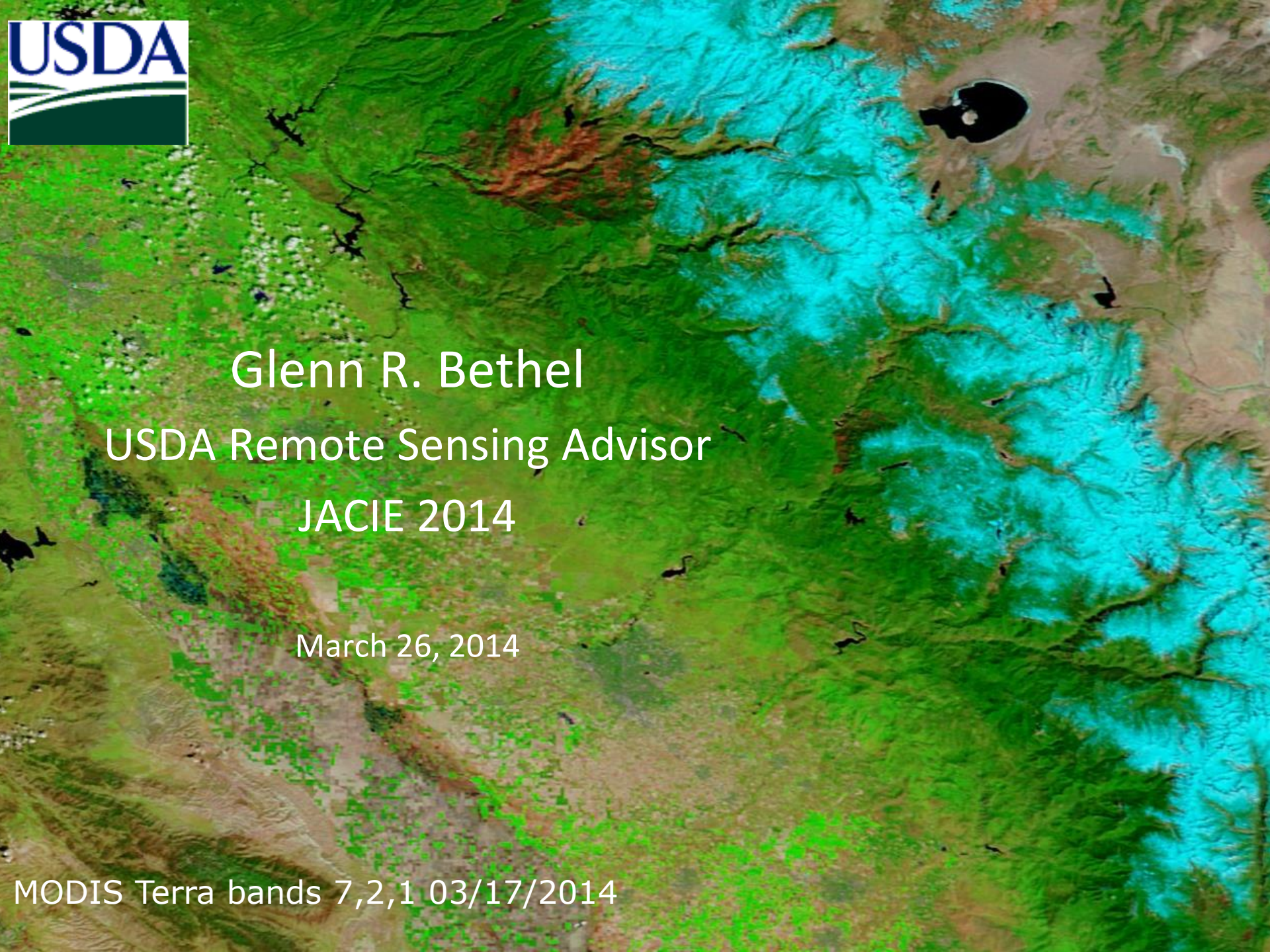


Glenn R. Bethel

USDA Remote Sensing Advisor

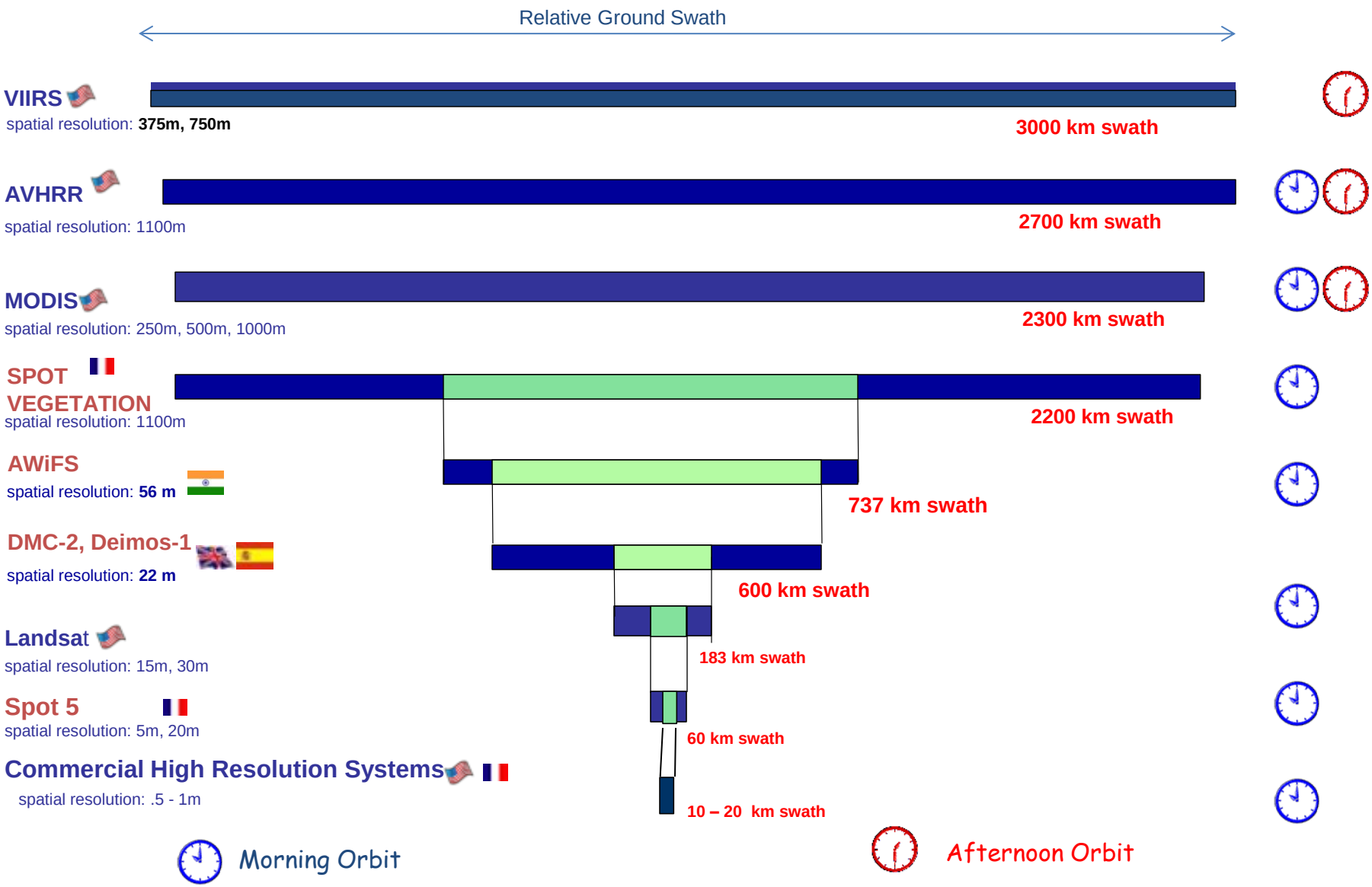
JACIE 2014

March 26, 2014

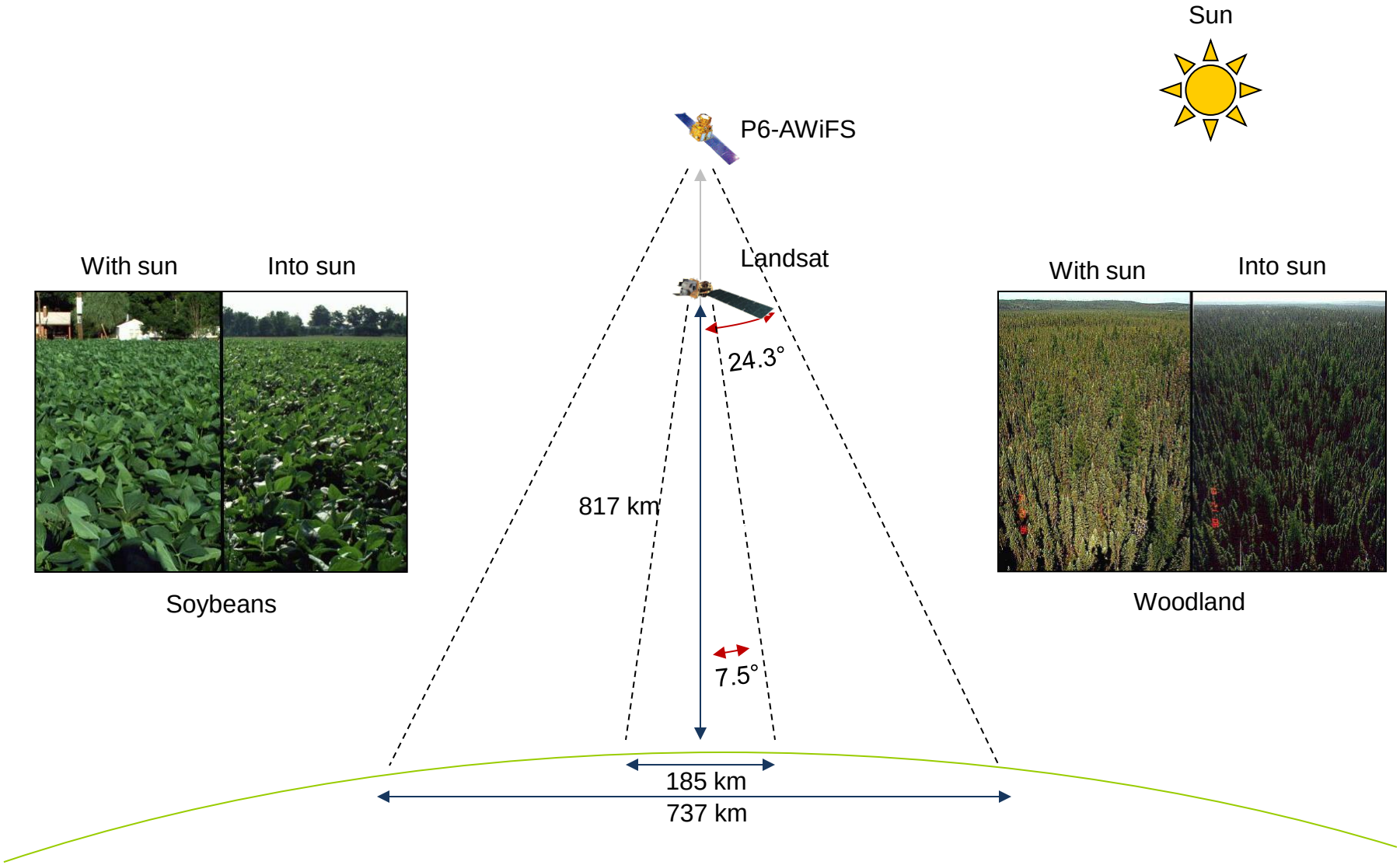
MODIS Terra bands 7,2,1 03/17/2014

- **USDA Mission:**
  We provide leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on sound public policy, the best available science, and efficient management.
- 11 USDA Agencies + Emergency Operations Center use imagery:
  - Monitor Crops and Forests
  - Administer Programs
  - Examples for today are from:
    - Forest Service, Natural Resources Conservation Service, Farm Service Agency, Risk Management Agency, and National Agricultural Statistics Service
  - Friday, two briefers from the Foreign Agricultural Service

USDA Agricultural Monitoring Satellites



Landsat / AWiFS viewing geometry / Swath

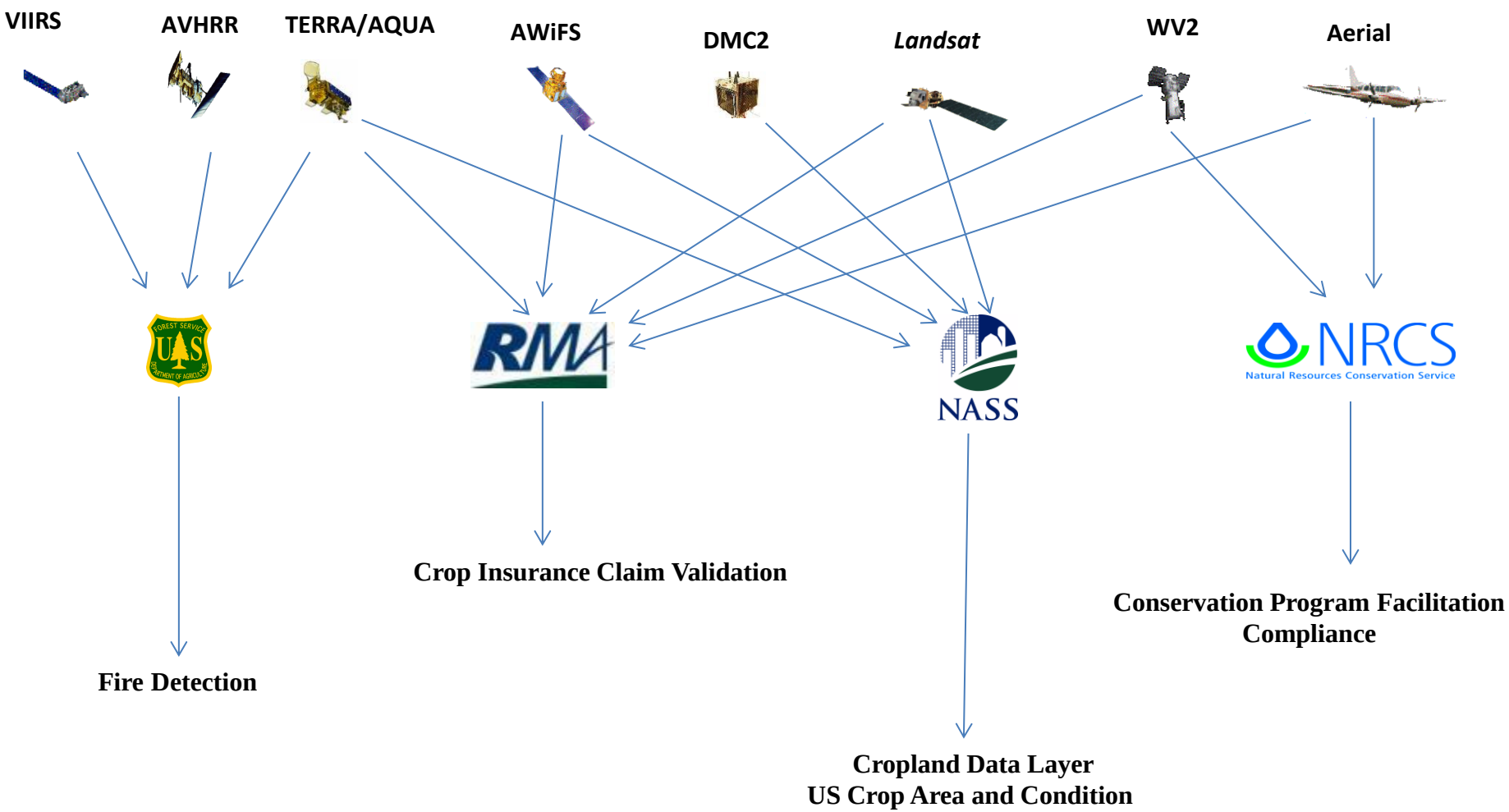


Operational use has shown that image crop classification accuracy does not decrease from 7.5 degrees to 24.3 degrees off nadir.

