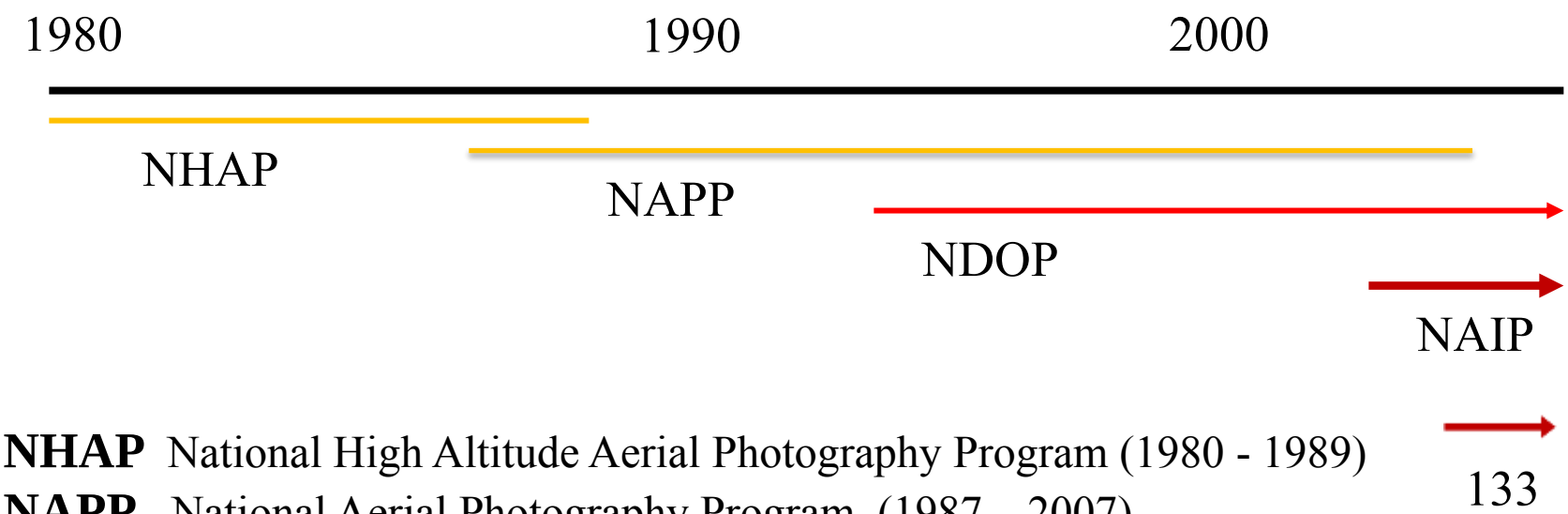
The National Agriculture Imagery Program (NAIP): Historical Context, Current Status, and What's New

Glenn R. Bethel
glenn.bethel@usda.gov

USDA Remote Sensing Advisor
June 11, 2014

National Imagery Programs

Multi-Departmental Coordination for Image Acquisition



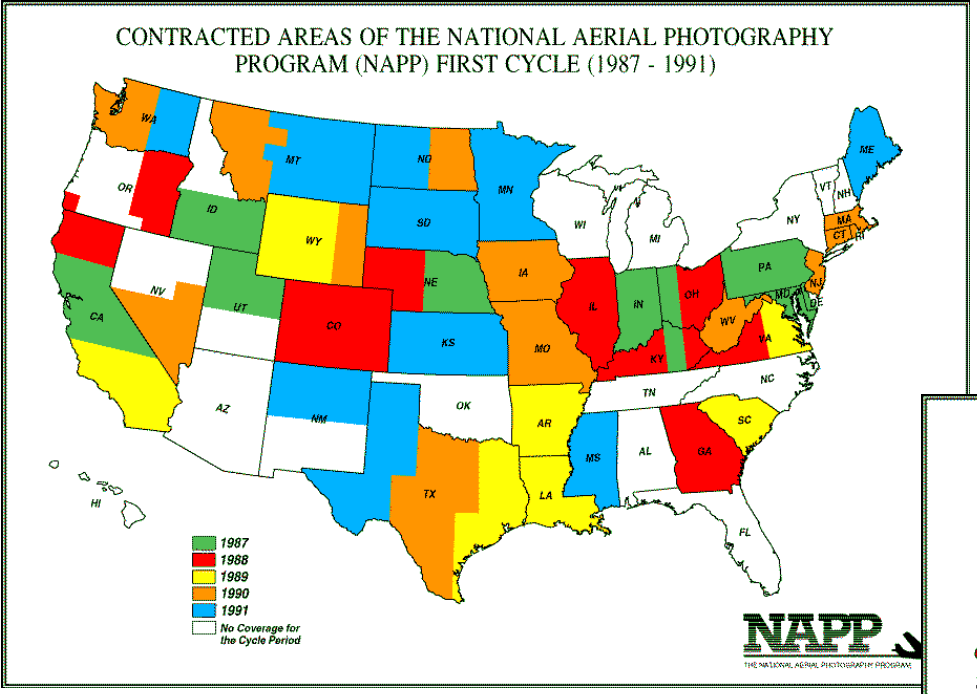
NHAP National High Altitude Aerial Photography Program (1980 - 1989)
NAPP National Aerial Photography Program (1987 – 2007)
NDOP National Digital Ortho-Photography Program
NAIP National Agriculture Imagery Program (2003 – ongoing)
133 133 Urban Areas

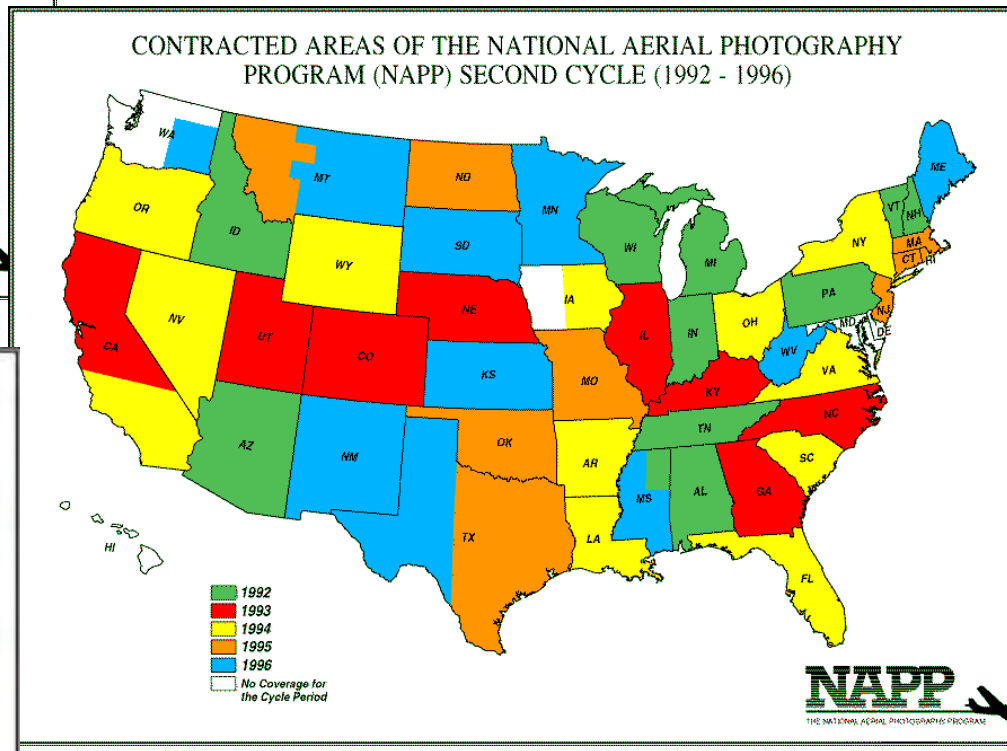
USDA acquired over 13 million aerial photograph items from 1932 – 1980

5 Million USDA items archived at NARA

3 NAPP Cycles

2-5 year and 7 year plan





Original Negatives:

- Eastern US Archived At APFO
- Western US Archived at EROS

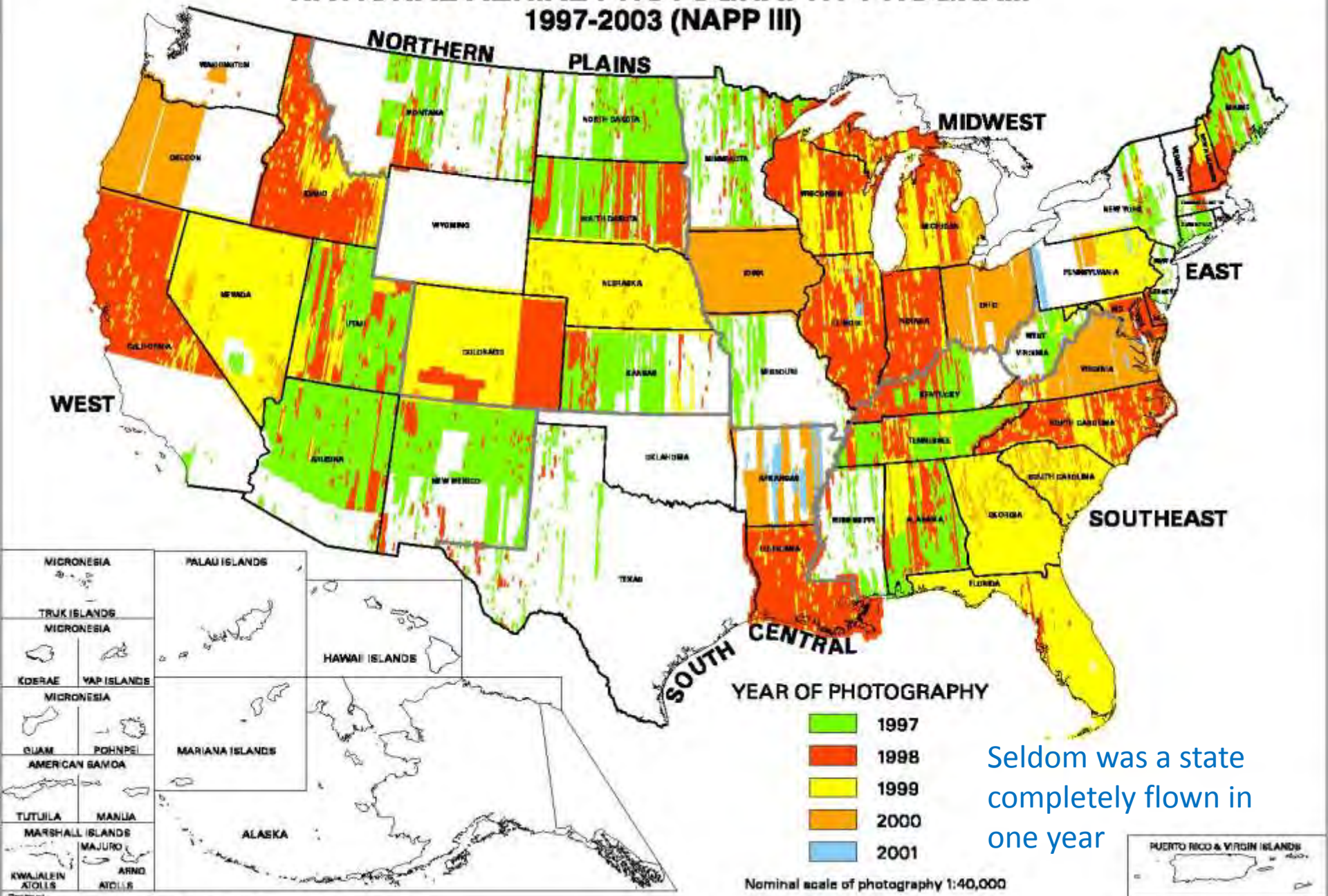
NATIONAL AERIAL PHOTOGRAPHY PROGRAM (NAPP)
SEVEN-YEAR ACQUISITION PLAN

Revised May, 1999

NAPP funding levels resulted in 7 year plan (~8 states per year)
NAIP is almost on a 2 year cycle.

NAPP
THE NATIONAL AERIAL PHOTOGRAPHY PROGRAM

NATIONAL AERIAL PHOTOGRAPHY PROGRAM
1997-2003 (NAPP III)



Seldom was a state completely flown in one year

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.

Revised July 25, 2001 1008389

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

NAPP Program Characteristics

- Funding Model – "The Golden Rule"
  - Federal agencies submit priorities by state
  - Fed agencies and states propose funding levels
  - States ranked by priorities and funding levels
  - States above funding line are contracted
  - Un-funded states are reconsidered the next year

- Annual Funding Range - $1.6 to $2.5 Million

- NAPP contracting 1987 to 2002 - $47,407,450
  (Includes state contracts and Innovative Partnership)

- Current Average Cost - $8.68 per square mile

- Federal funding has been flat between 1994 and 2002, or at a lower level (e.g. $1,523,000 in FY 2002)

USGS

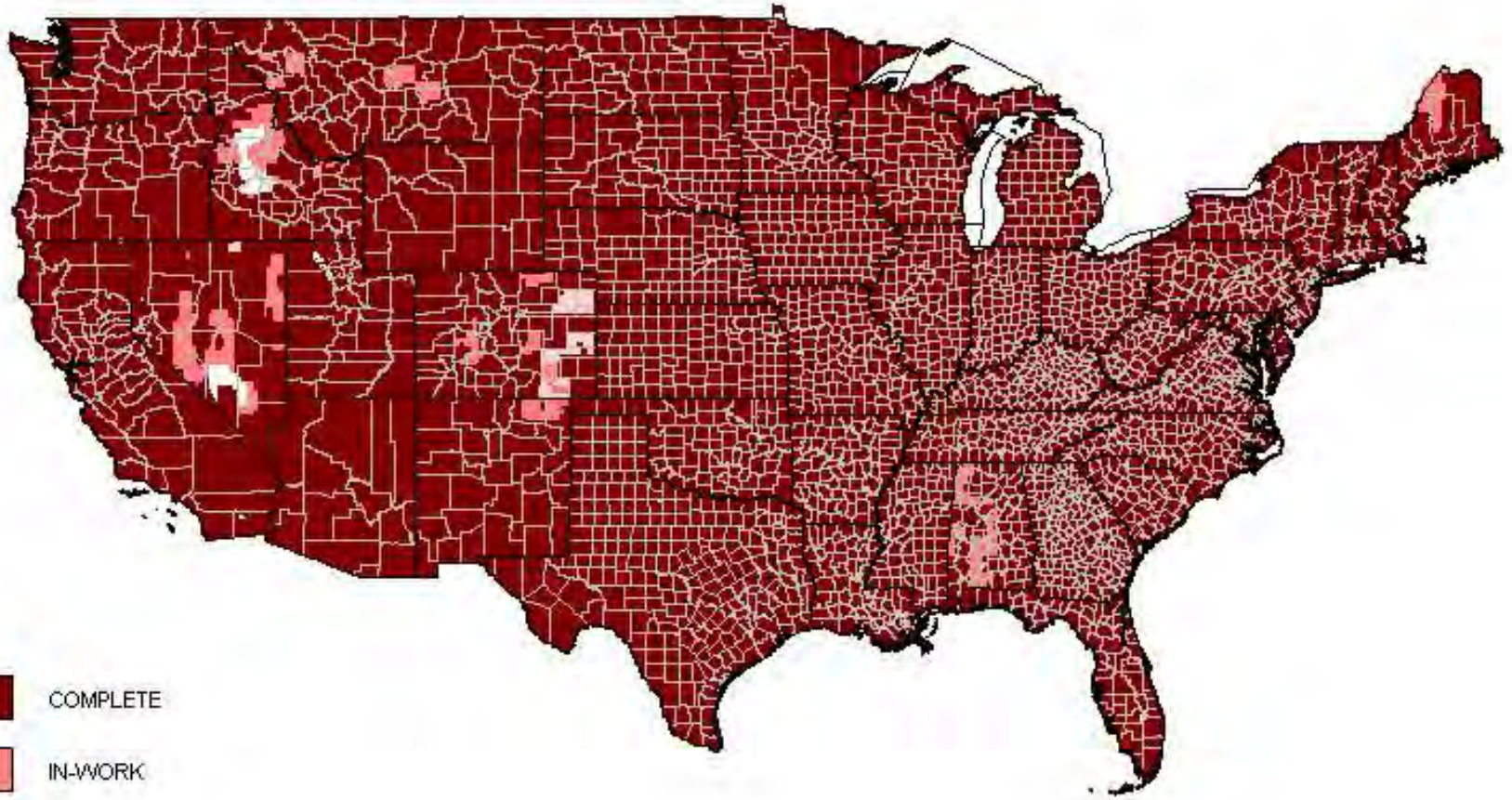
Source of information: PowerPoint by Jay Storey/USGS 11/13/2002

