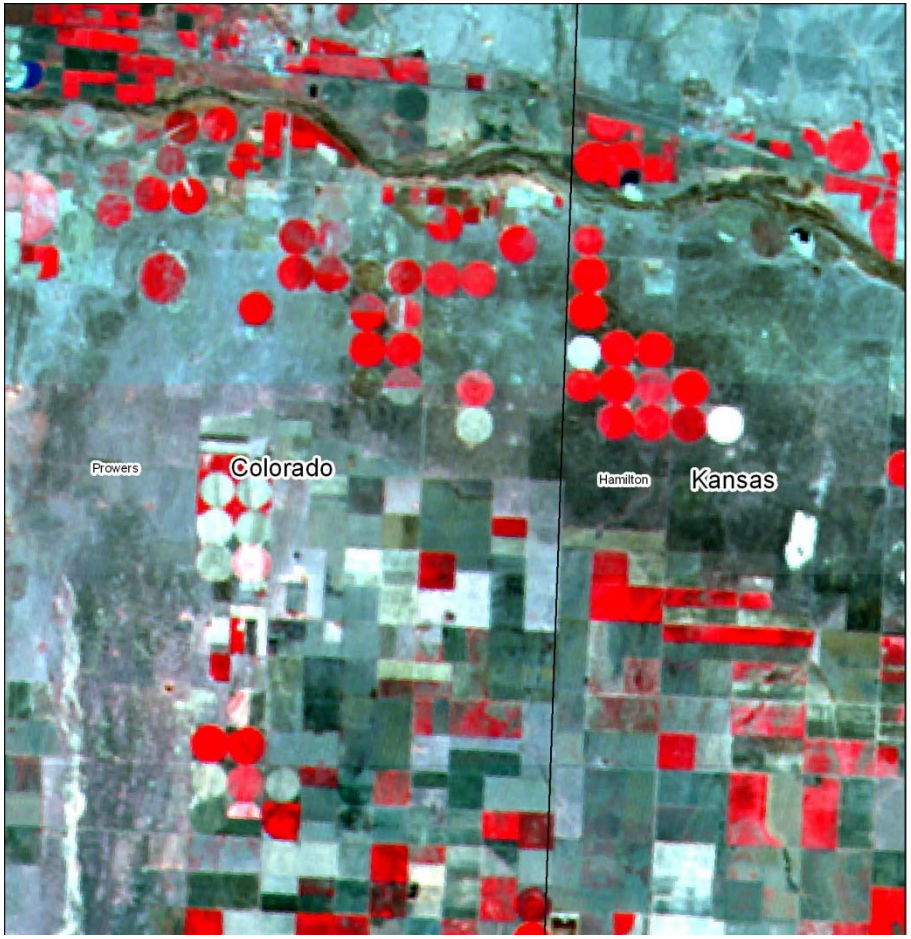
High : 1.0

Low : -1.0

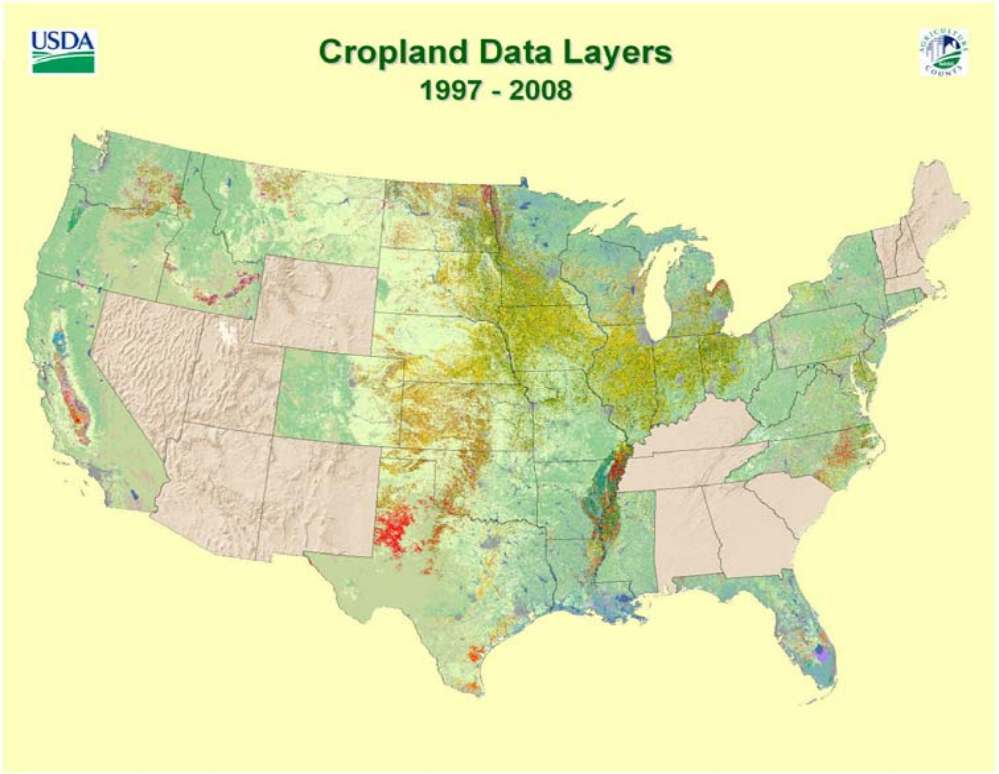
0 0.5 1 2 3 4 Miles

Normalized Difference Water Index





AWiFS Imagery has allowed for Increased Cropland Data Layer production.

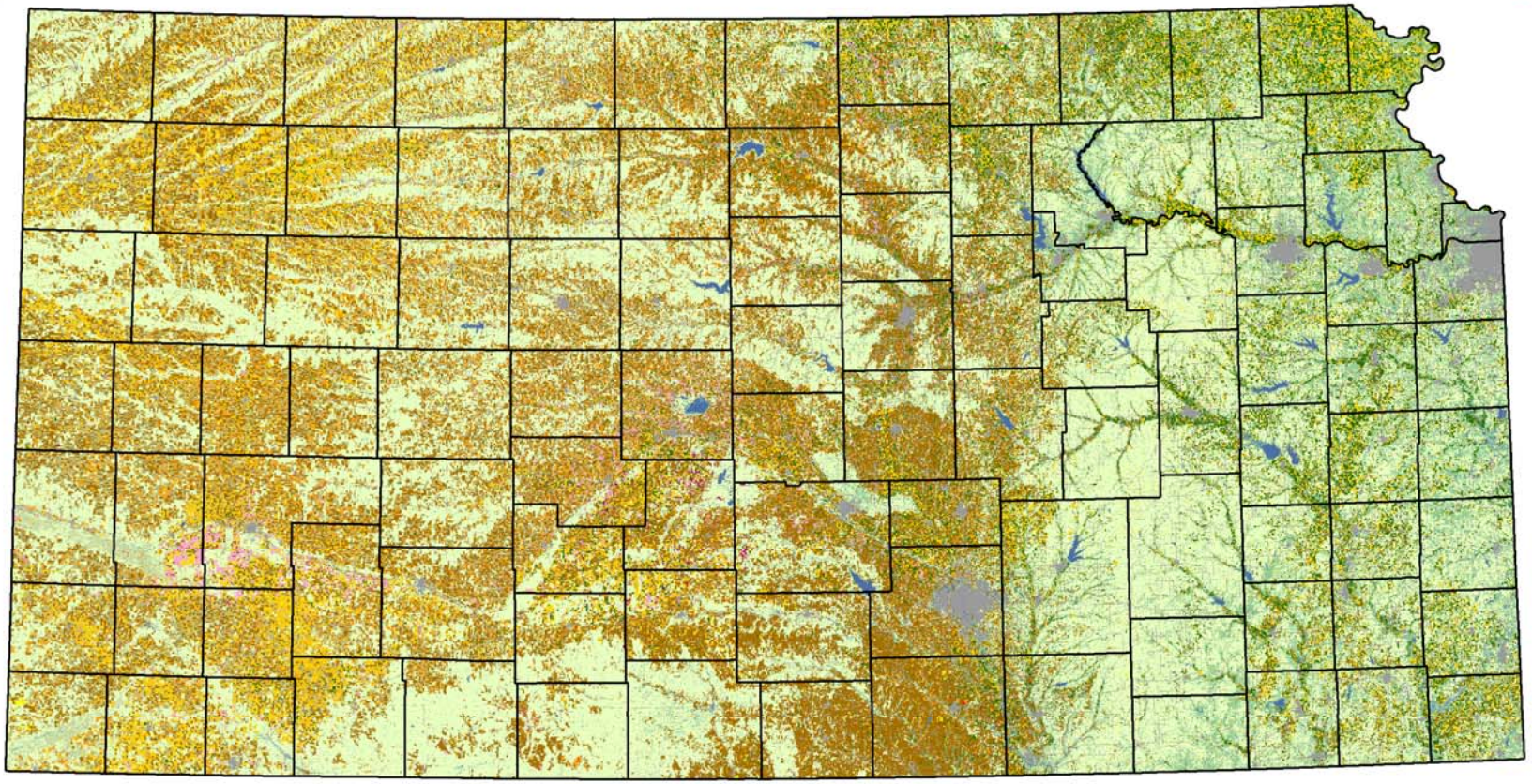


Expansion of NASS Cropland Data Layer

1. Increased amount of imagery for same cost.
2. Improved commercial software.
3. Increased amount of ground truth data.

Traditional (1997-2003)	Expansion (2004-2008)	Additions for 2009
North Dakota	Louisiana (’04)	California
Arkansas	South Dakota (’06)	Washington
Mississippi	Ohio (’06)	Montana
Illinois	Minnesota (’06)	Kentucky
Iowa	Kansas (’06)	North Carolina
Indiana	Oklahoma (’06)	Georgia
Missouri	Michigan (’07)	
Nebraska	Colorado (’08)	
Wisconsin	Texas (’08)	

Kansas 2008 Cropland Data Layer



Land Cover Categories

(Ordered by Decreasing Acreage)

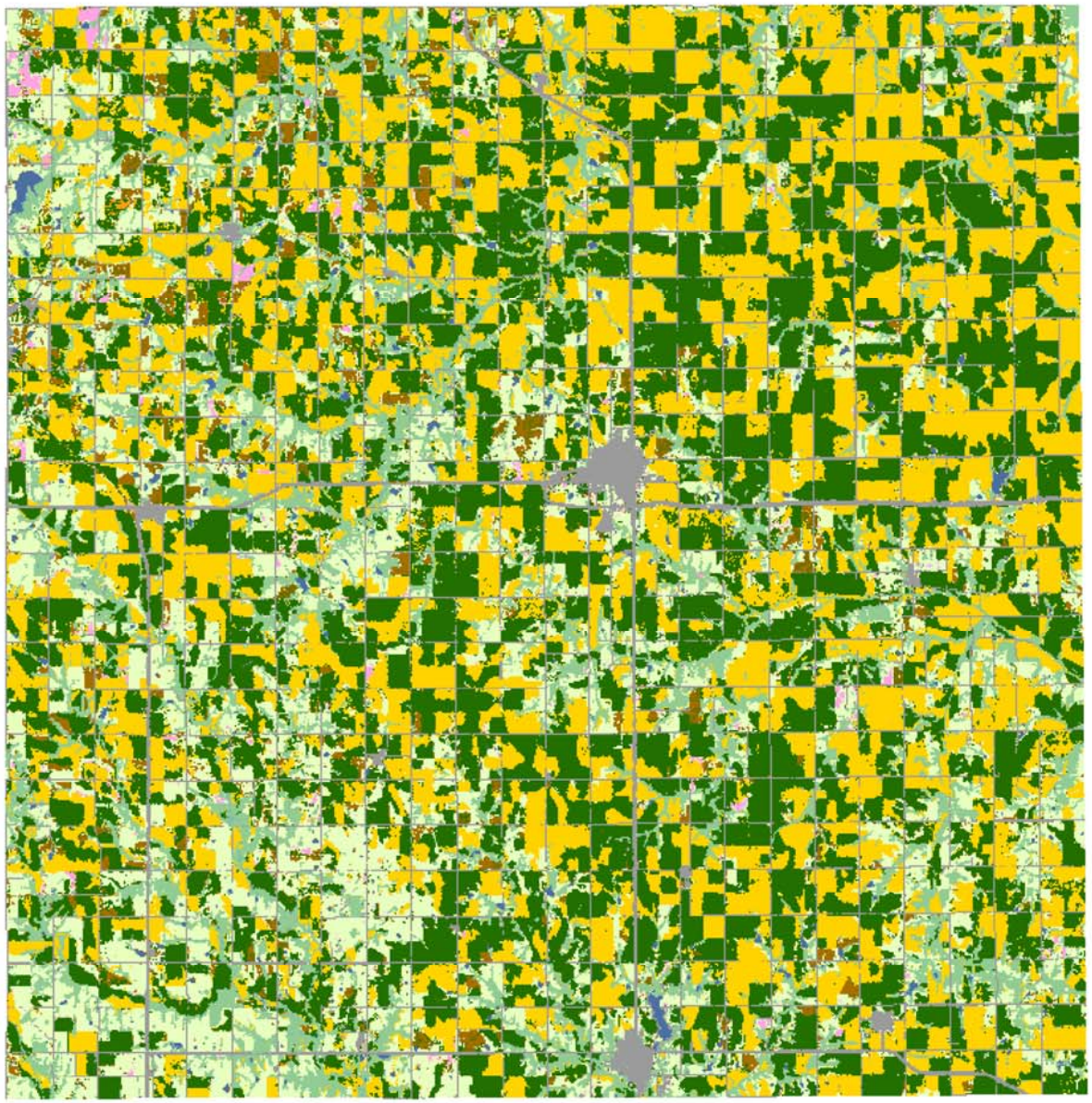
Agricultural

- Winter Wheat
- Corn
- Sorghum
- Soybeans
- Alfalfa
- W. Wht./Soy. Dbl. Crop.
- Sunflowers
- Rye
- Cotton
- Other Small Grains
- Clover/Wildflowers
- Oats
- Potatoes
- Seed/Sod Grass
- Canola
- Millet
- Other Crops
- Barley
- Other Tree Nuts
- Peas
- Apples
- Misc. Vegs. & Fruits

Non-Agricultural

- Grass/Pasture/Non-Ag
- Urban/Developed
- Woodland
- Fallow/Idle Cropland
- Water
- Wetlands
- Shrubland
- Barren

Brown County, Kansas
2008 Cropland Data Layer



Land Cover Categories

(Ordered by Decreasing Acreage)

Agricultural

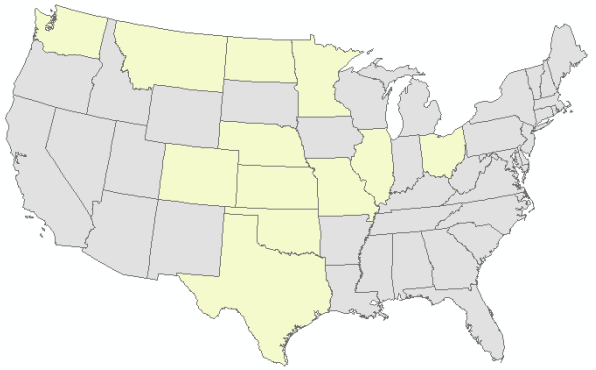
- Soybeans
- Corn/Sweet Corn
- Winter Wheat
- Alfalfa
- Win. Wht./Soyb. Dbl. Cropped
- Sorghum
- Clover/Wildflowers
- Other Crops/Grass Seed/Sod
- Other Small Grains
- Sunflowers
- Oats
- Cotton
- Barley
- Seed/Sod Grass
- Other Tree Nuts

Non-Agricultural

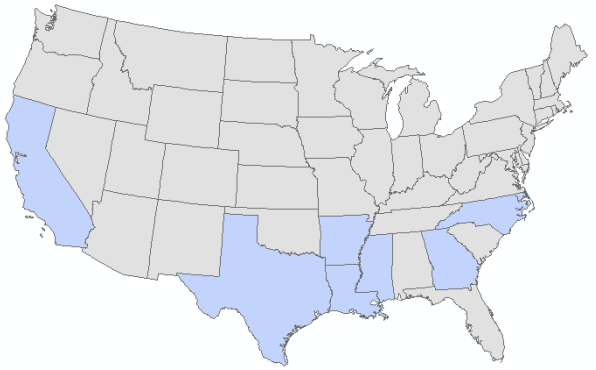
- Grass/Pasture/Non-Ag
- Woodland
- Urban/Developed
- Water
- Wetlands
- Barren
- Fallow/Idle Cropland
- Shrubland

Cropland Data Layer Future

- Improve acreage timing
  - Sept. Small Grain Summary
  - August district level estimates
- Expand geographic scope
  - Cotton, Winter, Durum and Spring Wheats
- Derivatives
  - Change detection
  - Crop rotations
- National program
  - Leverage resource partnerships