Photos by Don Deering

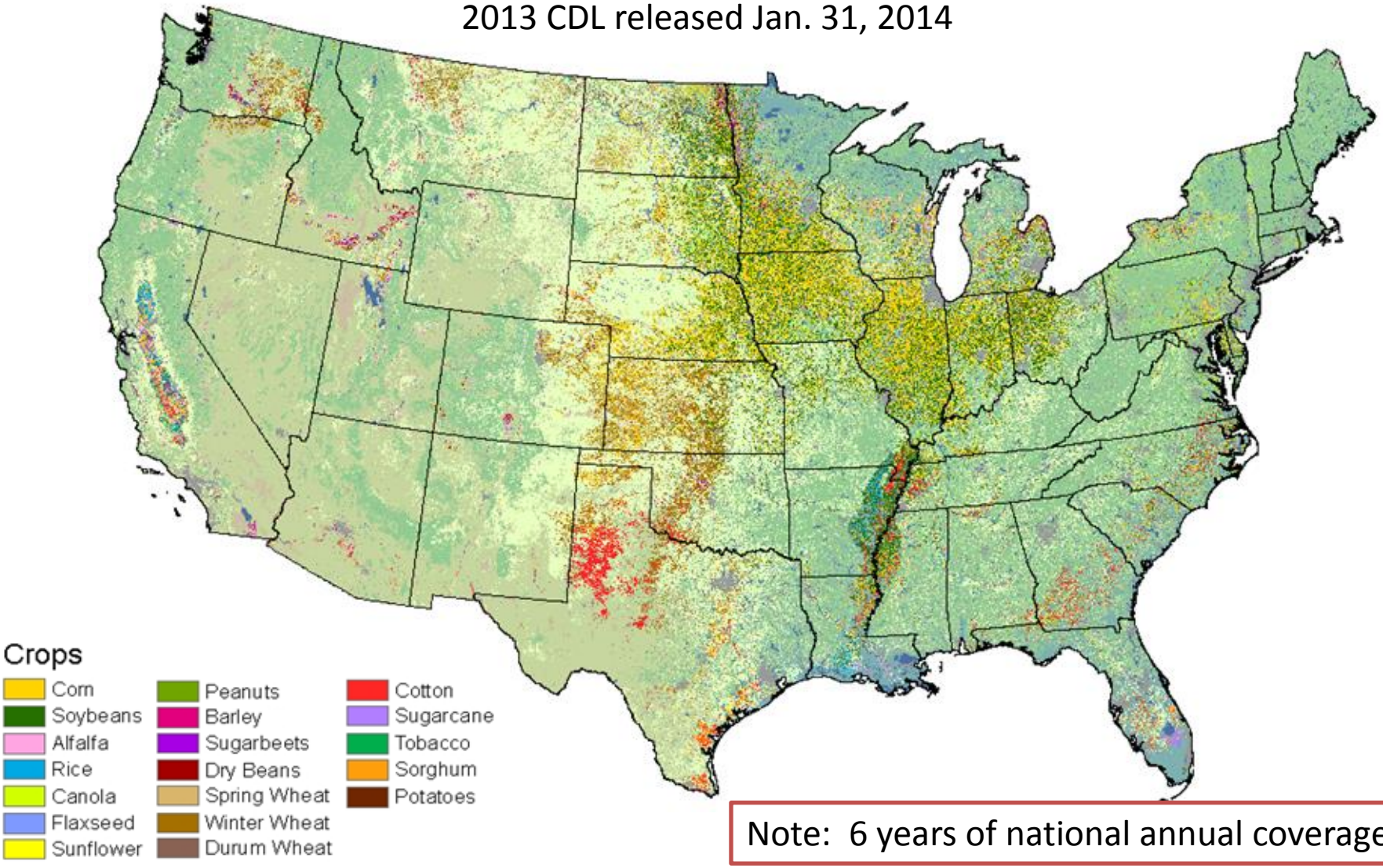
Slide Credit: David M. Johnson / USDA NASS

Examples of using multiple sources for operational applications



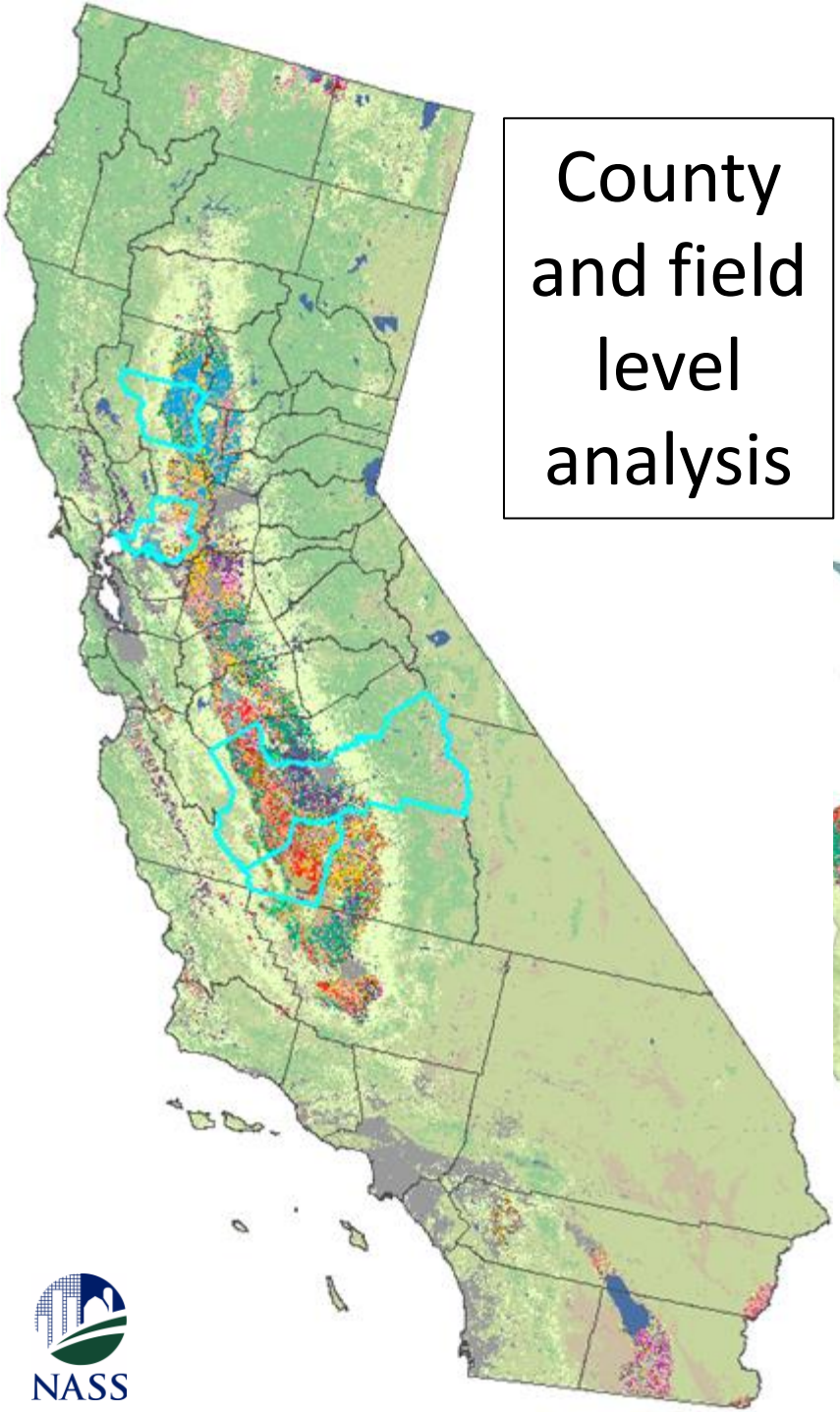
2008 – 2013 National Cropland Data Layers

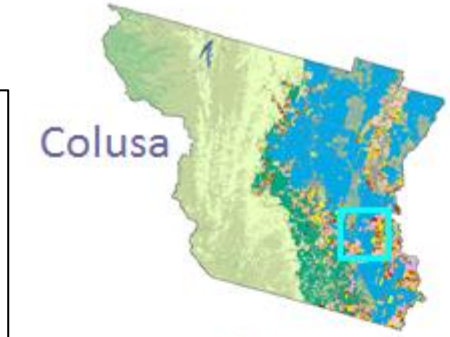
2013 CDL released Jan. 31, 2014

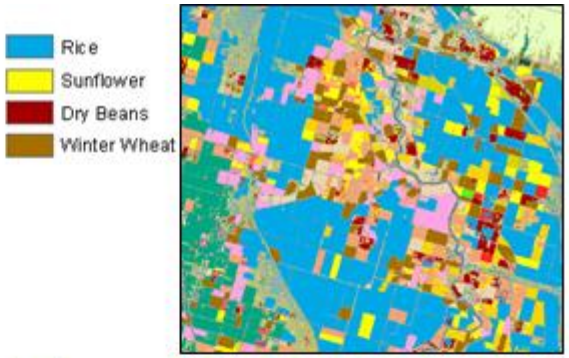


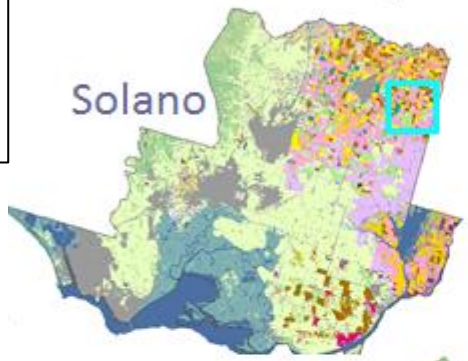
Note: 6 years of national annual coverage

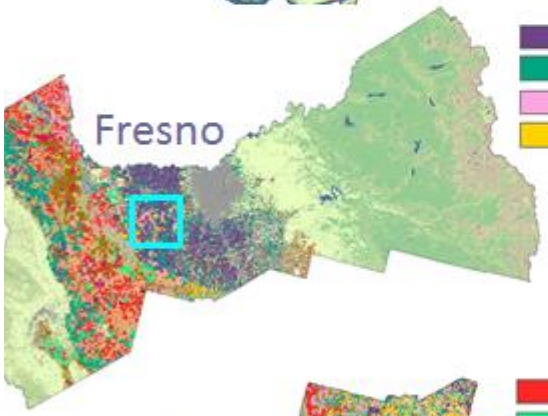
County and field level analysis

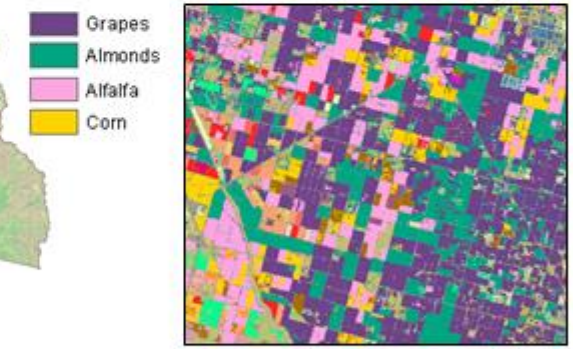


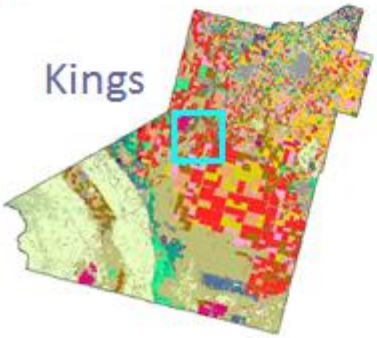






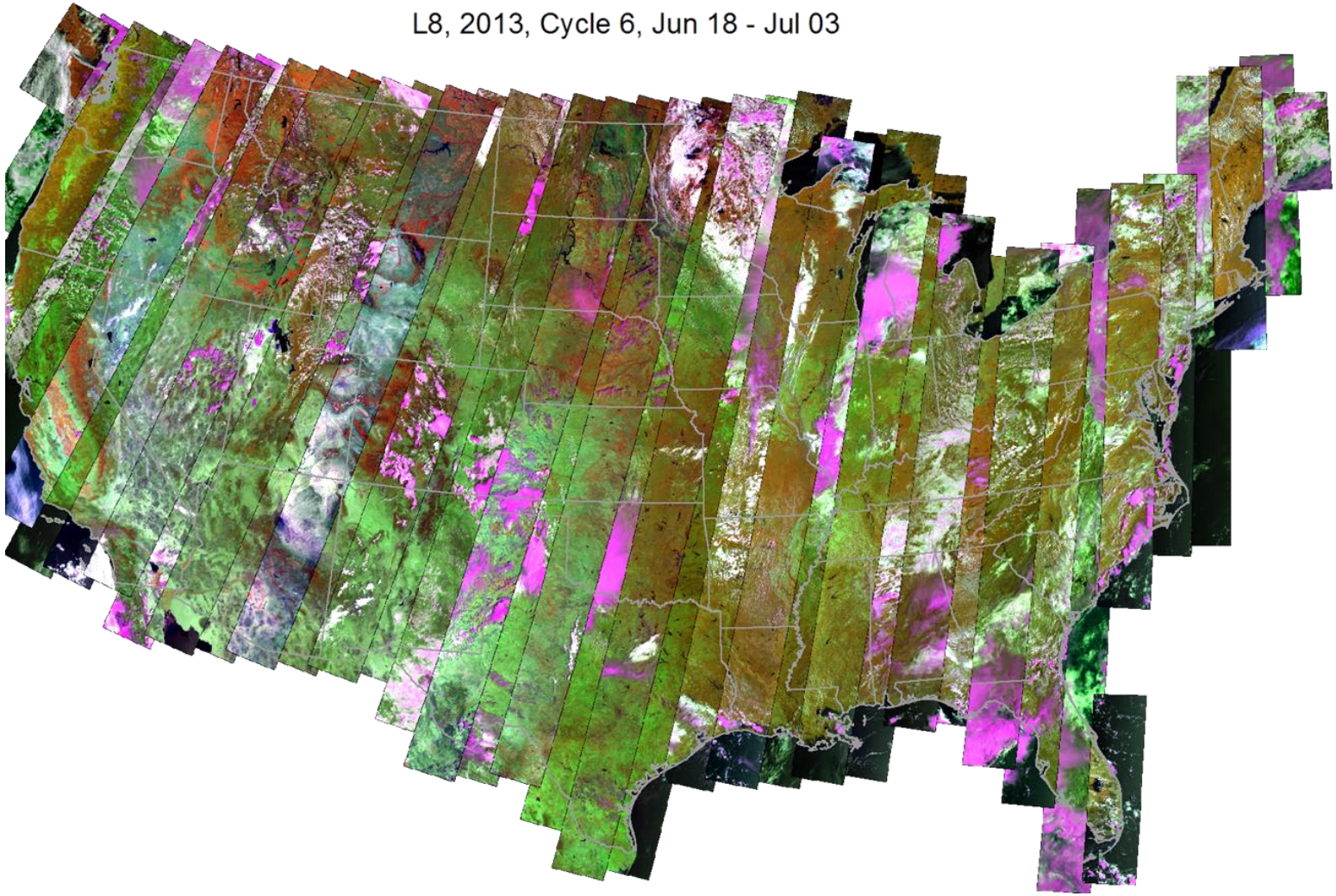






NASS

Inputs to Cropland Data Layer: Landsat 8 coverage for June 18-July 03, 2013

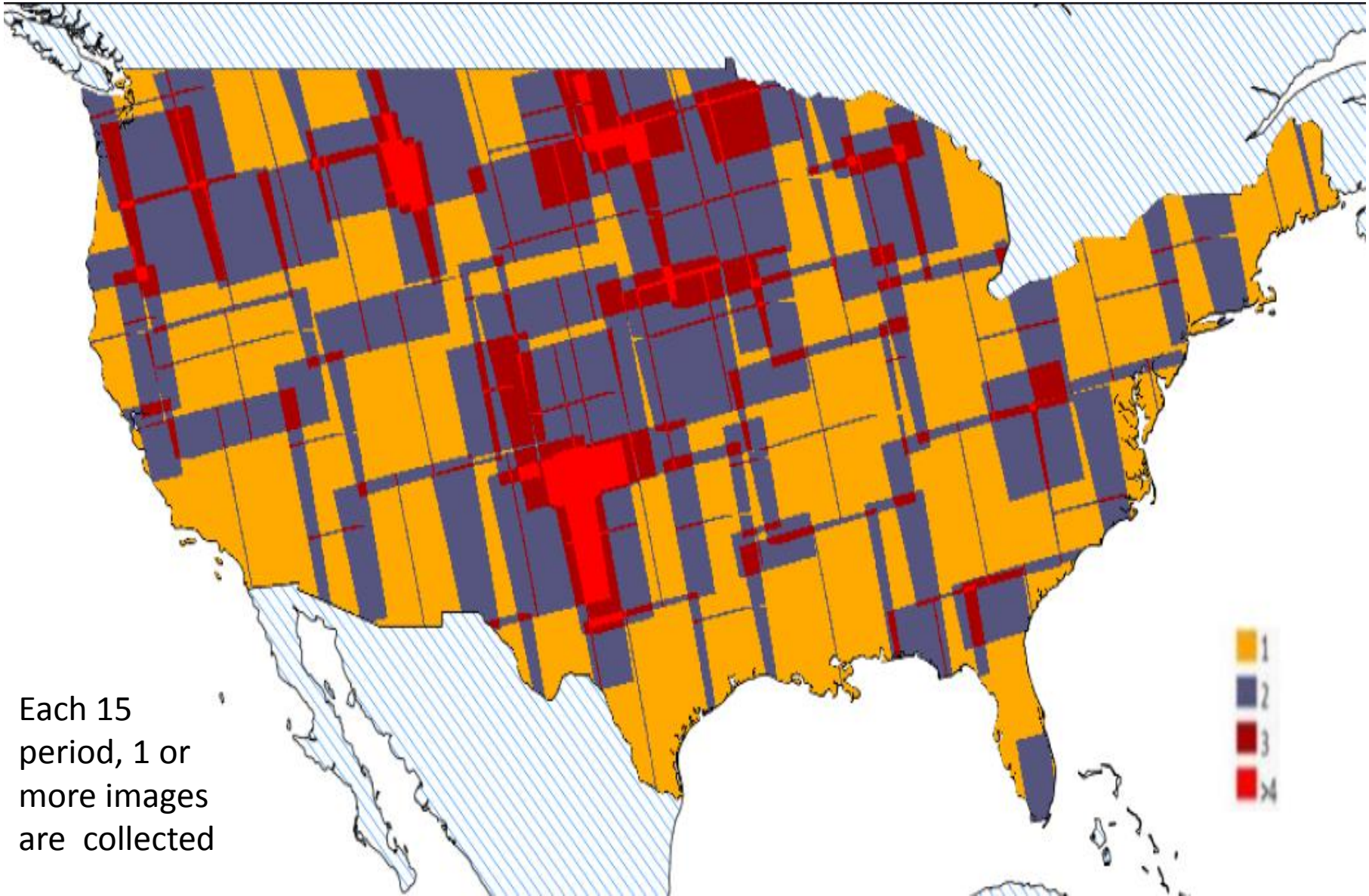


Choice of 457 Images every 16 days

Inputs to Cropland Data Layer: Deimos-1 UK-DMC-2 coverage for June 16-30 2014

Choice of 69 images from Deimos-1 and 59 from UK-DMC-2

Deimos-1 UK-DMC-2: Number of Coverages June 16-30

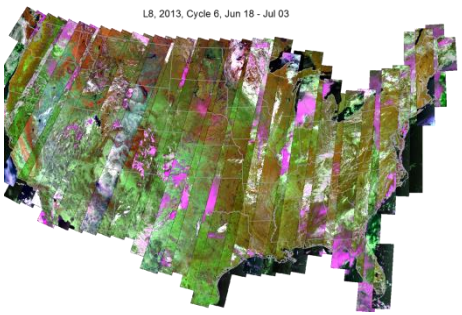


Each 15 period, 1 or more images are collected

Multi Source Time series imagery +

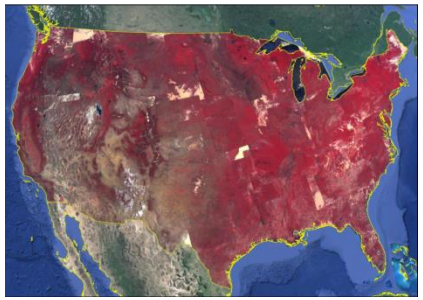
Landsat-8 OLI and TIRS

One Chance Every 16 Days



DMC Deimos-1 and UK-2

One or more Every 15 Days



MODIS NDVI

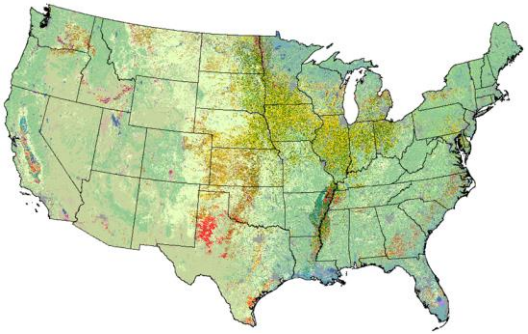
Two Chances Every Day

Ancillary Data

Elevation,
Imperiousness,
Forest Canopy,
NLCD …

Field level Crop Reporting

Cropland Data Layers



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

NASA/USDA-FAS Global Agriculture Monitoring (GLAM) System (since 2002)

to produce quantitative

crop area & yield estimates from remote sensing data

Global Landsat (30m)