NATIONAL DIGITAL ORTHOPHOTO PROGRAM

Status of Digital Orthophotoquad Production

First Generation Coverage

As of September 3, 2002



COMPLETE

IN-WORK

PLANNED

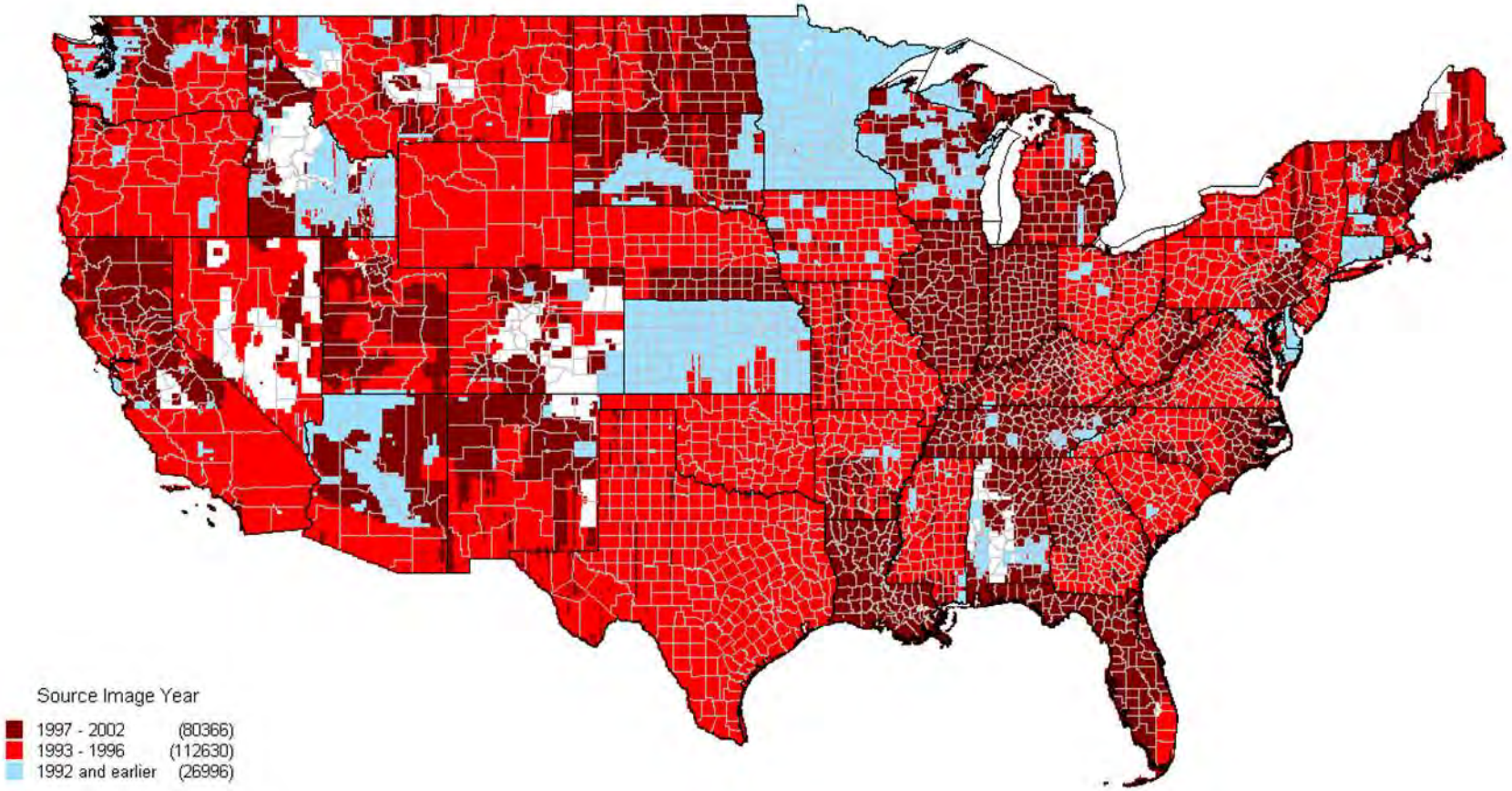
USDA Contributed $65 Million (60% of Contacted DOQ Costs)
+ FS in-kind contributions
USDA stops funding NAPP based DOQs in 2003

Source: Assignment Management System

Prepared by: U.S. Geological Survey
National Mapping Discipline
Cooperative Topographic Mapping
03-September-2002

NATIONAL DIGITAL ORTHOPHOTO PROGRAM

Source Year for Available Digital Orthophotoquads



Most DOQs created from old NAPP imagery (~1990 – 1996)
DOQs not edge matched
USDA Billed per DOQQ $1,020

Prepared by: U.S. Geological Survey
National Mapping Discipline
Cooperative Topographic Mapping
19-April-2002

FSA/NRCS Create Seamless County Mosaics (MDOQ) From DOQQs

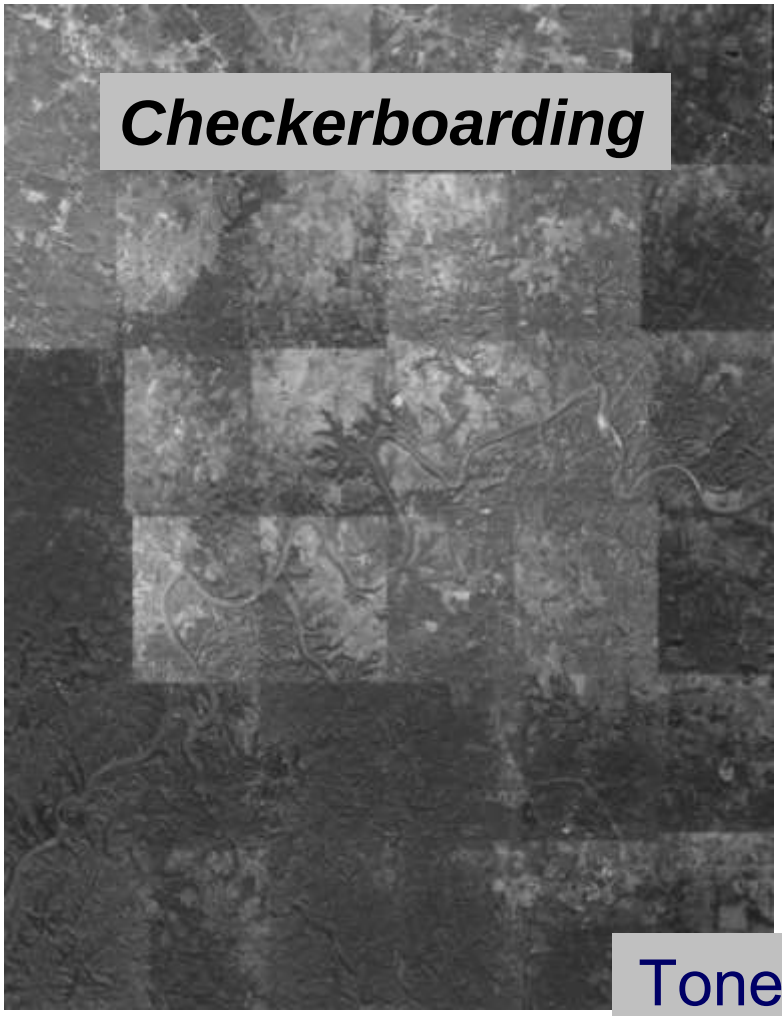
USDA needed a usable base image to digitize Farm Field Boundaries, Soils and Wetlands. Often the initial DOQs did not edge match.

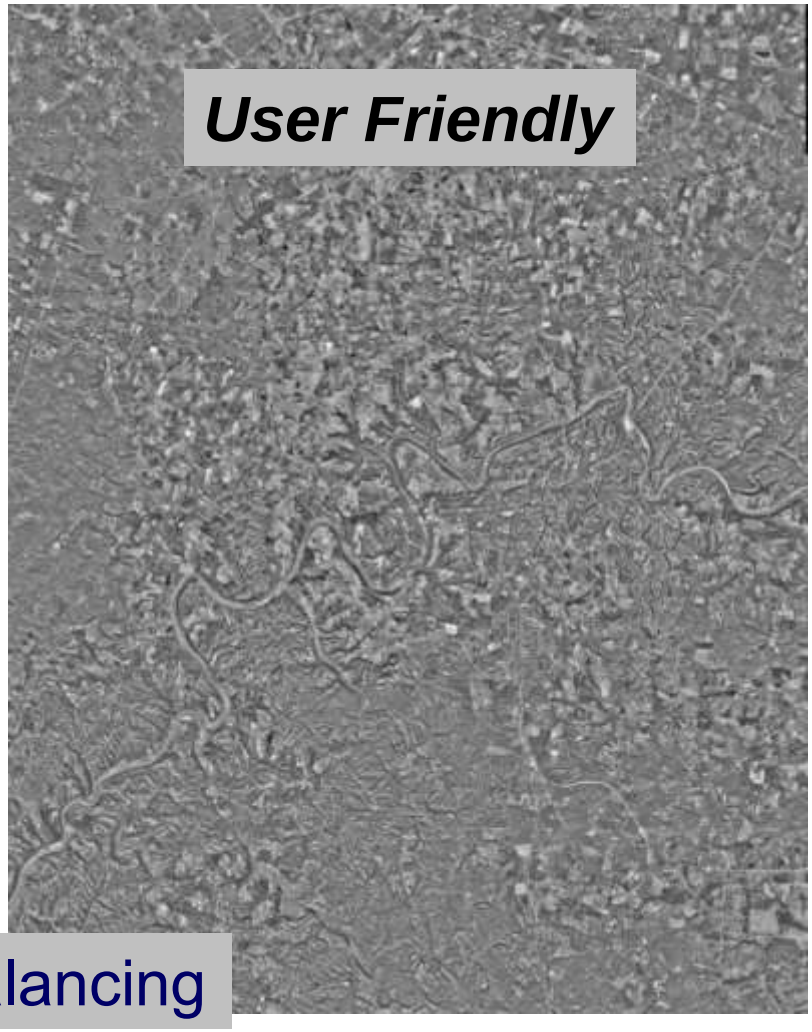
Differences in source photography and other factors, are minimized by the Mosaicking process. The mosaic cut line is placed in areas where differences are minimal, insuring ***CLU*** *(aka Farm Field) boundaries edge-match throughout a county coverage*.

This was Not a Perfect Solution*:*

- Manual Seam lines, could not fix source of errors.
- Reduced data complexity, one file was delivered per county rather than hundreds of DOQQs.

FSA INTEGRATION - MDOQ PRODUCTION

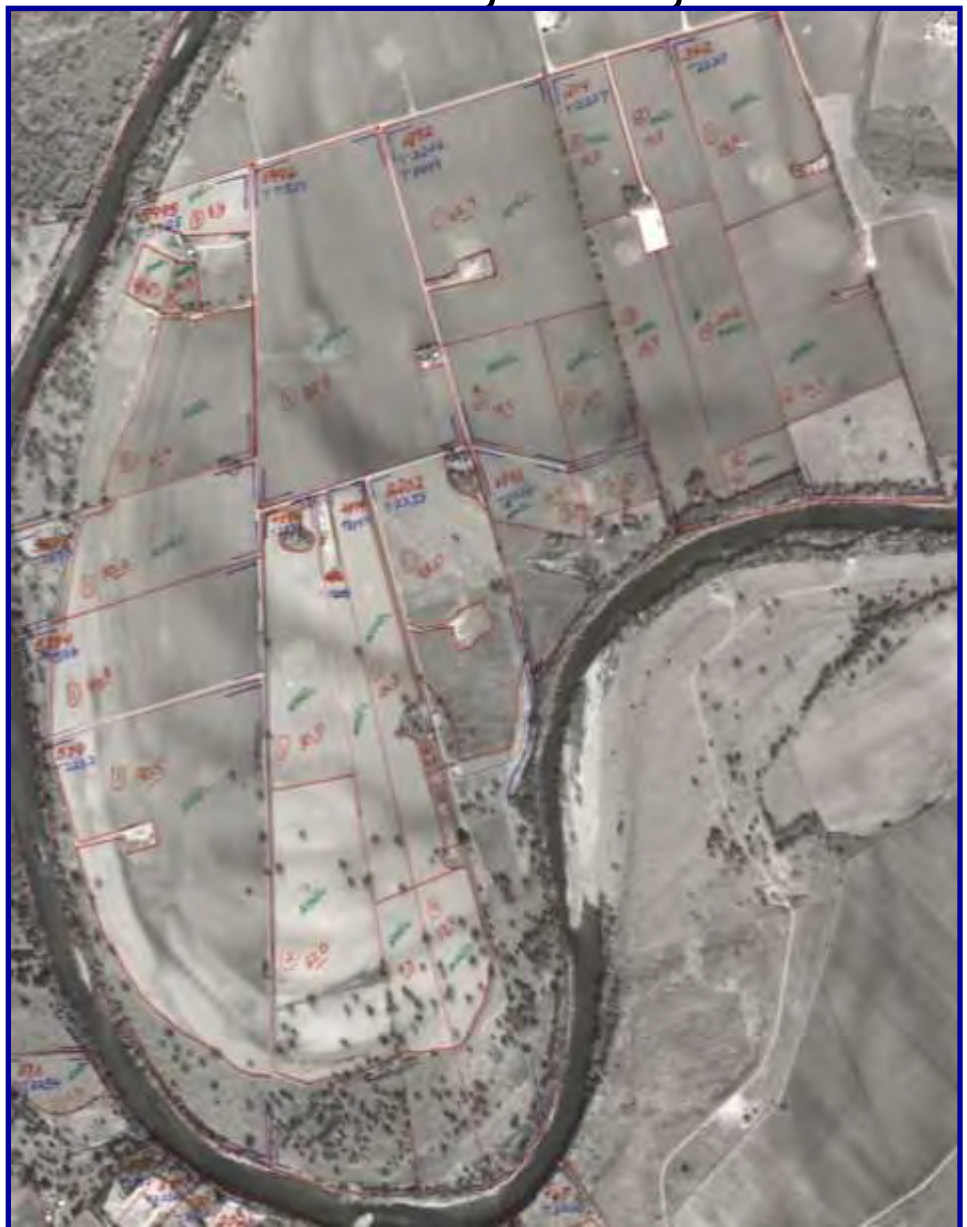




Tone Balancing

All DOQs were Processed from 1997 to 2005 to create county base imagery

FSA Converts from hardcopy to 56,000,000 CLU Shapefiles



FSA Map Layers for Renville County, MN

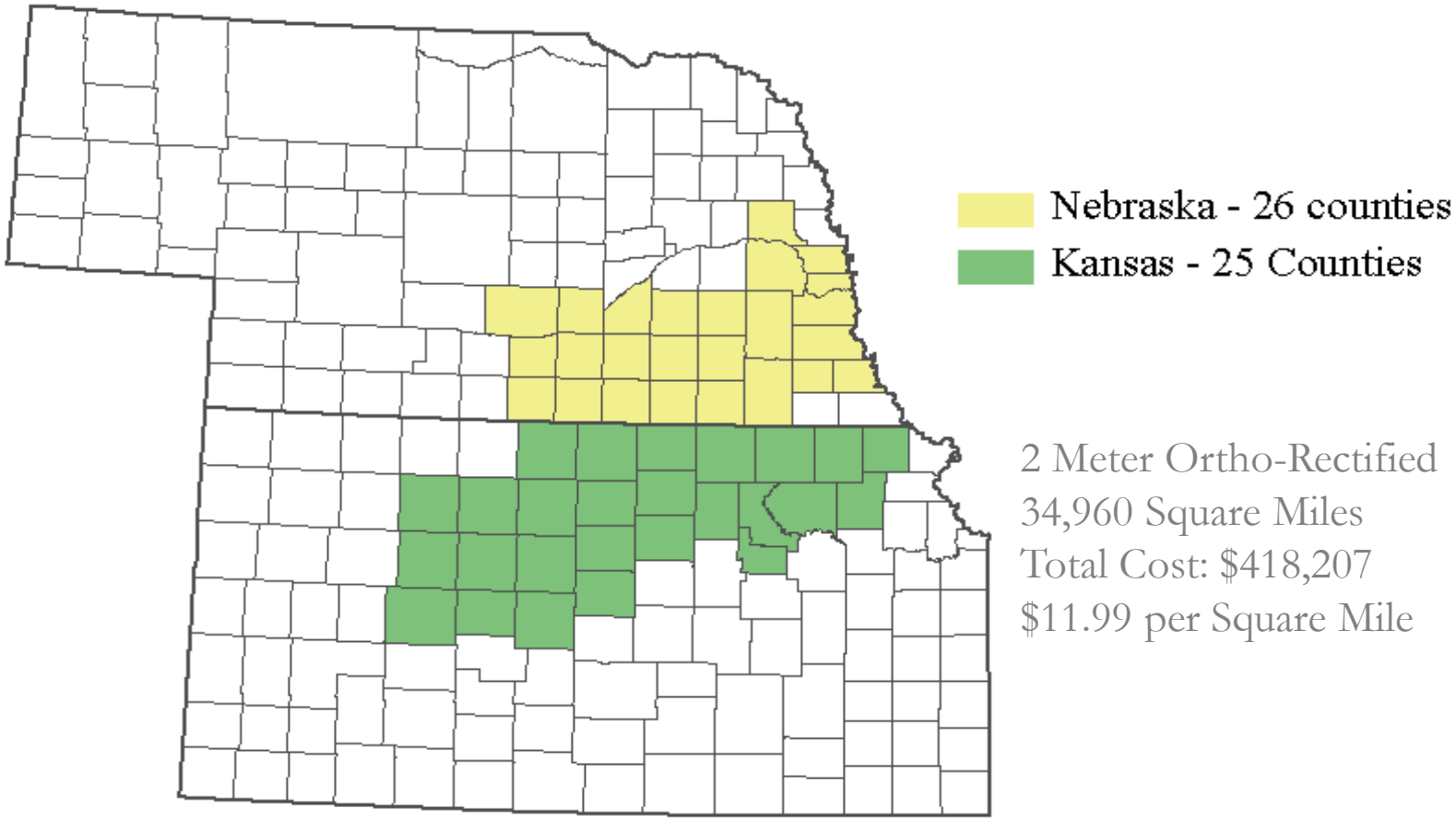
Glenn Bethel (202)720-1280
glenn_bethel@wdc.usda.gov
FSA/DAM/TSD/SDB/RSS
11/14/01