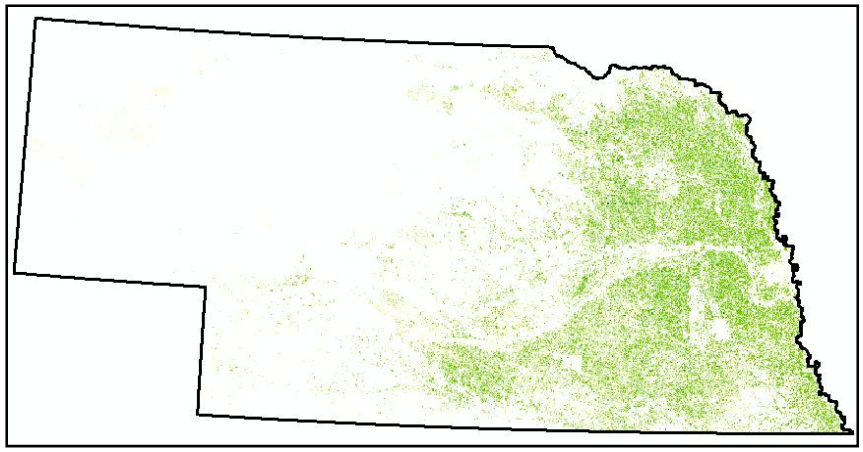


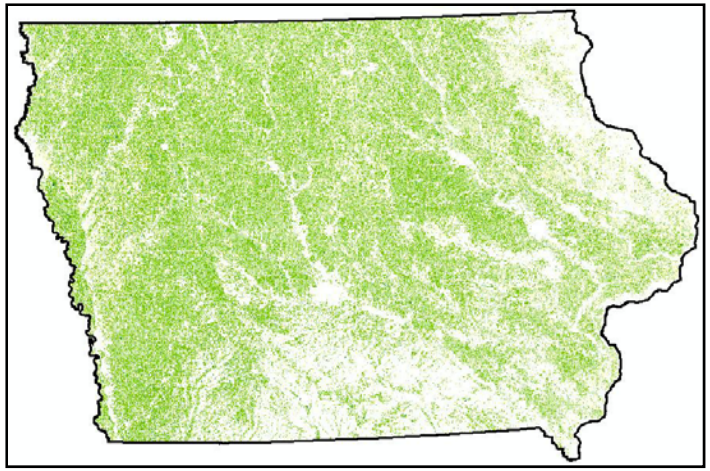
Primary Wheat States

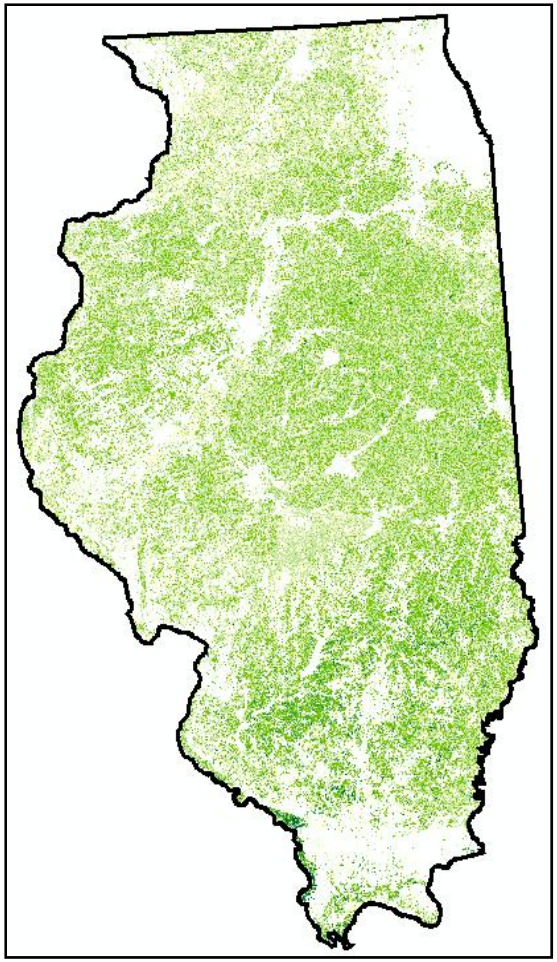


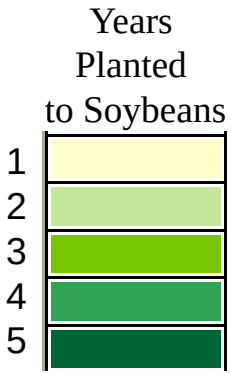
Primary Cotton States

Single Crop Planting Intensity, 2003-2007
Nebraska, Iowa and Illinois



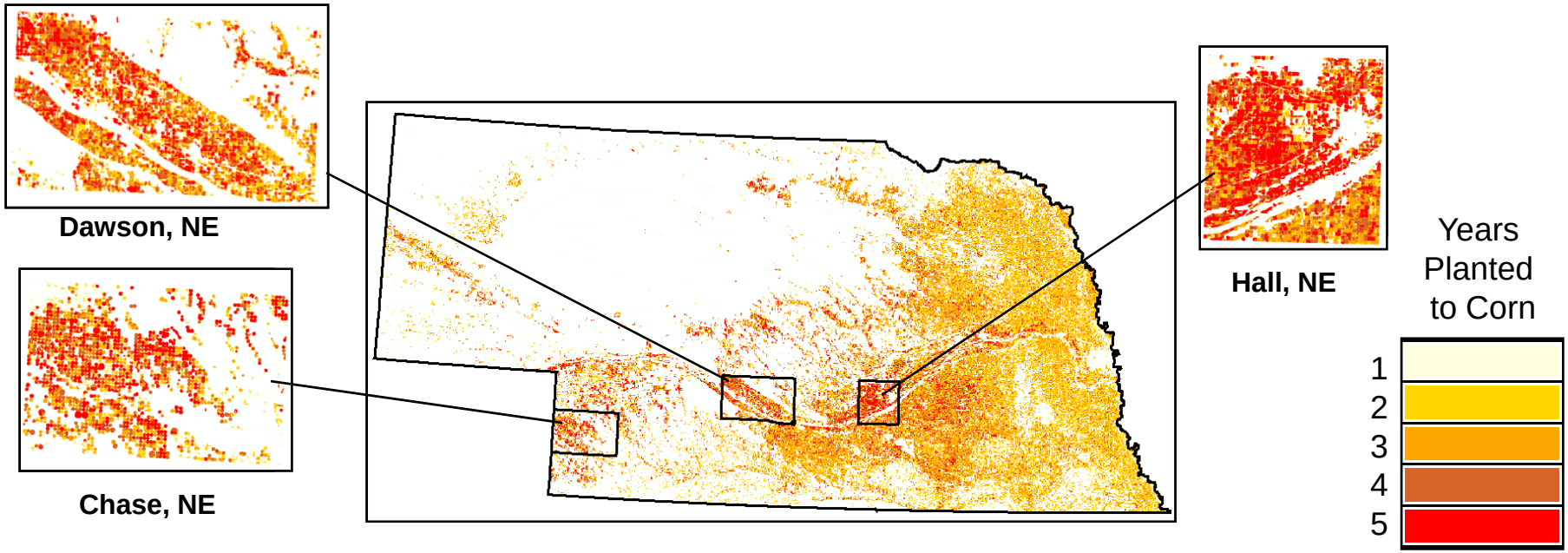






Cropland Data Layers (CDLs) utilized in assessment: 2003 - 2007

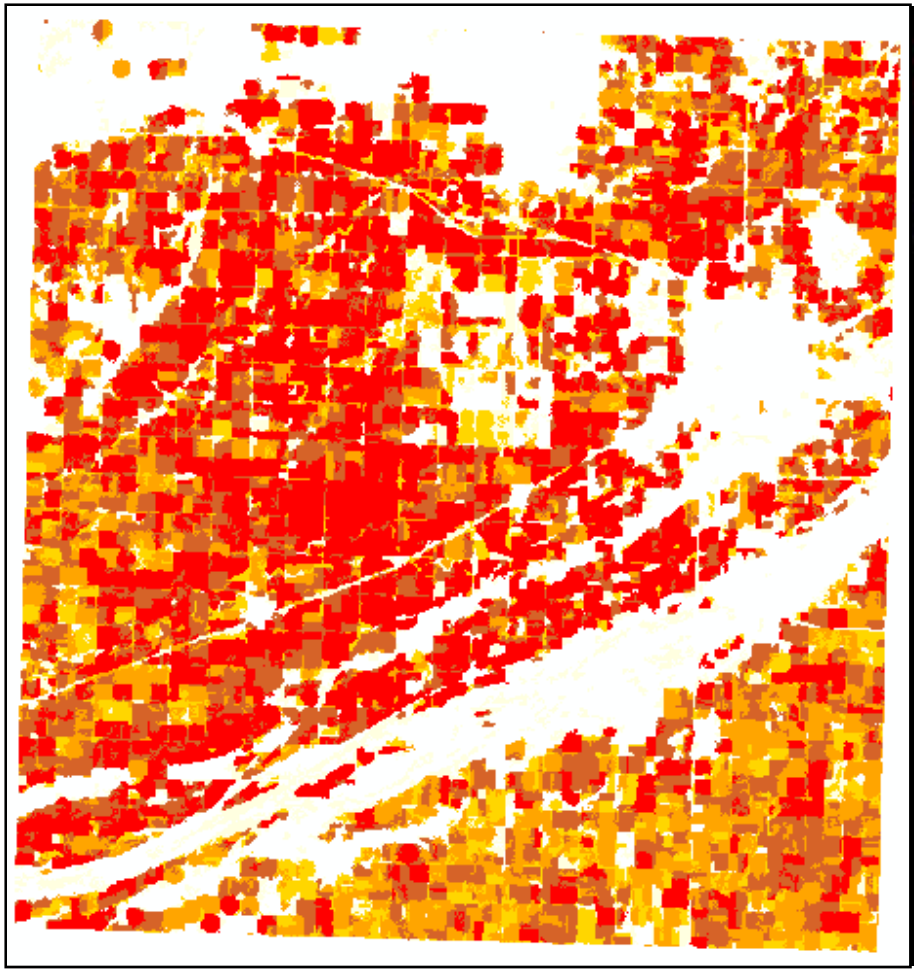
Corn Planting Intensity in Nebraska
2003-2007



Hall County	Chase County	Dawson County	State Total
5 years in a row planted to corn: 38%	5 years in a row planted to corn: 26%	5 years in a row planted to corn: 20%	5 years in a row planted to corn: 6%
4 out of 5 years planted to corn: 24%	4 out of 5 years planted to corn: 22%	4 out of 5 years planted to corn: 28%	4 out of 5 years planted to corn: 12%

Corn Planting Intensity, 2003-2007
Hall County, Nebraska

Hall County
5 years in a row planted to corn: **38%**
4 out of 5 years planted to corn: **24%**



Years Planted to Corn

1
2
3
4
5

AWiFS 8/13/2007
Bands 3/4/2
Red/Green/Blue

Percentages derived from total acreage in corn production


CIVIL AIR PATROL
Date: 24MAR09
TOT: 1447Z
Location: Abercrombie, ND
Latitude: N 46° 26.56' / Longitude: W 096° 43.70'
Object: Broadway Abercrombie

USDA Aerial Programs

Farm Service Agency
Forest Service
Natural Resources Conservation Service

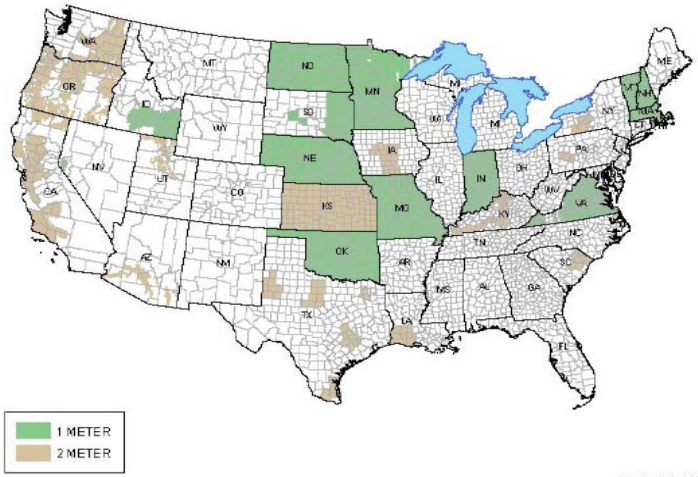
FSA
FARM SERVICE AGENCY

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

USDA NRCS
Natural Resources Conservation Service

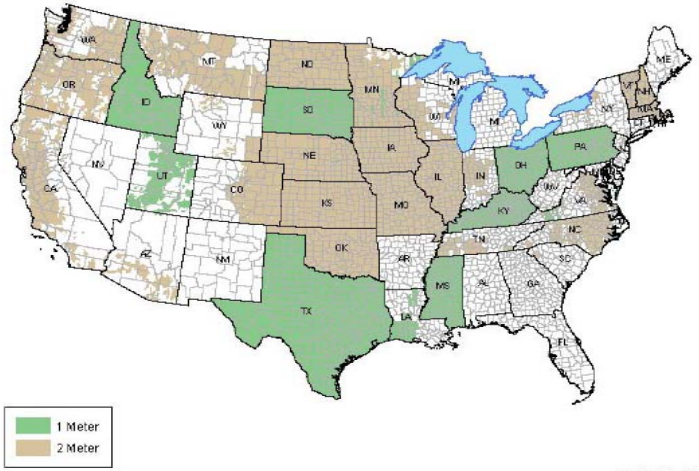
RMA

2003 NAIP COVERAGE



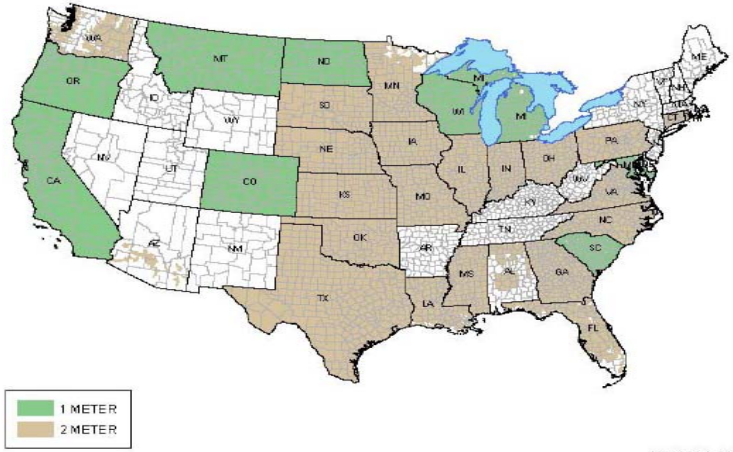
USDA-FSA-APFO

2004 NAIP COVERAGE



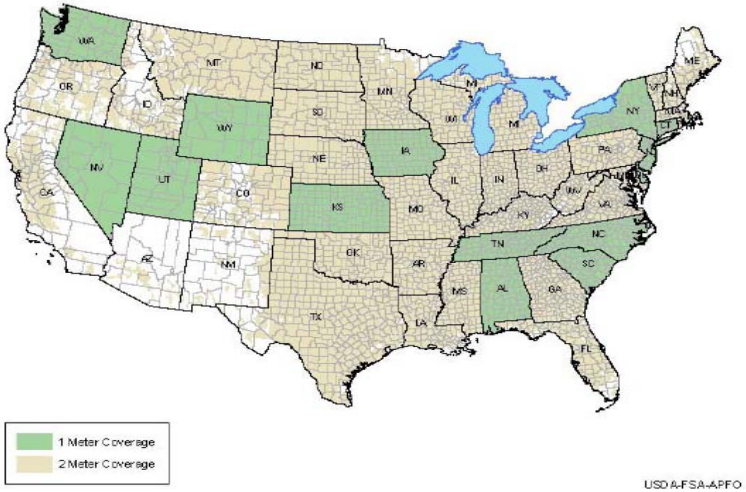
USDA-FSA-APFO

2005 NAIP COVERAGE



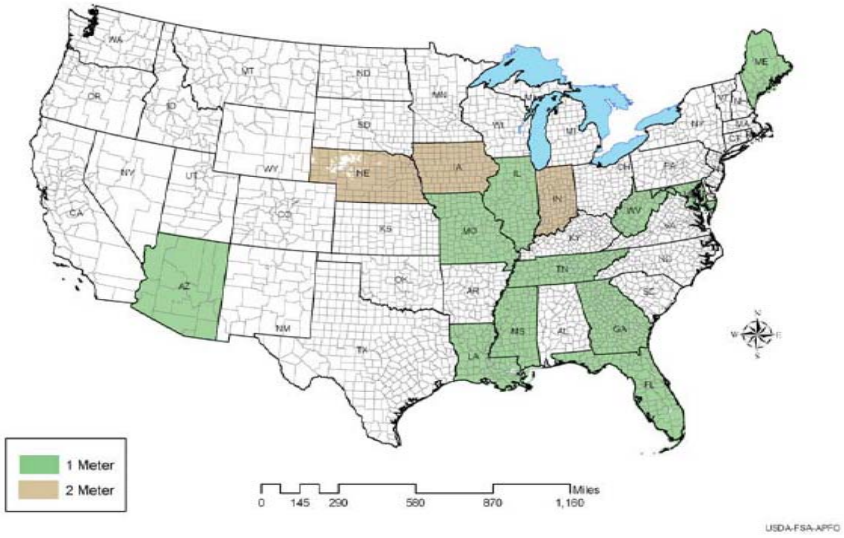
USDA-FSA-APFO

2006 NAIP COVERAGE

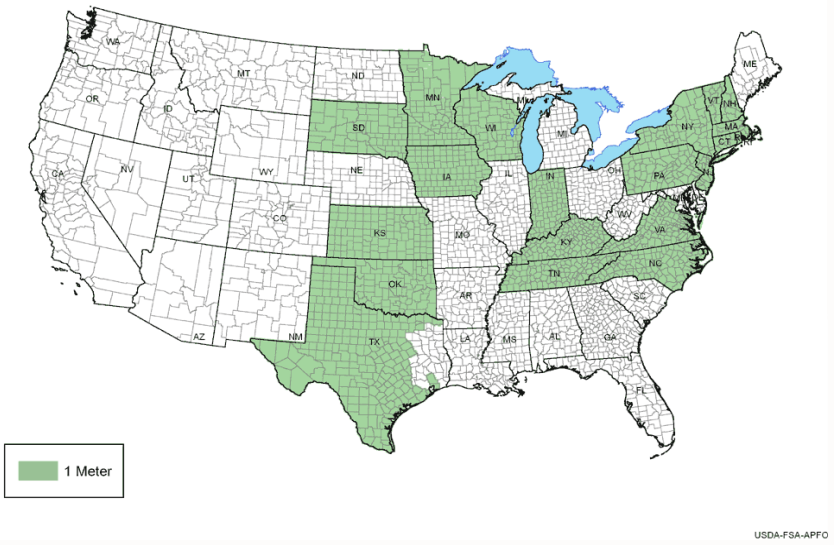


USDA-FSA-APFO

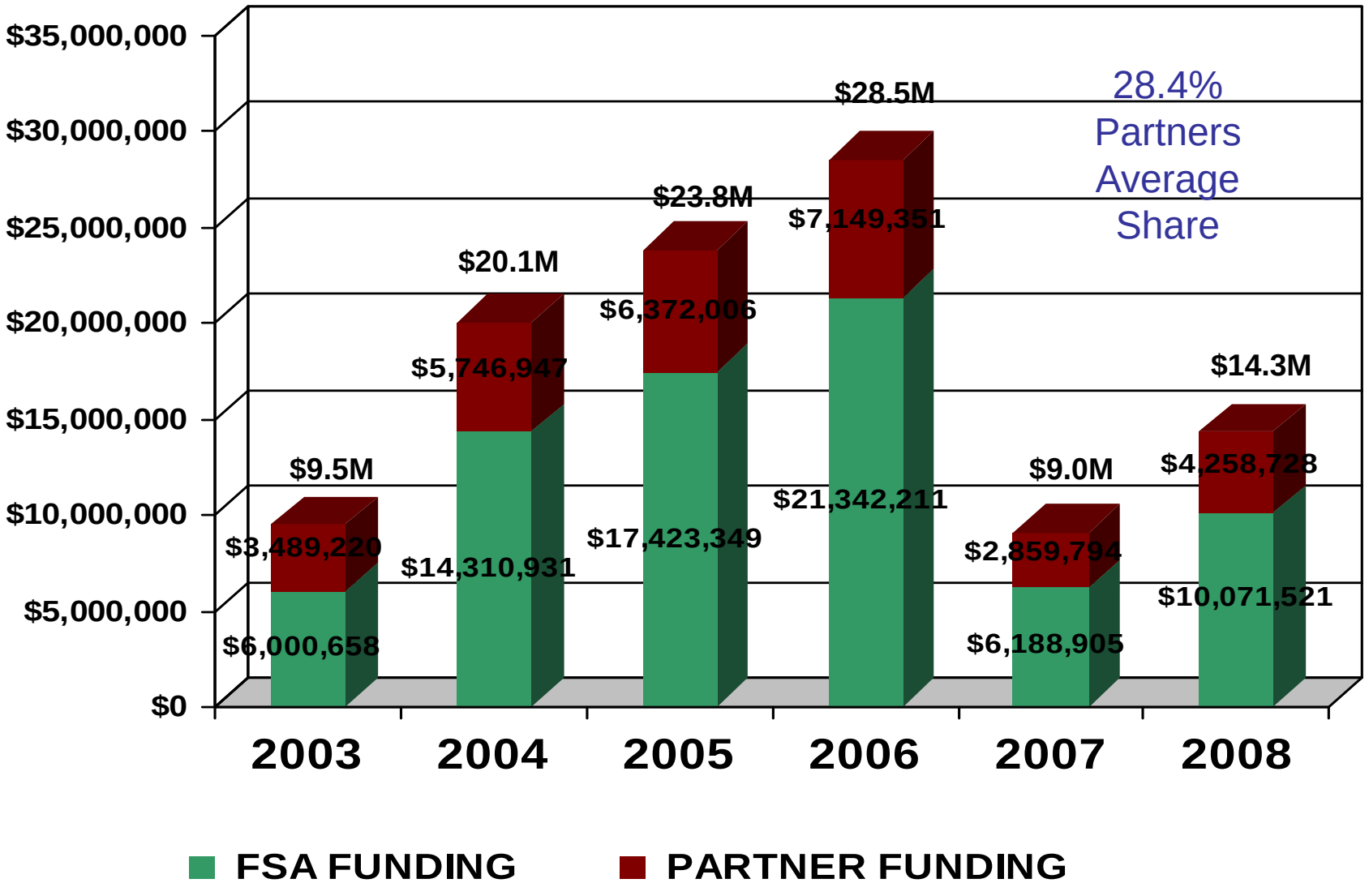
2007 NAIP COVERAGE



2008 NAIP COVERAGE



NAIP Funding History



2008 NAIP Funding Sources

U.S. Forest Service	$1,140,000
Natural Resource Consrv. Service	$500,000
U.S. Geological Survey	$150,000
FSA RMA (Coop with WVU)	$50,000
State Governments (12 states)	$2,418,728
Total 2008 Cost Shares:	**$4,258,728**
FSA Funding Amount	$10,071,521
2008 NAIP Funding Total:	***$14,330,249***