Global MODIS (250M)

Crop Area

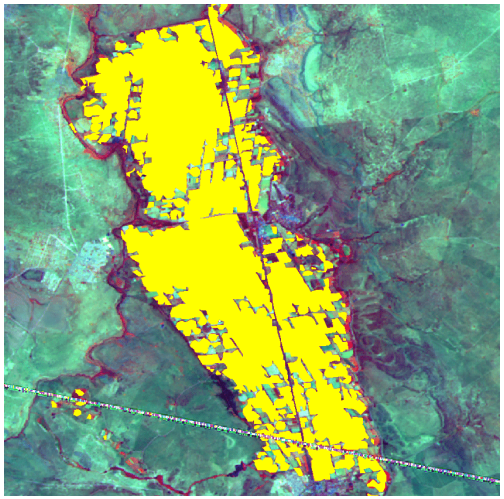
(16-days overpass)

Crop Yield

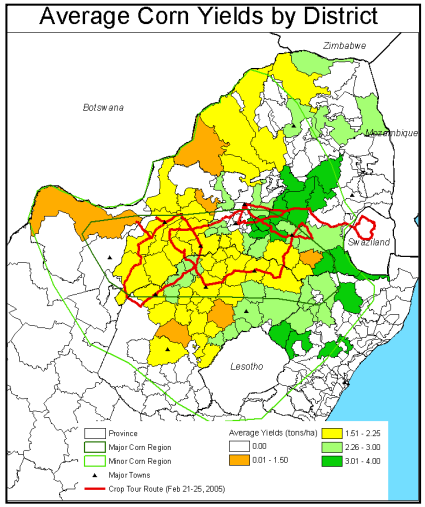
(daily AM/PM overpass)

This imagery is free, processing, storage and creation of automated products is not.

Specific Crop Area Estimates



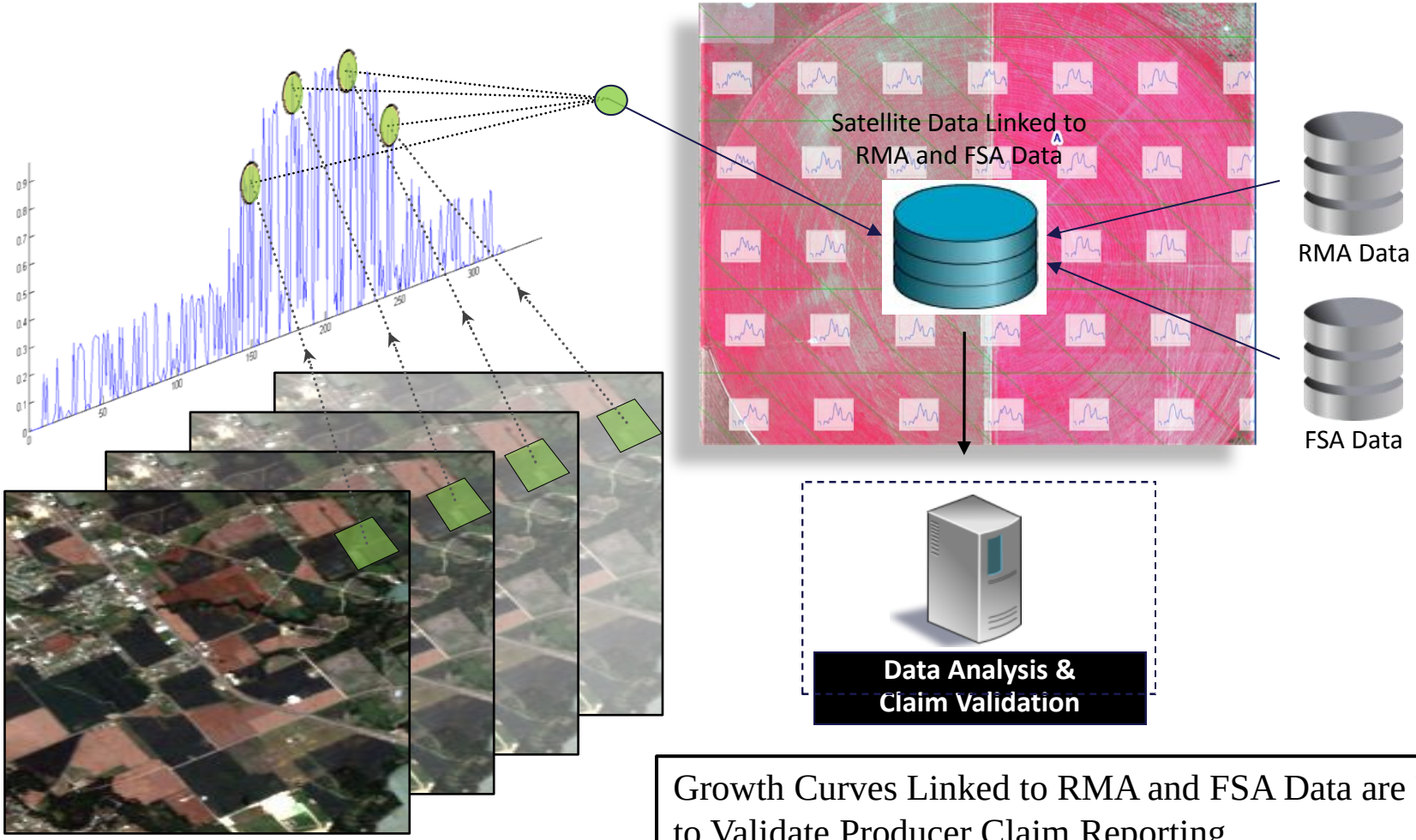
Relative Yield Estimates



United States Department of Agriculture

Foreign Agricultural Service

Automated Claims



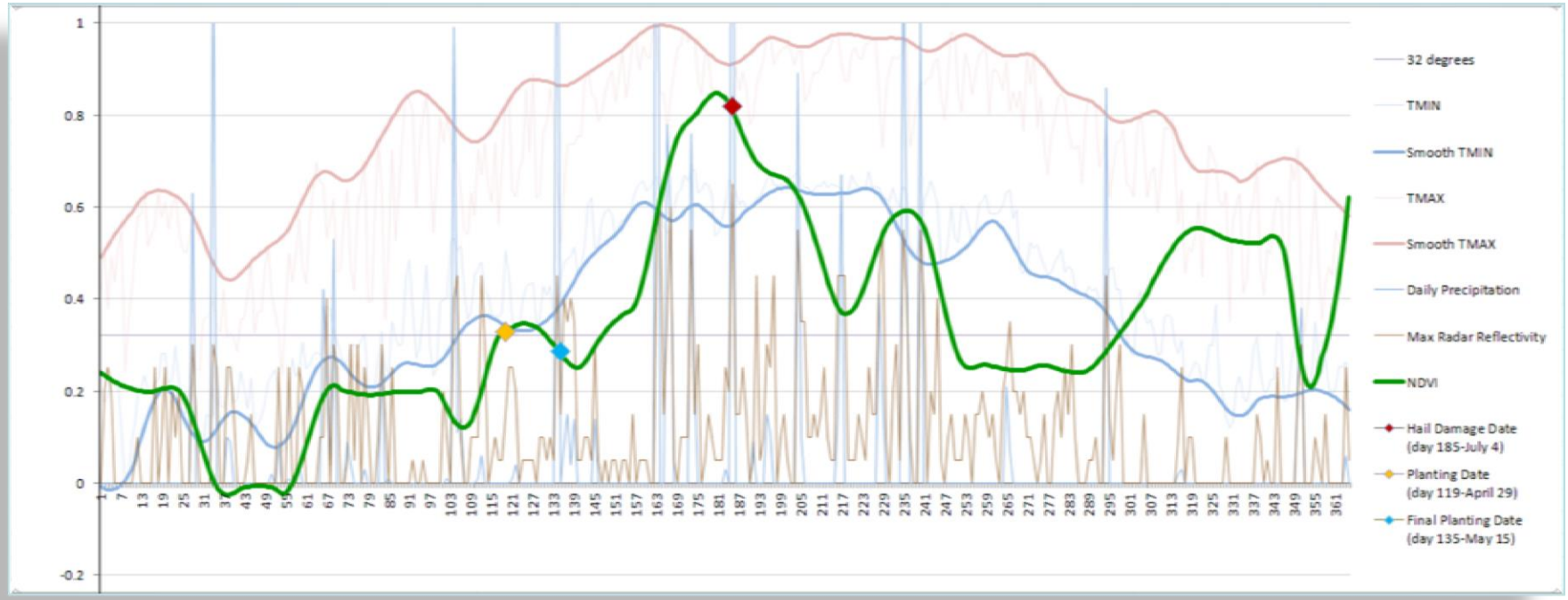
Daily MODIS Data Derives Growth Curves

Growth Curves Linked to RMA and FSA Data are Used to Validate Producer Claim Reporting

Slide Credit: Jim Hipple, Bert Little

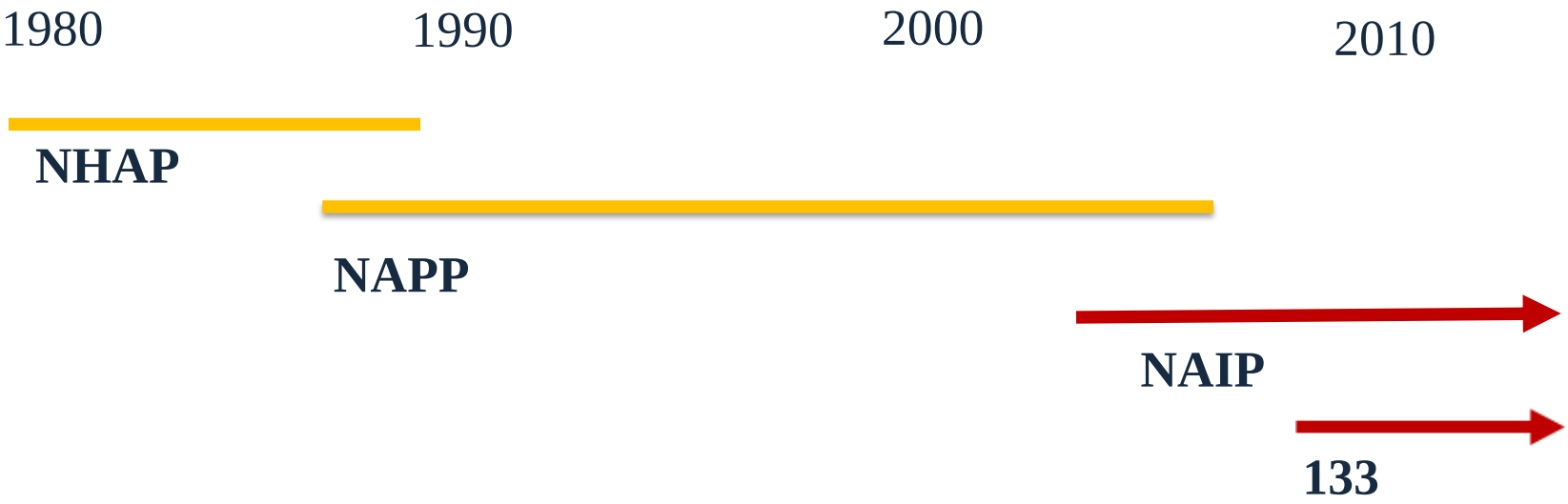
Growth Curve & Weather Data

- Field/Pixel Level Annual Growth Curve and Weather Data Graph
- Only Available for Large Fields with Multiple MODIS Grid Cells
  - Weather Data and Growth Curve Aggregated to Field Level
    - NDVI, TMAX, TMIN, Daily Precipitation, Max Radar Reflectivity, and RMA Dates



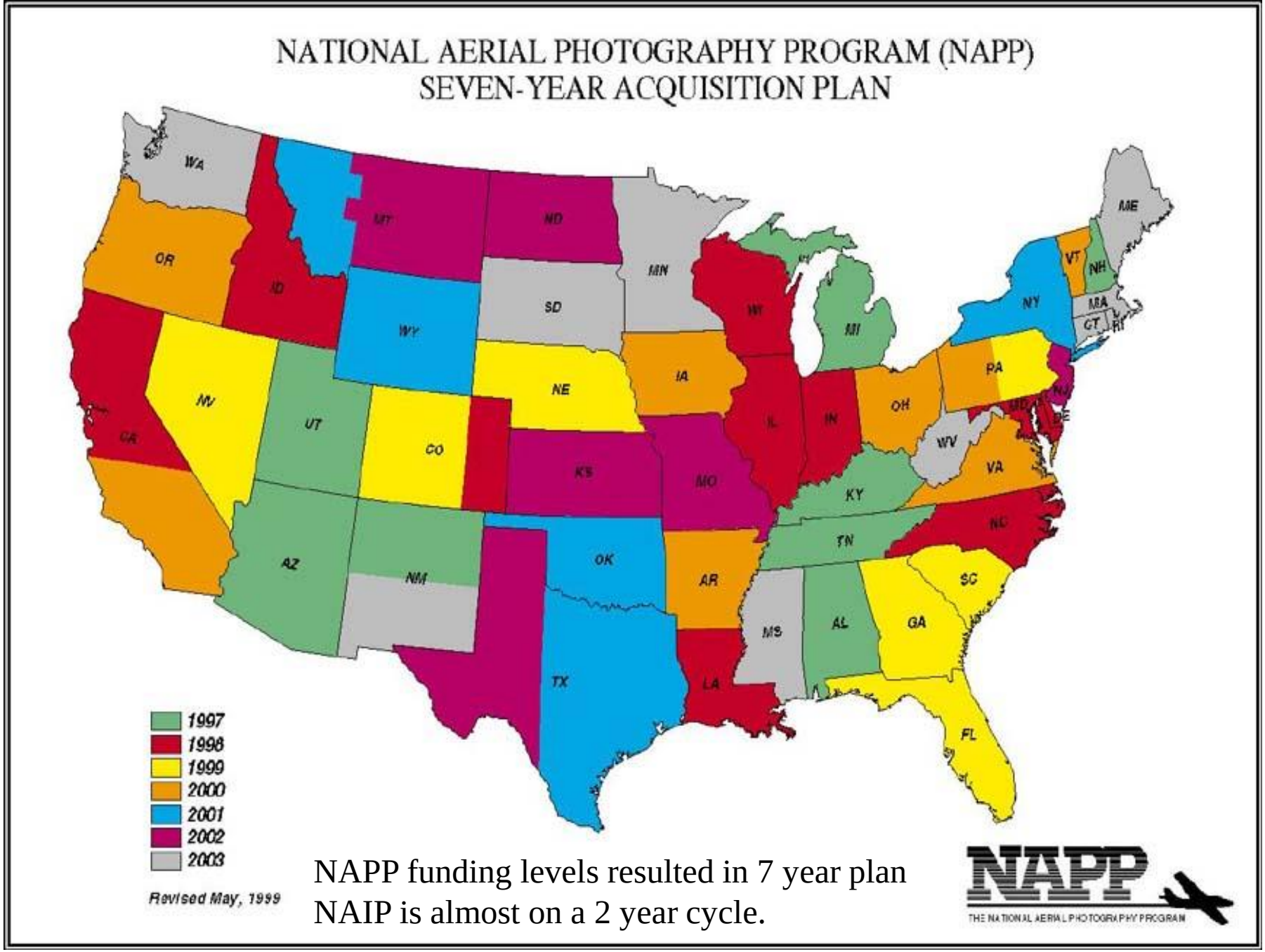
Slide Credit: Jim Hipple, Bert Little

National Imagery Programs



NHAP National High Altitude Aerial Photography Program (1980 - 1989)
NAPP National Aerial Photography Program (1987 – 2007)
NAIP National Agriculture Imagery Program (2003 – ongoing)
133 133 Urban Areas

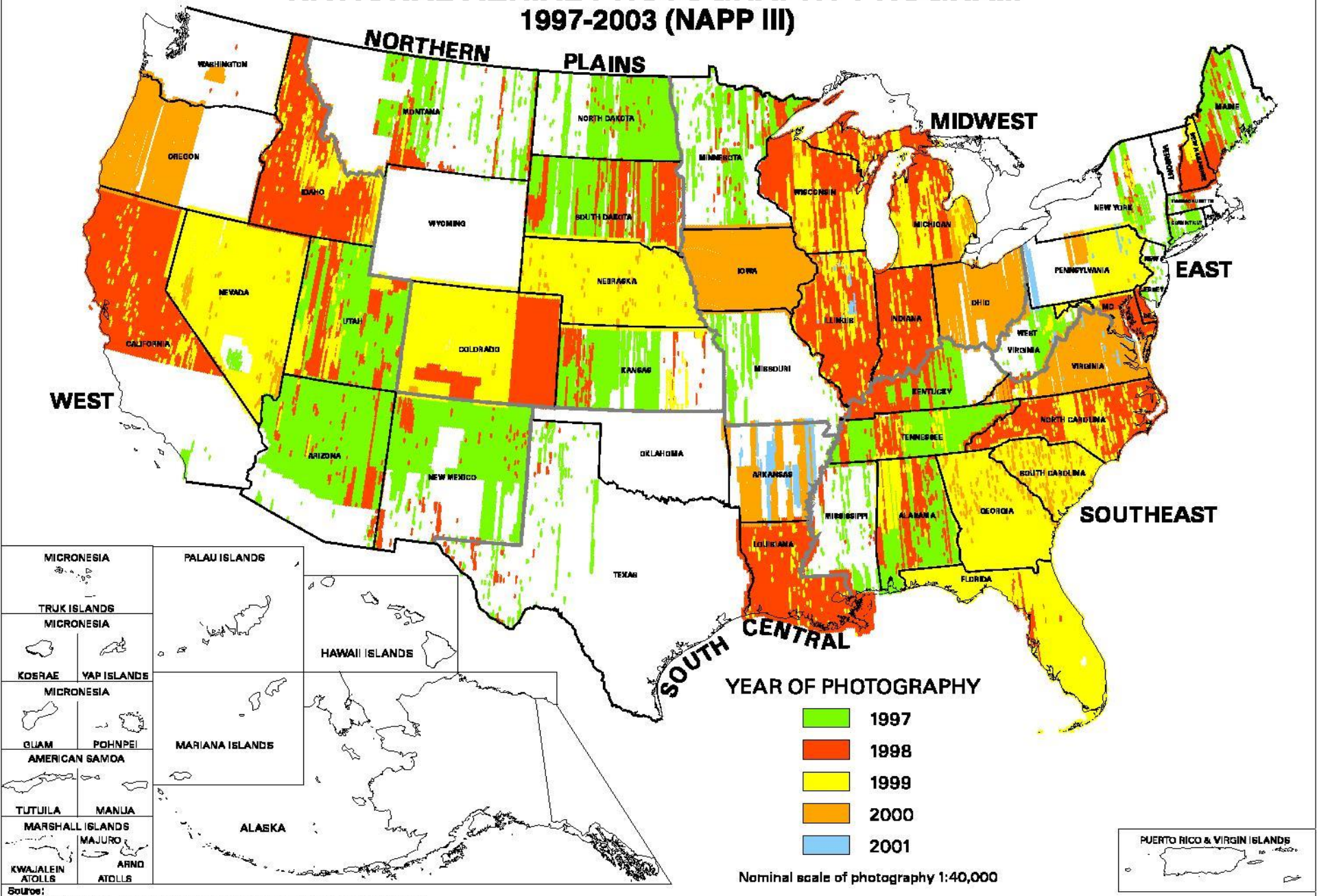
USDA acquired over 13 million aerial photograph items from 1932 - 1980



NAPP funding levels resulted in 7 year plan
NAIP is almost on a 2 year cycle.

