

NRCS NCGC Elevation Activities

December 12, 2007

Steven Nechero

Technology Applications Team Leader

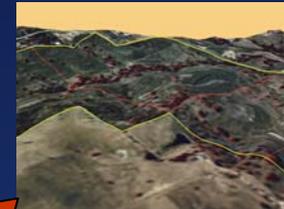
National Cartography & Geospatial Center

Fort Worth, Texas

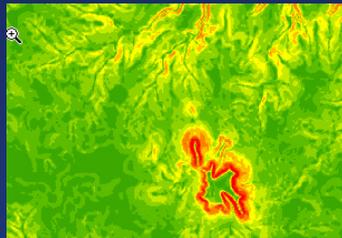
- NRCS supports a multi-resolution and sensor approach to creating elevation for the nation
- We currently use Elevation Data from 30 & 10 meter NED to IFSAR 5 meter and LIDAR < 3 meter products
- We need assistance with standards and specifications and contract vehicles to purchase elevation products in FY2008 and beyond

Terrain Modeling

What are our
elevation
requirements?



Analysis



Visualization



DEM



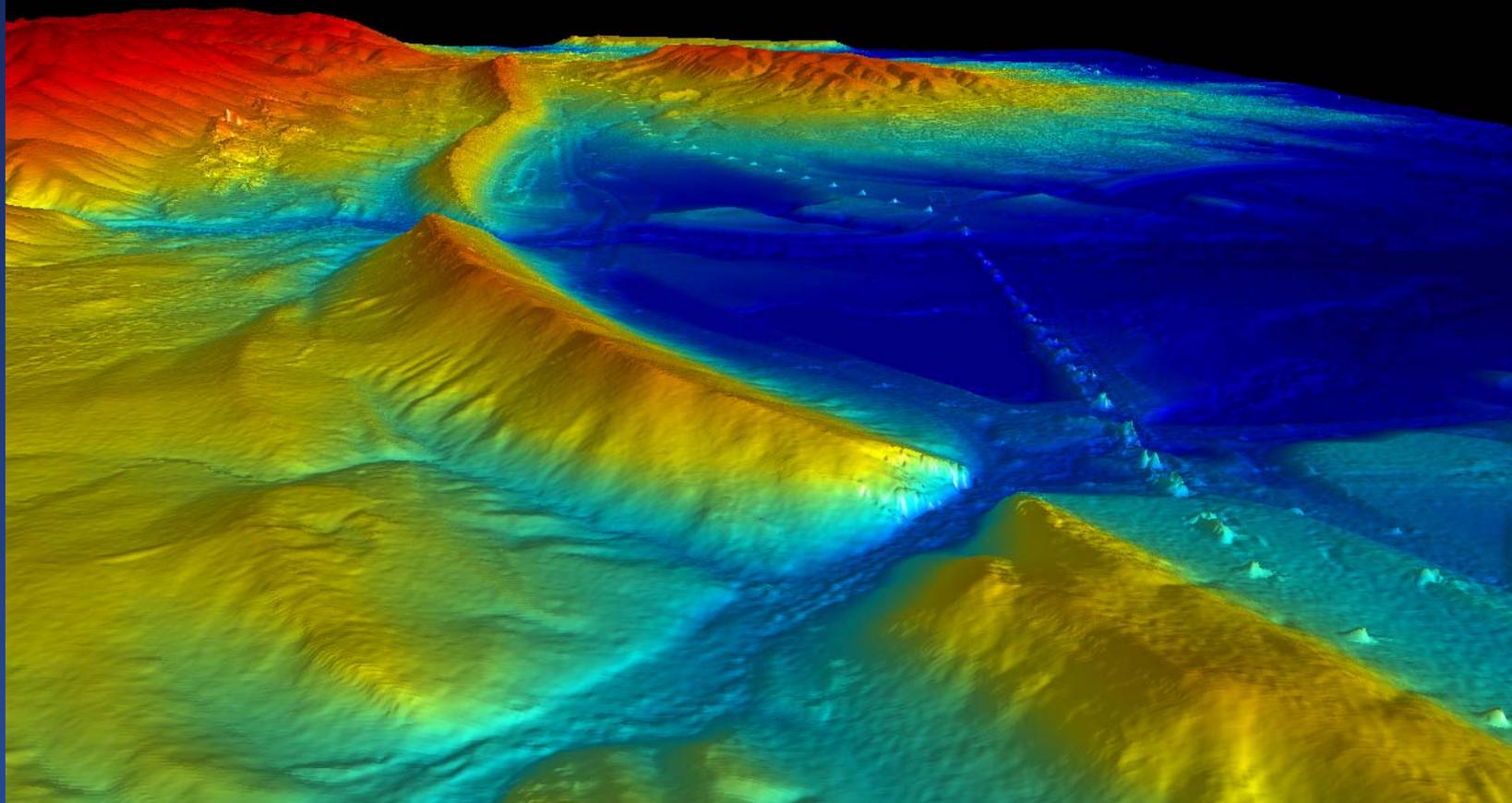
Reality



NRCS 10m DEM Contract

- Level 2 DEMs, **hydro-enforced**
- DEMs 99% percent free of **artifacts**
- Besides DEM, contractor provides **contours** and **hydrography** for the quads
- Contract ended September 30, 2007
- Initial task order was 128 quads (States - ND, WI, IA, KS, and OK)
This task is complete.
- Oct 2006 task order is for 221 quads (States – AL, GA, ME, MS)
This task is still in progress. Tiles for ME and GA are at NCGC for review.