FSA FARM SERVICE AGENCY

NSGIC

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

USDA NRCS Natural Resources Conservation Service

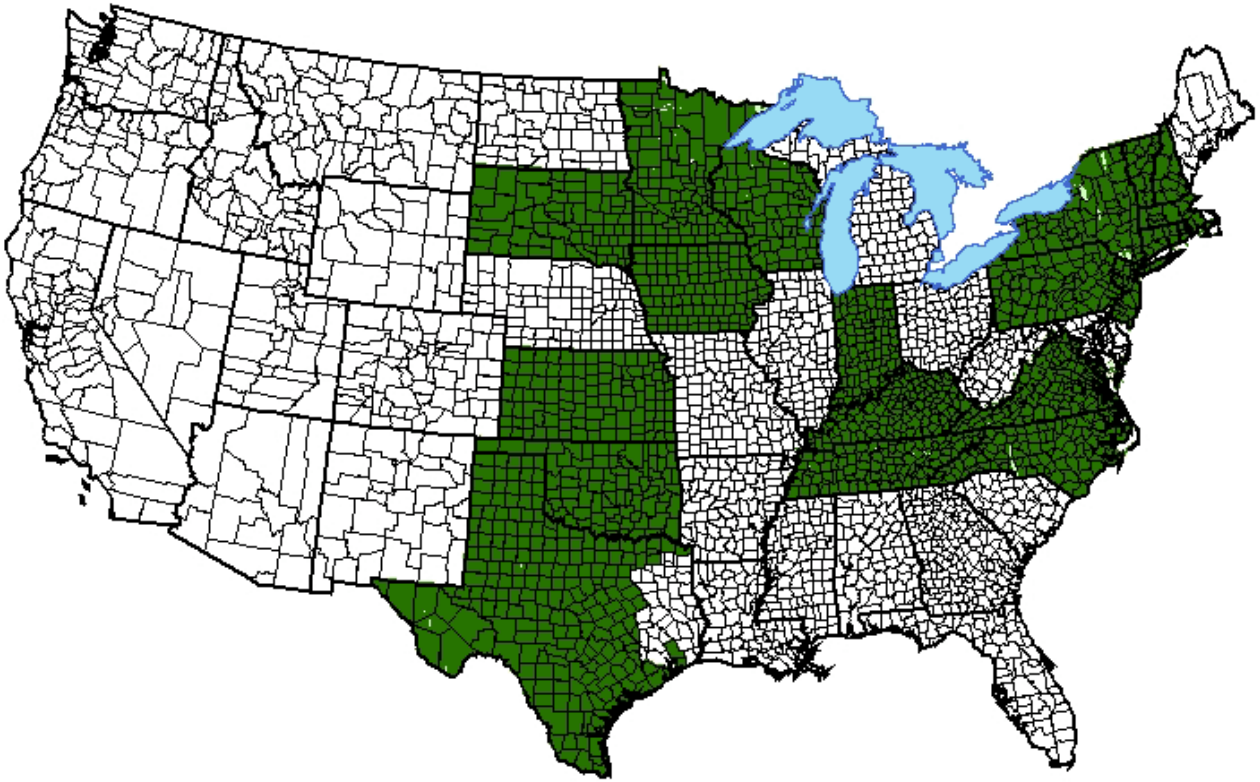
USGS science for a changing world

RMA

FSA
FARM SERVICE AGENCY

November 24, 2008

2008 NAIP IMAGERY STATUS

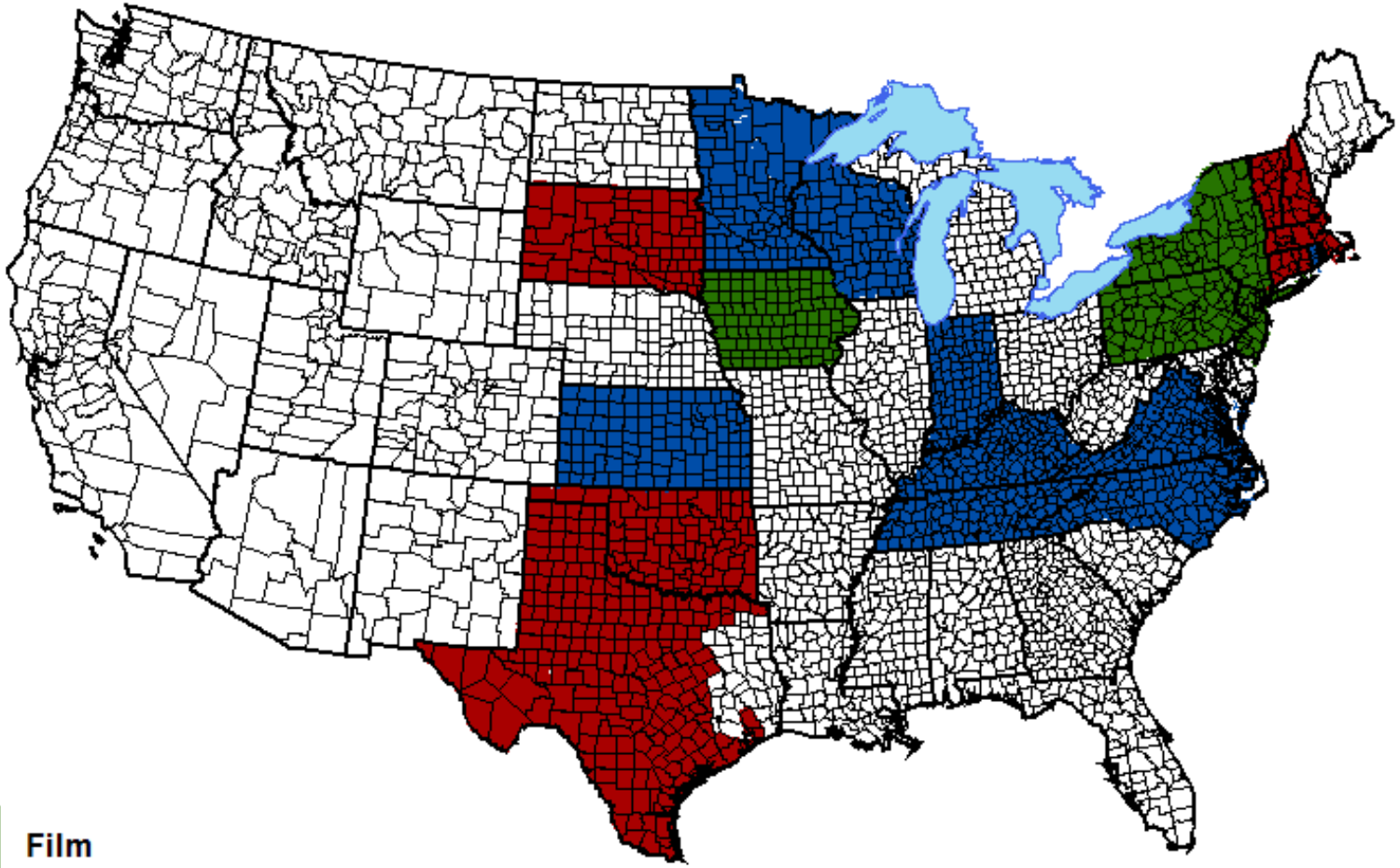


AREAS FLOWN

AREAS CONTRACTED

73,236 - DOQQ'S FLOWN

2008 NAIP CAMERA TYPES



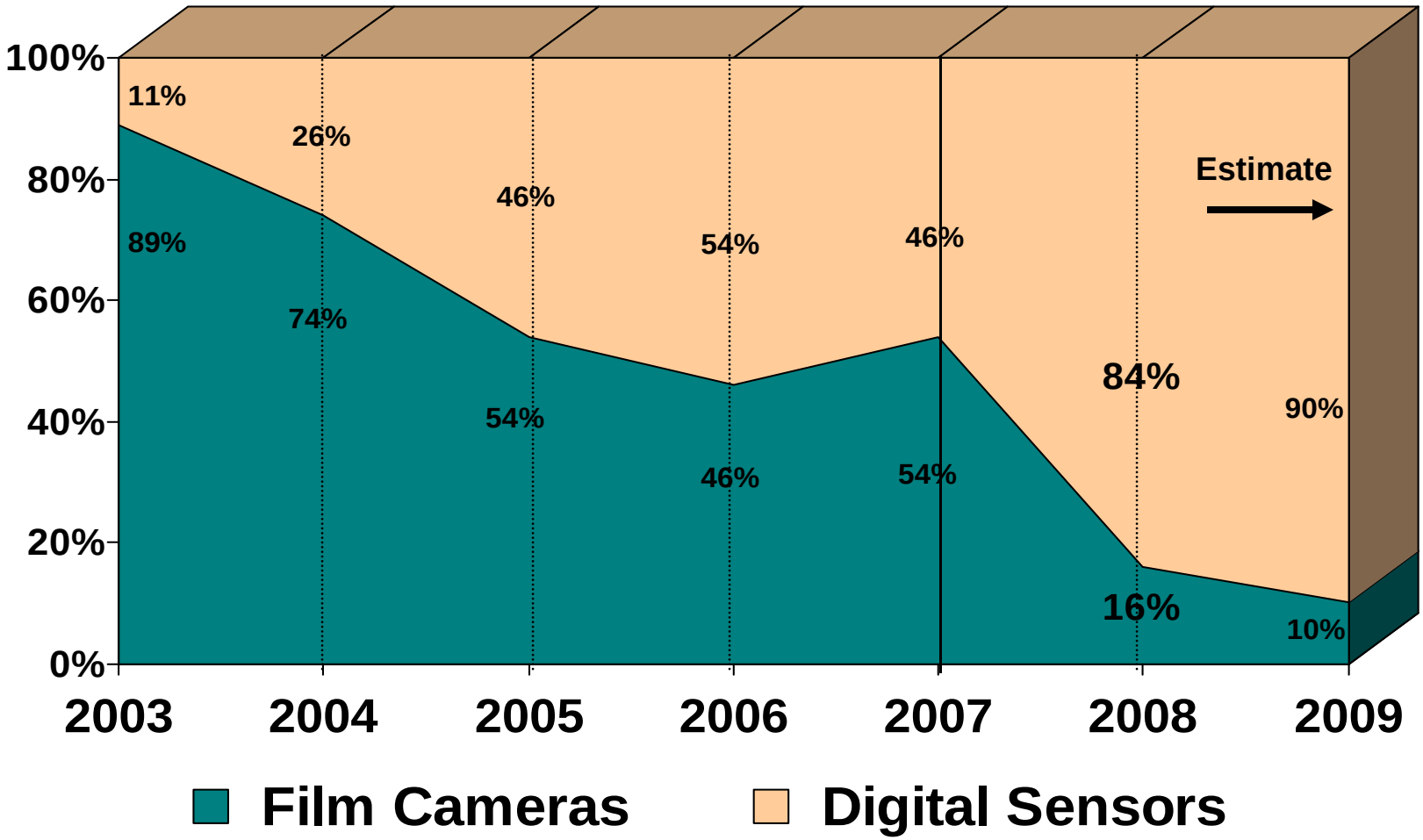
Film

ADS40-II

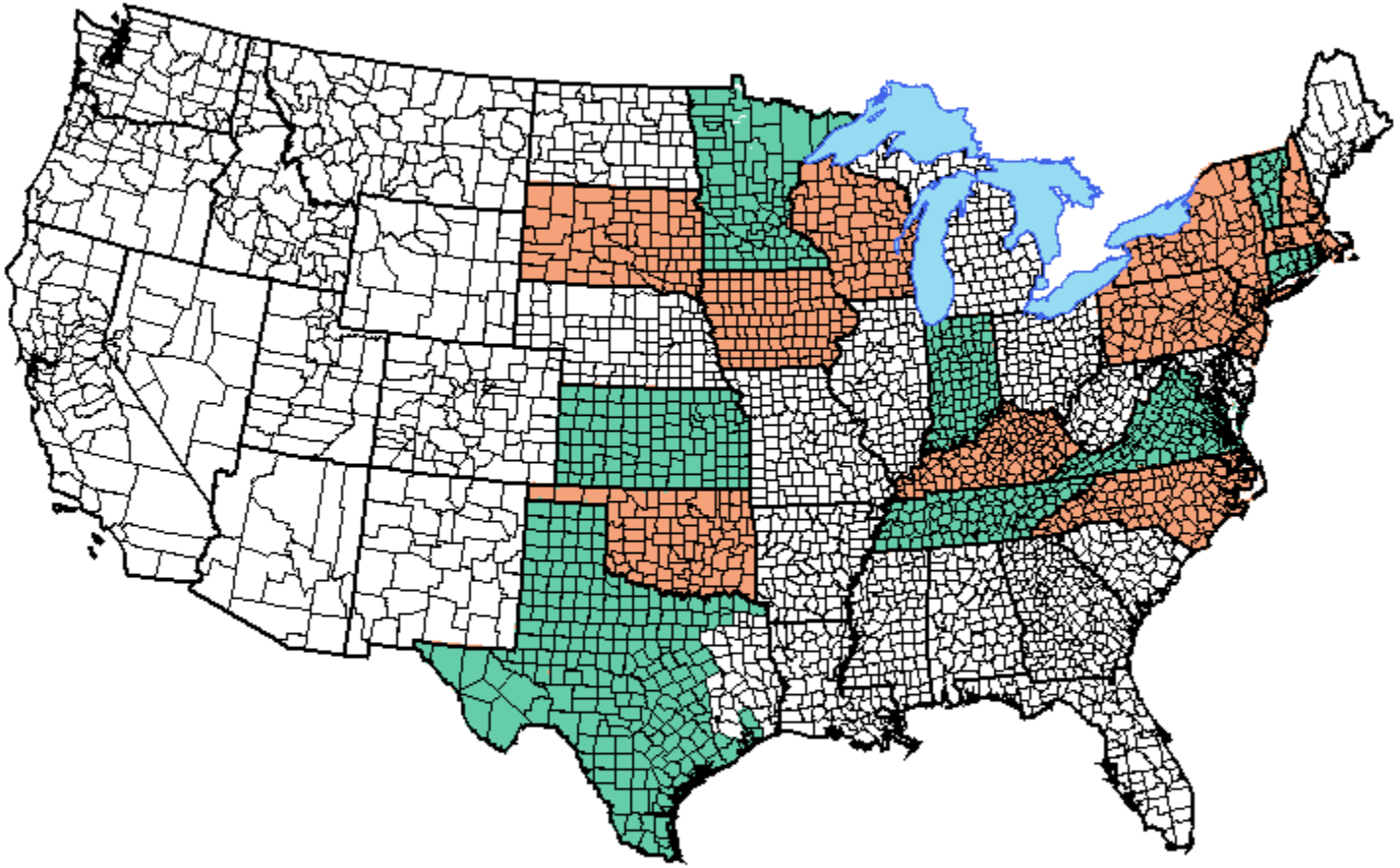
DMC

NAIP Camera Trends

Film Cameras vs. Digital Sensors



2008 NAIP 3 BAND VS 4 BAND

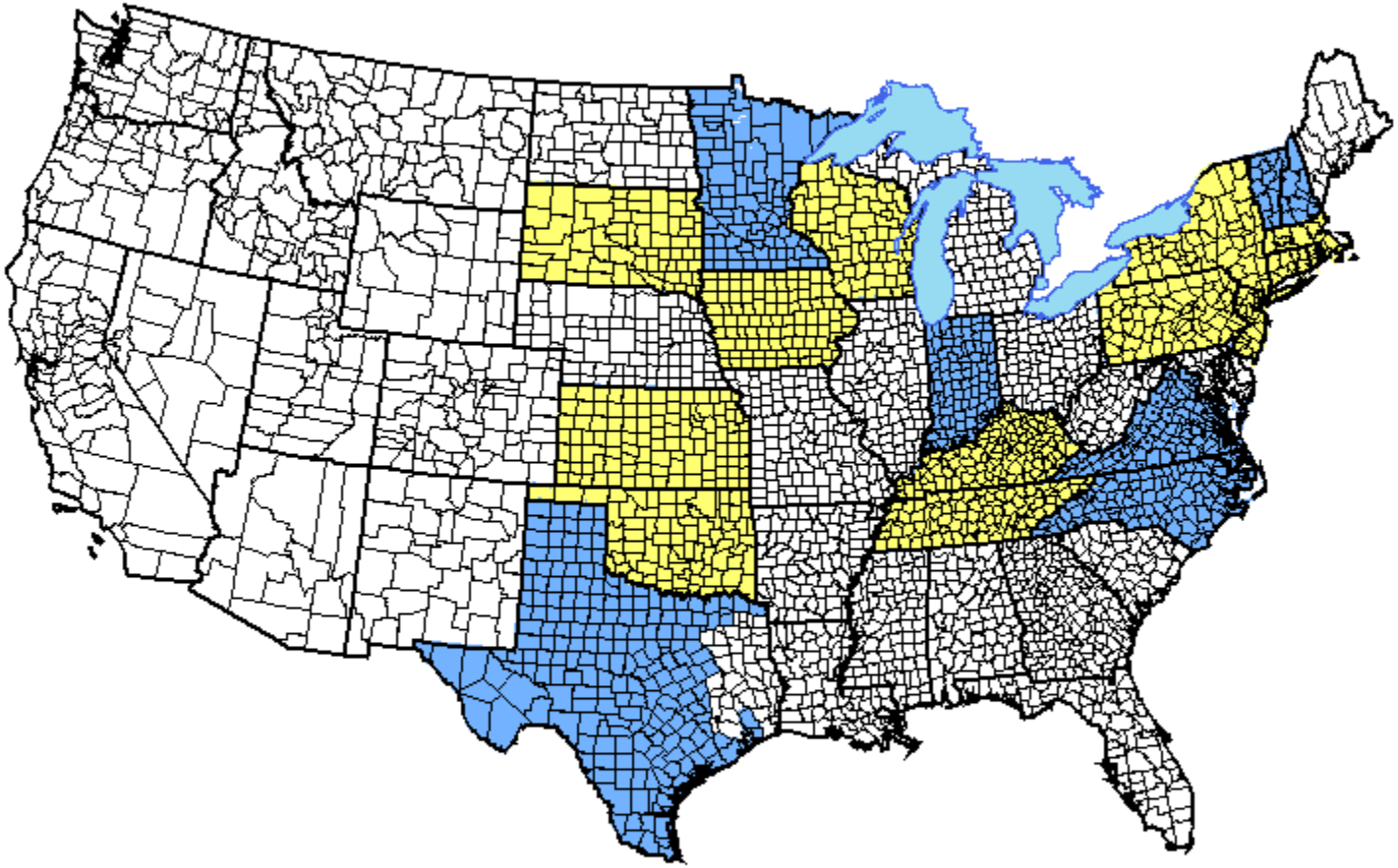


3 BAND

4 BAND 52%

USDA-FSA-APFO

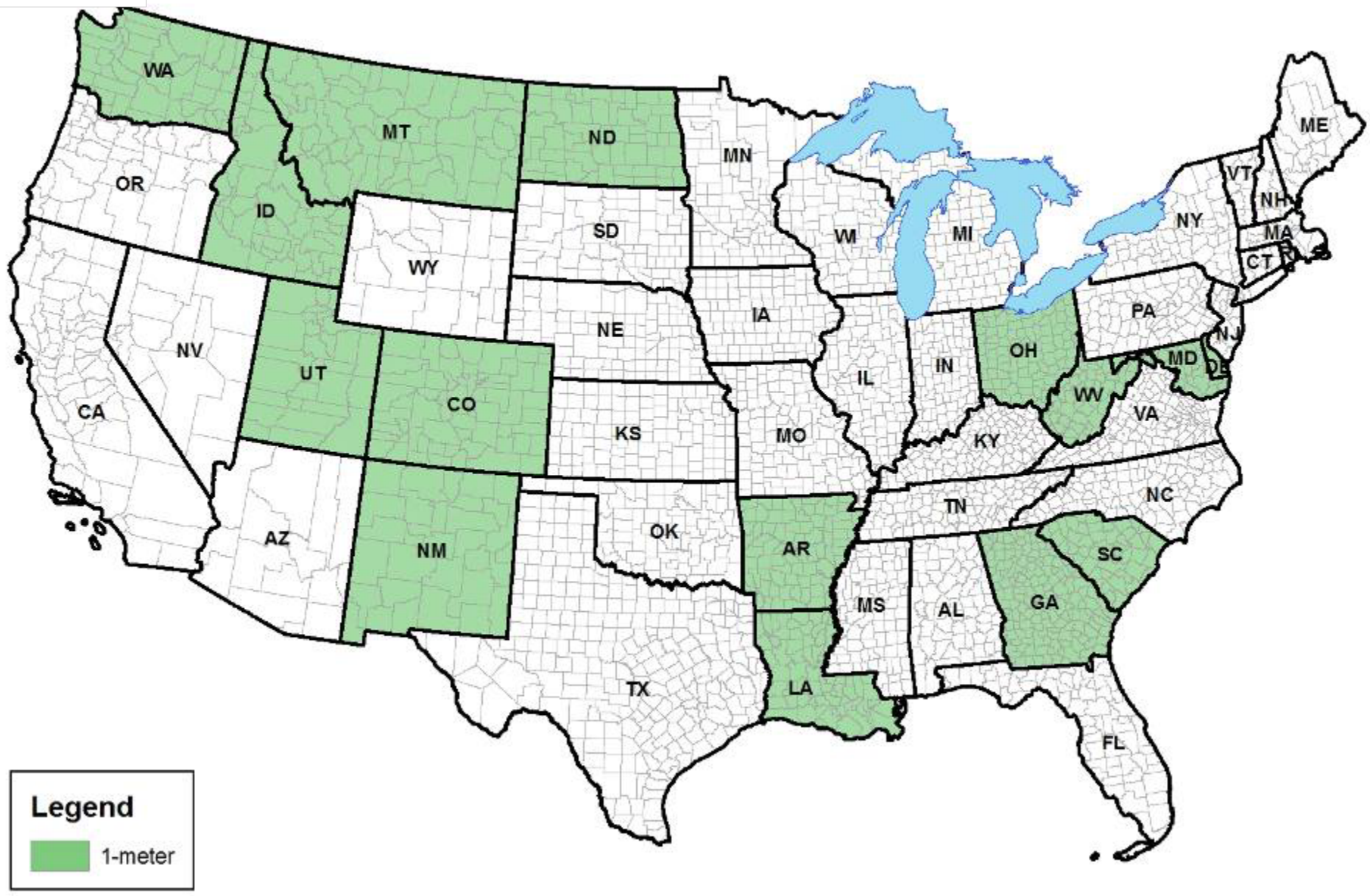
2008 NAIP ABSOLUTE VS RELATIVE CONTROL