USDA stops NAPP funding in 2001.

NATIONAL AERIAL PHOTOGRAPHY PROGRAM
1997-2003 (NAPP III)



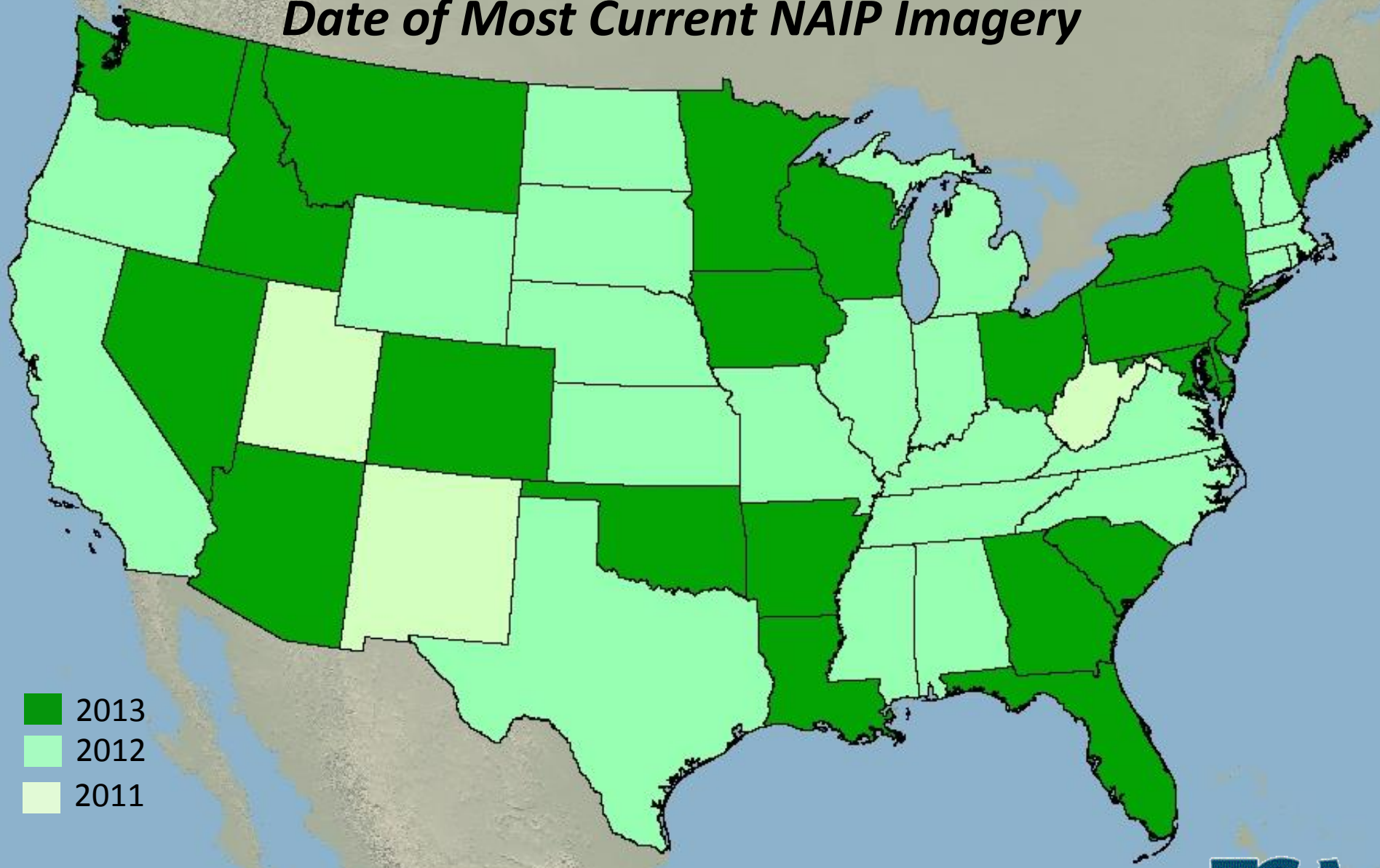
Source:
US Geological Survey , NAPP Group, MS 542 12201 Sunrise Valley Dr, Reston, VA 22092
Albers Equal Area Projection, 96°W & 23°N. 21 May 2001.

USDA-NRCS National Cartography & Geospatial Center, Fort Worth, Texas, 2001.

Revised July 25, 2001 1008369

As of July 25, 2001

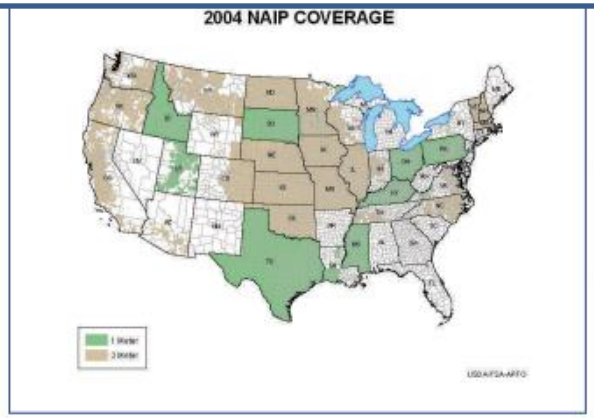
Date of Most Current NAIP Imagery

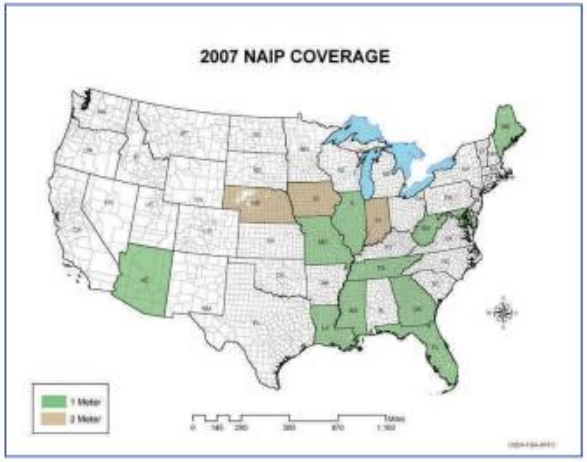


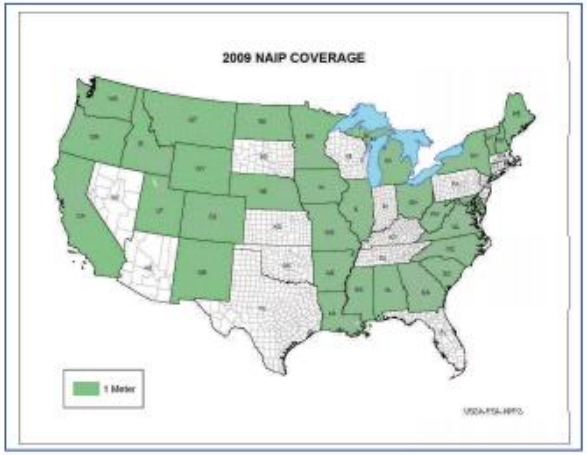
2/25/2014

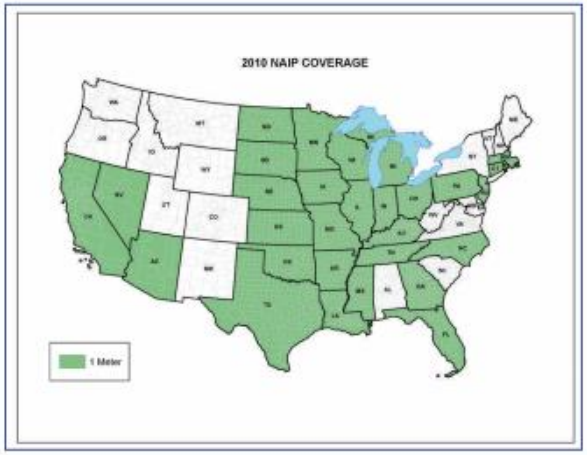
FSA
FARM SERVICE AGENCY

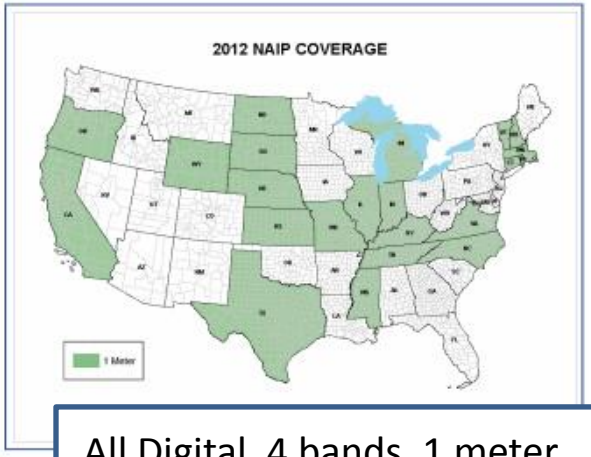
All Film, 3 bands, 1 and 2 meter











All Digital, 4 bands, 1 meter

Meeting FSA Requirements
Coverage with NAIP

FSA Requirements		NAIP Spec	Actual	Improvements
Support Farm Programs	Coverage	Supports Annual Coverage	**2 to 2.5 year cycle**	Funding Dependent
		Full State		
		Acquired within Crop Growing Season	75% to 97%	

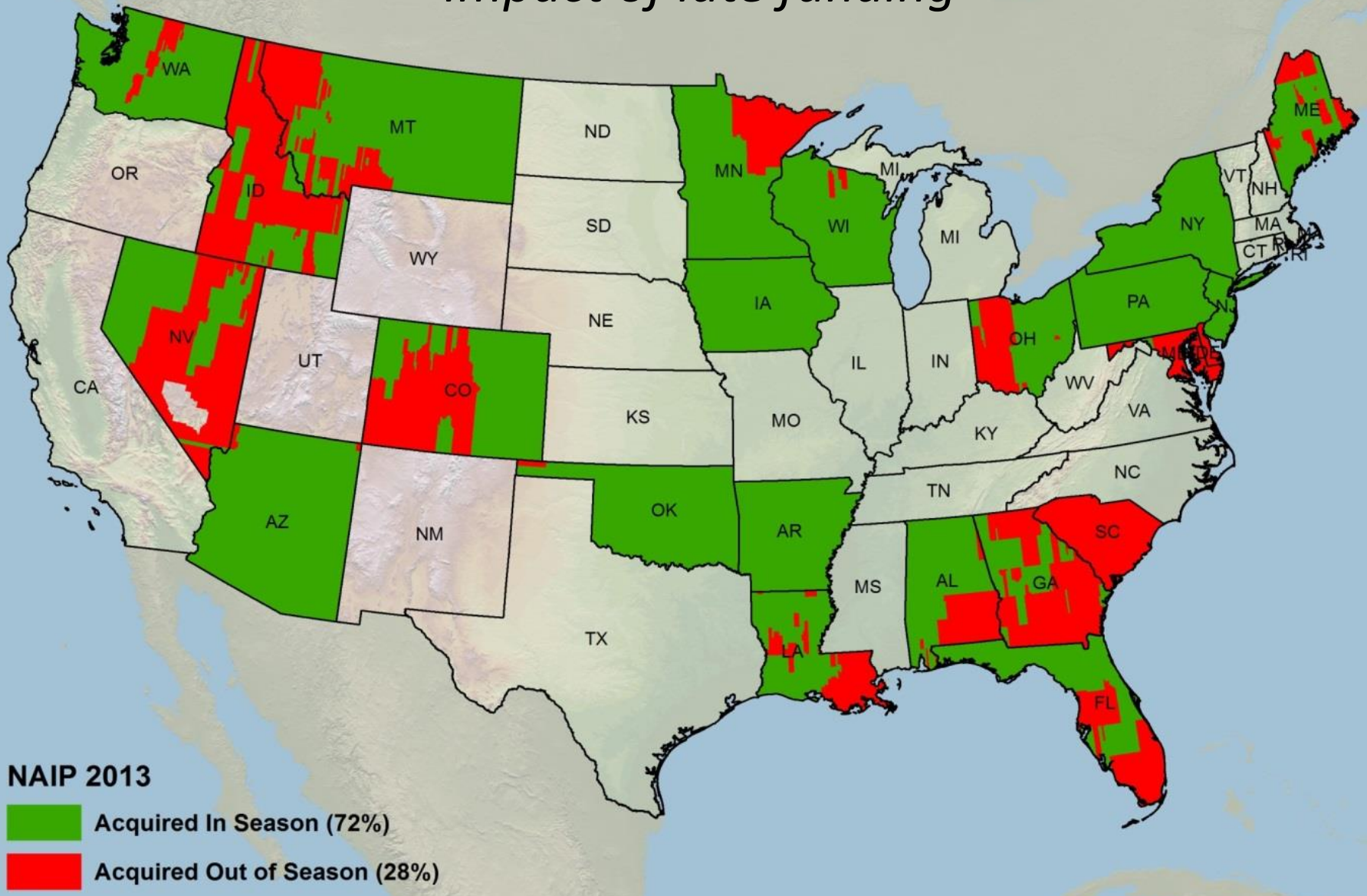
NAIP 2013 Task Orders

- Task orders were awarded in 2 parts:
  - Part 1 - May 23, 2013 (sixteen states) (Normally April 1)
    - $11,150,024.82
  - Part 2 - **July 17, 2013** (seven states)(Very Late Funding!)
    - $3,367,384.95
  - Funding:
    - FSA: $9.6M, FS: $1.7M, NRCS: $1.3M, & DOI:$1.9
    - **87% USDA; 13% DOI**

NEW Early Access Web Service pilot (Faster)

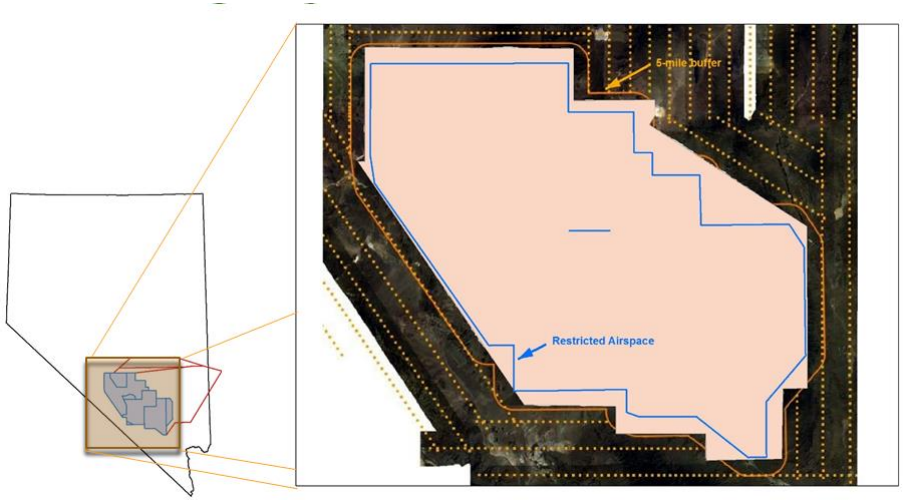
NEW Idaho ½-meter pilot (Better)