National Agriculture Imagery Program (NAIP) More, Better, Faster, and Cheaper

Industry Responds to Program Goals

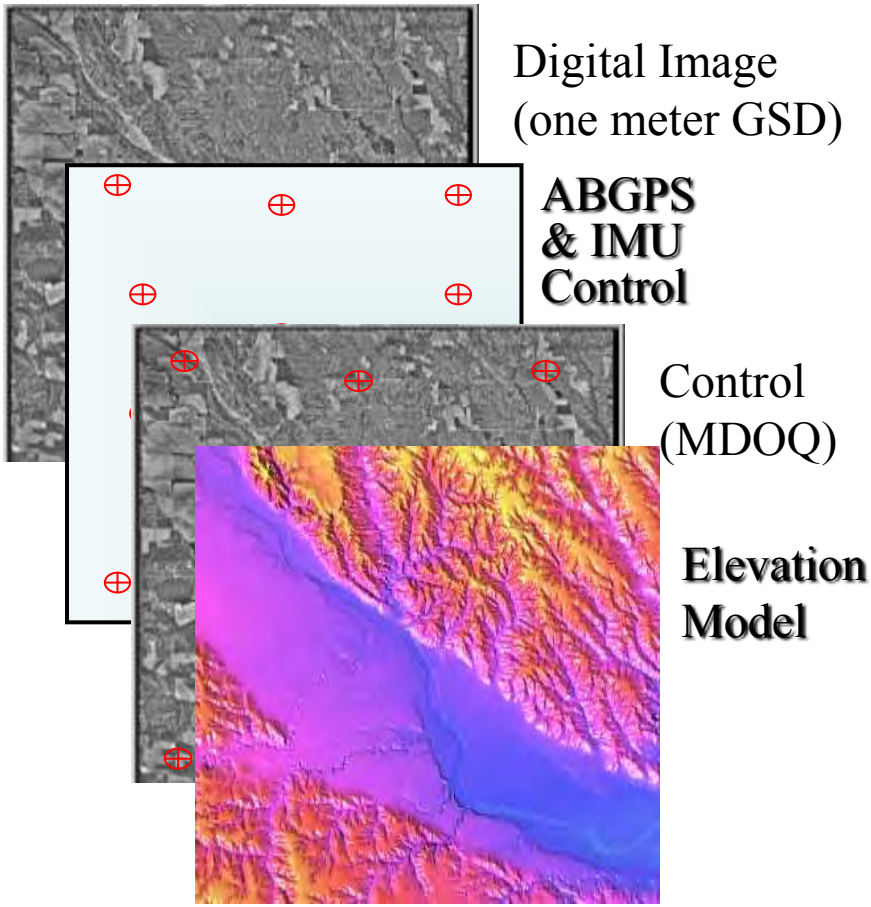
APFO Contracting Officers work to build Win-Win relationship with Contractors: Payment Schedule, Product Warrantees and Deliverables

2001 NAIP Beta Contract



2002 NAIP Products and Cost

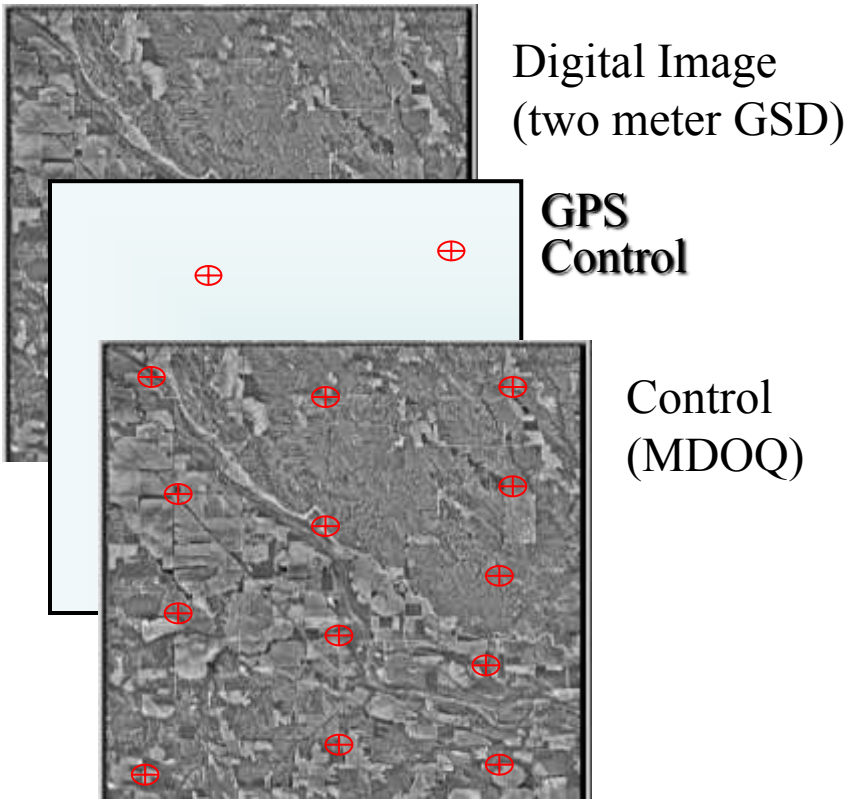
1m Ortho-Rectified



$18.99 / Square Mile

USGS NDOP: $45 / Square Mile

2m Geo-Rectified

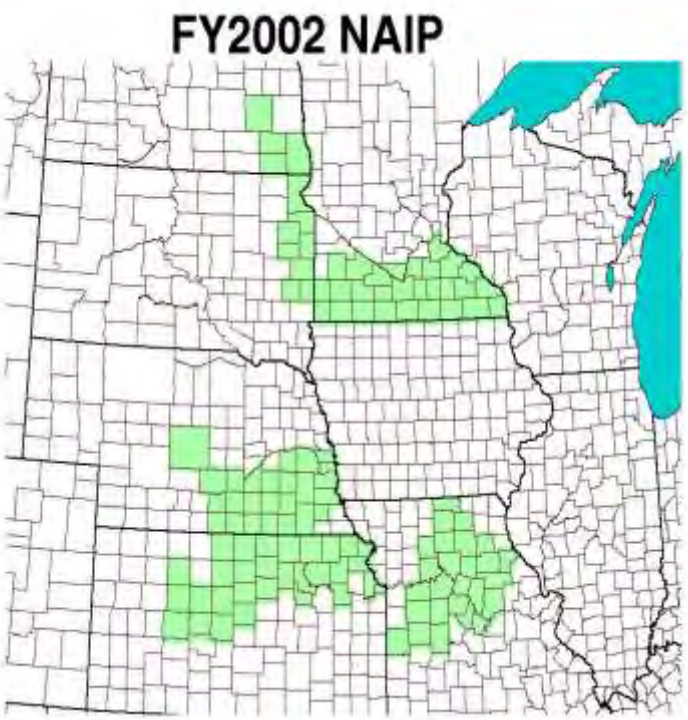


$6.94 / Square Mile

Original Plan was to use MDOQ to Control NAIP… $8.68 Cost of NAPP

2002 FSA NAIP Contracts

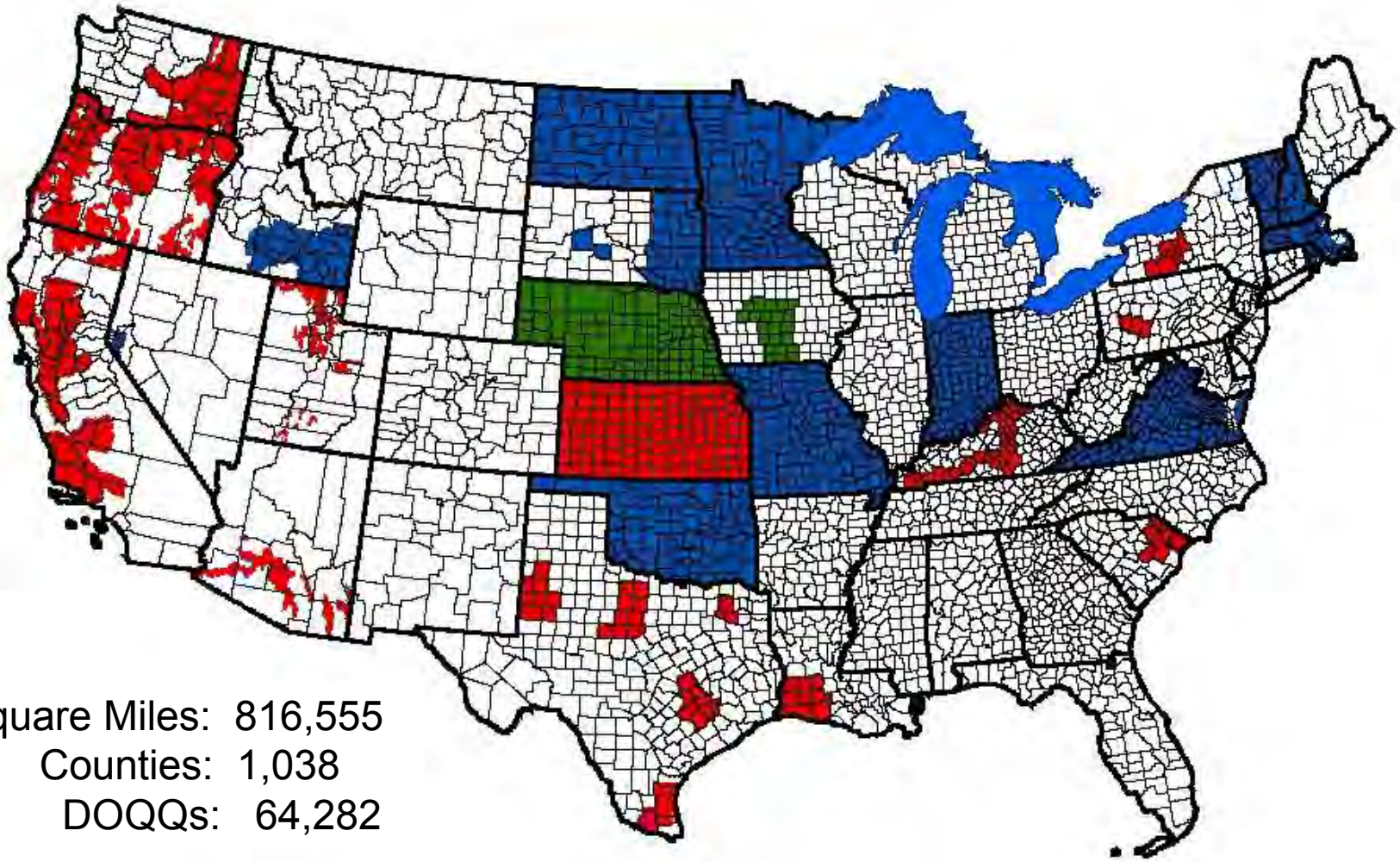
Aerial Imagery Contracts



Contracts Summary

- Six States Contracted: KS, NE, ND, SD, MO, and MN
- 121 Counties Covered
- 82,727 Square Miles
- 28,932 Linear Miles of NAPP-Like Aerial Photography (Film archived at APFO)
- Summer 2002 Flying Season

NAIP 2003 CONTRACTS



Square Miles: 816,555
Counties: 1,038
DOQQs: 64,282

1 METER 2 METER DIGITAL

2004 NAIP COVERAGE

2005 NAIP COVERAGE

2006 NAIP COVERAGE

2007 NAIP COVERAGE

2008 NAIP COVERAGE

2009 NAIP COVERAGE

2010 NAIP COVERAGE

2011 NAIP COVERAGE

2012 NAIP COVERAGE

Meeting FSA Requirements

Coverage with NAIP

FSA Requirements	NAIP Specification / Goal	Actual	Improvements
Support Farm Programs	Supports Annual Coverage	**2 to 2.5 year cycle**	Funding Dependent
	Full State		
	Acquired within Crop Growing Season	75% to 97%	(Weather and Start of Contract)