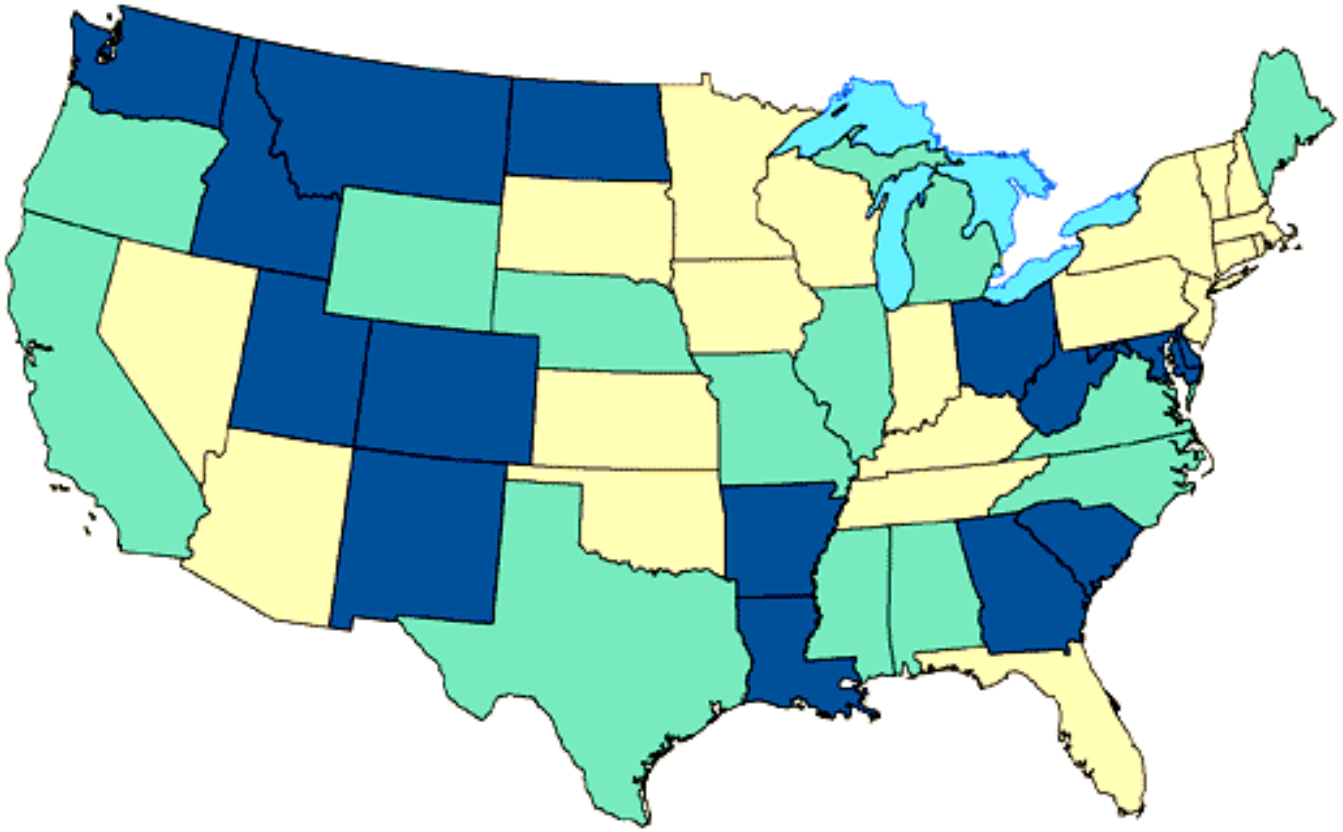
ABSOLUTE CONTROL 45%

RELATIVE CONTROL

Proposed 2009 NAIP Coverage



Proposed NAIP Acquisition Cycle

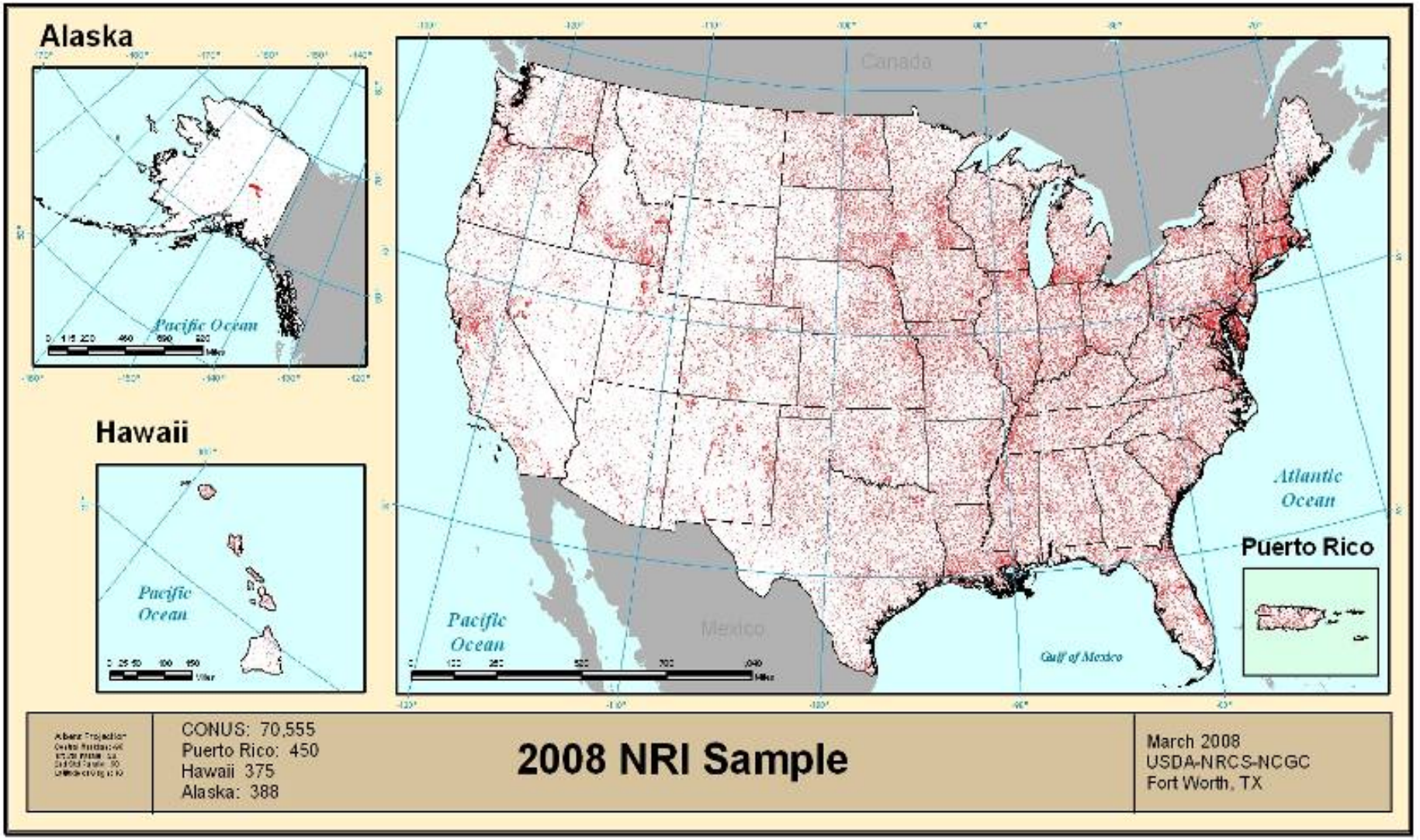


Cycle Dates

- 2009
- 2010
- 2011

June 3, 2008

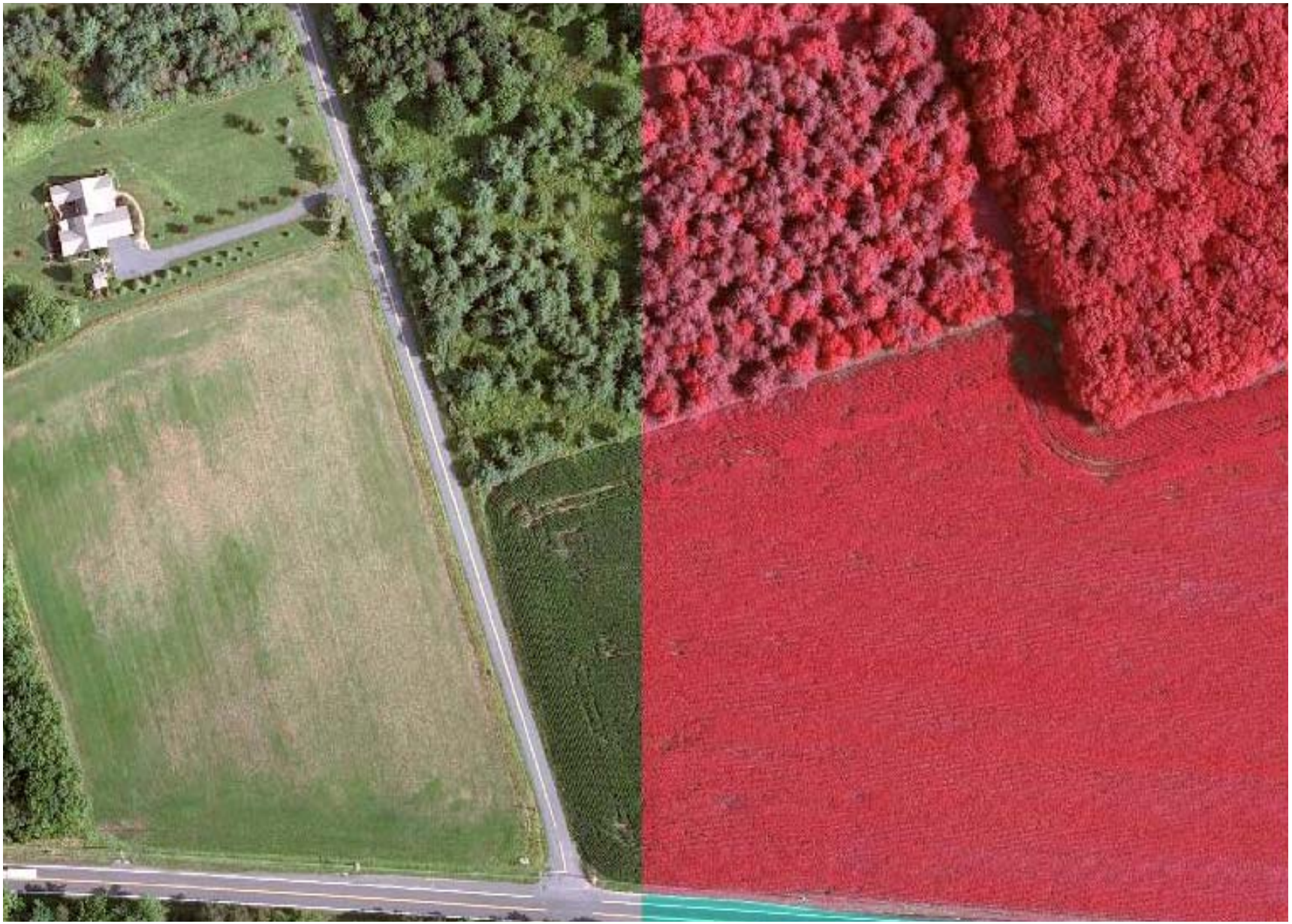
NRCS, Natural Resources Inventory Imagery



1:7,920

Wetland Reserve Program, Program Integrity Acquisitions

Four Band Imagery Increases Applications



UltraCamX – Color and CIR – 8” GSD

The Return to Stereo Acquisitions

- The Forest Service and The Natural Resource Conservation Service were significant users of contact prints for stereo applications.
- These agencies are experimenting with the use of direct digital, 4-band stereo imagery and soft-copy exploitation software.