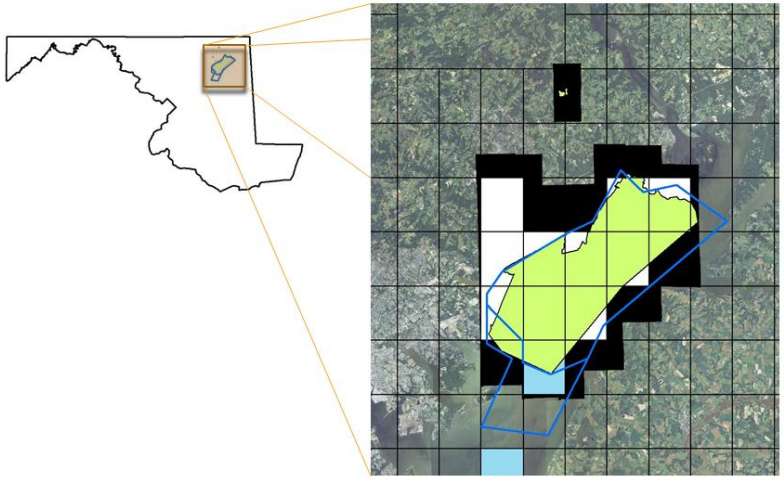
2013 Acquisition within Seasons: Impact of late funding



2013 NAIP Status

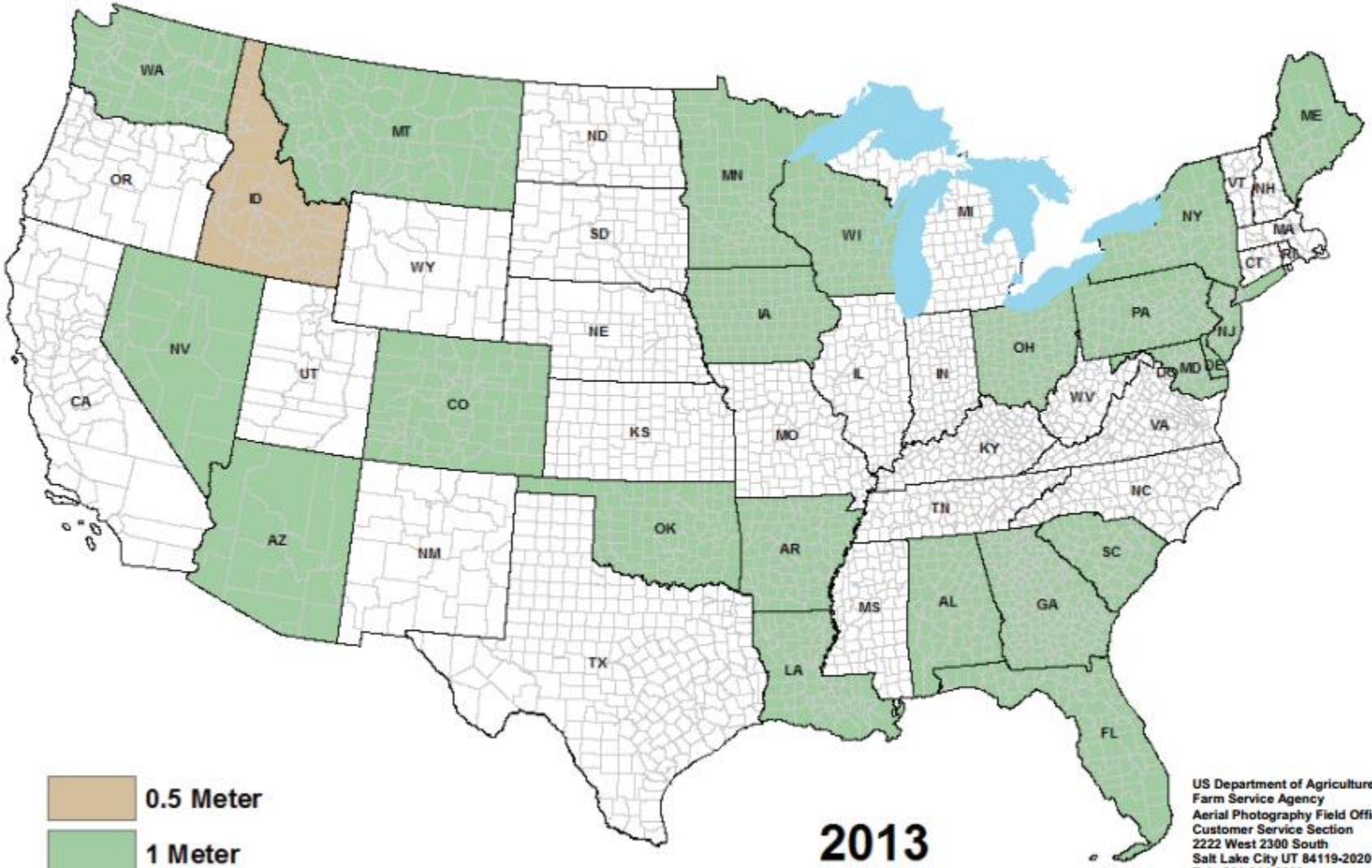
- 100% acquired
  - Except for restricted airspace:
    - Aberdeen Proving Grounds, Maryland
    - Nevada Test and Training Range, Nevada
- All DOQQs have been delivered





USDA

United States Department of Agriculture



0.5 Meter

1 Meter

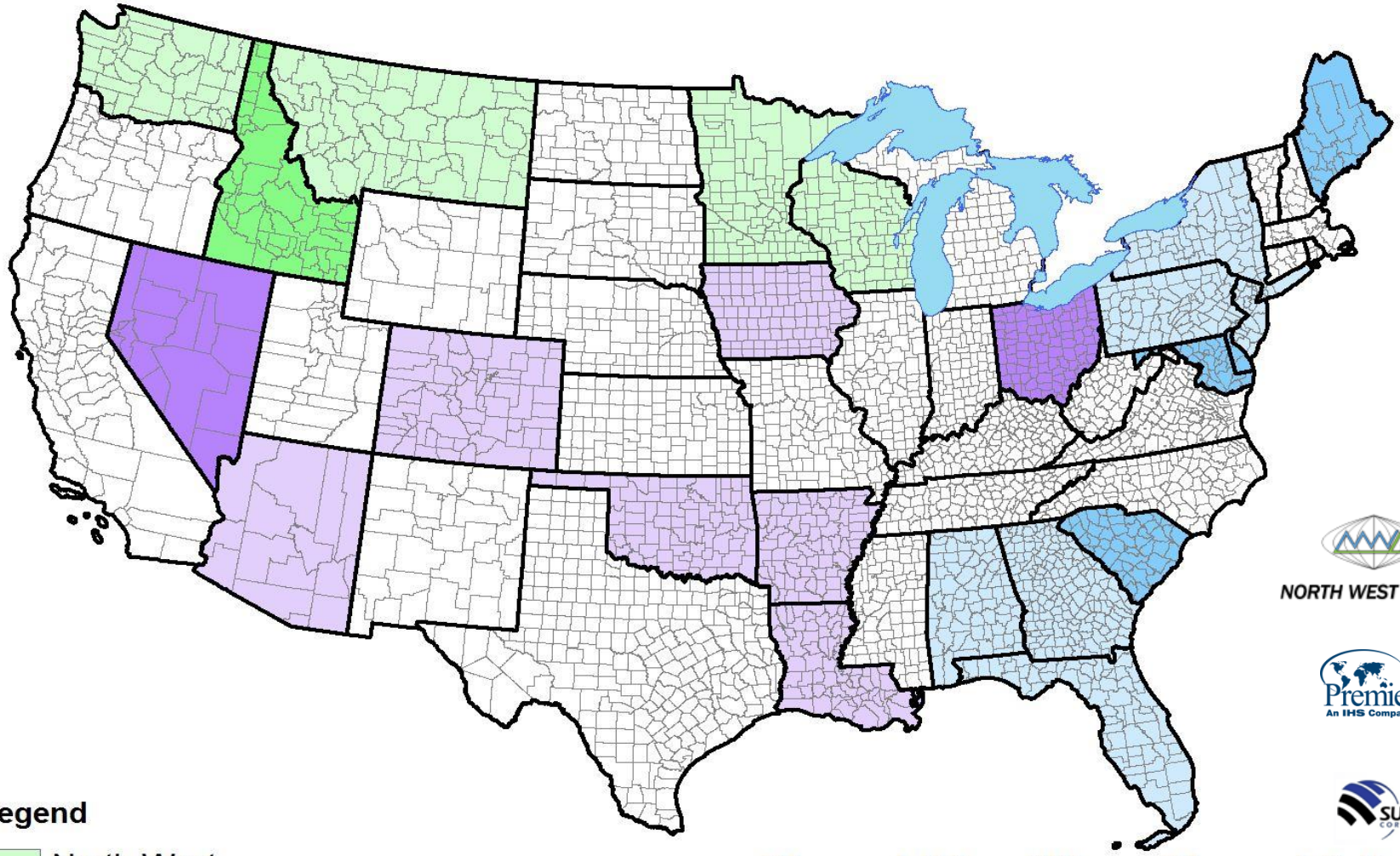
2013

NAIP COVERAGE

US Department of Agriculture
Farm Service Agency
Aerial Photography Field Office
Customer Service Section
2222 West 2300 South
Salt Lake City UT 84119-2020
Tel: 801-844-2922
Fax: 801-956-3653
Email: apfo.sales@slc.usda.gov
Website: http://www.apfo.usda.gov
NAIP Coverage Viewer: http://gis.apfo.usda.gov/gisviewer

USDA-FSA-APFO

2013 National Agriculture Imagery Program



NORTH WEST GROUP

PremierGeo
An IHS Company

SURDEX CORPORATION

Legend

- North West
- Premier Geospatial
- Surdex

Phase I (May 23)
States: 16
DOQQs: 78,972

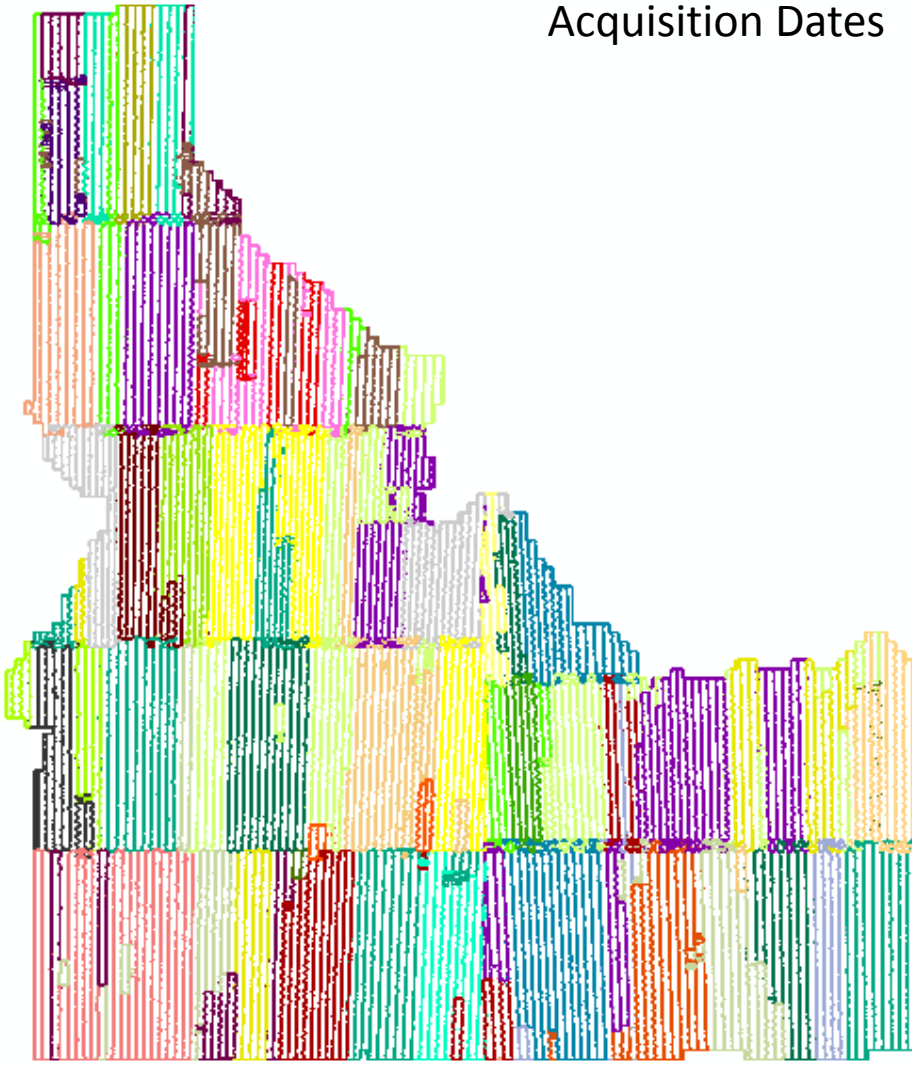
Phase I & II
States: 23
DOQQs: 102,013

Early Access Web Service Pilot

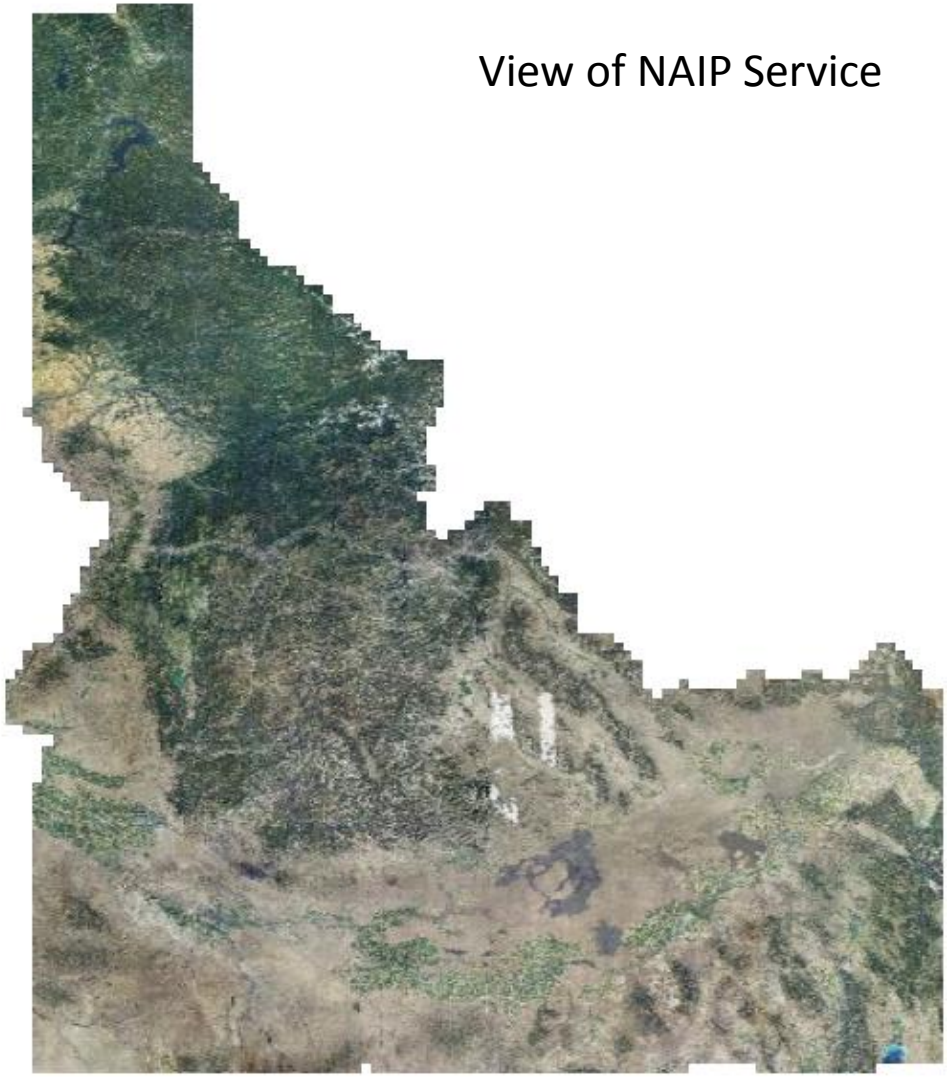
- Horizontal Accuracy
  - 2.9 to 4.1 meters (Service) 2 to 3.4 meters final NAIP product
- APFO Service Delay
  - 28 to 153 days
- Average Acquisition to Upload Delay
  - 3 to 5.3 days.