2004 Compressed County Mosaic

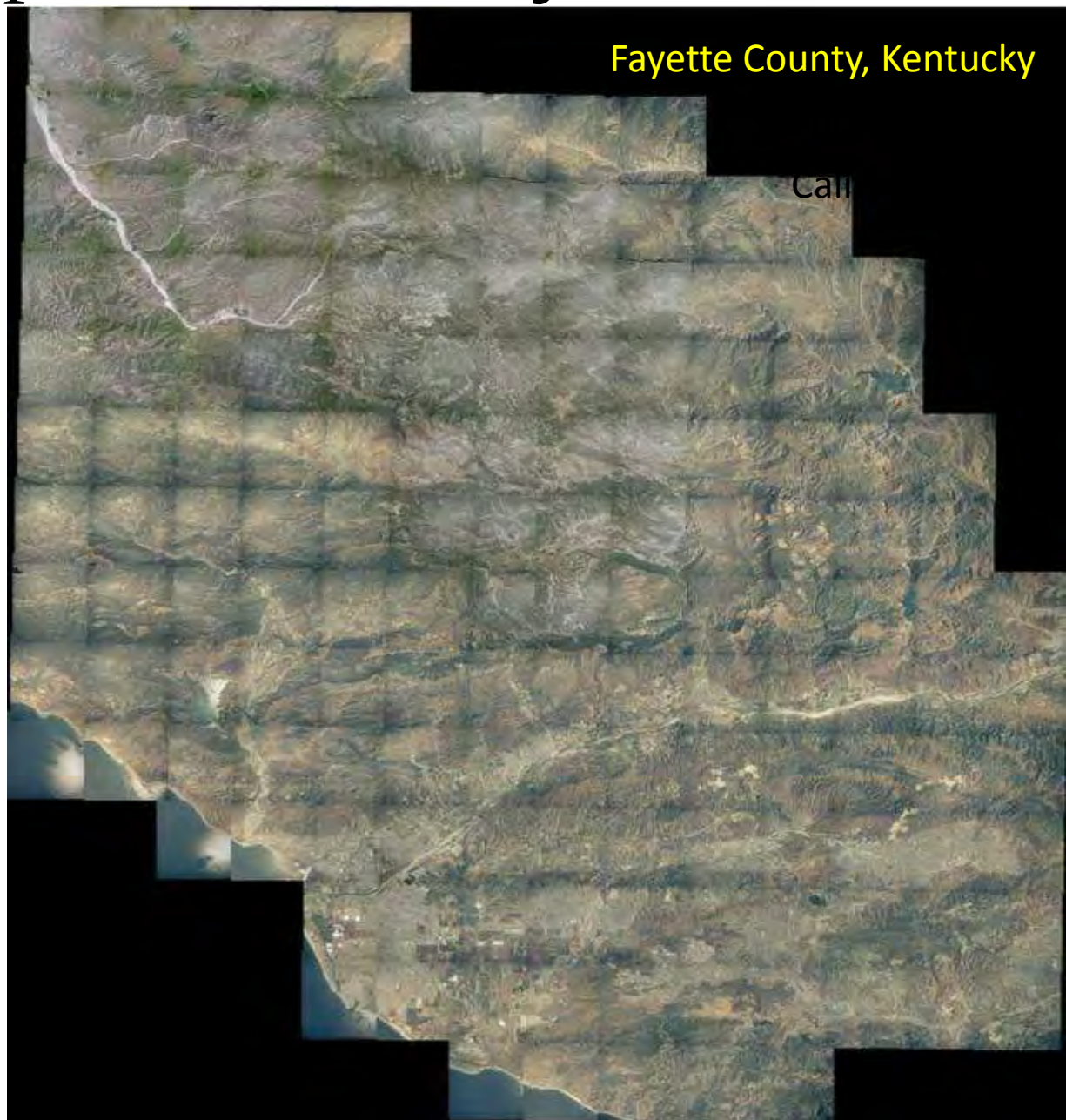
Delivered on CDRom

MrSid Compression

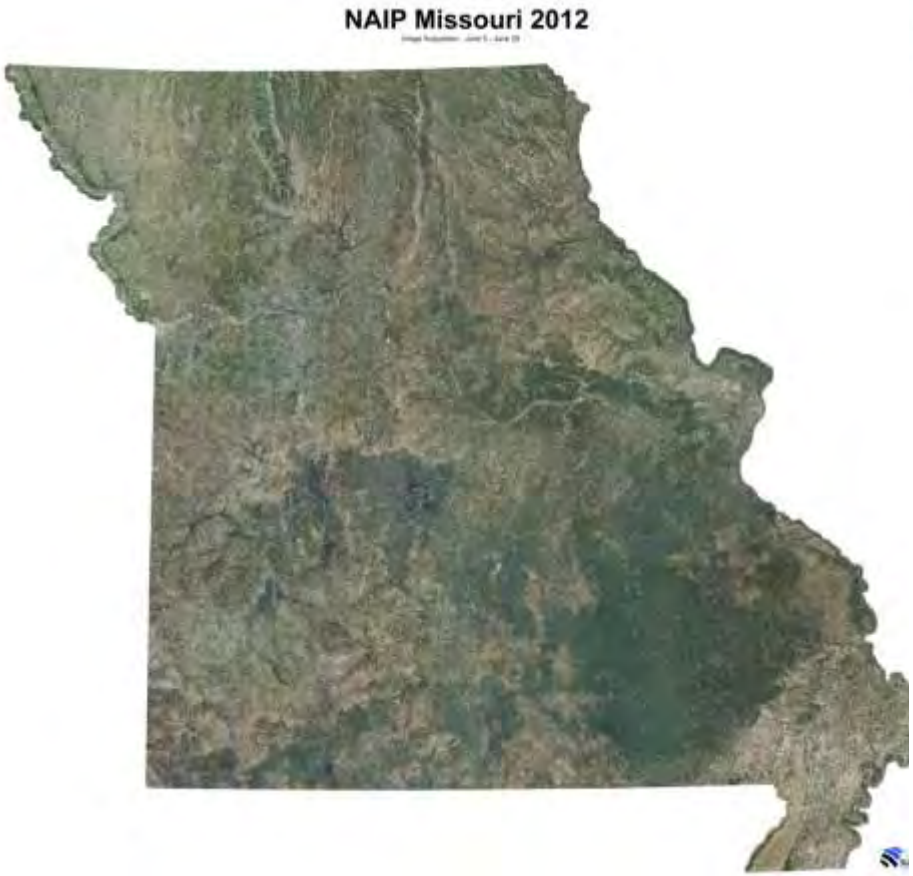
1:50 Compression
For 1m Imagery

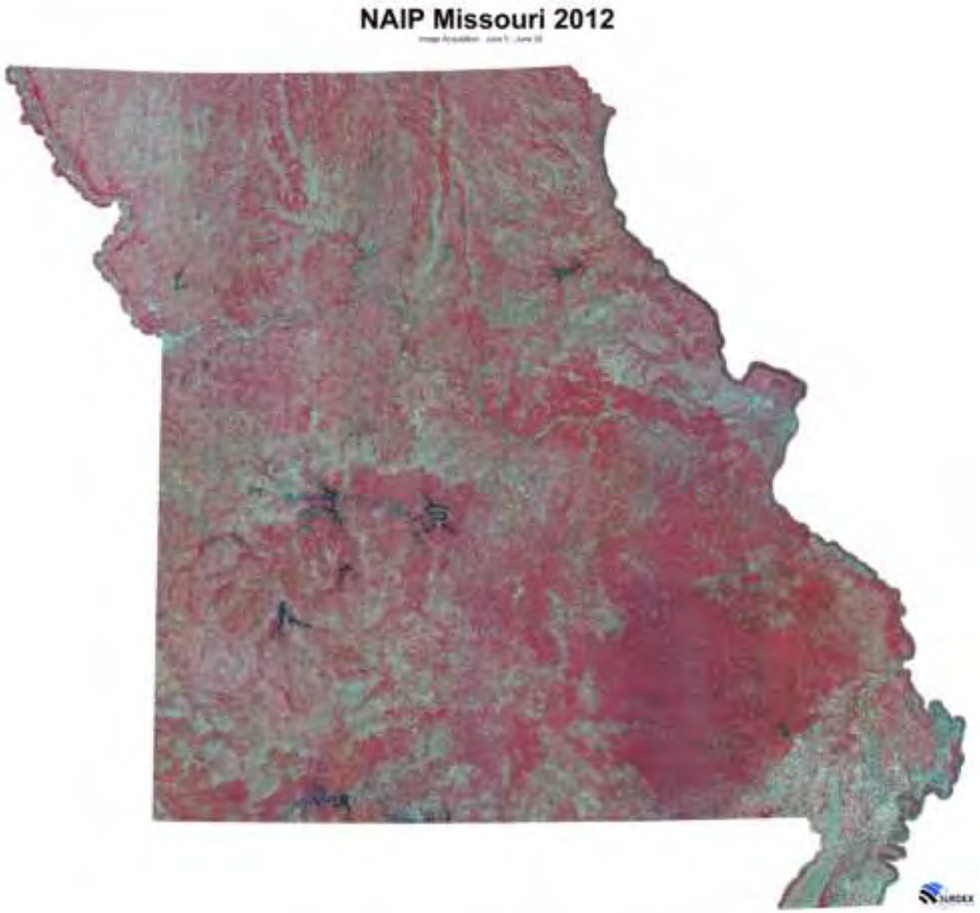
1:20 Compression
For 2m Imagery

FGDC Metadata



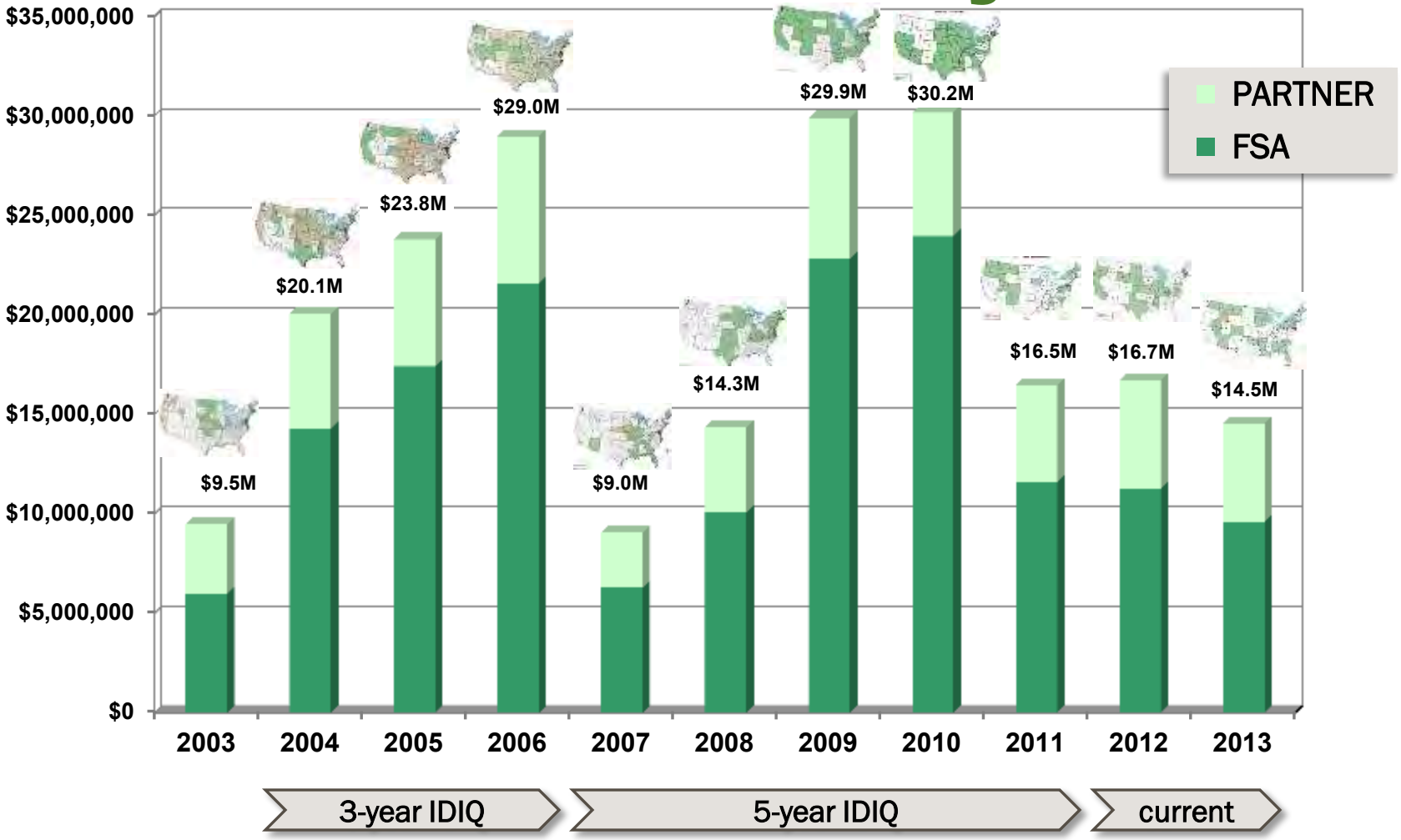
NAIP Finished Products:
Evolution to Seamless Natural Color and CIR Mosaics



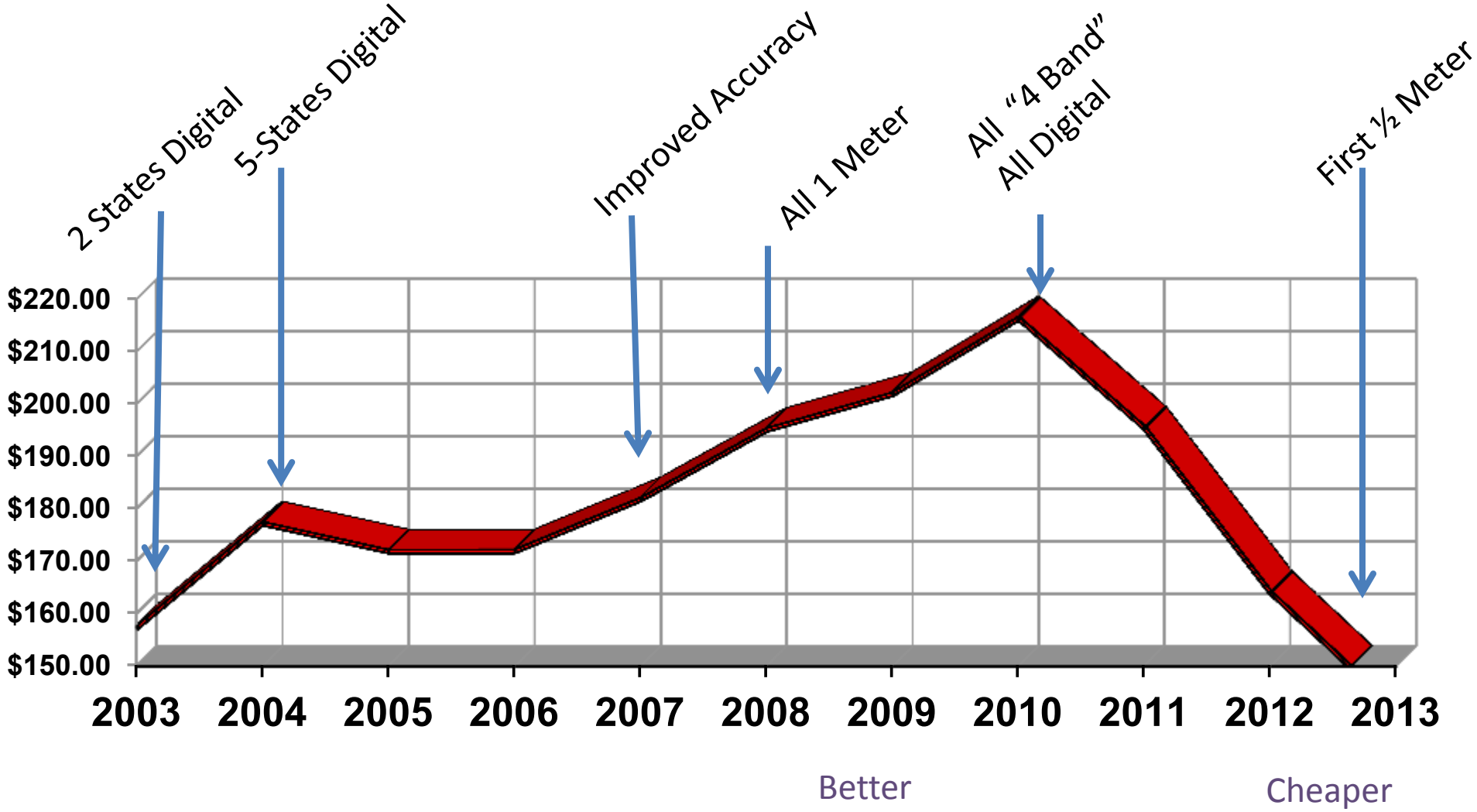


Evolution of Best Practices and the development of standards for radiometry. My imagery is too dark, it is washed out…

NAIP Contract History



NAIP (Average Cost per DOQQ): Continuous Improvement



NAIP 2013 Task Orders

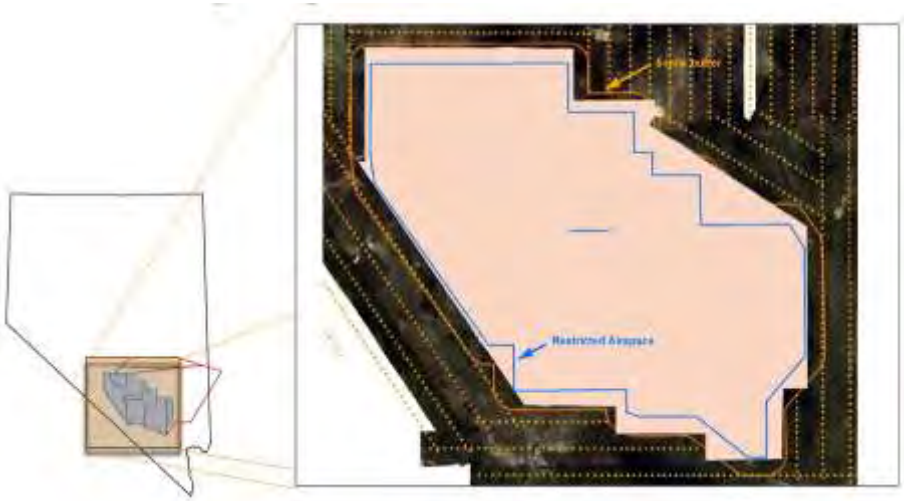
- Task orders were awarded in 2 parts:
  - Part 1 - May 23, 2013 (sixteen states) (Normally April 1)
    - $11,150,024.82
  - Part 2 - **July 17, 2013** (seven states)(Very Late Funding!)
    - $3,367,384.95
  - Funding:
    - FSA: $9.6M, FS: $1.7M, NRCS: $1.3M, & DOI:$1.9
    - **87% USDA; 13% DOI**

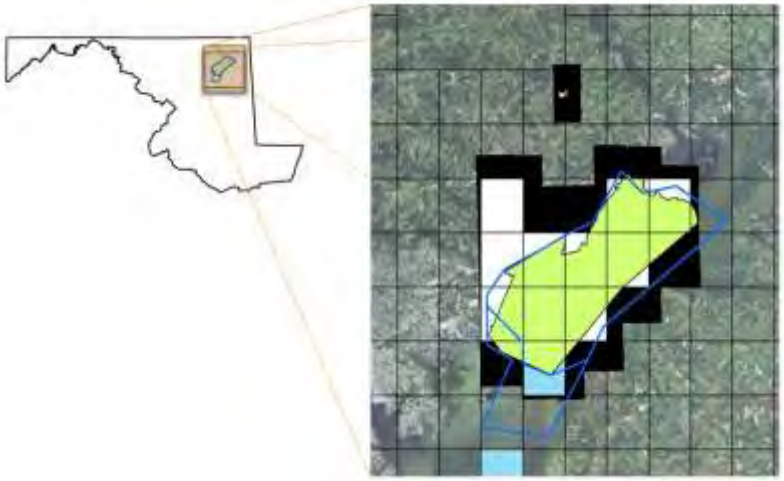
NEW Early Access Web Service pilot (Faster)

NEW Idaho ½-meter pilot (Better)