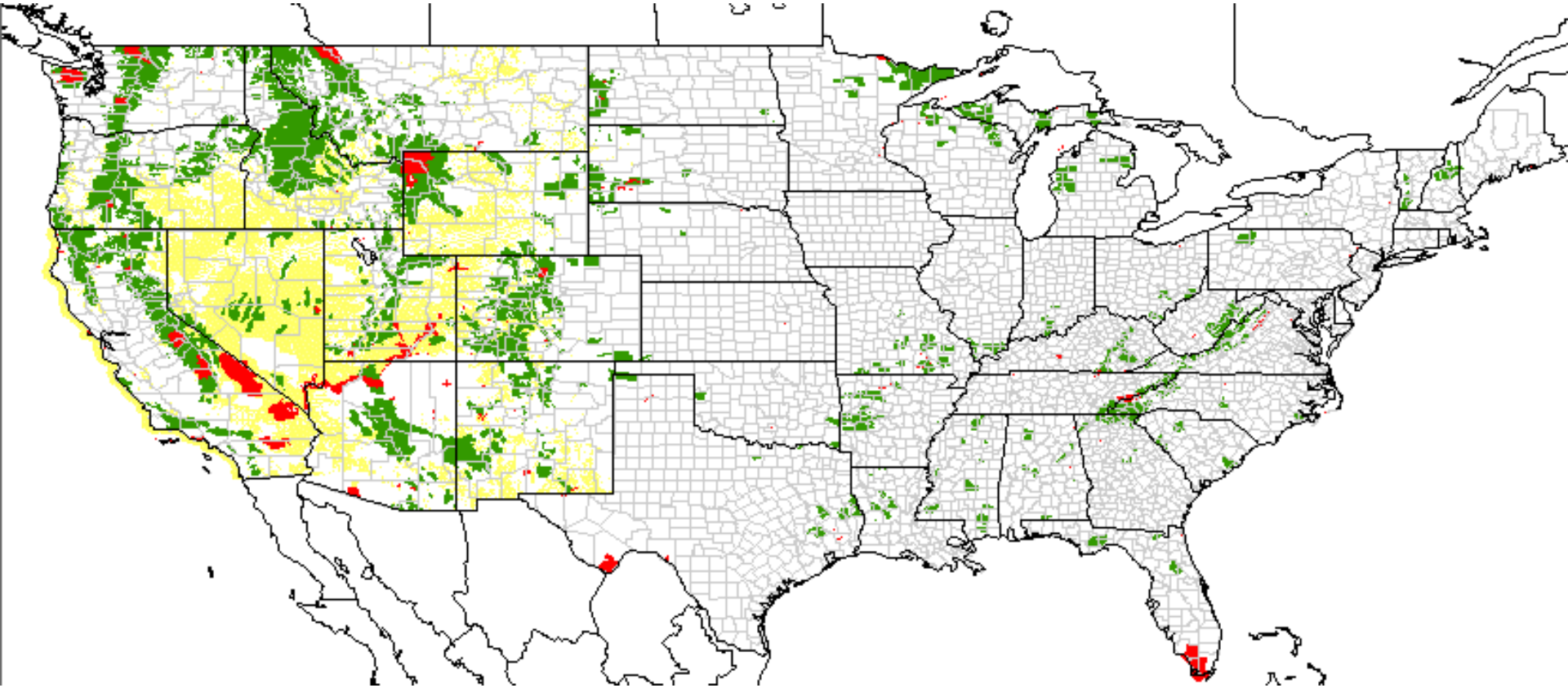
CRISIS ON PUBLIC LANDS

Illegal Occupation of Public Lands

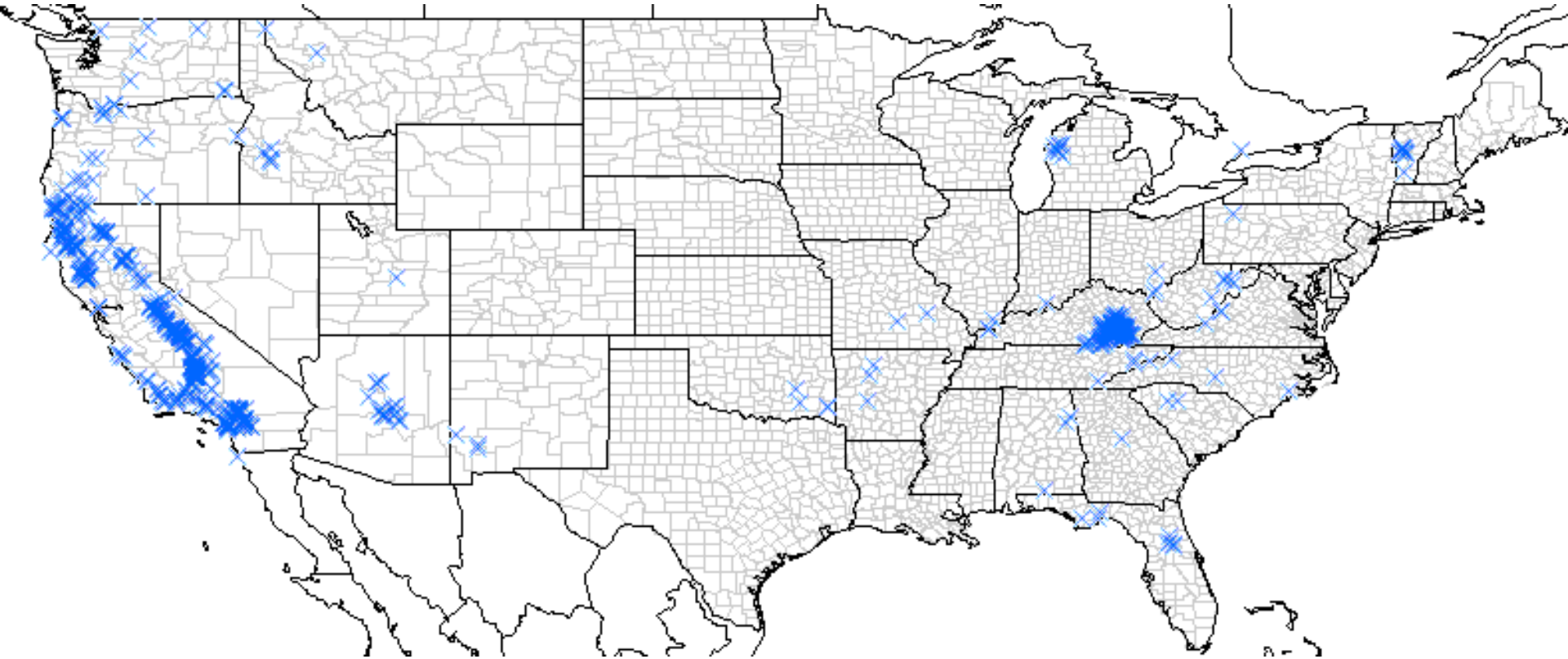
By

Drug Trafficking Organizations

FS, BLM and NPS Land

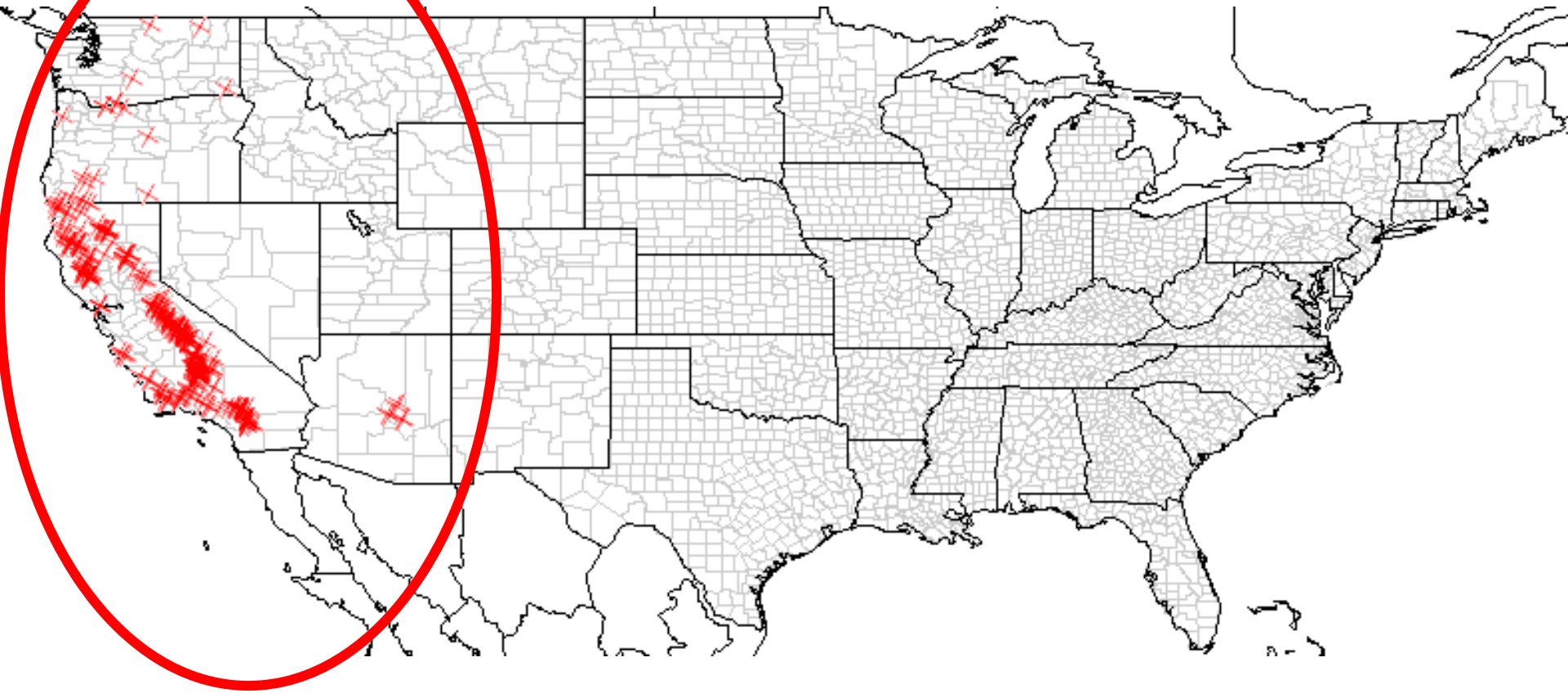


2007 Locations of Cannabis Gardens on National Forests.

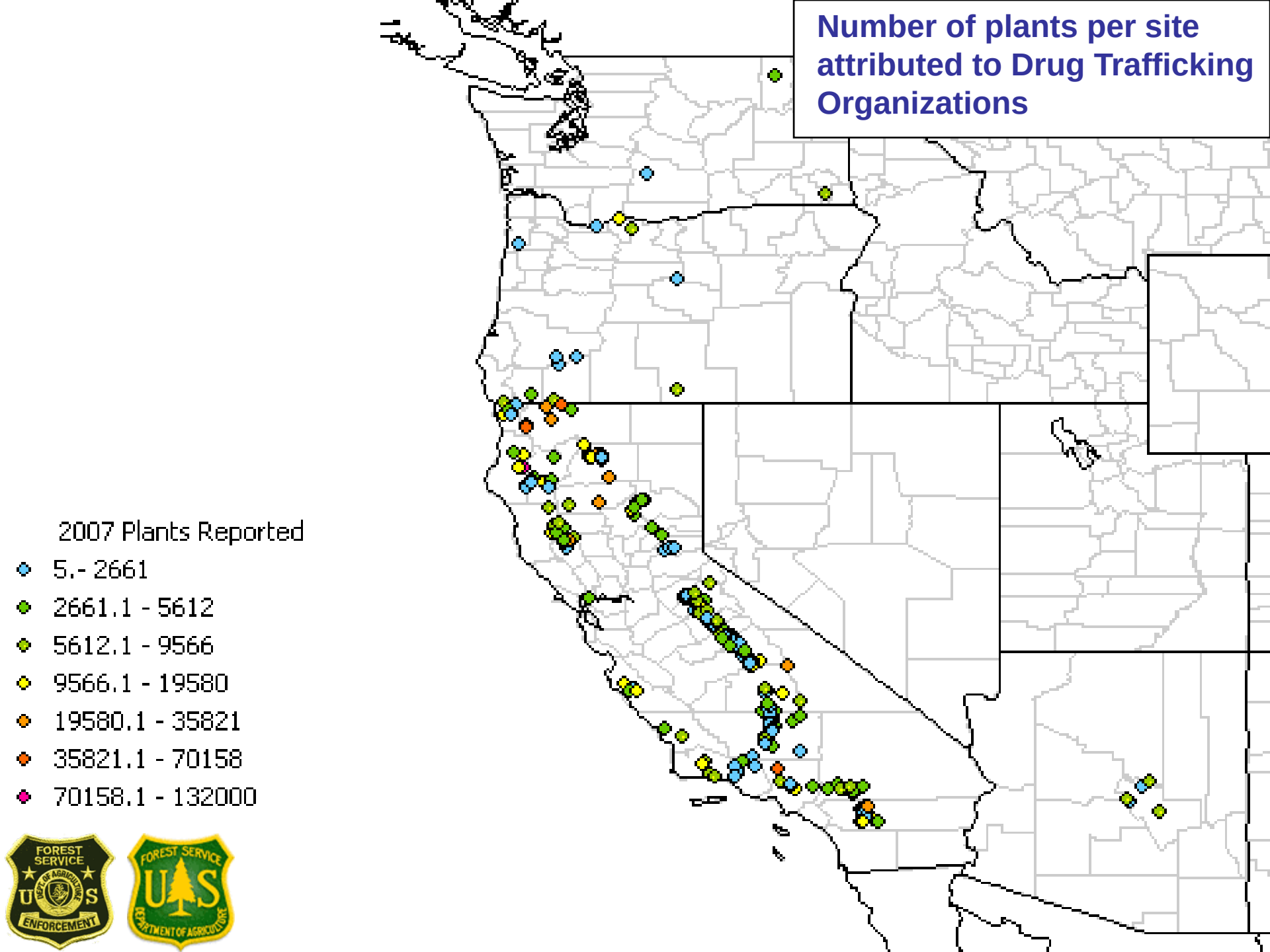


Source: FS Law Enforcement and Investigations

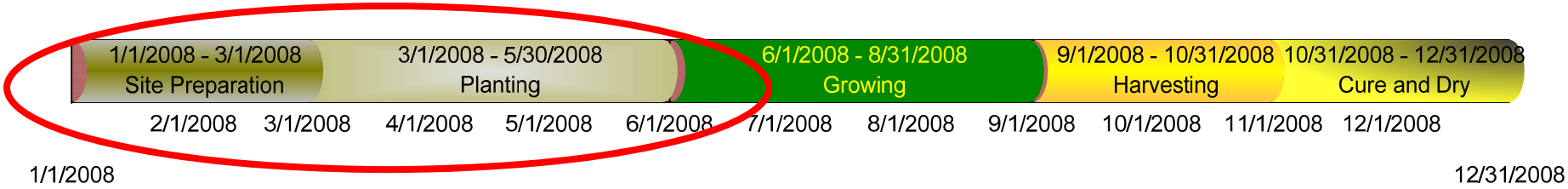
2007 Cannabis Gardens Linked to Drug Trafficking Organizations



Number of plants per site attributed to Drug Trafficking Organizations



Notional Timeline for CA Cannabis

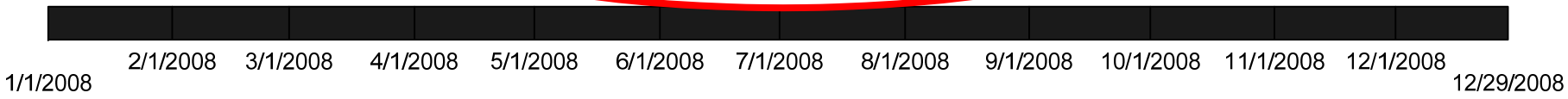


Optimal Detection:

Connect Local Growers to Support Network

Camp Sites

People Living In Camps 24 x 7



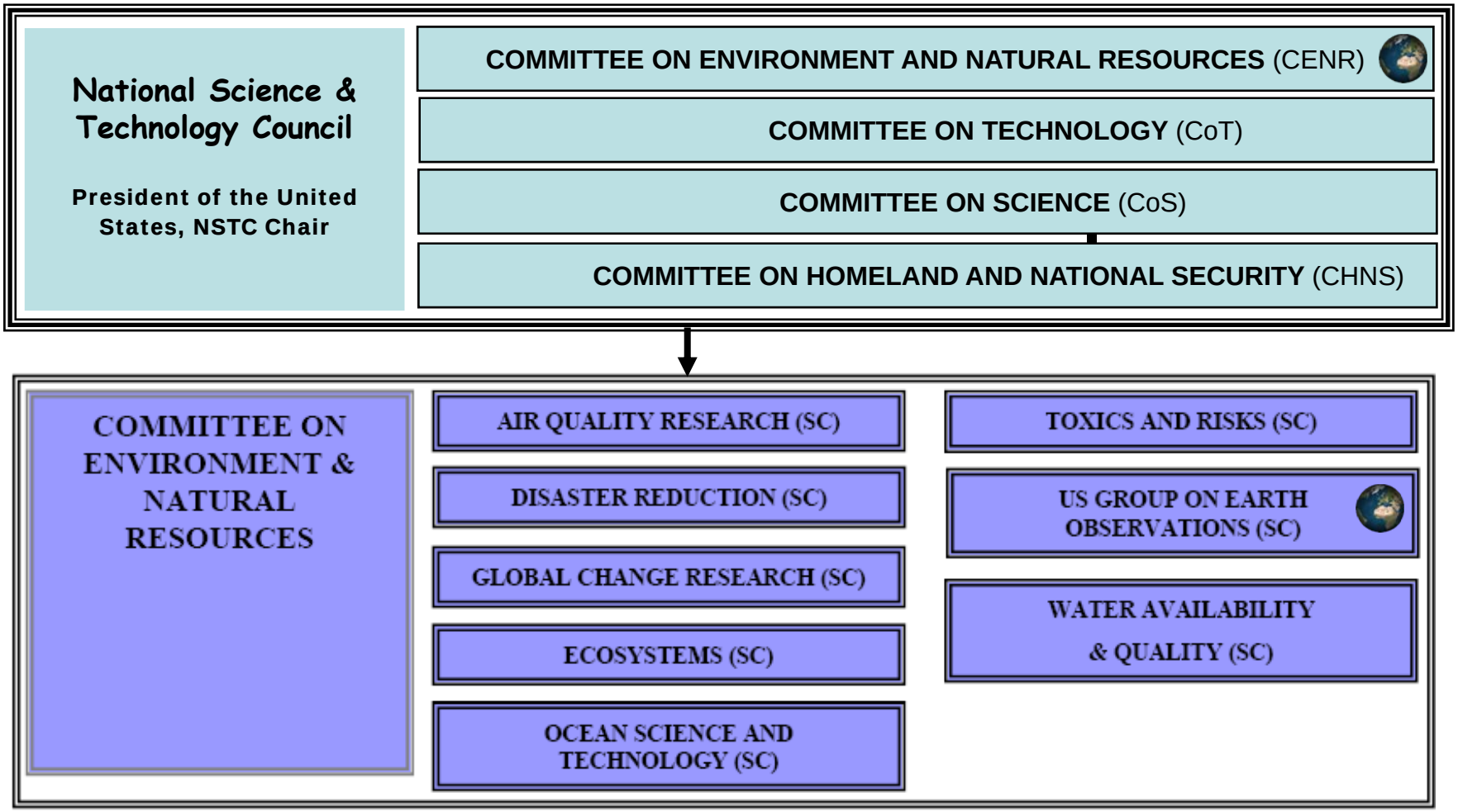

POLICE


MAR 19 2004

10,000+ USDA personnel on the landscape every day, using GPS to provide program assistance, service, and technical support to USDA customers and partners

- Safety-of-Life operations –Fire, Snow Survey
- Administration of the Farm Bill
- Conservation Planning and Application
- Natural and Cultural Resource Data Collection, Inventorying and Monitoring
- Landscape Characterization & Engineering Applications
- Soil Mapping

USGEO Context



USGEO

National Science and Technology Council

Committee on Environment and Natural Resources

= USDA Represented

= USDA Not Represented

U.S. Group on Earth Observations

Exec Committee = Co-chairs + Group Chairs

FUNCTIONAL GROUPS

- Strategic Assessment Group
- Architecture and Data Management Group
  - Information Dissemination Coordination Team
- International Working Group
  - Architecture and Data Management Group
    - Communication, Outreach, Partner Group
- Policy and Planning Group

UNITED STATES GROUP ON EARTH OBSERVATIONS

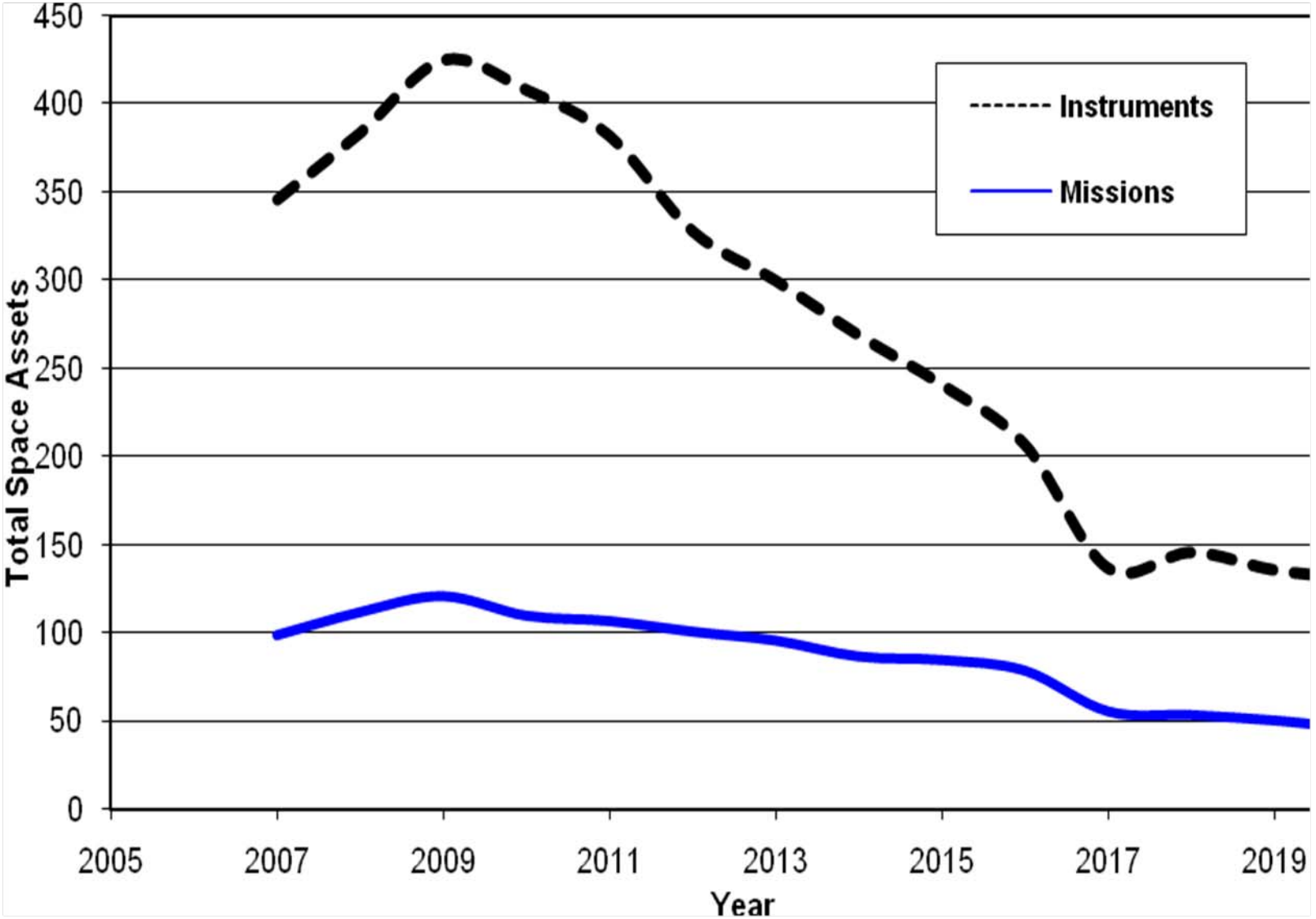
U.S. Group on Earth Observations

Strategic Assessment Group - SAG

"The current U.S. civilian Earth observing system...is at risk of collapse."