Idaho ½ Meter With ADS100

Acquisition Dates

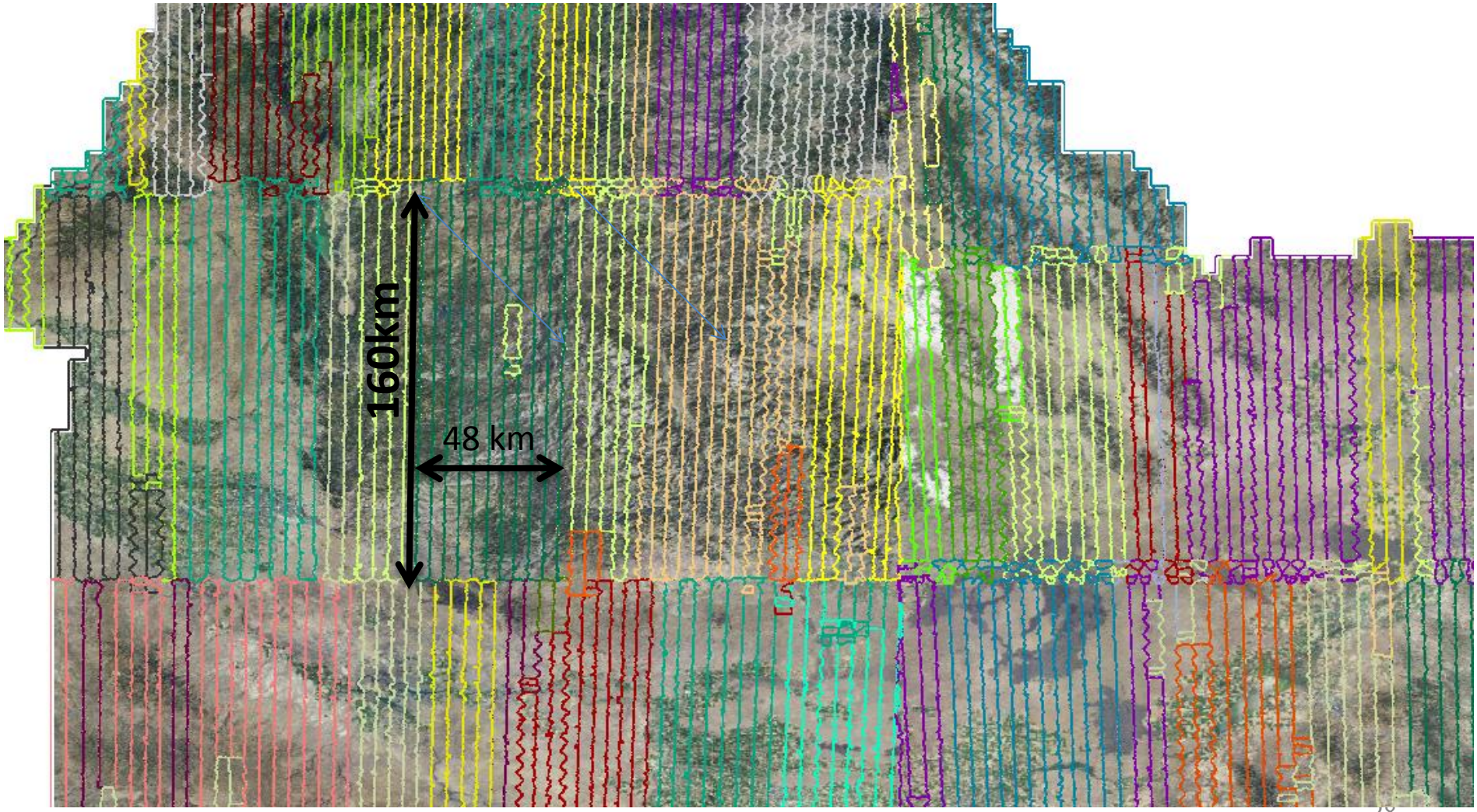


View of NAIP Service

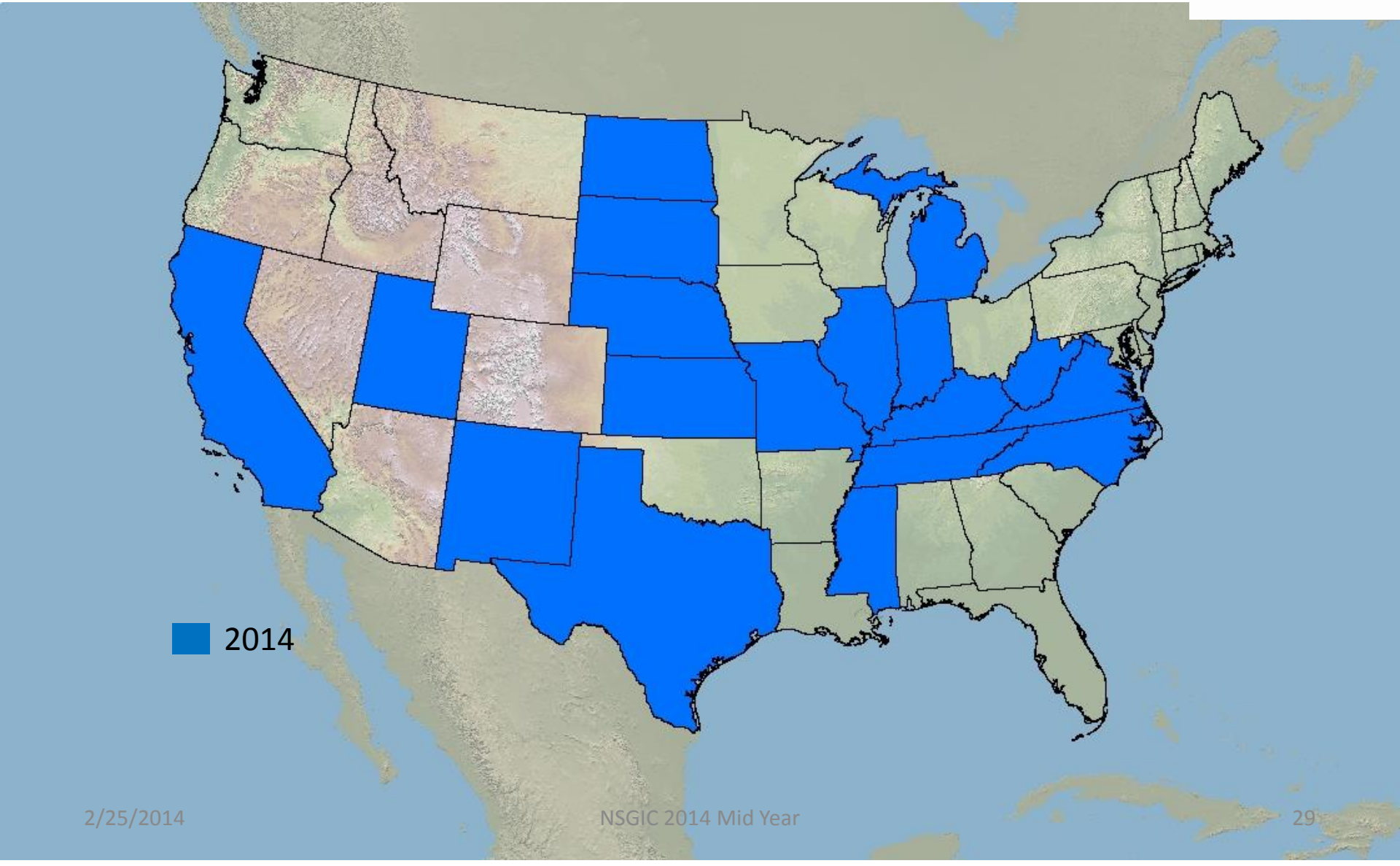


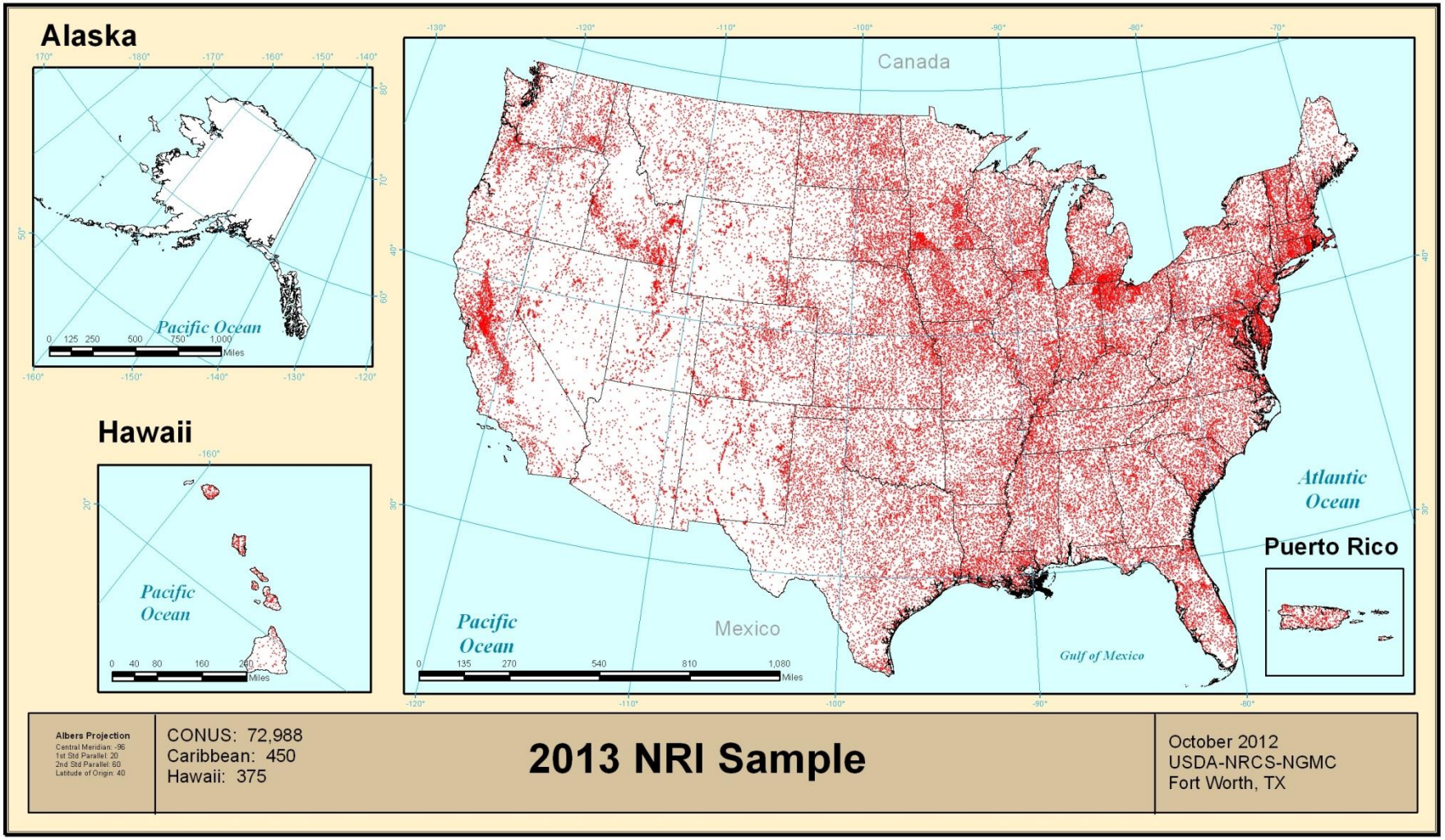
ARCGIS Service http://gis.apfo.usda.gov/arcgis/services

ADS100 Collecting large blocks of .5 meter 4-band imagery (Block: 48km X 160 km)



NAIP
2014 Planned Acquisition

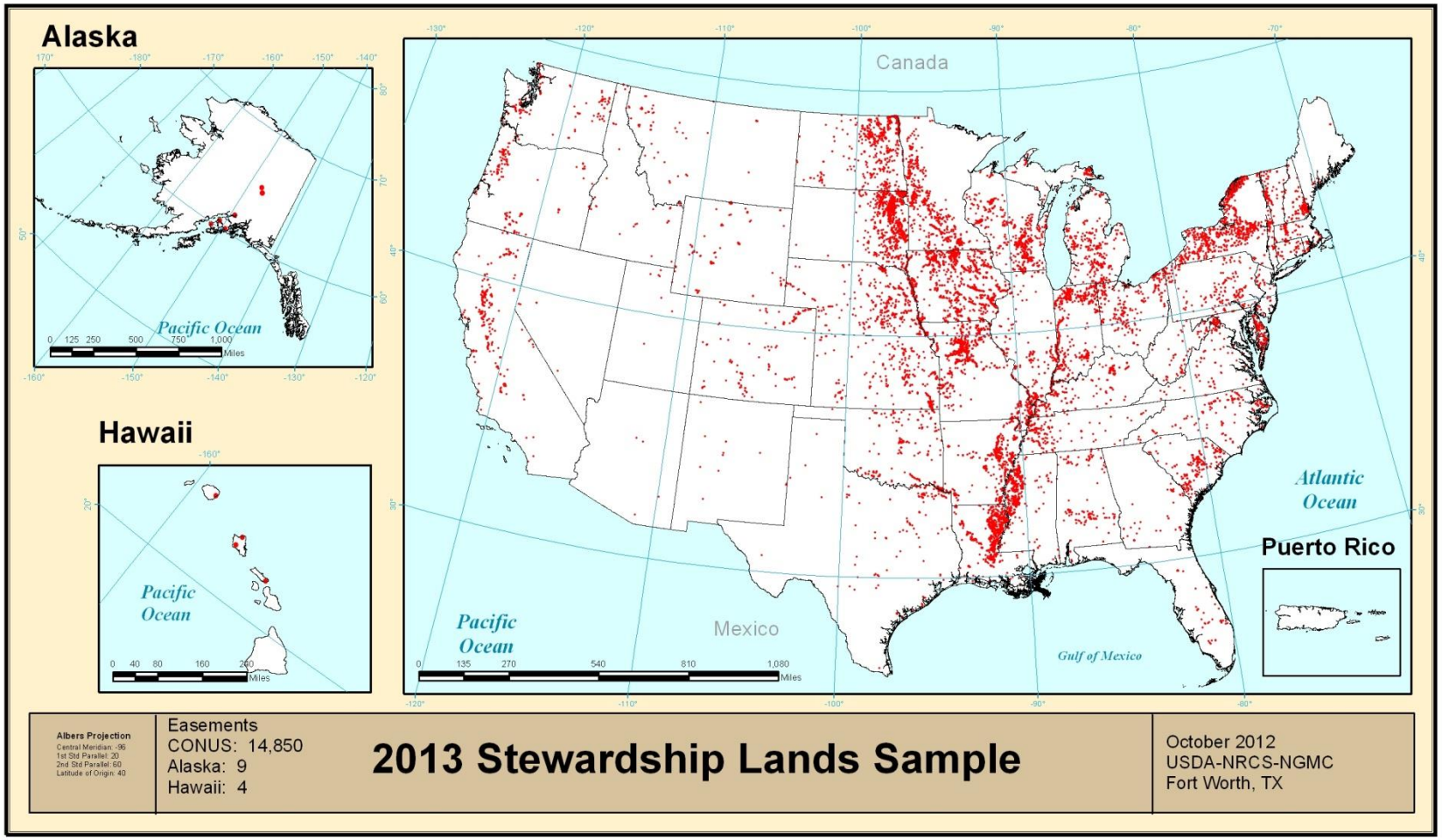



Alaska
Pacific Ocean
0 125 250 500 750 1,000 Miles
Hawaii
Pacific Ocean
0 40 80 160 240 Miles
Canada
Mexico
Pacific Ocean
Atlantic Ocean
Gulf of Mexico
Puerto Rico
0 135 270 540 810 1,080 Miles
Albers Projection
Central Meridian: -96
1st Std Parallel: 20
2nd Std Parallel: 60
Latitude of Origin: 40
CONUS: 72,988
Caribbean: 450
Hawaii: 375
2013 NRI Sample
October 2012
USDA-NRCS-NGMC
Fort Worth, TX

NRCS continues to acquire aerial film for the National Resources Inventory and Stewardship Lands Monitoring

Film is about 60% of the cost of digital for these programs

9” x 9”
GSD ~ 1 foot
NRI Photo


Alaska
Pacific Ocean
0 125 250 500 750 1,000 Miles
Hawaii
Pacific Ocean
0 40 80 160 240 Miles
Canada
Mexico
Pacific Ocean
Atlantic Ocean
Gulf of Mexico
Puerto Rico
0 135 270 540 810 1,080 Miles
Albers Projection
Central Meridian: -96
1st Std Parallel: 20
2nd Std Parallel: 60
Latitude of Origin: 40
Easements
CONUS: 14,850
Alaska: 9
Hawaii: 4
2013 Stewardship Lands Sample
October 2012
USDA-NRCS-NGMC
Fort Worth, TX

Pacific Basin Orthoimagery, Version 2

2011-2014 Acquisition Highlights
Continued Partnership: USDA-NRCS, USDA FS, and NOAA

- **Guam**: High Resolution Aerial/Satellite Orthoimagery (Completed, 2013)

- **Guam:** DG-WV2 (Completed, 09/2013)

- **American Samoa**: DG-WV2 (Completed), High Resolution Orthoimagery (Completed, 2013)

- **Commonwealth of the Mariana Islands**: DG-WV2 (Completed, 2013), New USDA Contract for Rota

- **Palau** : DG-WV2 Tasking, under USDA Contract

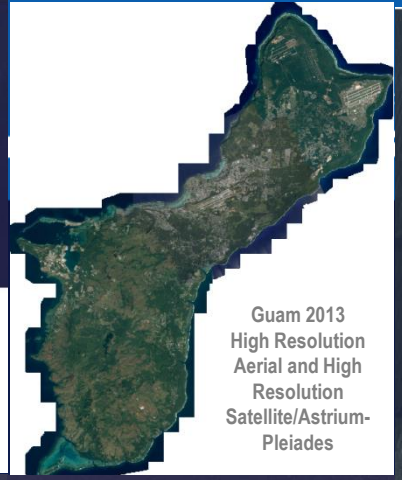
- **Marshall Islands**: DG-WV2 (Completed, 2013)

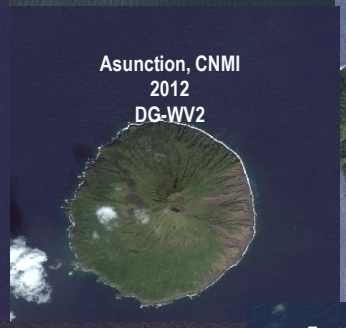
- **Federated States of Micronesia**: DG-WV2 Tasking, Main islands under USDA Contract

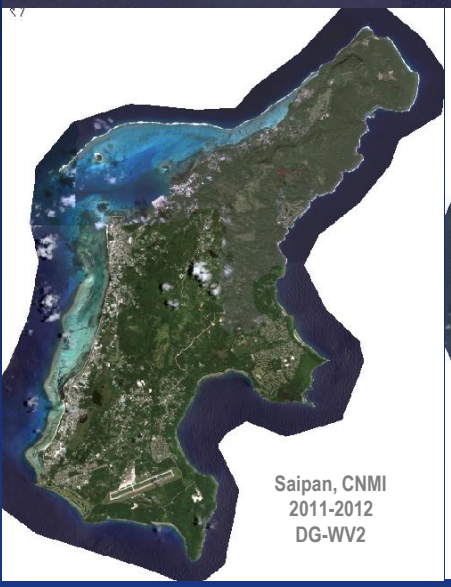
- **Outlying Territories (Wake, Palmyra etc..)** : DG-WV2 (Completed, 2013)

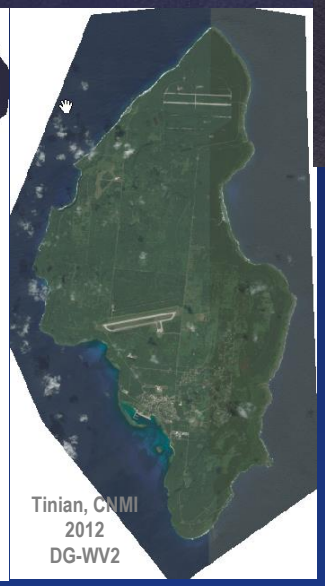
NOAA Collected the following (DG-WV2, 8 Band)