2013 NAIP Status

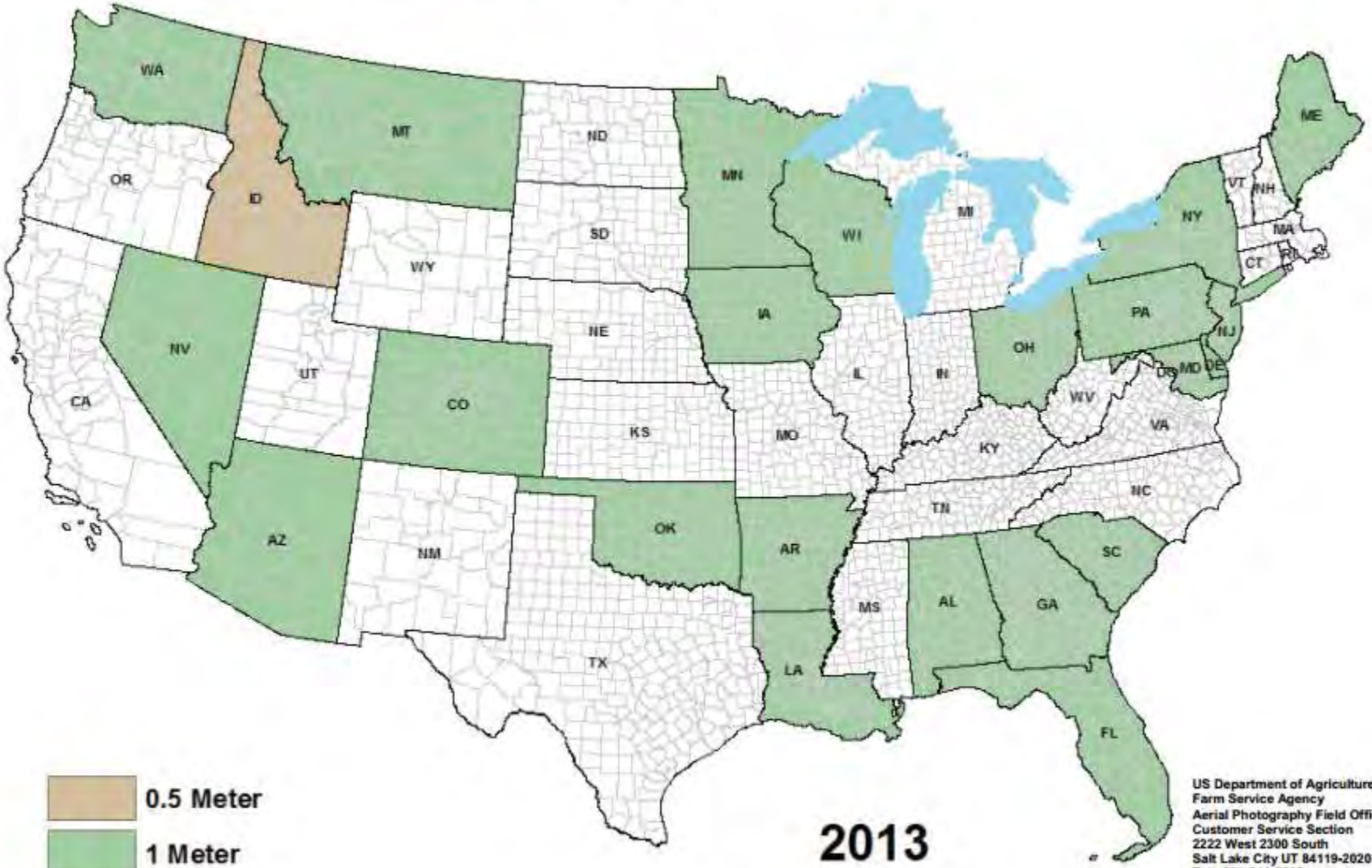
- 100% acquired
  - Except for restricted airspace:
    - Aberdeen Proving Grounds, Maryland
    - Nevada Test and Training Range, Nevada
- All DOQQs have been delivered





USDA

United States Department of Agriculture



0.5 Meter

1 Meter

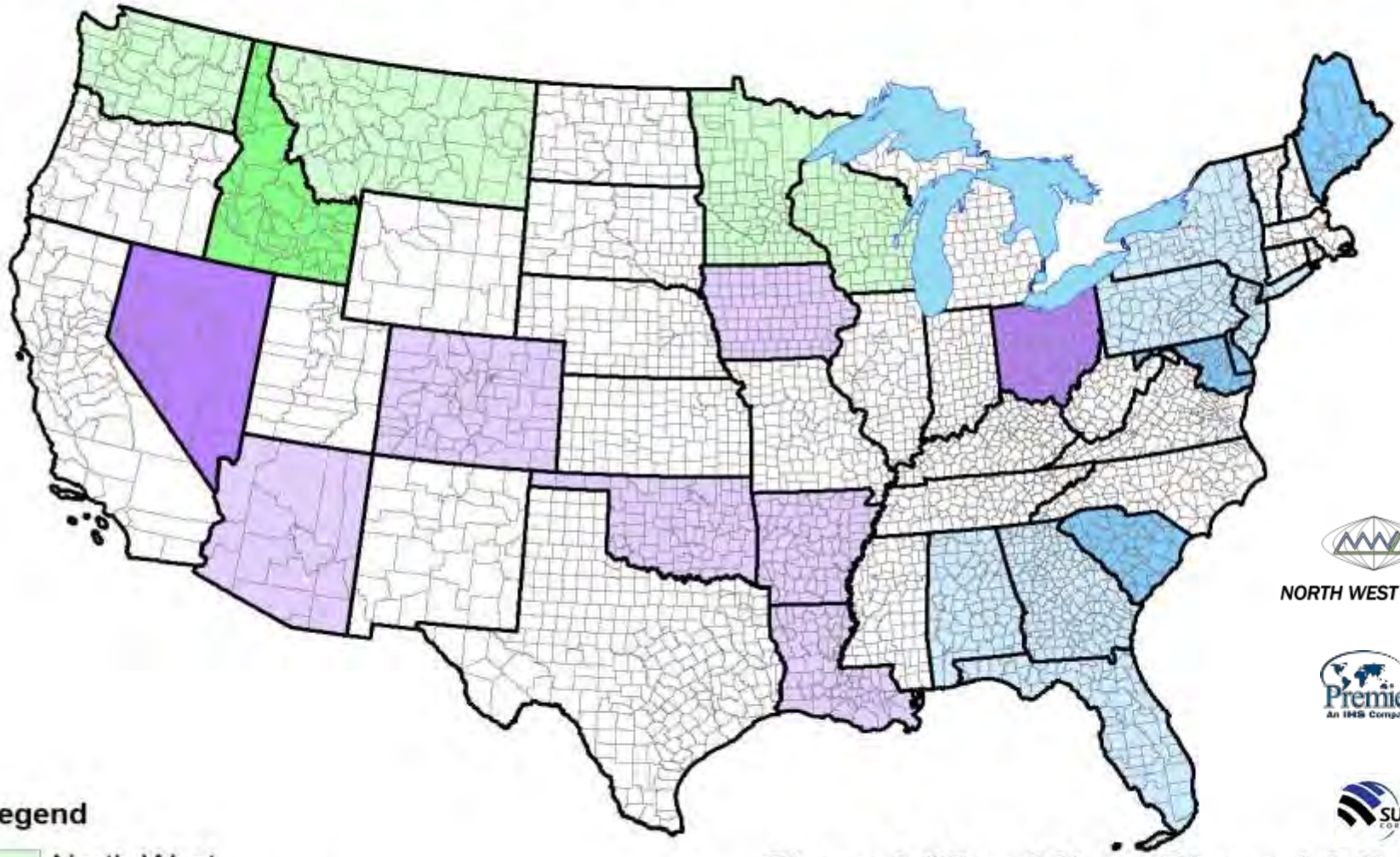
2013

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

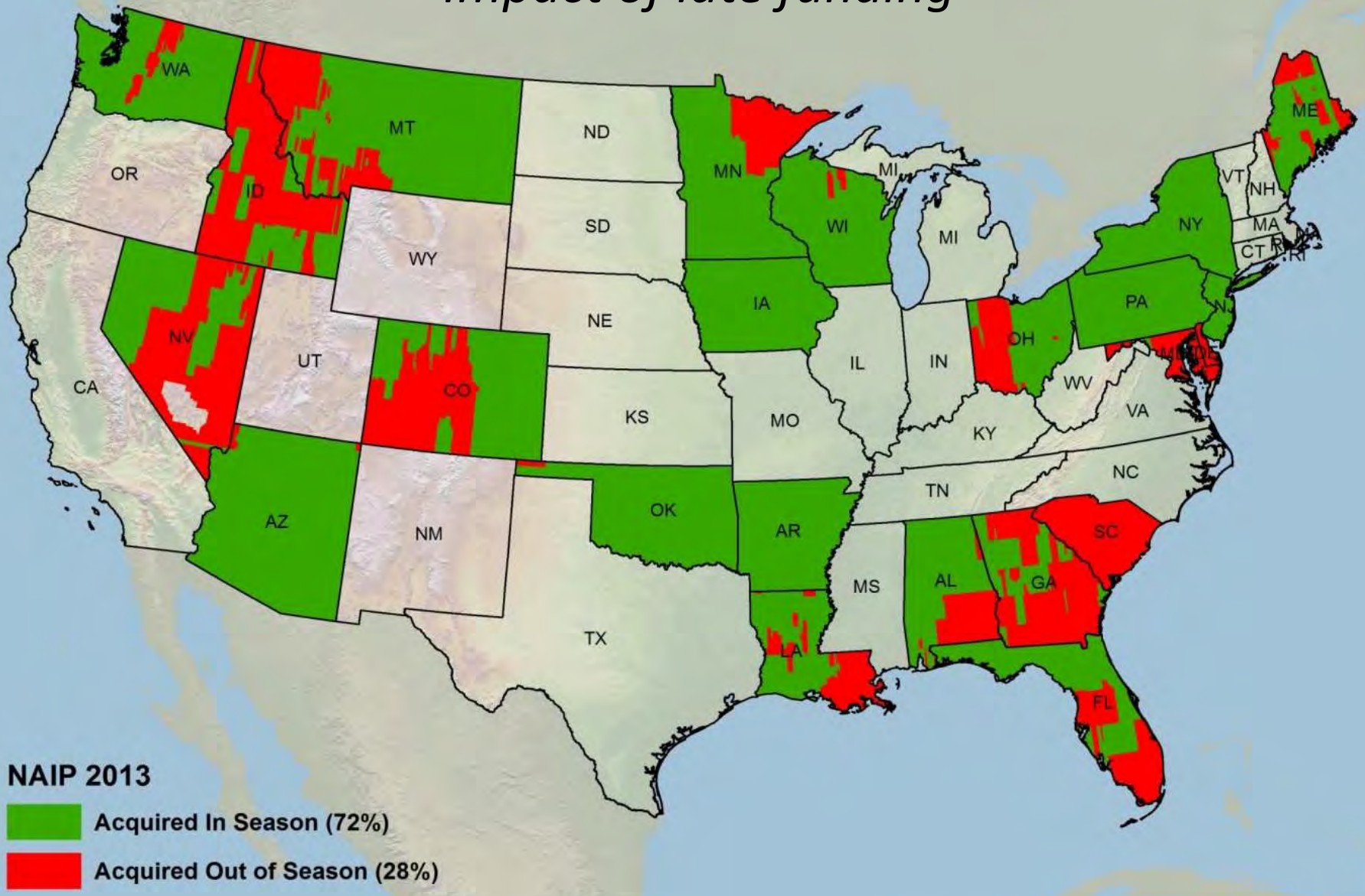
Legend

- North West
- Premier Geospatial
- Surdex

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

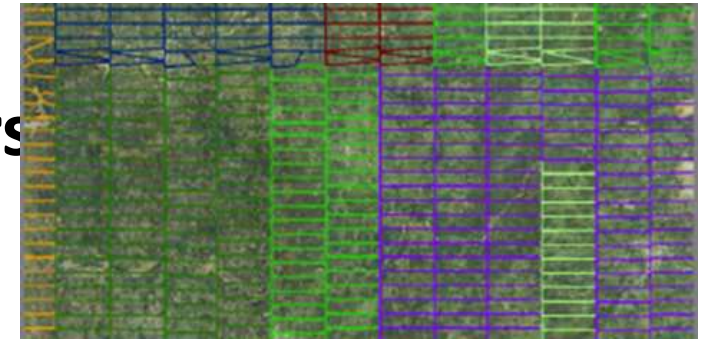
Phase I & II
States: 23
DOQQs: 102,013

2013 Acquisition within Seasons: Impact of late funding



2013 Early Access Web Service Pilot

- Each Vendor had one state that where imagery was loaded to Web Service as acquired.
- Loaded within 5 days of acquisition
- RGB and CIR services
- Acquisition date vector service
- 10 meter horizontal accuracy (final NAIP is 6 meters)
- **Support for 25 concurrent users**
- ESRI Compatible

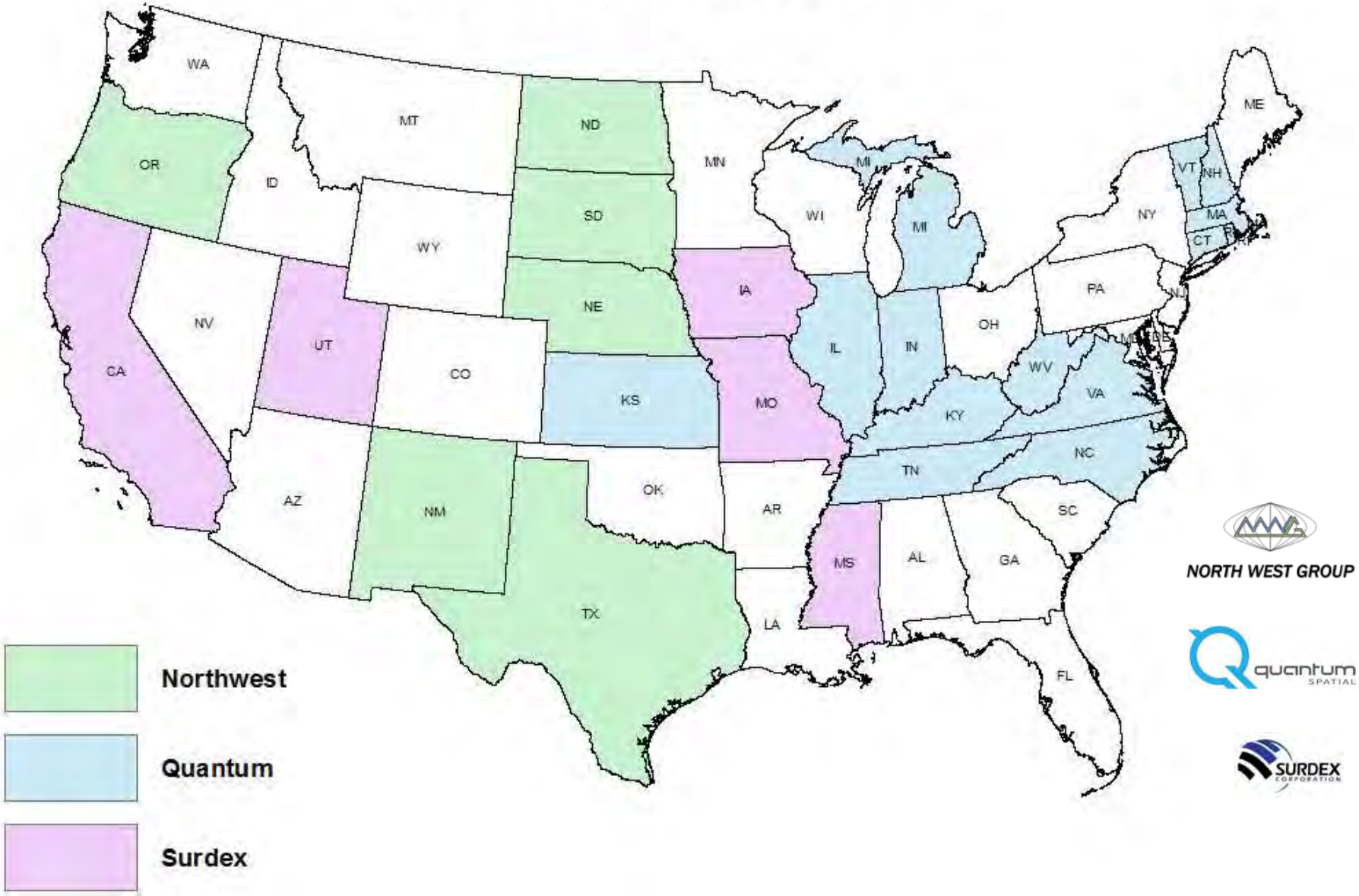


2013 Early Access Web Service Pilot

- 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.