National Research Council, 2005

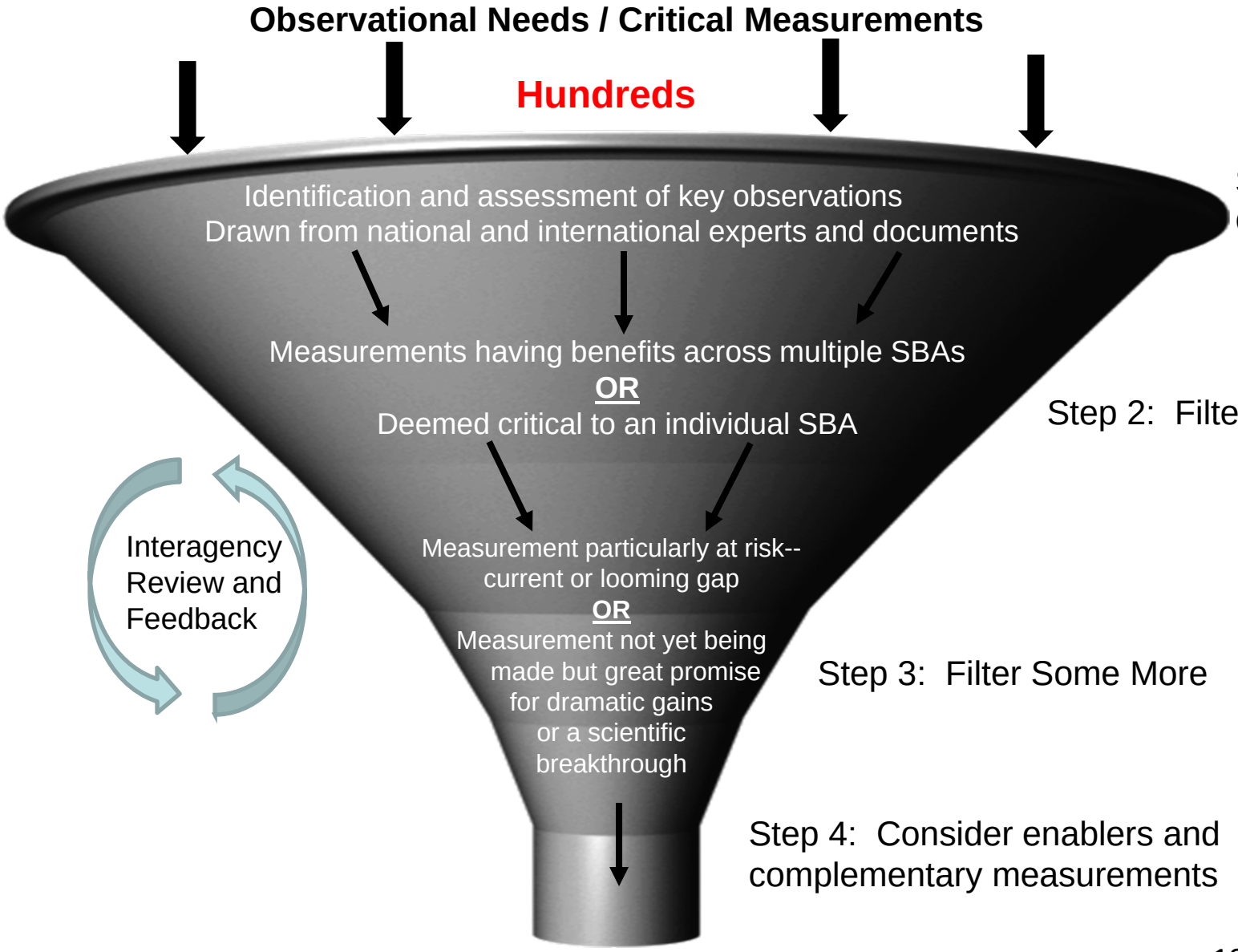
Status of Civilian Space Assets



USGEO Strategic Assessment Group

- Background
  - Sept 2007: Strategic Assessment Group (SAG) formed
  - Charge:
    - To deliver a strategic portfolio
      - of high priority national Earth observation investment recommendations
      - for existing and future capabilities
      - to inform decision-makers,
        - » including OSTP, OMB, Congressional Committees, and Agencies' budget planners
      - and improve decisions regarding national investments in Earth observations

Assessment Methodology



17 Near-Term Threats and Potential Breakthroughs

USGEO Strategic Assessment Group

- **A First Assessment:**

Observing Earth's Vital Signs

USGEO Strategic Assessment of Earth Observations

Near-Term Gaps and Opportunities

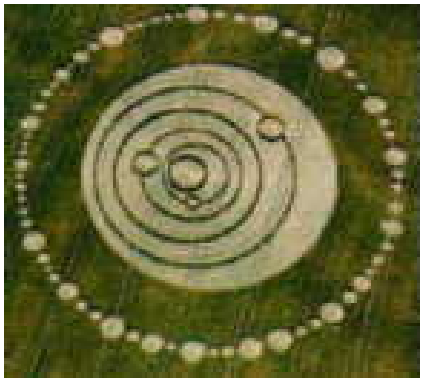
- **Final document to be coordinated between USGEO and OSTP CENR in the next few weeks**

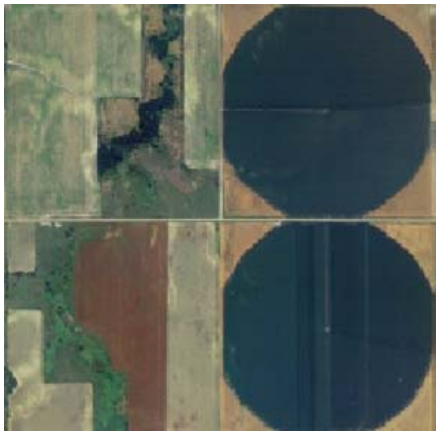
USGEO Strategic Assessment Group

- **Developing a Strategic Assessment Process**
  - February 2008: Established Societal Benefit Area (SBA) Teams
    - Provide synthesis of existing documents and recommendations
    - Basis for further analysis and development of priorities

SBA Team Leads

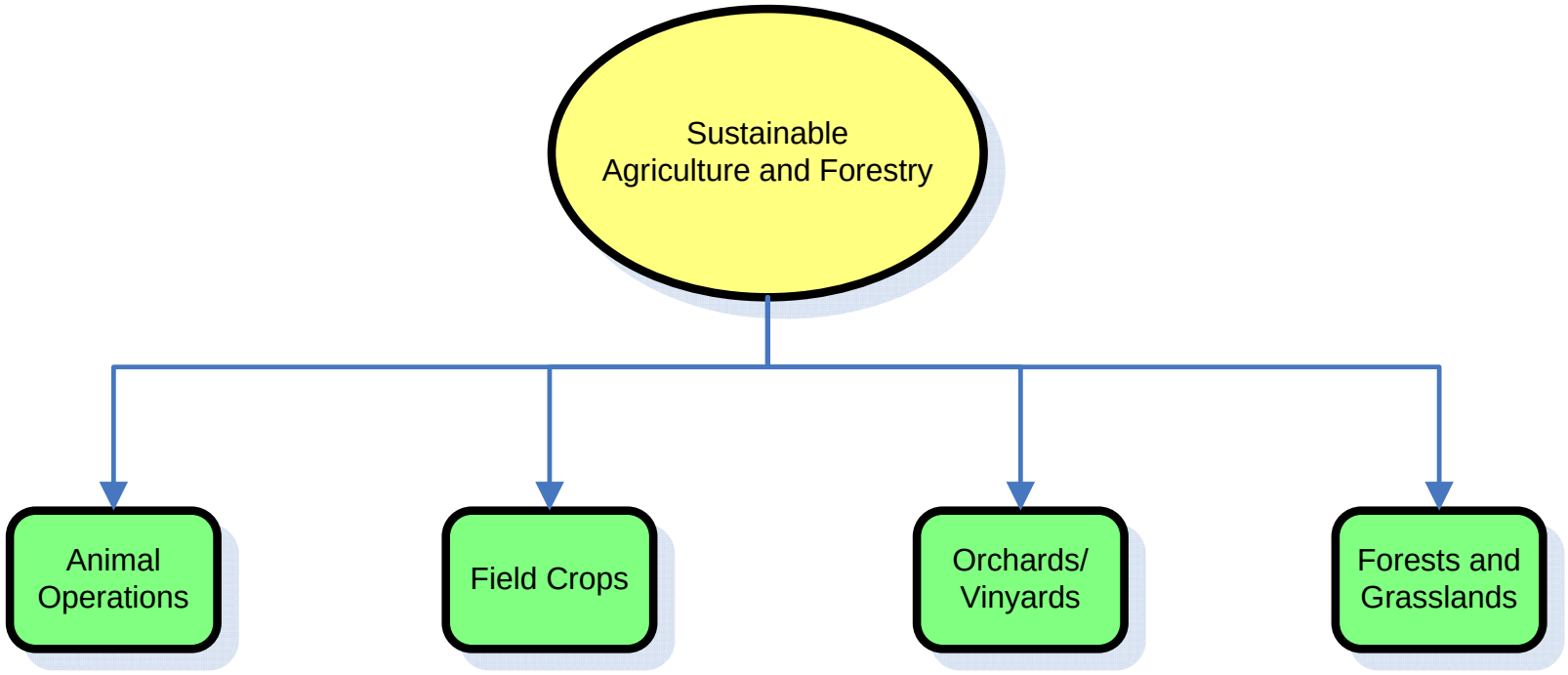
– Disaster	USGS (Bill Leith)
– Weather	OFCM (Michael Babcock)
– Oceans	NOAA (Zdenka Willis)
– Climate	NASA/CCSP (Jim Tucker)
– Agriculture	USDA (Glenn Bethel)
– Human Health	NIH (Ann Davis)
– Ecology	Smithsonian (Len Hirsch)
– Water	EPA (John Lyon)
– Energy	DOE (Graham Pugh)

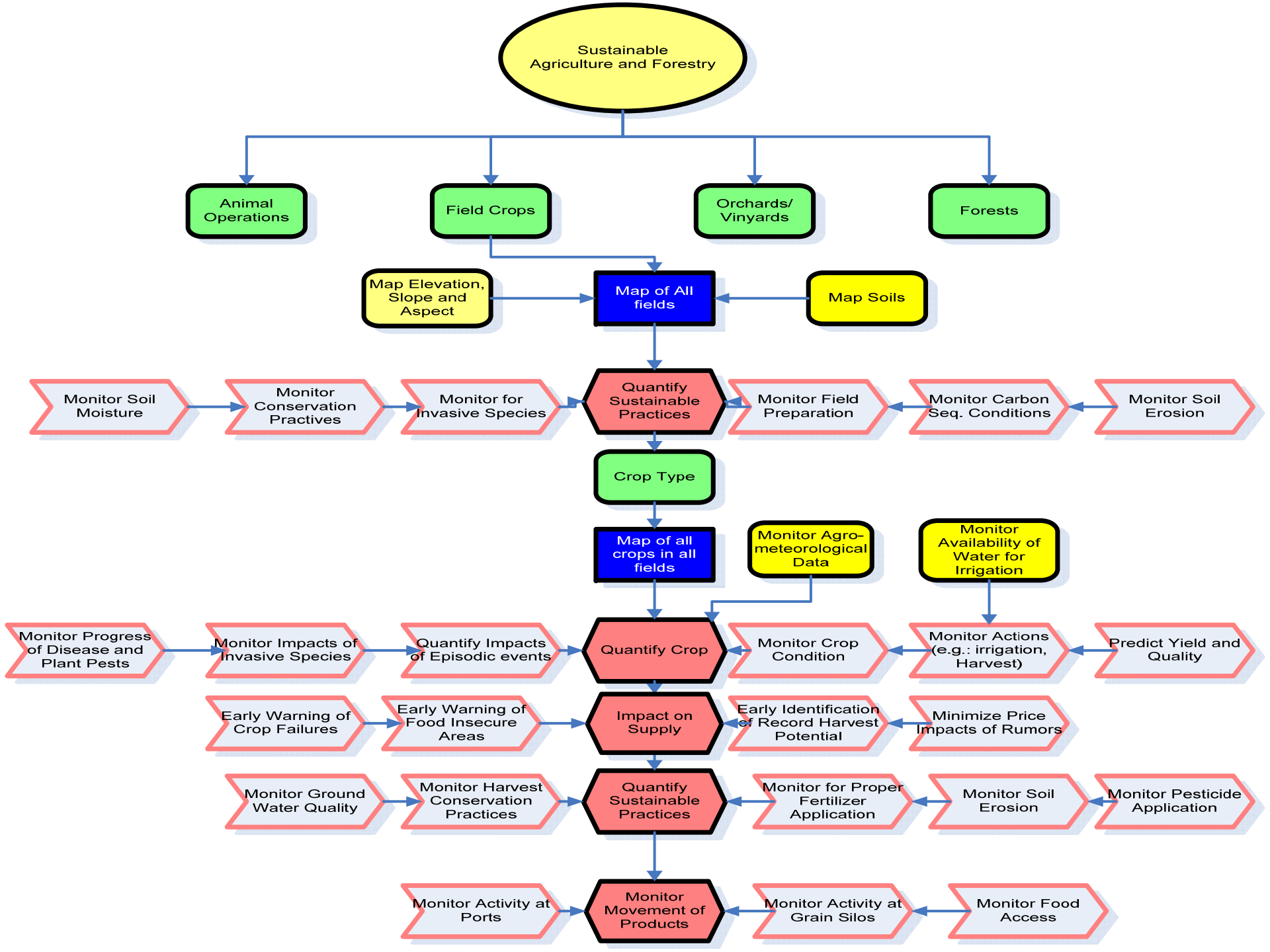




Support Sustainable Agriculture and Forestry, and Combat Land Degradation

Glenn Bethel
SBA Lead

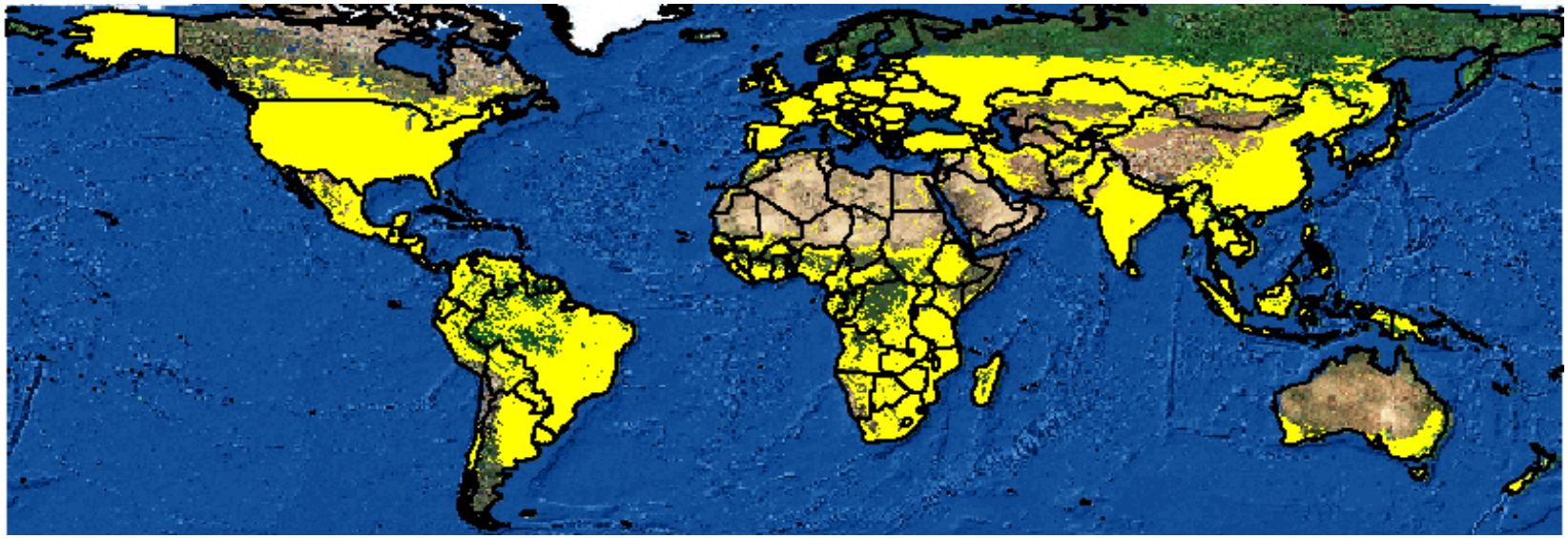

Sustainable
Agriculture and Forestry
Animal
Operations
Field Crops
Orchards/
Vinyards
Forests and
Grasslands