- **North West Hawaiian Islands**: Midway, French Frigate Shoals, Gardner Pinnacles, Kure Atoll, Laysan Island, Lisianski Island, Maro Reef and Pearl and Hermes Atoll



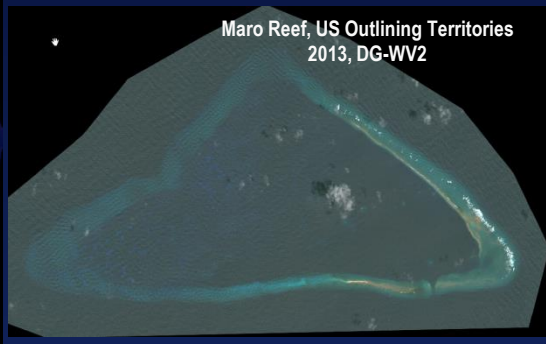


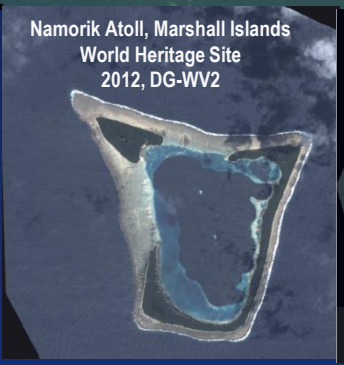




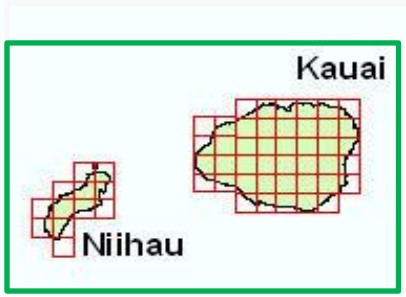
Pacific Basin Orthoimagery
USDA-NRCS-NGCE
Guam and CNMI
March, 2014

USDA-NRCS has submitted speculative tasking requests for over 100 areas in the US Pacific Basin



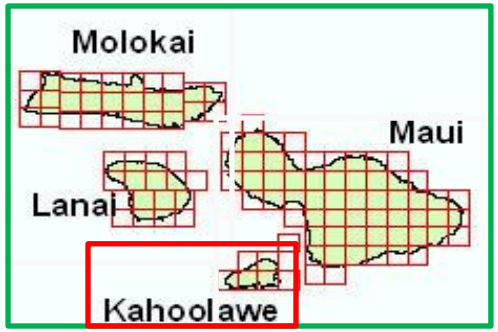


Hawaiian Islands
Status of DG-WV2
March, 2014

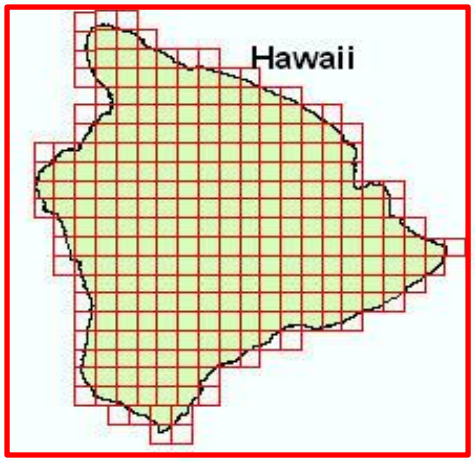


Version 2, Disc 1

Version 2, Disc 2



Hawaiian Islands



- Version 2 of Orthoimagery for Hawaii is complete
- Data distribution is via two portable discs, 3 TB each disc
- Hawaii Island and Kahoolawe were updated and released as "Version 2, Release 2".

United States Department of Agriculture
Natural Resources Conservation Service

Hawaii Island Orthoimagery Mosaics

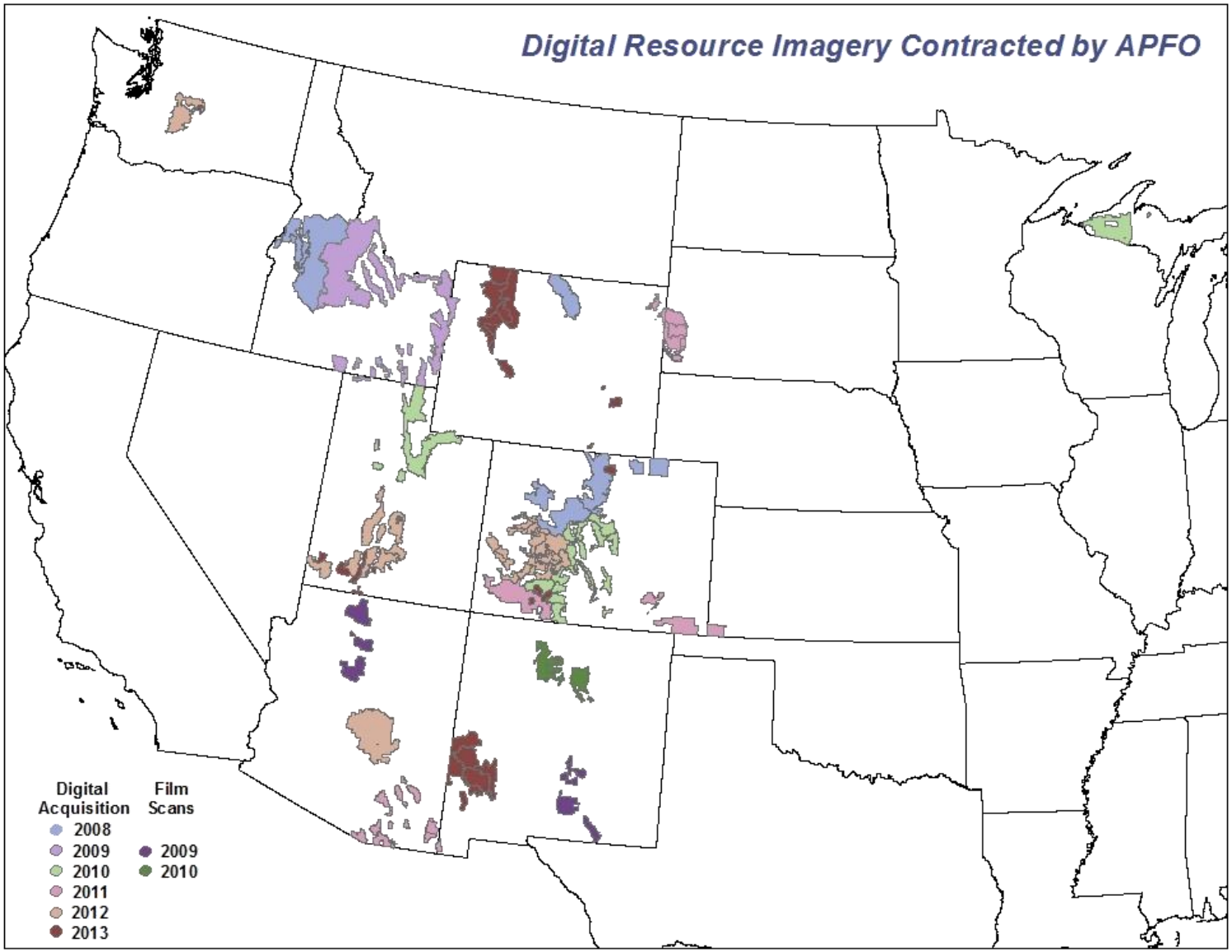
Release 1 (March, 2013)

Release 2 (July, 2013)

Forest Service Resource Photography

- Digital imagery allows meet multiple requirements to be satisfied with the same acquisition.
- **High Spatial Resolution**
  - **(25cm to 50cm)**
- Ortho image base updates as a contract option
- 4-band, 16-bit imagery exploitation
- **Stereo**
- Cover Extent of Forest Service Land or Extent of Fire Event
- Autocorrelated DEM as option (new)
- Start of 2nd generation.

Digital Resource Imagery



Approximately 119,000 Square Miles & 225 TB of Data 50cm or better

Forest Service Direct Readout - VIIRS Active Fire Product

Brad Quayle

USDA Forest Service
Remote Sensing Applications Center

USDA Forest Service, Remote Sensing Applications Center,
FSWeb: http://fsweb.rsac.fs.fed.us
WWW: http://www.fs.fed.us/eng/rsac

RSAC X-Band Direct Readout Ground Station

Location:

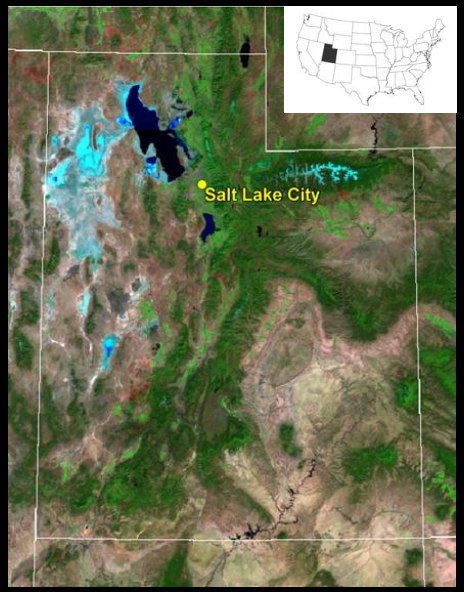
- Salt Lake City, Utah;

History:

- MODIS direct broadcast data collection since 2002
- VIIRS direct broadcast data collection since 2012

Antenna:

- 2.4 meter X-band antenna; 3-axis SeaTel Model 9497A-7
- Radome enclosure



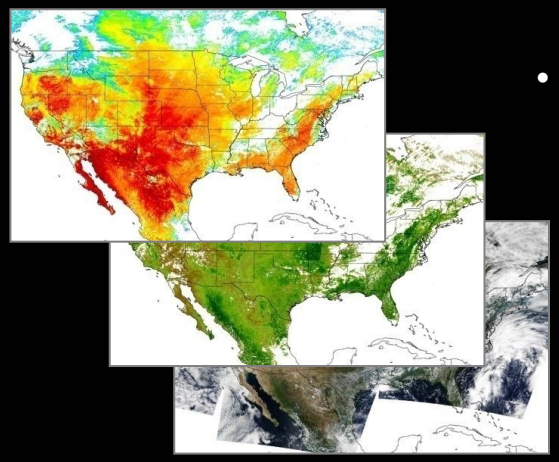
RSAC X-band antenna in radome

MODIS/VIIRS Imagery to Information In Near Real-Time

MODIS/VIIRS Direct Readout Imagery

Similar orbits of AQUA and VIIRS results in conflicts

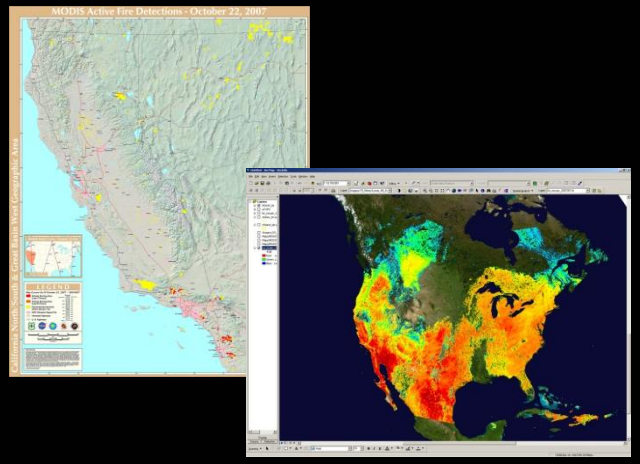
VIIRS fire products are being refined.



Higher Level MODIS/VIIRS Science Data Products

Autonomous Processing & Delivery System

- Imagery reception/pre-processing
- Generation of derivative science datasets
- Generation of value-added geospatial products
- Product updates and delivery via public-facing website portal

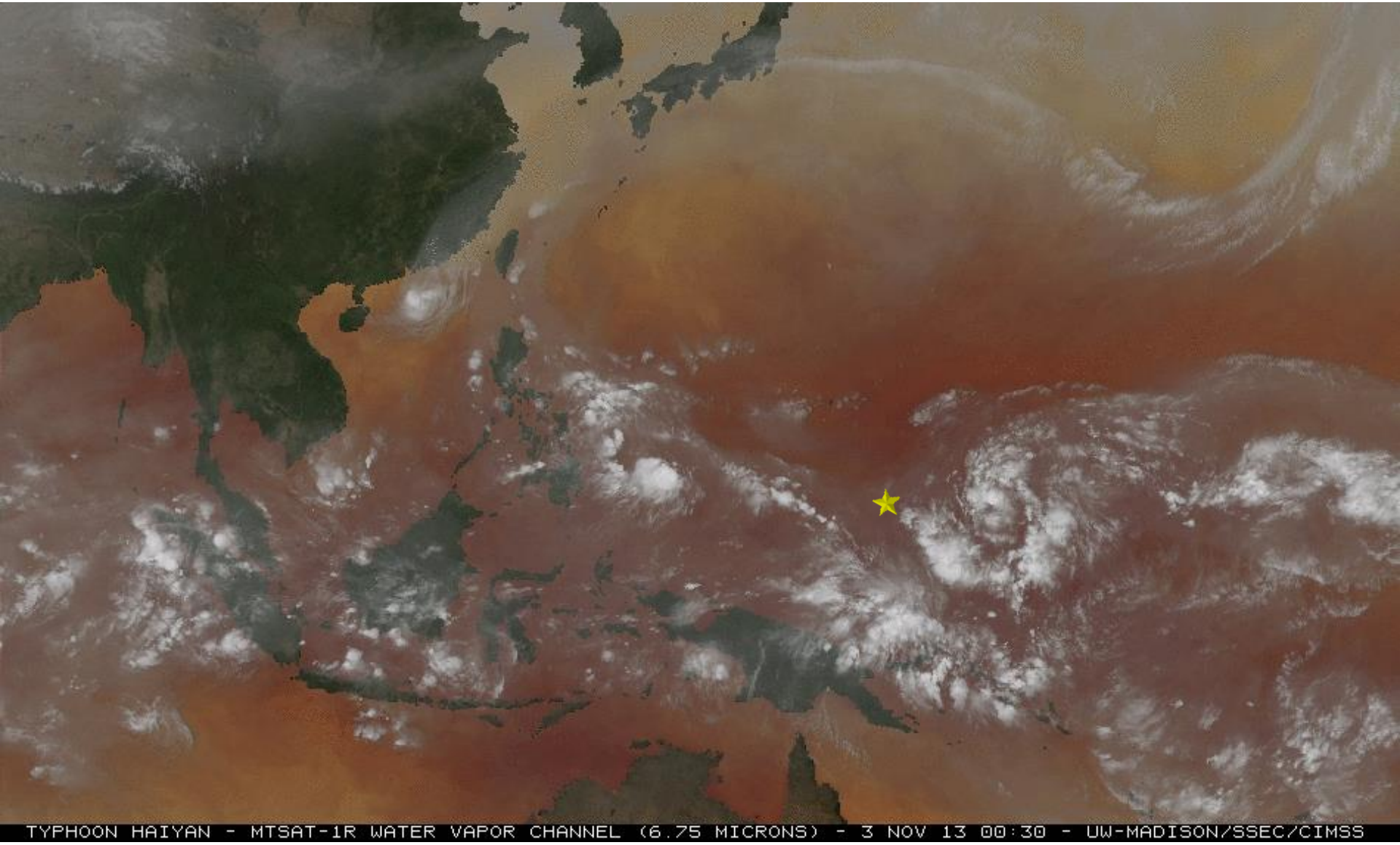


Value-added Mapping/Visualization, Data & Analysis Products

When MODIS Terra is decommissioned, the temporal resolution for fire detection will be greatly reduced.