2014 NAIP Contract Awards

2014 NAIP Contractors



USDA-FSA-APFO

2014 NAIP Contract Awards

- 25 States Awarded on April 29
  - 4 week delay
- $15.2M
  - $131/quarter quad
- 1 meter
- 4 Band

2014 NAIP Cost Share

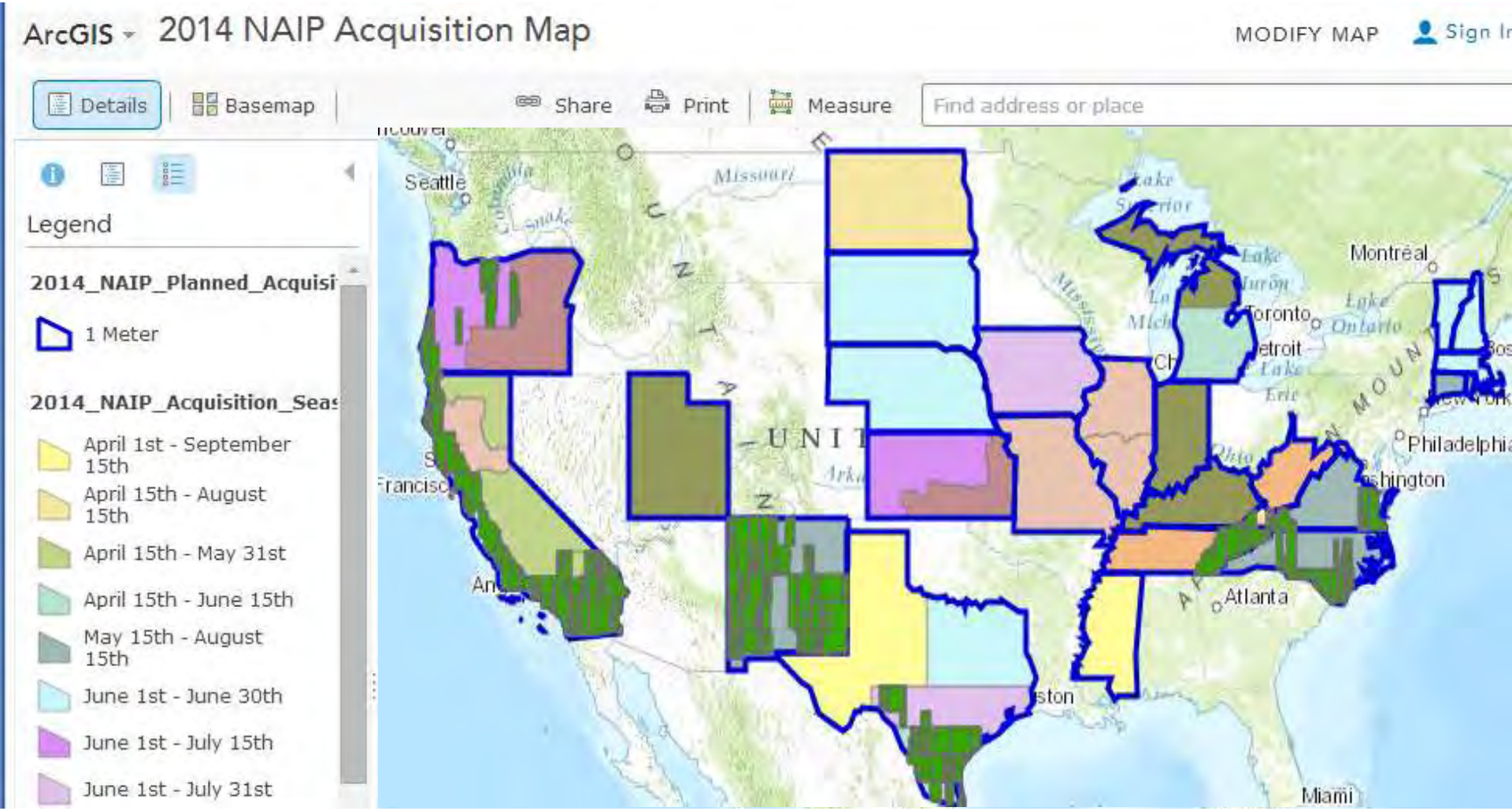
Farm Service Agency	$10,100,000
Natural Resources and Conservation Service	$1,710,000
US Forest Service	$1,441,000
USDA Total	$13,251,000
Department of Interior	$1,900,000
International Boundary and Water Commission	$63,000
	$15,214,000

International Boundary and Water Commission (IWBC), Department of State
Adding 10km buffer into Mexico

Prototyping ArcGIS Online maps **Acquisition Map**:

http://bit.ly/1iDgOIs **As of 6/11/2014**

Green areas have been acquired.



See also the USDA Web Service Availability Map: http://bit.ly/1iDghqf

2104 Early Access Web Services
100 Concurrent Users

Quantum / Photo Science

New England (CT/MA/NH/RI/VT), IL, IN, KS, KY, MI, VA, WV (ArcGIS Server)

https://eaws.photoscience.com/arcgis/services

NW Group / Valtus

NE, NM, ND, SD, and TX (WMS Server)

https://www.valtus.com/eaws/wms

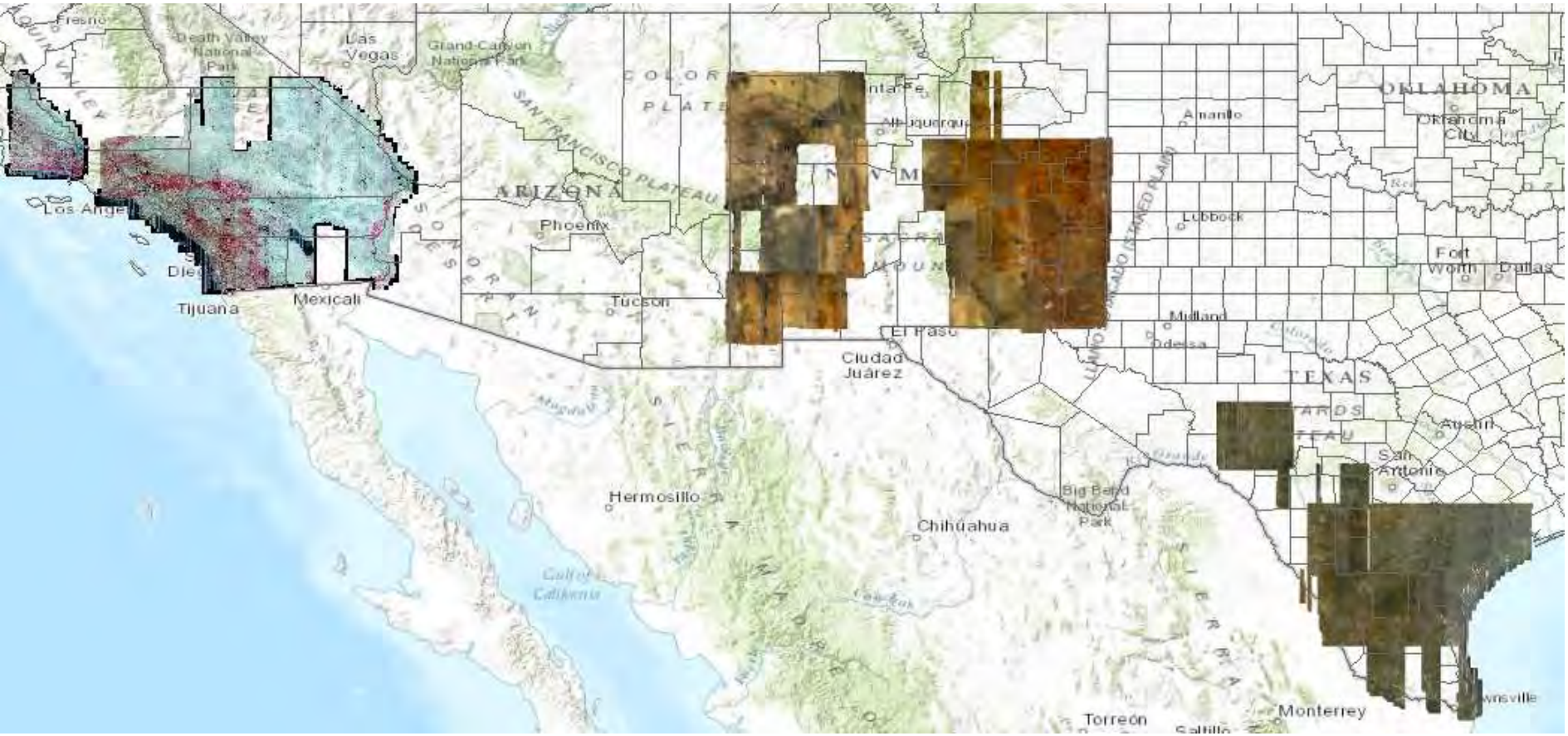
Surdex

CA, IA, MO, and UT (ArcGIS Server)

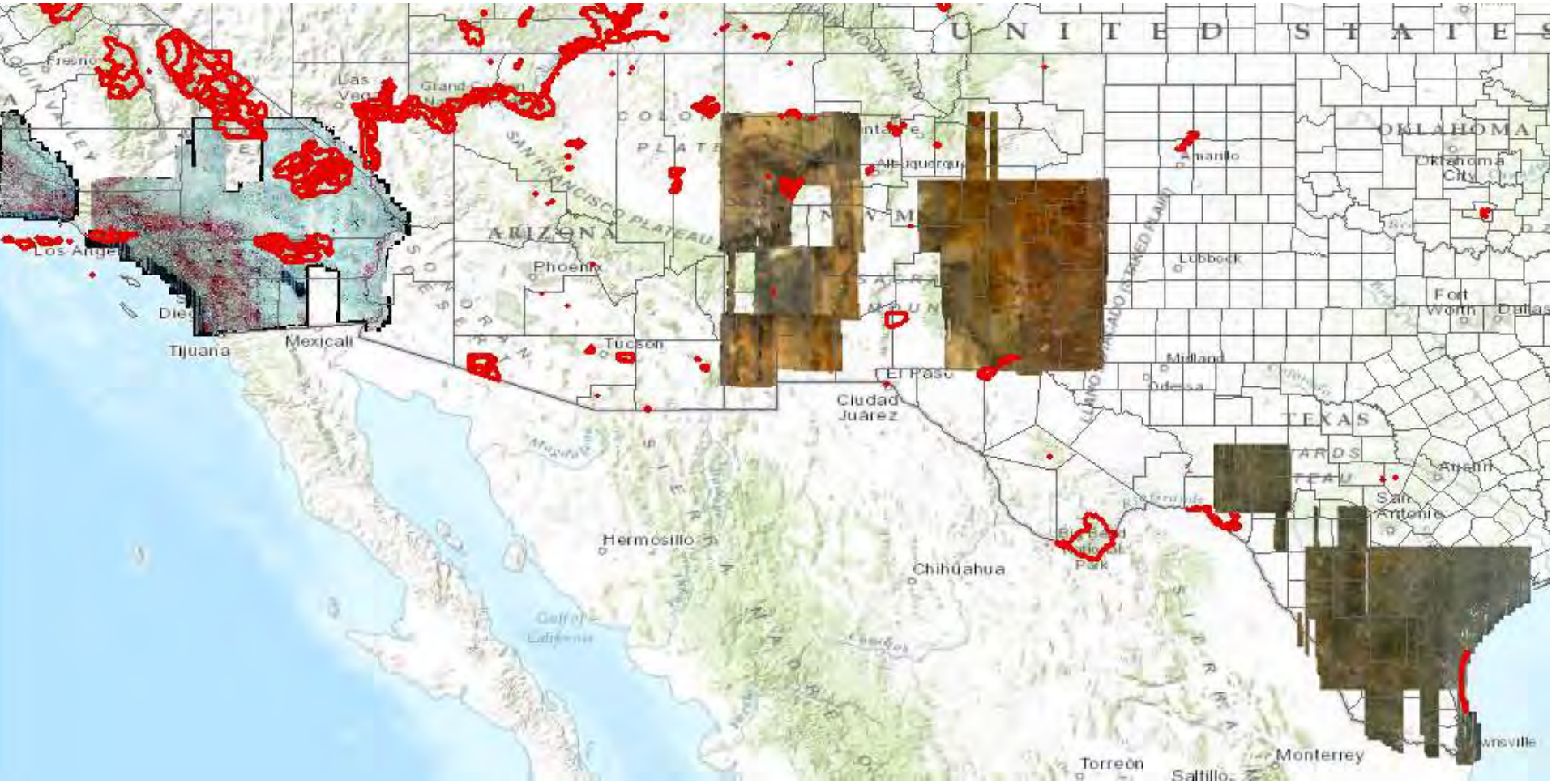
https://gissvr.surdex.net/arcgis/services

21 of 25 States

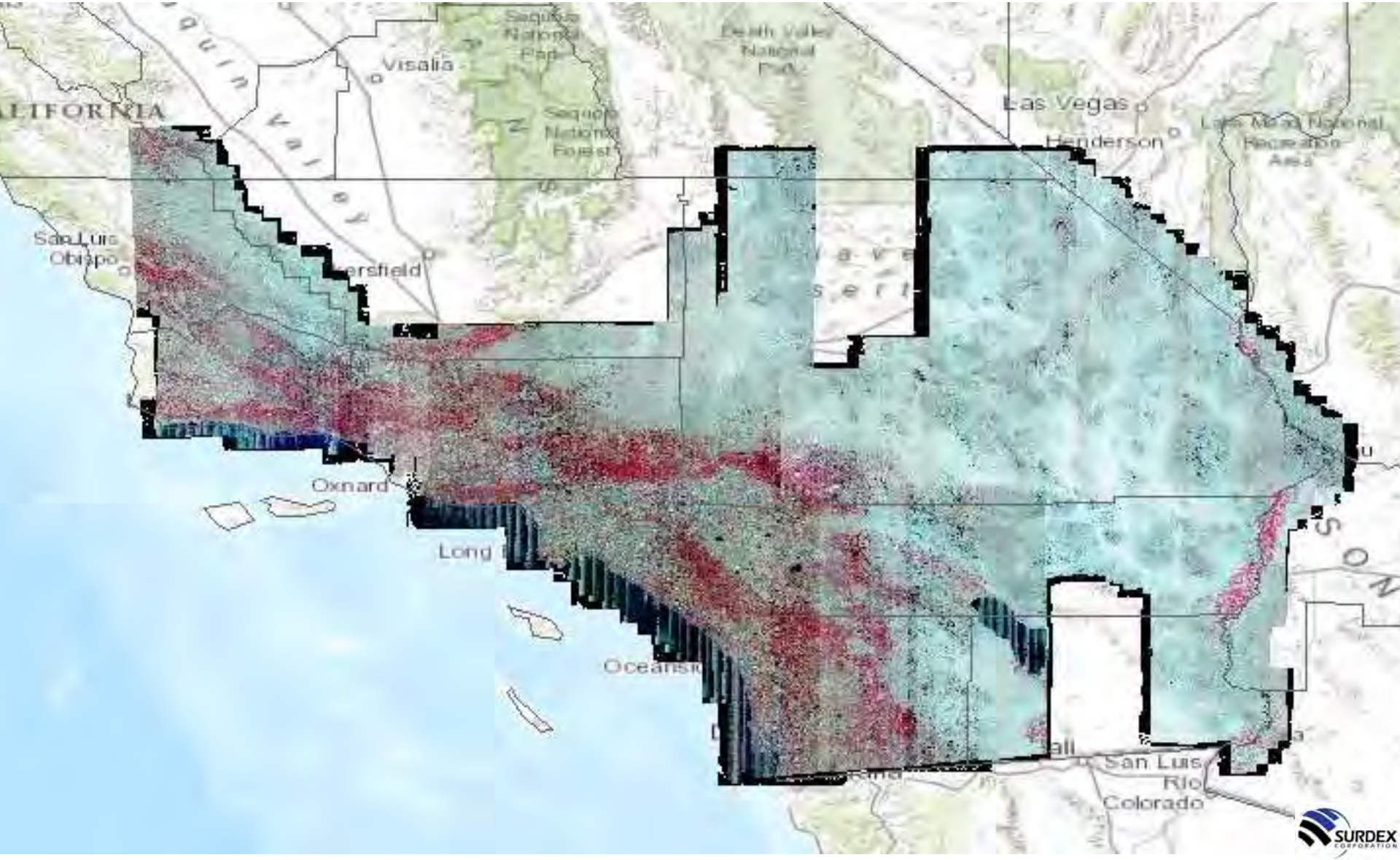
Early Access Service Example As of 6/10/2014 (Faster)