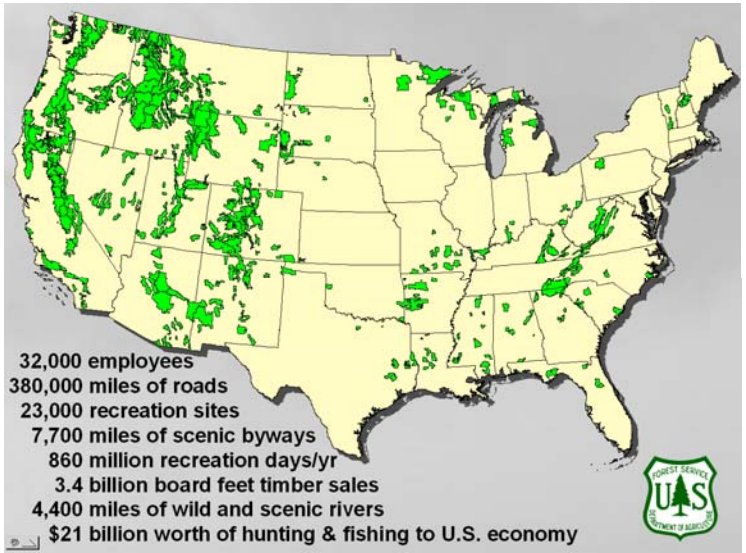

Sustainable Agriculture and Forestry
Animal Operations
Field Crops
Orchards/ Vinyards
Forests
Map Elevation, Slope and Aspect
Map of All fields
Map Soils
Monitor Soil Moisture
Monitor Conservation Practives
Monitor for Invasive Species
Quantify Sustainable Practices
Monitor Field Preparation
Monitor Carbon Seq. Conditions
Monitor Soil Erosion
Crop Type
Map of all crops in all fields
Monitor Agro-meteorological Data
Monitor Availability of Water for Irrigation
Monitor Progress of Disease and Plant Pests
Monitor Impacts of Invasive Species
Quantify Impacts of Episodic events
Quantify Crop
Monitor Crop Condition
Monitor Actions (e.g.: irrigation, Harvest)
Predict Yield and Quality
Early Warning of Crop Failures
Early Warning of Food Insecure Areas
Impact on Supply
Early Identification of Record Harvest Potential
Minimize Price Impacts of Rumors
Monitor Ground Water Quality
Monitor Harvest Conservation Practices
Quantify Sustainable Practices
Monitor for Proper Fertilizer Application
Monitor Soil Erosion
Monitor Pesticide Application
Monitor Activity at Ports
Monitor Movement of Products
Monitor Activity at Grain Silos
Monitor Food Access

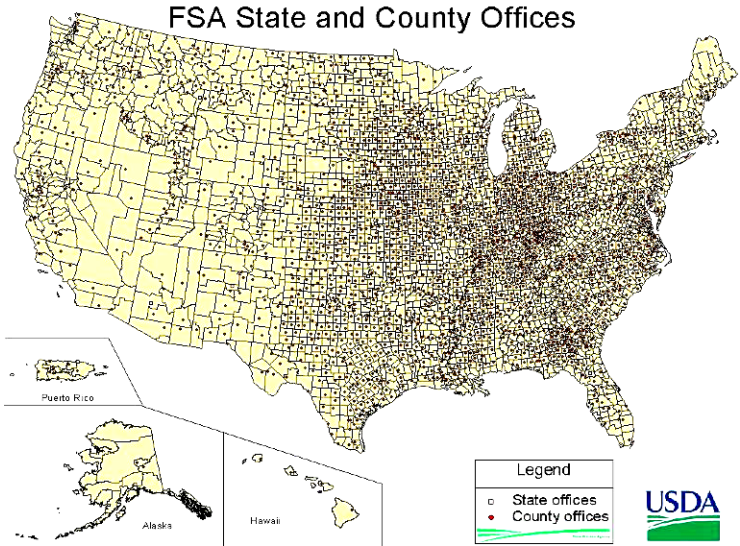
Types of Features NRI Needs Analyze

Global to Field Level Requirements

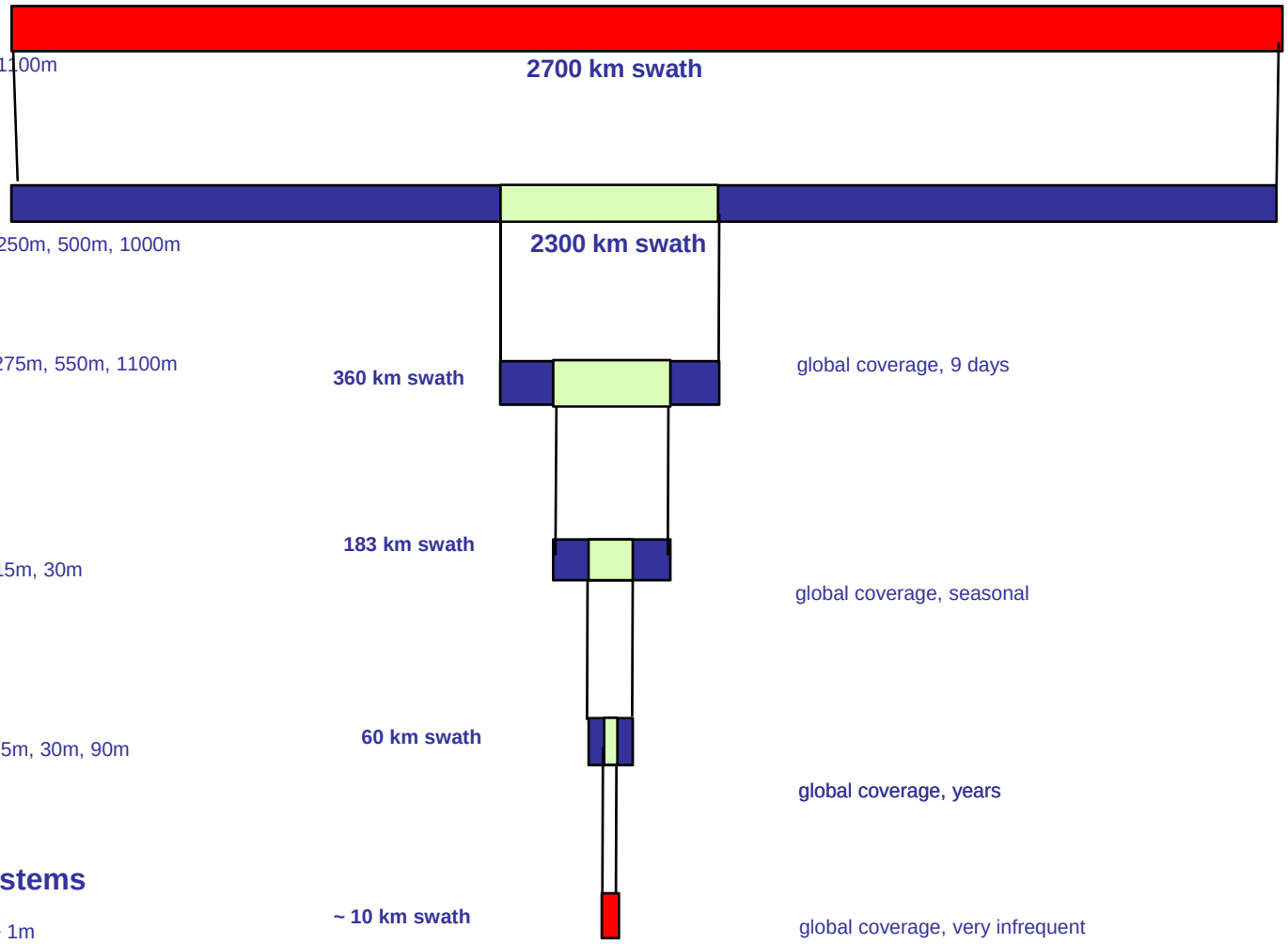
Global Monitoring







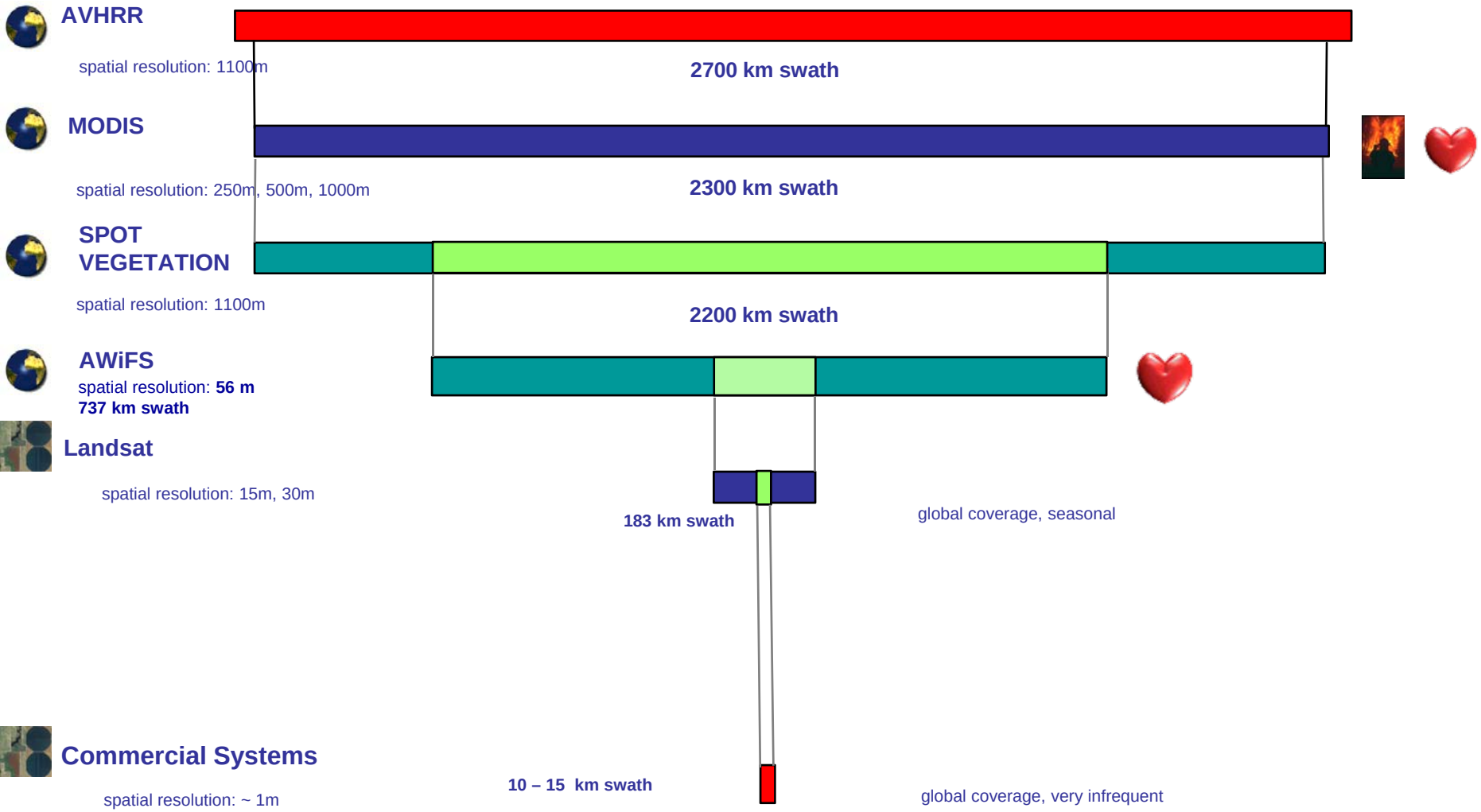
Current US Land Remote Sensing Missions



= Science Missions

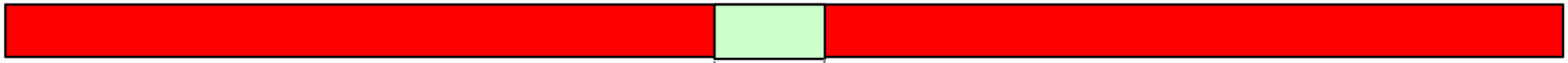
= Operational Missions

Current USDA Land Remote Sensing Uses



Future US Land Remote Sensing Missions

✔ **VIIRS**



spatial resolution: 400/800m (nadir(Vis/IR))

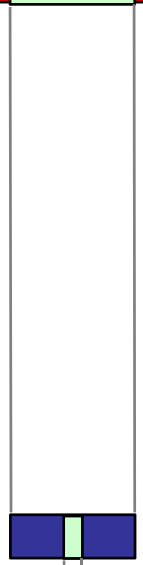
3300 km swath

global coverage, 2x/day/satellite

★ **Landsat**

spatial resolution, 15m, 30m

183 km swath



global coverage, seasonal

✔ **Commercial Systems**

spatial resolution ~ 1m

10- 15 km swath

global coverage, very infrequent

★ **= Science Missions**

✔ **= Operational Missions**

Future Operational Monitoring Satellites used by USDA

VIIRS

spatial resolution: 400/800m (nadir(Vis/IR))
3300 km swath

global coverage, 2x/day/satellite

AWiFS

spatial resolution: **25 m**
600 km swath

Landsat

spatial resolution: 15m, 30m

183 km swath

global coverage, seasonal

LISS-3:

spatial resolution: **23.5 m**
141 km swath

Commercial Systems

spatial resolution ~ 1m

10 - 20 km swath

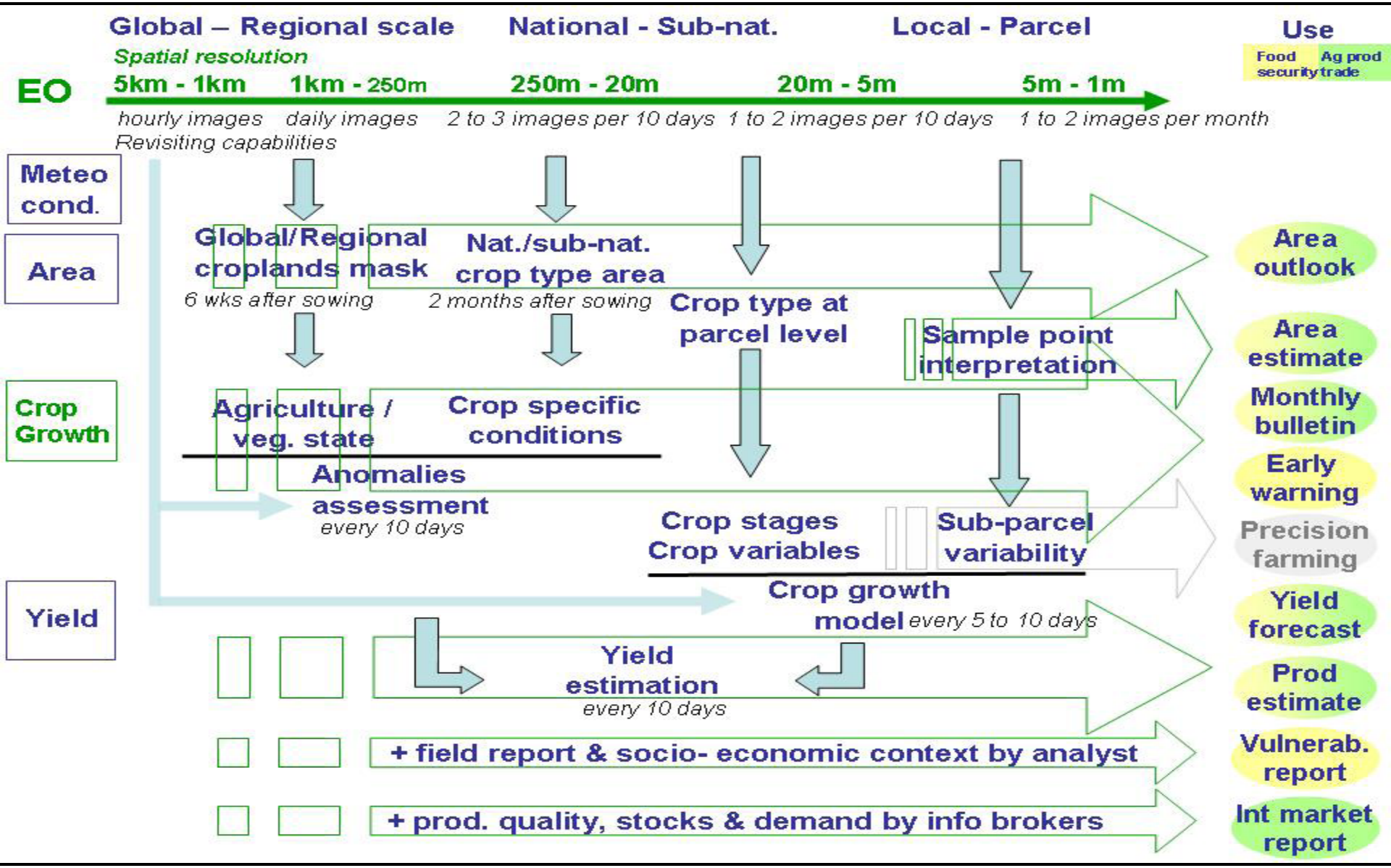
global coverage, very infrequent

= Monitoring

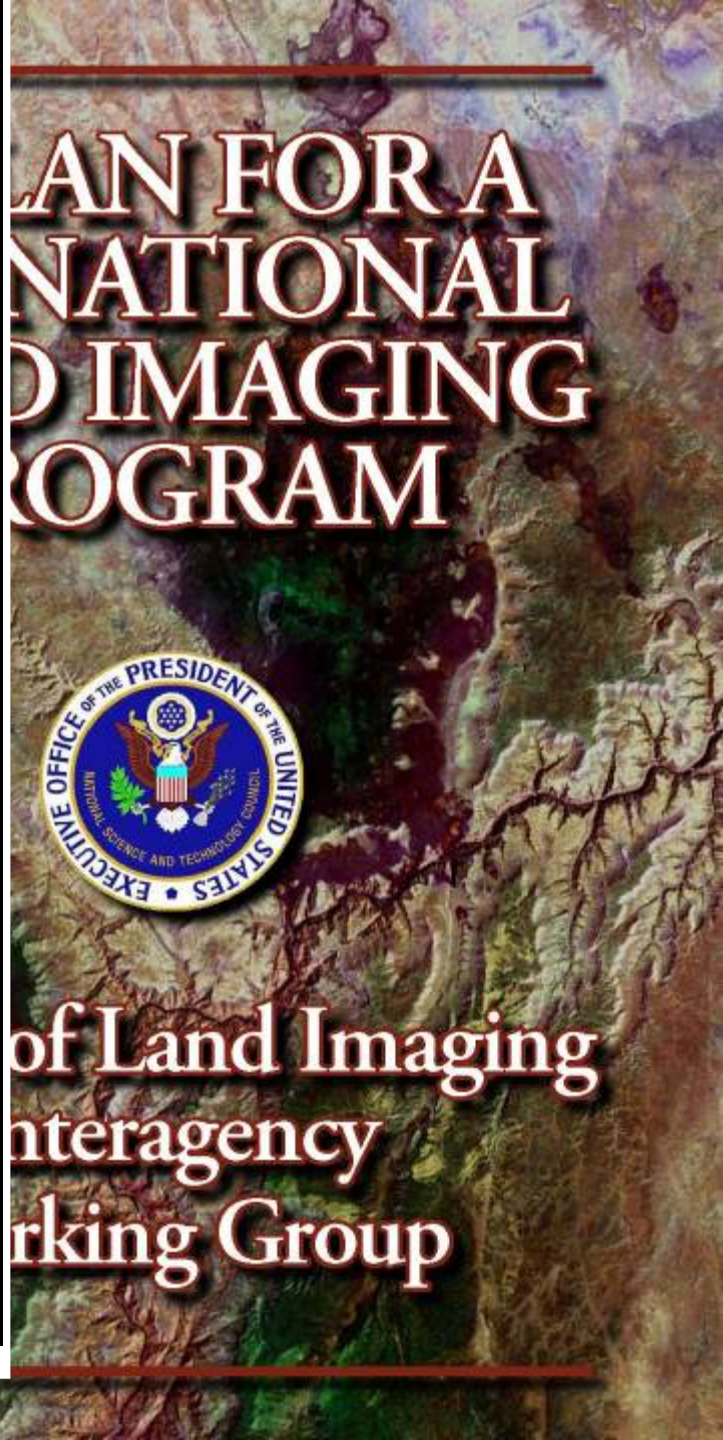
= Mapping

= Fire Monitoring

Global Agricultural Monitoring System of Systems



“It presents a set of policy recommendations to achieve a stable and sustainable U.S. operational space-based land imaging capability….”