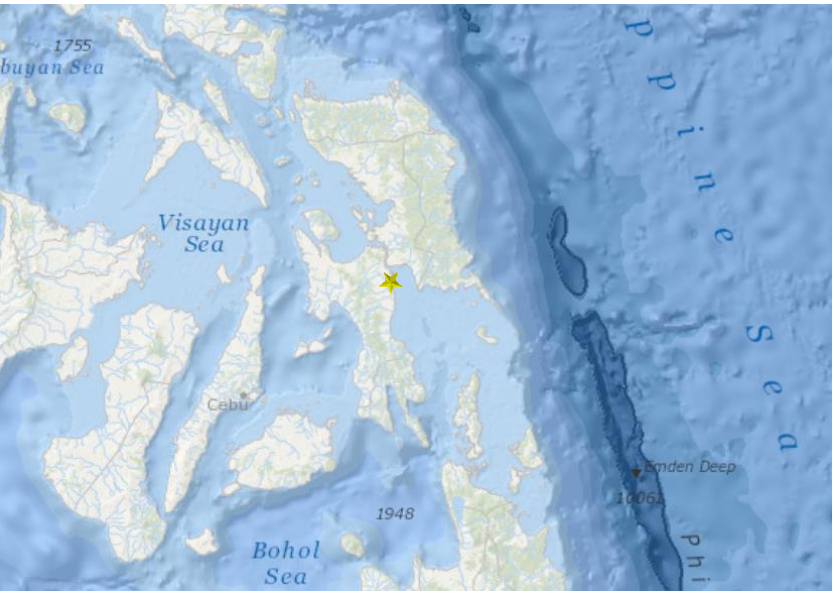
Super Typhoon Haiyan Loop

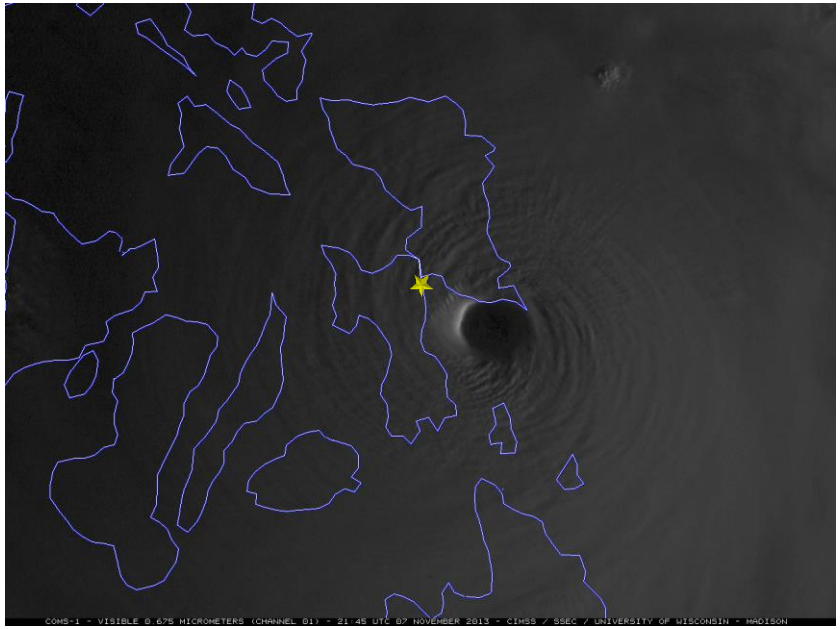
Multi-functional Transport Satellite (MTSAT) of Japan Meteorological Agency (JMA)



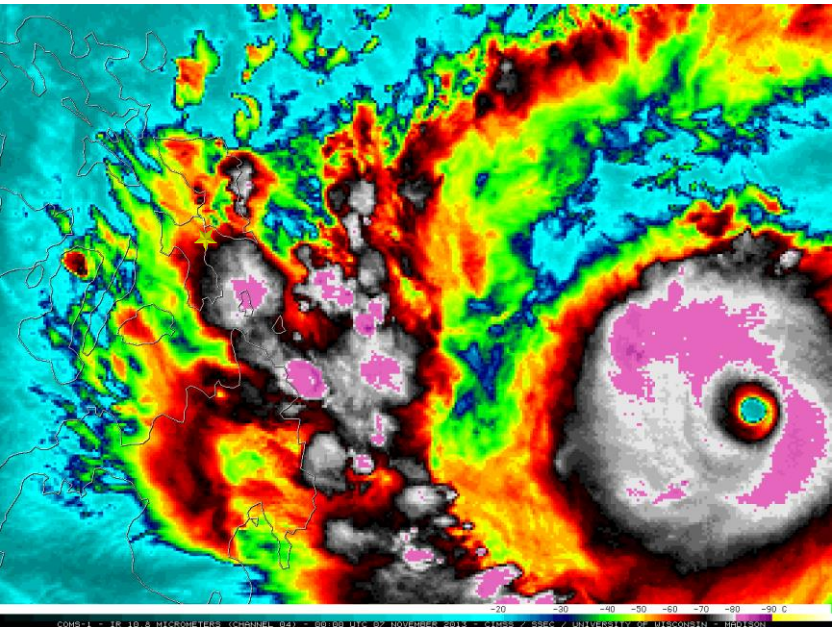
GIF Credit: CIMSS, Rick Kohrs http://tropic.ssec.wisc.edu/storm_archive/2013/storms/31W/31W.html

Eye landfall near Tacloban





COMS-1 0.675 µm visible channel image
http://cimss.ssec.wisc.edu/goes/blog/wp-content/uploads/2013/11/131107_coms1_vis_haiyan_landfall_anim.gif



- Ten-minute sustained winds to 230 km/h (145 mph)
- 13-19 foot storm surge
- November 2, 2013 – November 11, 2013
- Landfall: November 8, 2014
- Category 5 Super Typhoon

Animated Gifs from Cooperative Institute for Meteorological Satellite Studies
http://cimss.ssec.wisc.edu/

COMS-1 10.8 µm IR channel images
http://cimss.ssec.wisc.edu/goes/blog/archives/14311

Typhoon Yolanda/Haiyan in the Philippines Numbers At A Glance

- **16 million** People Affected
- **6,201** Deaths
- **4.1 million** People Displaced
- **1.1 million** Houses Damaged or Destroyed

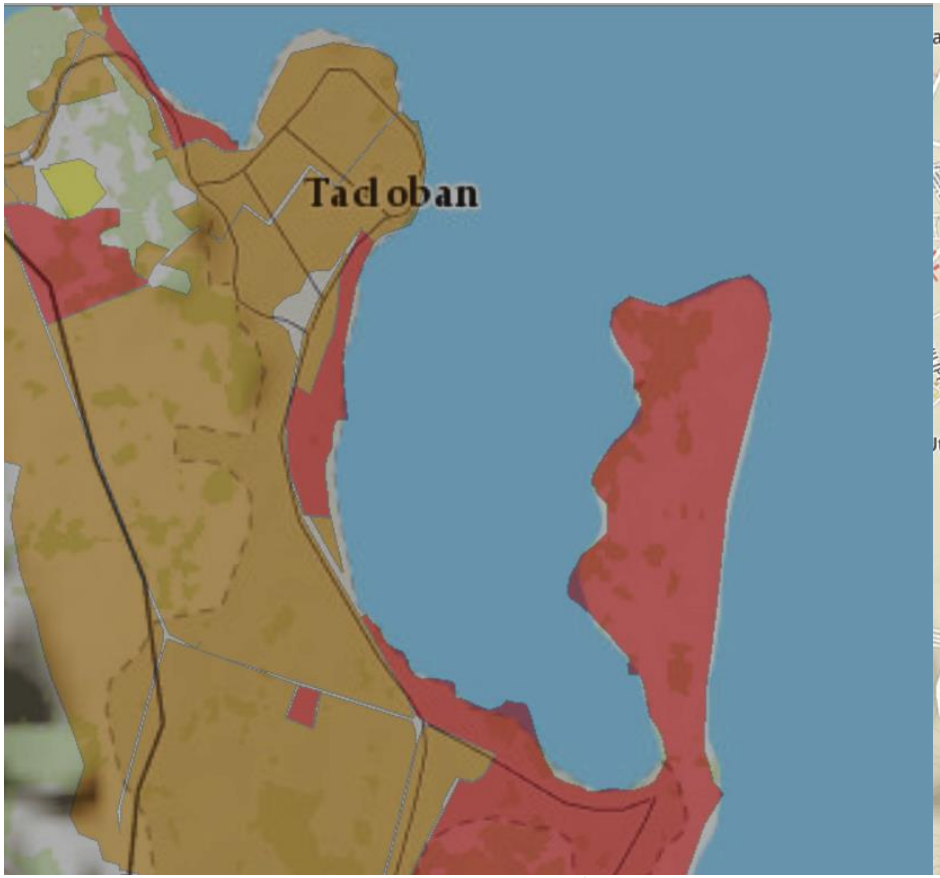
(Source: USAID)
http://www.usaid.gov/haiyan/fy14/fs21

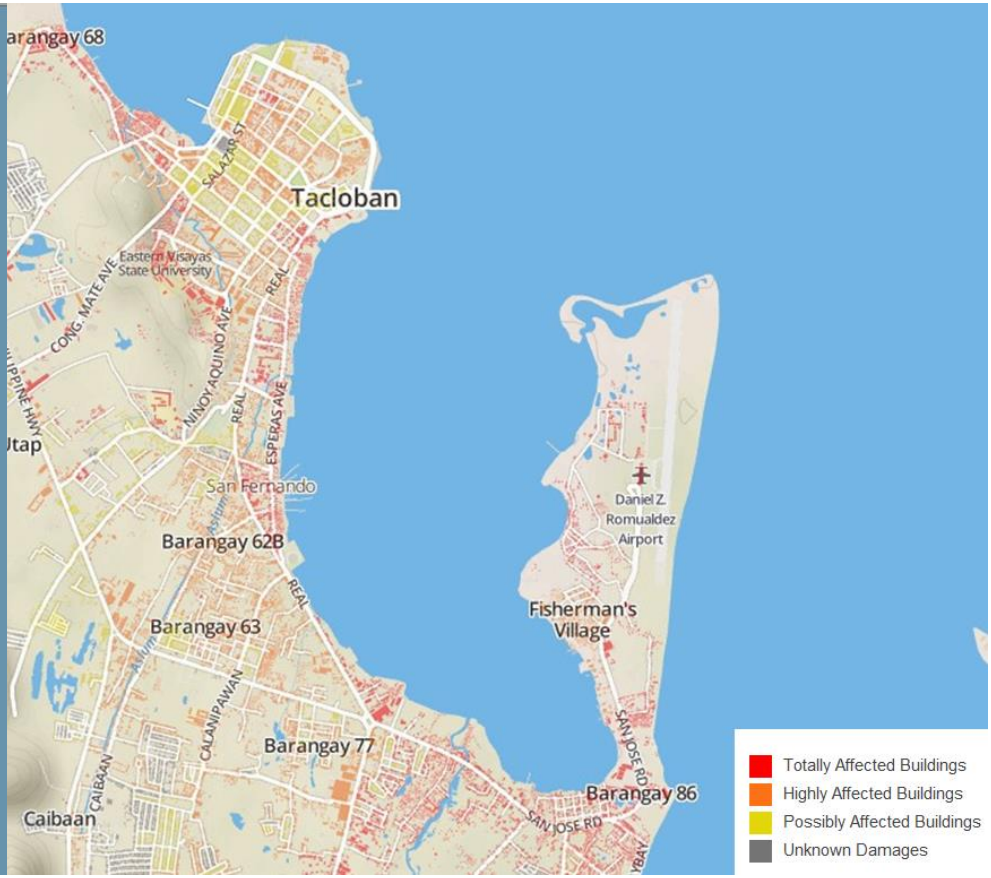
- **27,665** Injured
- **1,785** Missing

(Source: Official Gazette of the Philippines **)**
http://www.gov.ph/crisis-response/updates-typhoon-yolanda/

Photo Credits: http://harryosborne.blogspot.com/2013/11/day-of-planning-in-cebu.html

Early Estimates Refined to House Level

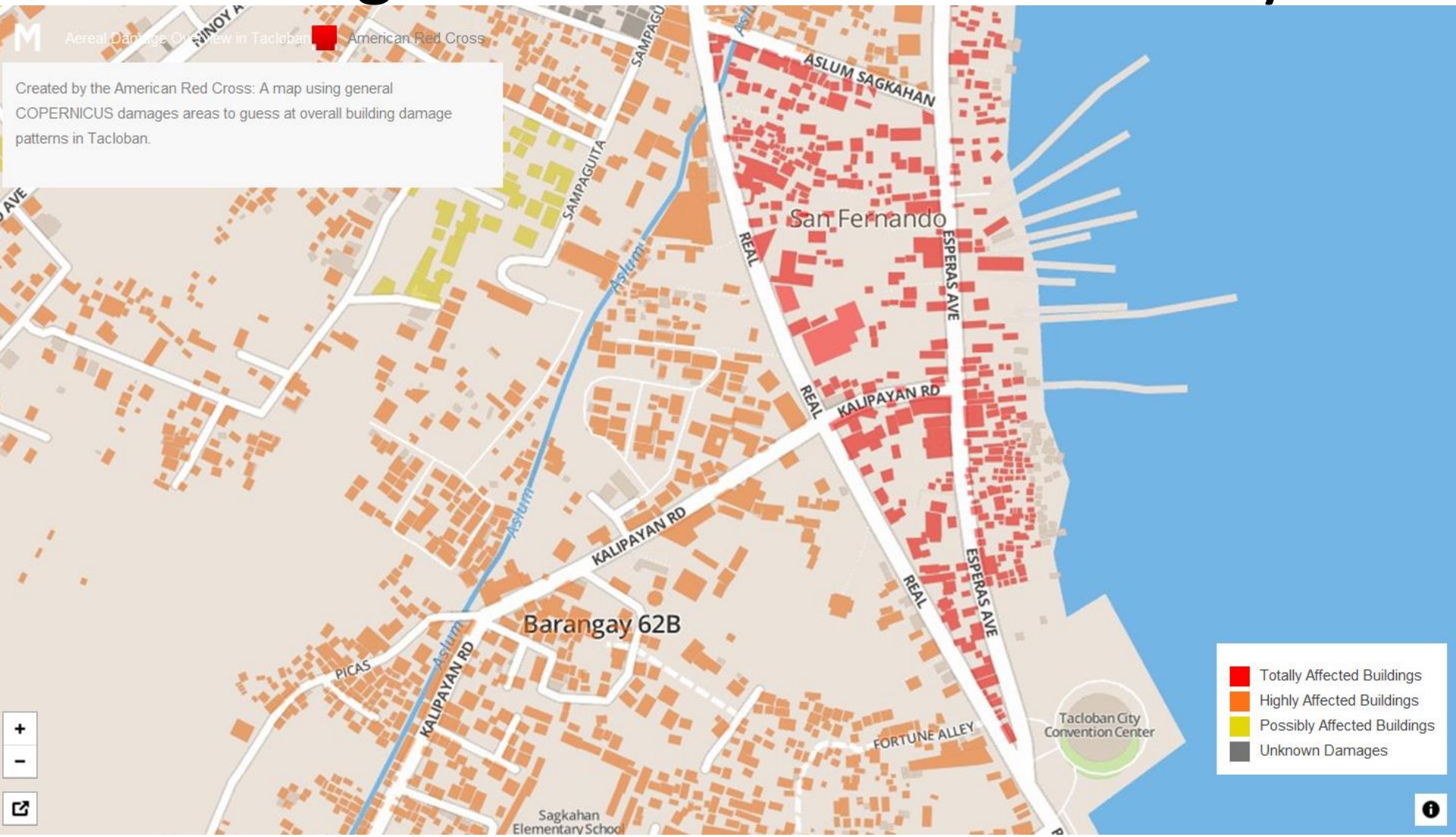




Damage_25NOV13_e1500_Haiyan_Full_Extent

- CATASTROPHIC
- EXTENSIVE
- MODERATE
- LIMITED

American Red Cross
Damage Assessment Tacloban City



http://a.tiles.mapbox.com/v3/americanredcross.map-ms6tihx6/page.html#17/11.22429/125.00181

Typhoon Haiyan (Yolanda) - Philippines

Satellite Imagery to Support Response and Recovery
Available from HDDS

Landsat 8 (37 images)
Landsat 7 (22 images)
ASTER (57 images)
NASA ISS (183) images

WorldView 2 (1044 tiles)
WorldView 1 (419 tiles)
Quickbird (51 tiles)
GeoEye-1 (39 tiles)

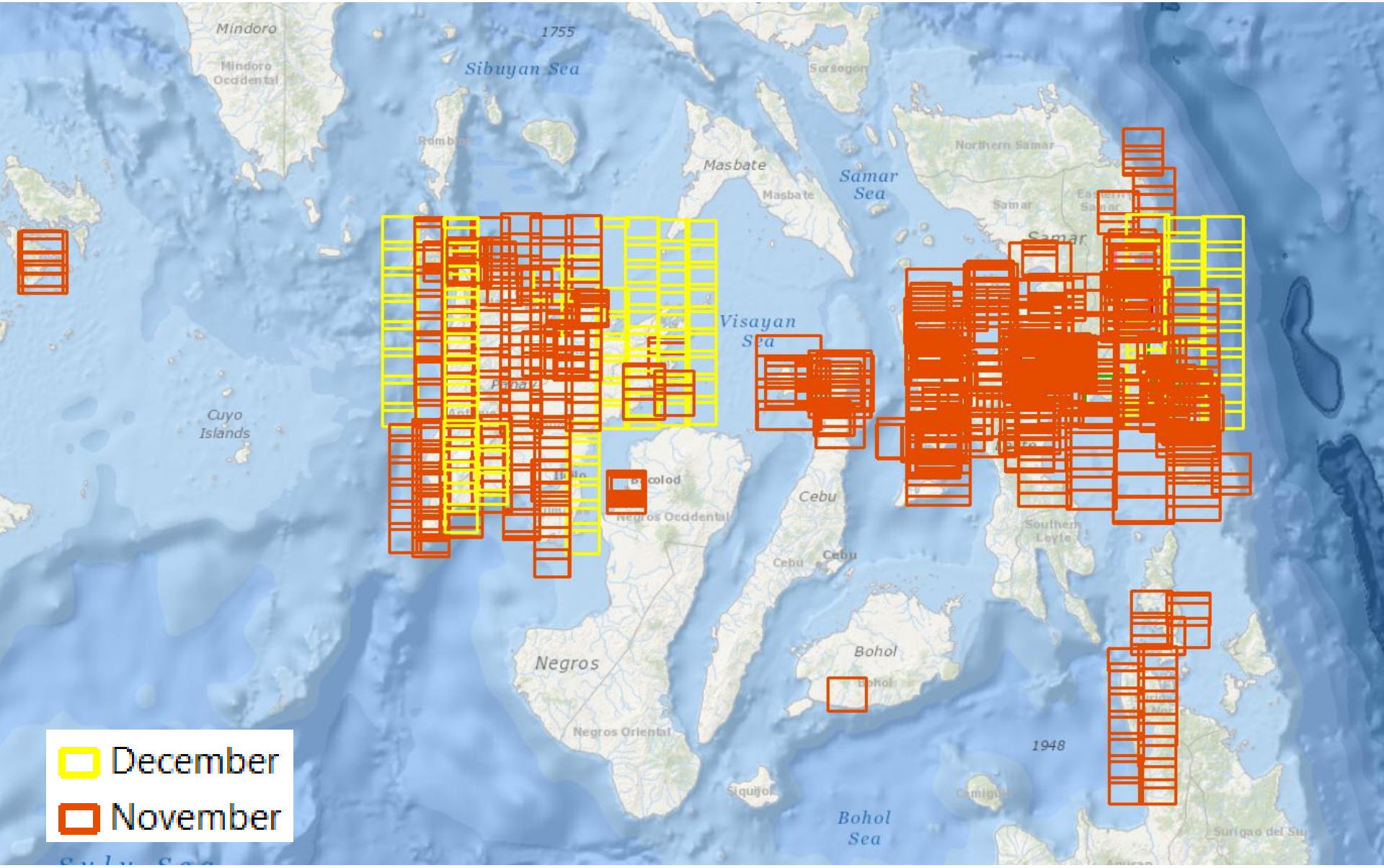
TerraSAR-X (5 images)

COSMO-SkyMed (7 images)

Funded by NGA

http://hdds.usgs.gov/EO/

Post Landfall Worldview Imagery Loaded to HDDS



For a period of thirty days, Digital Globe imagery was provided for free download in HDDS and as OGC services hosted by Digital Globe.

Questions?
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