National Park Service Property in Red

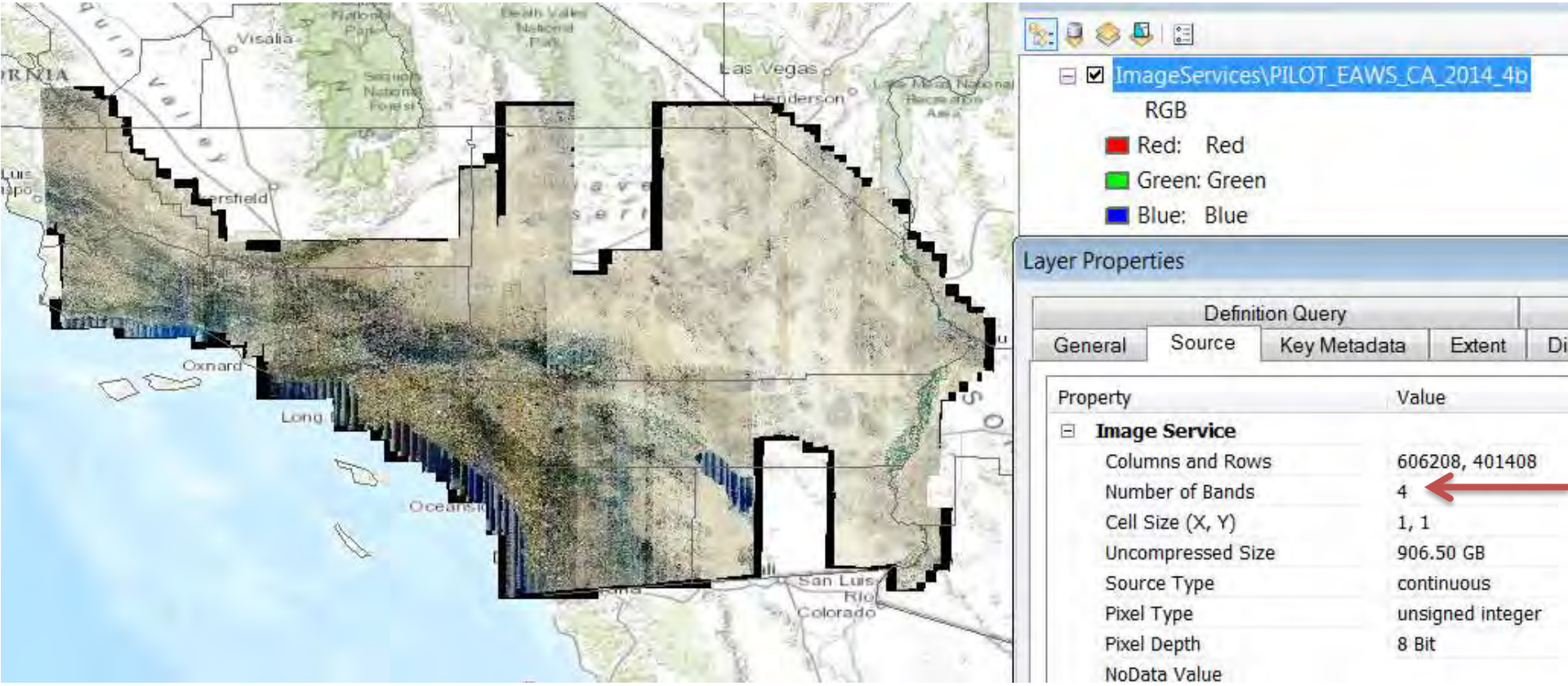


Surdex

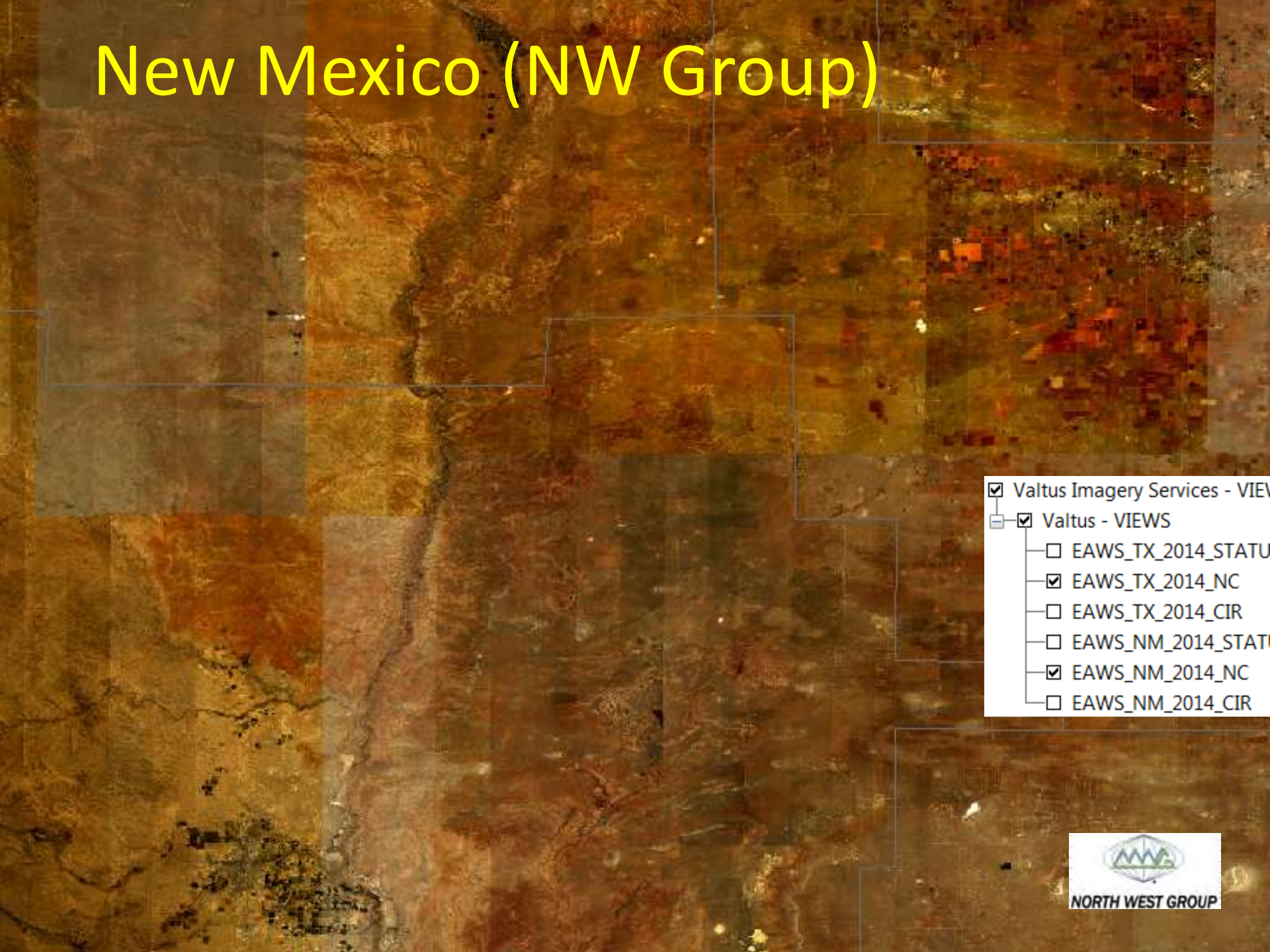

Visalia
Las Vegas
Henderson
San Luis
Obispo
Oxnard
San Luis
Rio
Colorado
SURDEX

SURDEX
CORPORATION

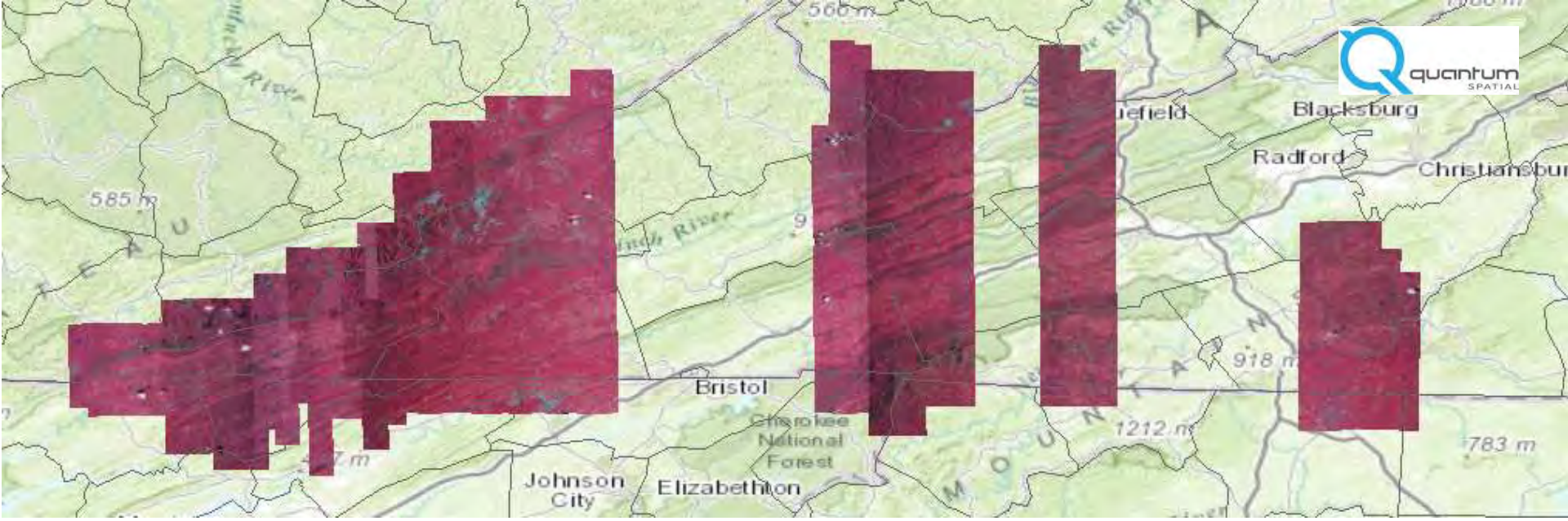
Surdex Implemented as four band Image Service



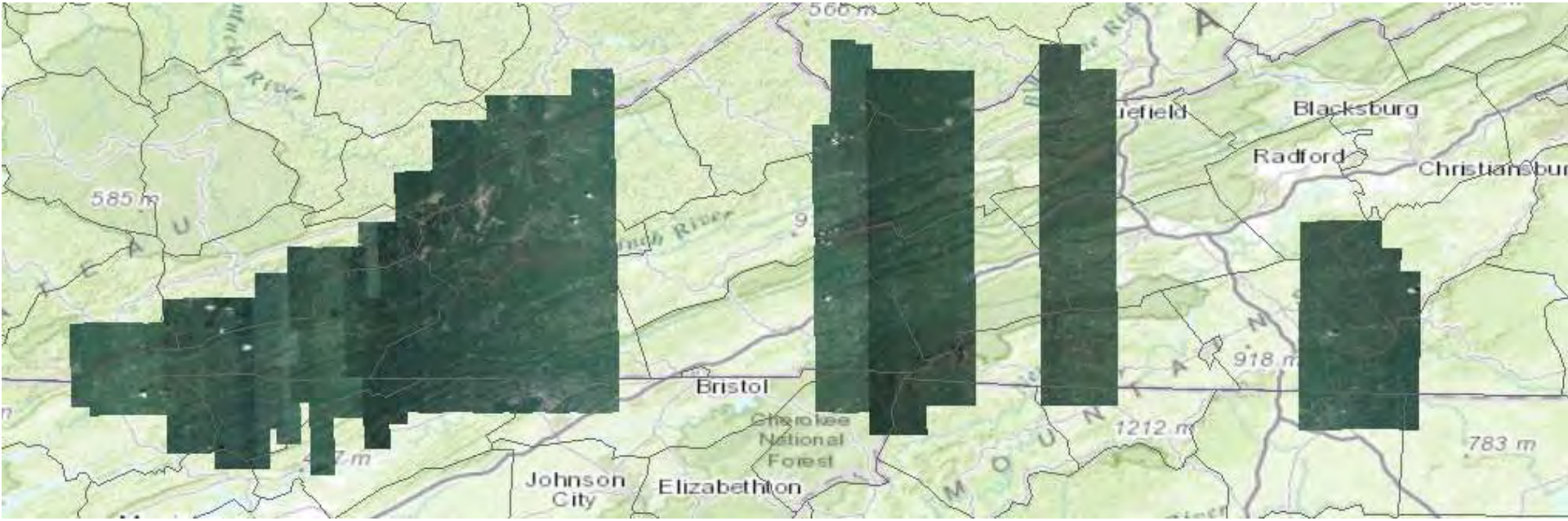
New Mexico (NW Group)

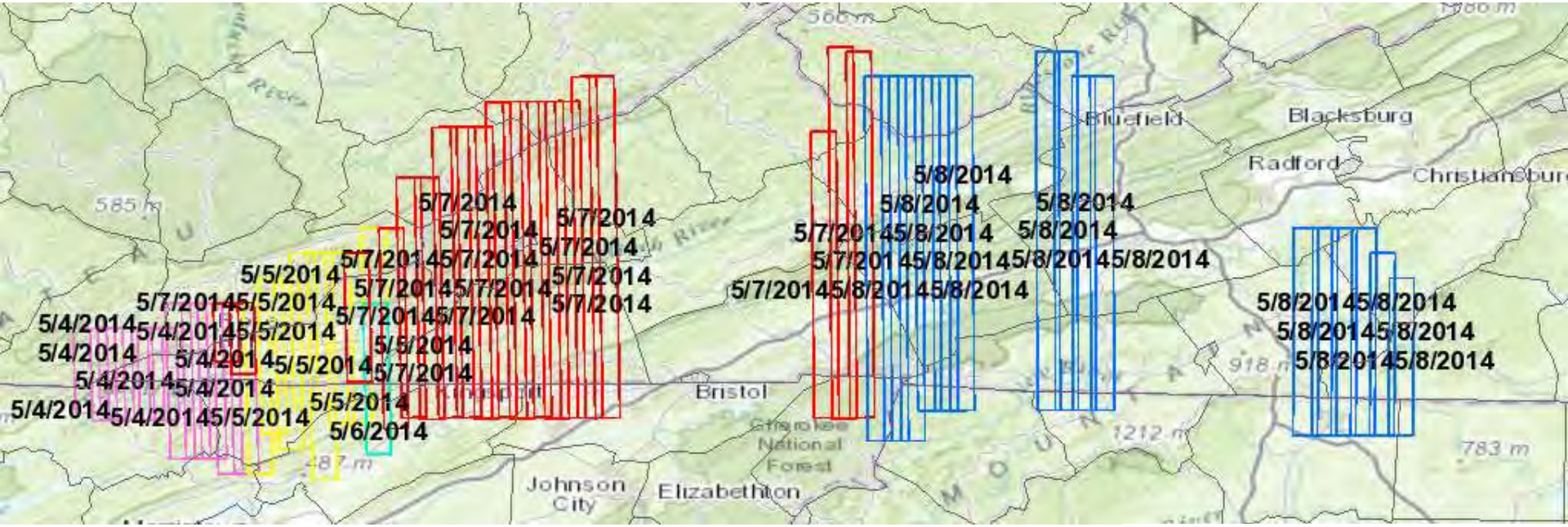


NORTH WEST GROUP

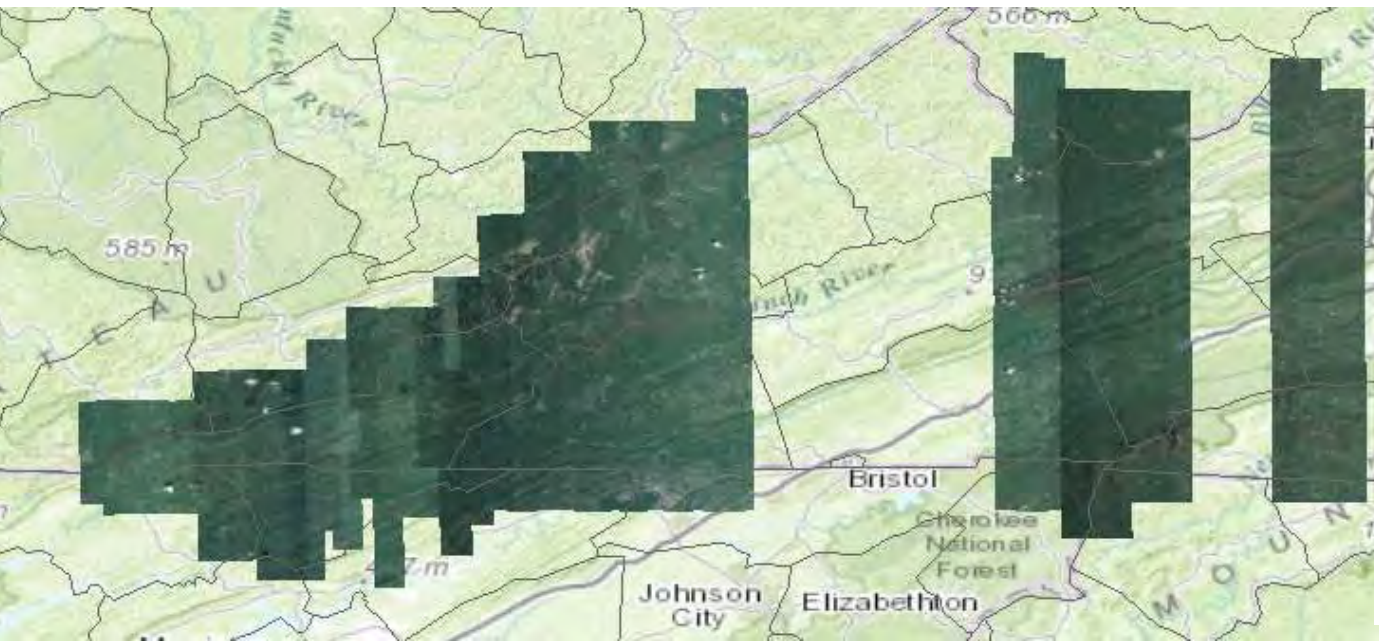


SW Virginia (Quantum / Photo Science)