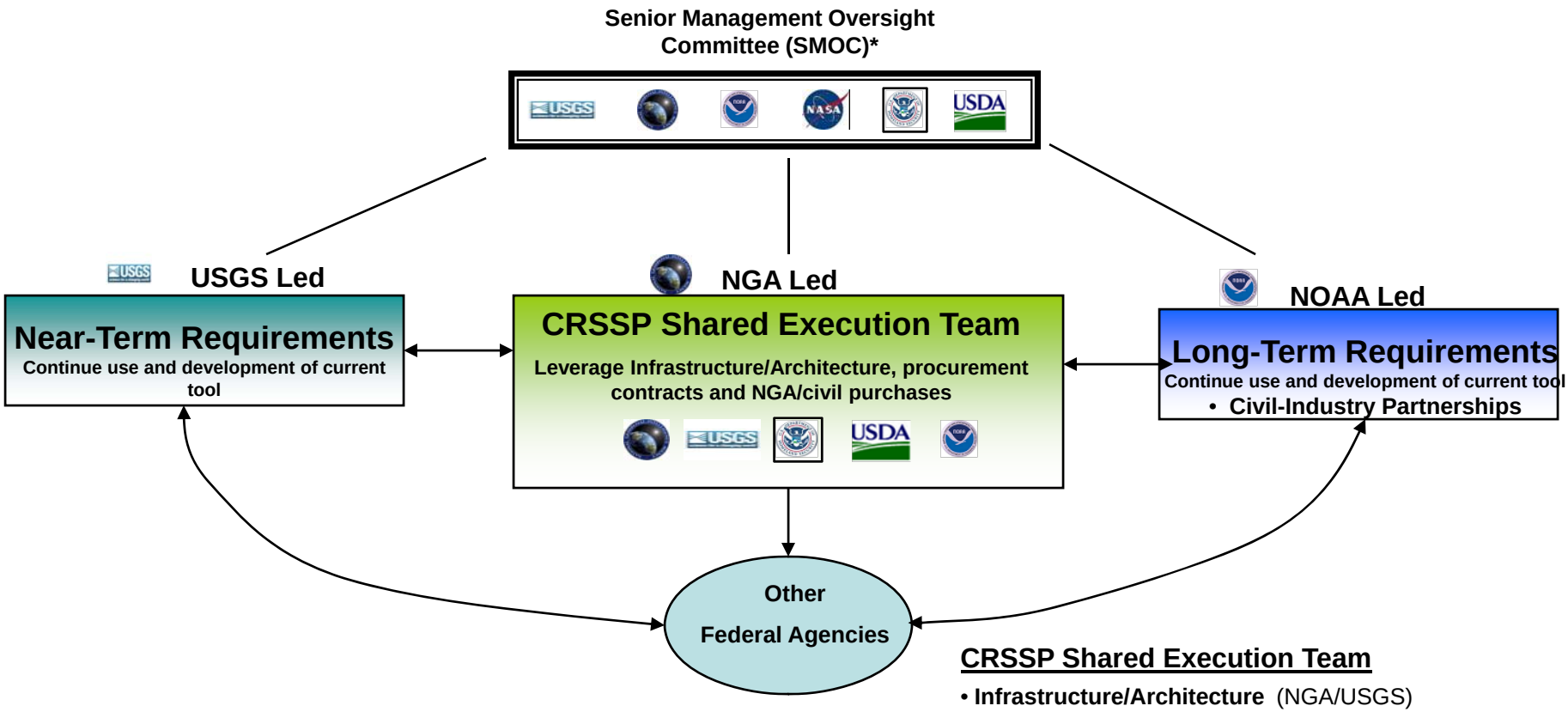


Commercial Remote Sensing Space Policy (CRSSP)

“The fundamental goal of this policy is to advance and protect U.S. national security and foreign policy interests by maintaining the nation’s leadership in remote sensing space activities, by sustaining and enhancing the U.S. remote sensing industry.”

President George W, Bush authorized a new national policy on April 25, 2003

CRSSP Civil/NGA Shared Execution



The SMOC provides strategic direction and policy guidance to all shared execution teams.

CRSSP Shared Execution Team

- **Infrastructure/Architecture** (NGA/USGS)
  - NGA provides for leveraging of its I/A and technology
  - USGS provides for leveraging of its I/A and technology
- **Contracts** (NGA/USGS)
  - Coordinate procurement vehicles
  - Ensure broad distribution options for civil needs
  - Bonus off NGA contracts
- **Purchases** (NGA/civil agencies)
  - Leverage NGA/civil purchases in areas of common interest
  - Upgrade licenses when additional needs can be met

Participating Agencies

- **Department of the Interior**
  - U.S. Geological Survey
  - Bureau of Land Management
  - U.S. Fish and Wildlife Service
  - National Park Service
- **Department of Commerce**
  - National Oceanic Atmospheric Administration
  - Census Bureau
- **Department of Defense**
  - National Geospatial Intelligence Agency
  - U.S. Army Corps of Engineers
- **Department of Energy**
- **Department of Homeland Security**
  - Federal Emergency Management Service
  - Transportation Safety Administration
  - U.S. Coast Guard
- **U.S. Department of State**
- **Department of Transportation**
- **Federal Geographic Data Committee**
- **National Aeronautics and Space Administration**
- **National Capital Planning Commission**
- **U.S. Department of Agriculture**
  - Forest Service
  - Natural Resources Conservation Service
  - Foreign Agricultural Service
  - Farm Service Agency
- **Environmental Protection Agency**

CRSSP data requirements:?

- Data Request
  - **Interested in obtaining imagery over a specific area, but funding is uncertain**
- Planned Data Acquisition
  - **Currently planning to acquire (fund) new or archived imagery over a specific area**

CRSSP Imagery Derived Requirements (CIDR) tool

- Designed to collect federal agency near-term land remote sensing data requirements

WHY WOULD YOU CARE?

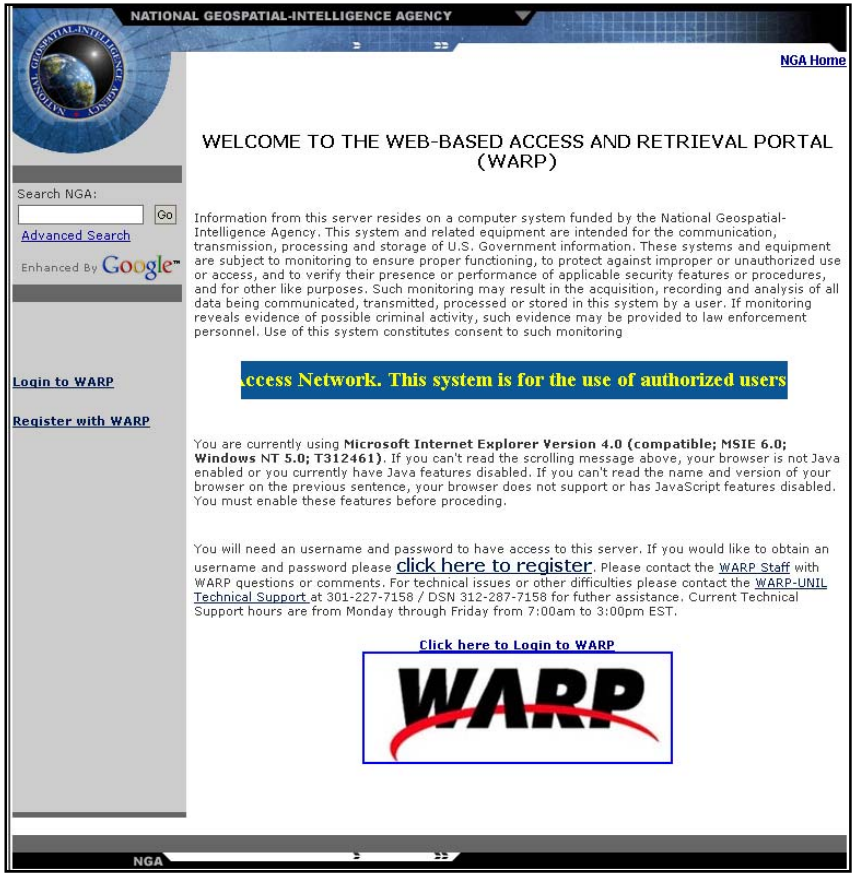
- You Can Request Free High Resolutions Imagery
- Recently NGA has been providing considerably more data for civil needs (no cost)
  - WorldView-1 and GeoEye-1 add considerable capacity
  - Includes new collects, NGA archive, vendor archive, reprocessed scenes
  - Data comes with NextView licenses

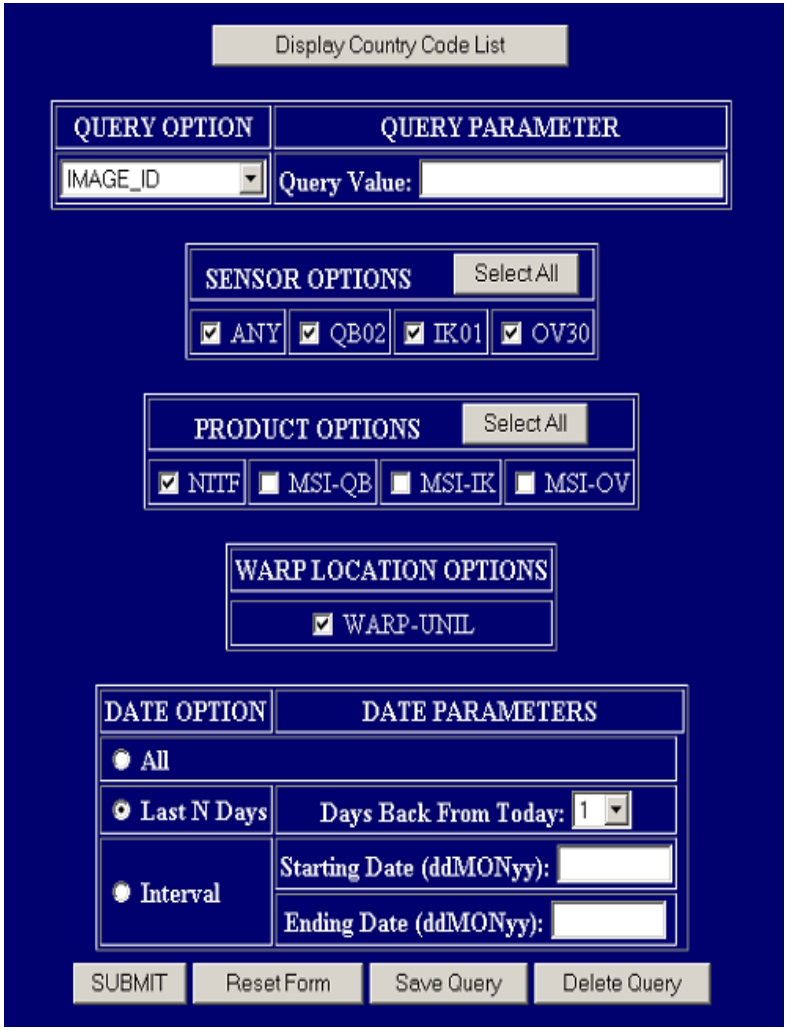
Free NGA High Resolution Imagery?

WARP-UNIL

- *Users can download Commercial Satellite Imagery that has been acquired by NGA. Users must request an account from the registration link.*
- *Note: This imagery is not GIS ready. You must be able to load NITF format to use imagery.*
- https://warp.nga.mil/

Imagery Archive Discovery Tools-WARP





https://warp.nga.mil

Briefing Secretary Vilsack and deputy chief of staff Carole Jett Next Week

- 11:00 - 11:25 Dr. Bruce Molnia, Executive Director of the Civil Application Committee (CAC), will brief Intelligence Oversight, Environmental Applications of the CAC and will discuss the stand up of the National Applications Office.

- 11:25-11:40 Bob Tetrault, FAS/OGA will brief the use of imagery for monitoring global crop conditions and the NGA / FAS cooperation in the Middle East.

- 11:40-12:00 Marjorie Hall, NGA will brief the NGA / FAS cooperation and other environmental monitoring.

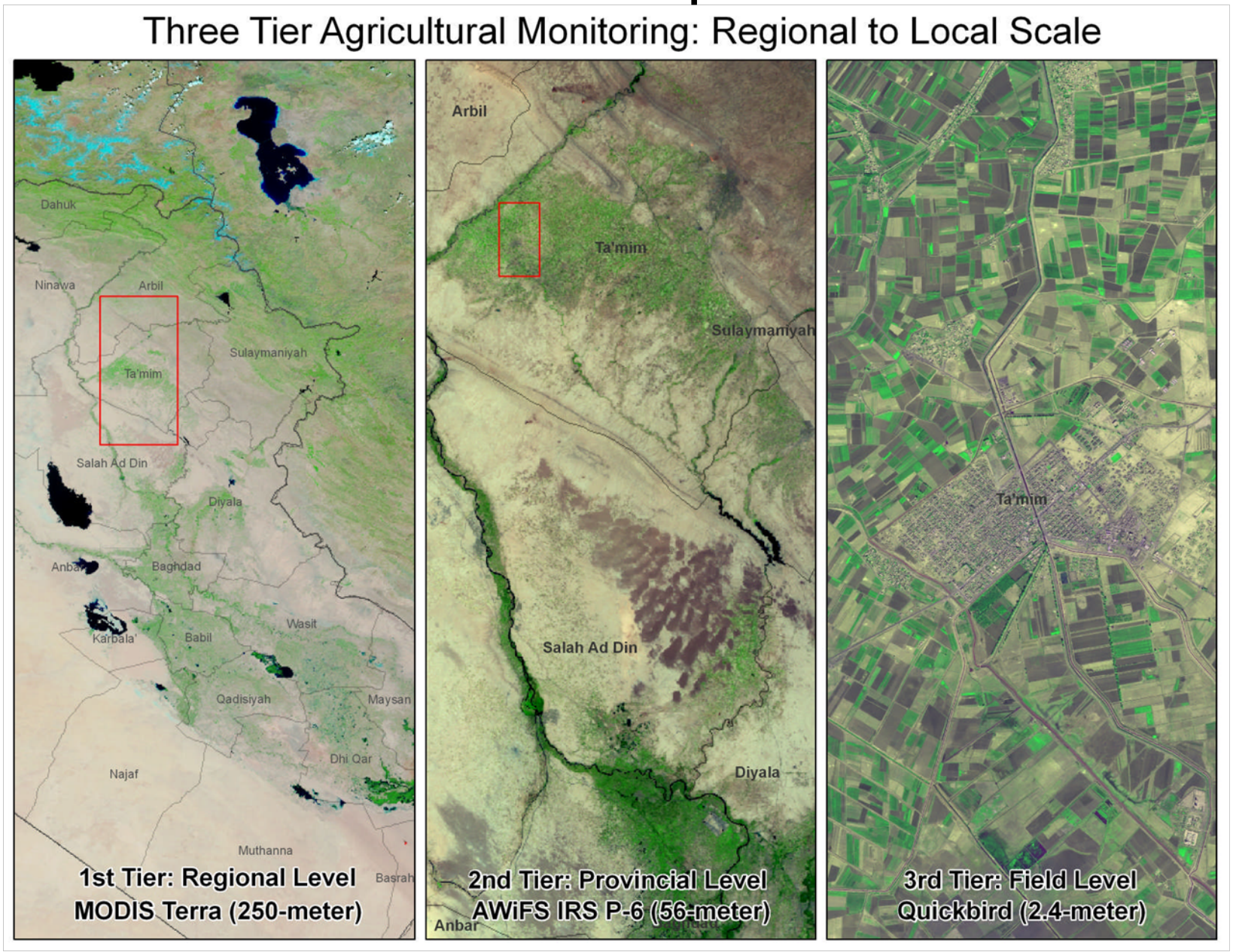
Civil Applications Committee

The Civil Applications Committee (CAC) is an interagency committee that coordinates and oversees the Federal civil use of classified collections. The CAC was officially chartered in 1975 by the Office of the President to provide Federal civil agencies access to National Systems data in support of mission responsibilities

Examples Applications :

- monitoring volcanoes;
- detecting wildland fires;
- coordinating emergency response to natural disasters,
- monitoring ecosystems; and mapping wetlands.

FAS / NGA Partnerships: Middle East




Questions?

Links

- CropExplorer:
  - http://www.pecad.fas.usda.gov/cropexplorer/
- MODIS Rapid Response System:
  - http://rapidfire.sci.gsfc.nasa.gov/
- CropLand Data Layer
  - http://www.nass.usda.gov/research/Cropland/SARS1a.htm
- USDA Data Gateway
  - http://datagateway.nrcs.usda.gov/
- APFO NAIP
  - http://www.apfo.usda.gov

Forest Service Wildland Fire Support Websites

MODIS Active Fire Mapping
- http://activefiremaps.fs.fed.us

Forest Service's Remote Sensing Applications Center (RSAC)

http://www.fs.fed.us/eng/rsac/

National Infrared Operations
- http://nirops.fs.fed.us/

UAS's for Active Fire Mapping and Communications
- http://nirops.fs.fed.us/UASDemo/
- http://geo.arc.nasa.gov/sge/WRAP/

Burned Area Emergency Response Imagery Support
- http://www.fs.fed.us/eng/rsac/baer

Monitoring Trends in Burn Severity
- http://svinetfc4.fs.fed.us/mtbs

Additional RSAC Information

RSAC Operations Program
Brian Schwind
bschwind@fs.fed.us

BAER Imagery Support
Jess Clark
jtclark@fs.fed.us
http://www.fs.fed.us/eng/rsac/baer

MODIS Active Fire Mapping
Brad Quayle
bquayle@fs.fed.us
http://activefiremaps.fs.fed.us

RAVG Support
Tony Guay
tguay@fs.fed.us
http://frdev.ftcol.wo.fs.fed.us/postfirevegcondition/index.php

Post-Catastrophic Storm Assessment
Chuck Werstak
cwerstak@fs.fed.us

Vendor archives

- DigitalGlobe: http://www.digitalglobe.com
- GeoEye: http://www.geoeye.com
- MacDonald Dettwiler & Associates (MDA) Federal: http://gs.mdacorporation.com
- SPOT: http://www.spot.com

For More Information on CRSSP

USGS CRSSP Home Page: *http://crssp.usgs.gov*

CIDR tool: *http://cidr.cr.usgs.gov*

Email: crssp@usgs.gov

Phone: 1-800-252-4547