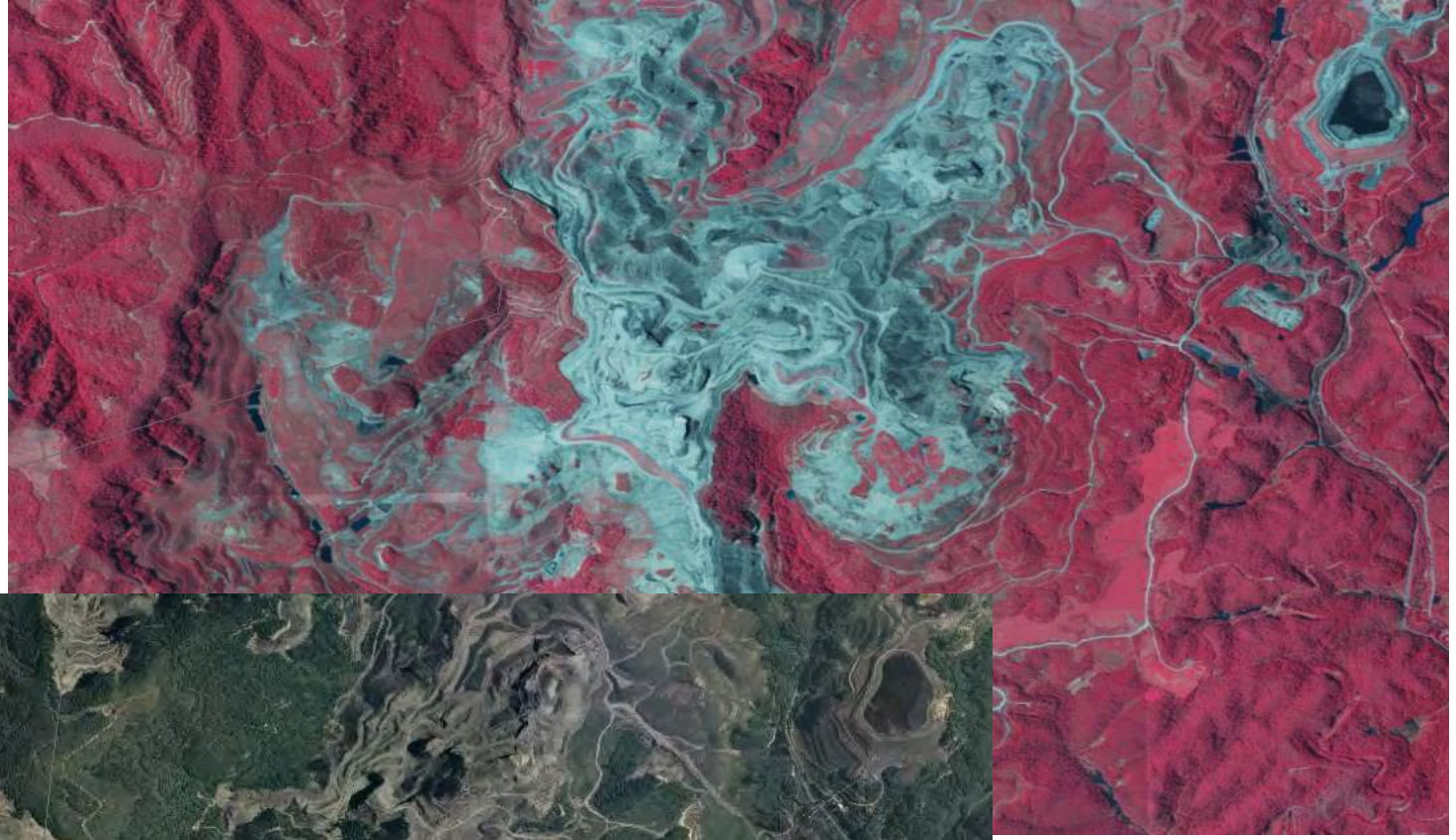


Quantum / Photo Science



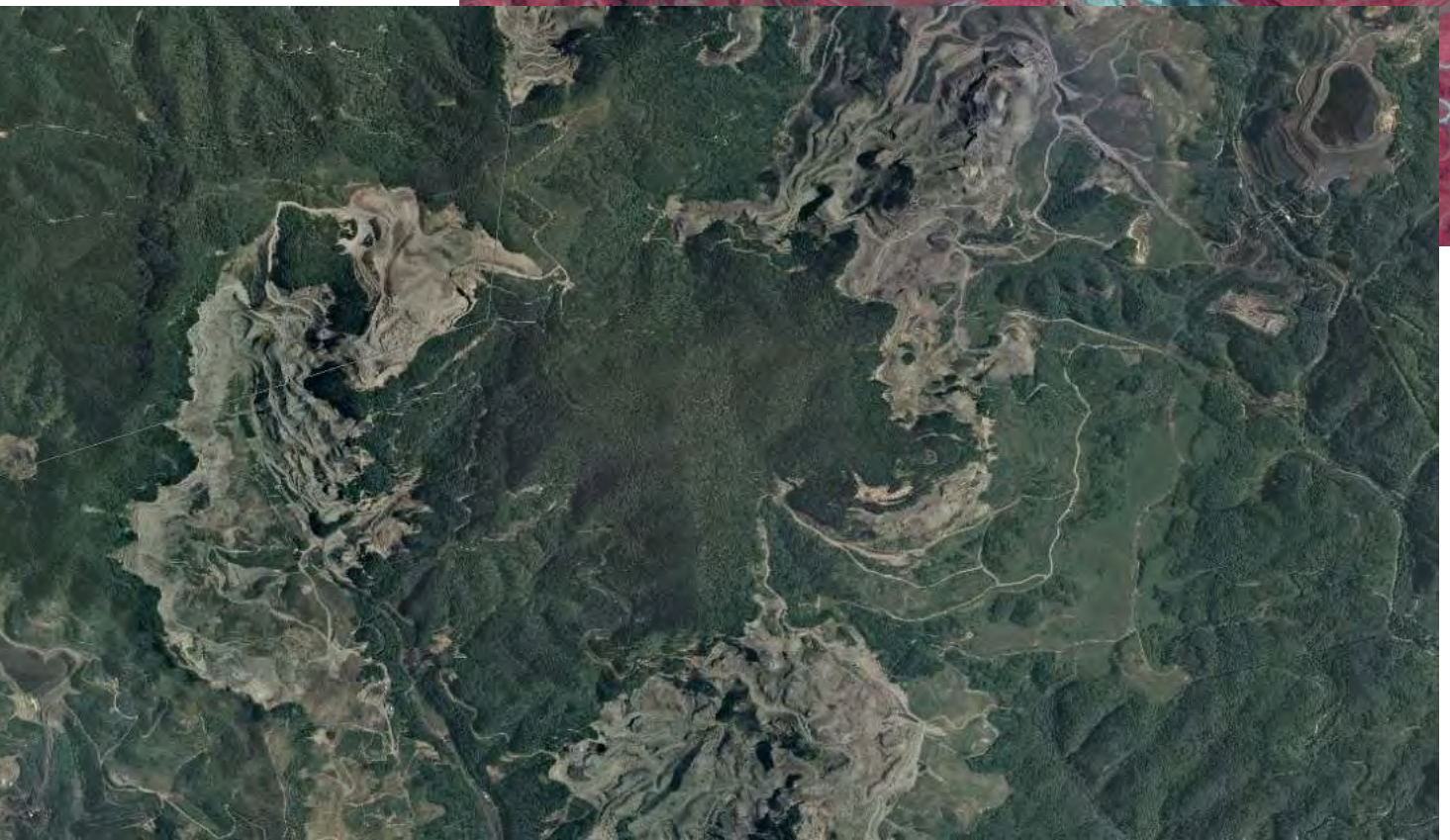
- PILOT_EAWS_VA_2014_NC
  - RGB
  - Red: Red
  - Green: Green
  - Blue: Blue
- PILOT_EAWS_VA_2014_CIR
  - RGB
  - Red: Infrared
  - Green: Red
  - Blue: Green
- PILOT_EAWS_VA_2014_FOOTPRINT
  - PILOT_EAWS_VA_2014_FOOTPRINT
    - Acq_Date
    - 5/8/2014
    - 5/7/2014
    - 5/6/2014
    - 5/5/2014
    - 5/4/2014

6 Miles West of
Eolia, VA



2014 CIR NAIP

ESRI Imagery
World 2D Layer



2014 NAIP Delivery Schedule

Quarter Quads and
Compressed County Mosaics

California	5-Oct-14
Connecticut	13-Oct-14
Illinois	28-Sep-14
Indiana	13-Oct-14
Iowa	13-Nov-14
Kansas	30-Oct-14
Kentucky	13-Oct-14
Massachusetts	29-Oct-14
Michigan	29-Oct-14
Mississippi	29-Oct-14
Missouri	28-Sep-14
Nebraska	29-Oct-14
New Hampshire	29-Oct-14

New Mexico	13-Oct-14
North Carolina	13-Oct-14
North Dakota	18-Oct-14
Oregon	13-Oct-14
Rhode Island	13-Oct-14
South Carolina	29-Aug-14
Tennessee	13-Nov-14
Texas	28-Nov-14
Utah	13-Oct-14
Vermont	29-Oct-14
Virginia	13-Oct-14
West Virginia	28-Nov-14

FSA
FARM SERVICE AGENCY

2015 - 2016 NAIP PLANNED ACQUISITION

2015

2016

FSA

FARM SERVICE AGENCY

NAIP Buy Ups

- **Buy-Ups**
  - Half Meter Resolution (Full State Only)
  - Out of Cycle State (Full State Only)

- **Federal partnerships**
  - Agreements (FMS 7600 forms) are required no later than January 31
  -

- **State government partnerships**
  - Issue a formal commitment by January 31
  - Fully pay upfront no later than March 1

- Please contact Bridget Barlow for additional information

  Bridget Barlow (801) 844-2911
  bridget.barlow@slc.usda.gov

FSA
FARM SERVICE AGENCY

NAIP Buy Ups

Half Meter Buy Up Estimates

- Depends on the State
  - Hi relief, higher cost more work required on DSM
  - 40-60% additional costs to 1 meter base cost (Cost estimates are available)

	2015			2016			
$/QQ	State	Quarter Quads	Buy Up Cost	State	Quarter Quads	Buy Up Cost	$/QQ
	AL	3,481	$310,157.10	CA	11,095	$928,651.50	$84
	AR	3,600	$310,248.00	CT	413	$39,689.30	
$89	AZ	7,629	$685,847.10	IA	4,239	$318,179.34	
$89	CO	7,423	$667,327.70	IL	4,131	$323,457.30	$78

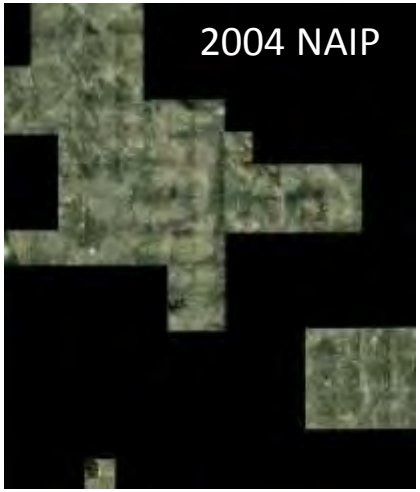
Half Meter Product Specifications

- Ground sample distance: 0.5 meter
- Acquisition pixel resolution: 0.3-0.55 meter
- Horizontal accuracy: 6-meter to ground (same specification as 1-m NAIP)
- Image formats: DOQQ GeoTIFF and Compressed County Mosaic (CCM) MrSID Generation 3
- Compression ratio for CCM: 60:1 (1-m NAIP has a 15:1 ratio)

Additional National Agriculture Imagery Program (NAIP) Access

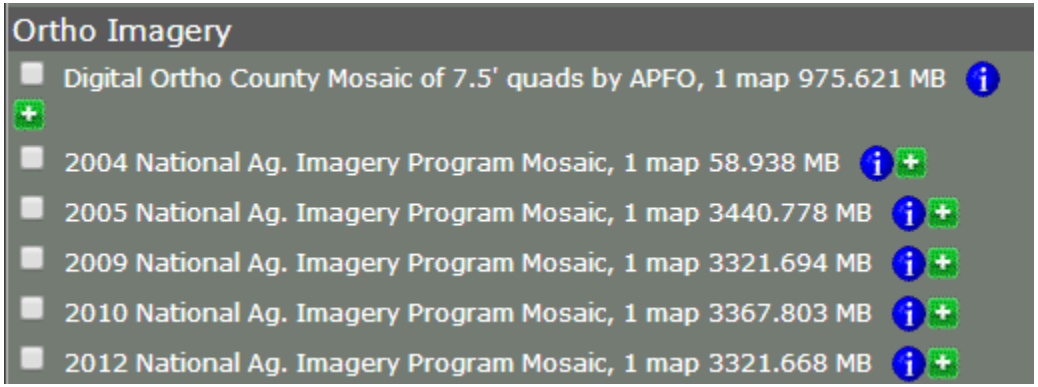
- For each state, the most recent year of the Natural Color NAIP Imagery is available on an ArcGIS server. The state based services can be added into ArcGIS Desktop by adding http://gis.apfo.usda.gov/arcgis/services
  - NAIP → Select State Image Service
  - For detailed image meta data add NAIP_Image_Dates service to your session.
    - NAIP → NAIP_Image_Dates Map Service
- Compressed County Mosaics are available for free download through the USDA Geospatial Data Gateway, http://datagateway.nrcs.usda.gov/

Using Geospatial Data Gateway



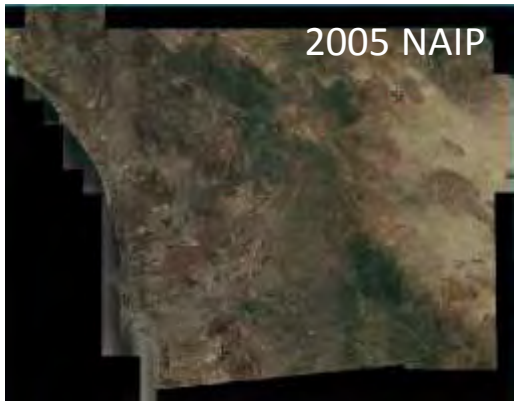
http://datagateway.nrcs.usda.gov/
Click on “Get Data”
Pick A State then one or more counties

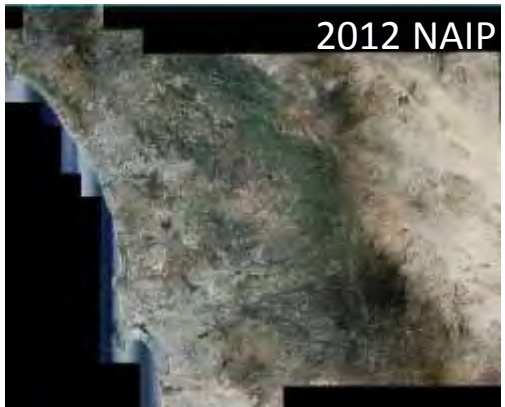
Ortho Imagery (CA → San Diego County)



Check what you want :

- FTP Delivery (Free)
- DVD delivery $100





Disaster Data Sources Document

- Creating as a service to the disaster community since Hurricane Katrina in 2005
- Provides links on where to find event specific imagery and GIS data.
- Anyone can get on the distribution list: Federal, State, Local, or Public.
- Over 400 people on list.
  - 88.mil; 45.com; 18.edu; 26 from NPS
- Send email to glenn.bethel@udsa.gov
- Only one list, once you are on, you need to request removal.

Events Covered this Year

- Tornadoes in AL, AR, LO, MS
- Fires in AK, AZ, CA
- Landslide in CO
- Floods in Florida

News

- Google buys the Skybox satellite imaging firm for $500,000,000
  - http://www.spacedaily.com/reports/Google_buys_satellite_imaging_firm_for_500_mn_999.html

- DigitalGlobe will be permitted to sell imagery to all of its customers at up to 0.25m panchromatic and 1.0m multispectral ground sample distance (GSD) beginning six months after its next satellite WorldView-3 is operational. Worldview-3 is scheduled to launch, August 13 or 14, 2014

http://www.digitalglobe.com/imagery-completeness#completeness-as-a-component-of-quality.

Animation: ESRI Imagery World 2D Layer and 2014 CIR NAIP

6 Miles West of Eolia, VA