NRCS IFSAR & LIDAR Status





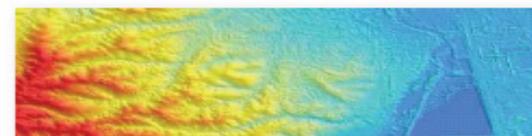
3D Digital Elevation Models

Intermap Technologies: providing geospatial professionals worldwide with reliable 3D digital elevation models (DEMs) that enable the timely and affordable development of innovative solutions.

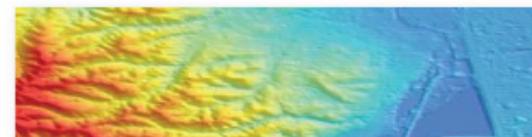
Proprietary Mapping Technology Creates Superior DEMs

The high-quality 3D digital mapping data afforded by our proprietary airborne Interferometric Synthetic Aperture Radar (IFSAR) technology meet the demanding needs of a wide range of geospatial applications. Our IFSAR DEMs are collected as part of our NEXTMap® countrywide mapping program at 5-meter post spacings, feature a vertical accuracy RMSE of 1 meter, and include:

- **Digital surface models (DSMs)** – a topographic model of the earth's surface that includes buildings, vegetation, roads, and natural terrain features. The key benefit of the DSM is that it provides a geometrically correct base map.
- **Digital terrain models (DTMs)** – a topographic model of the bare earth that has had vegetation, buildings, and other cultural features digitally removed, enabling users to infer terrain characteristics possibly hidden in the DSM.



Colorized DSM



Colorized DTM

Data Specifications

Vertical datum (geoid model):

Horizontal (geodetic) datum:

Projection/unit:

File format:

United States

NAVD88 (GEOID 99)

NAD83

Geographic latitude/longitude

32-bit floating point binary
grid format (.BIL)

Europe

NAP (EVRS)

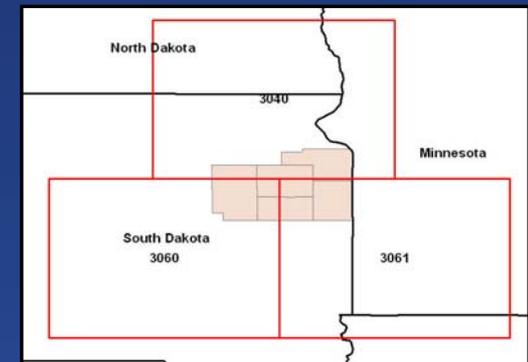
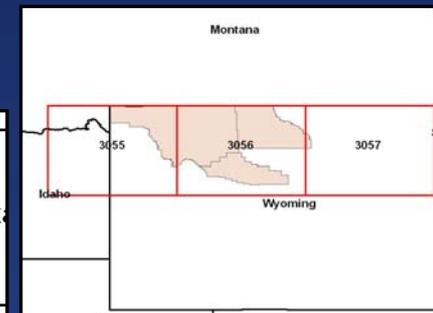
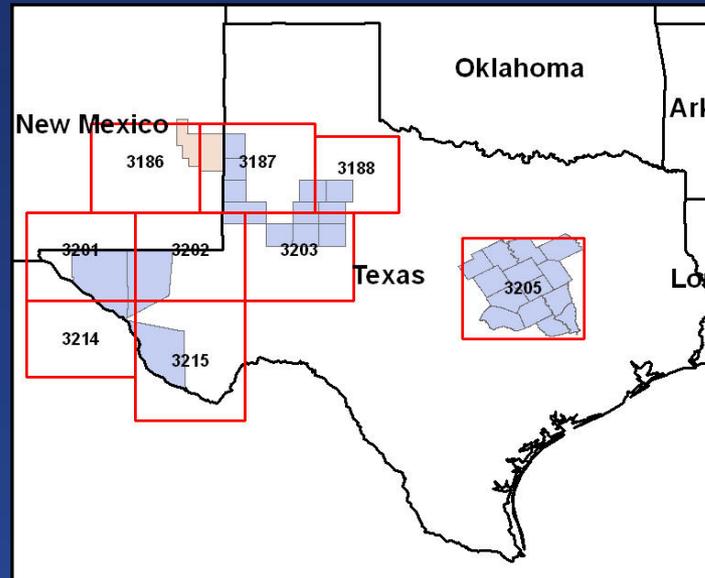
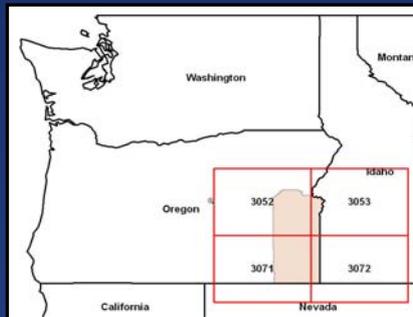
ETRS89

Geographic latitude/longitude

32-bit floating point binary
grid format (.BIL)

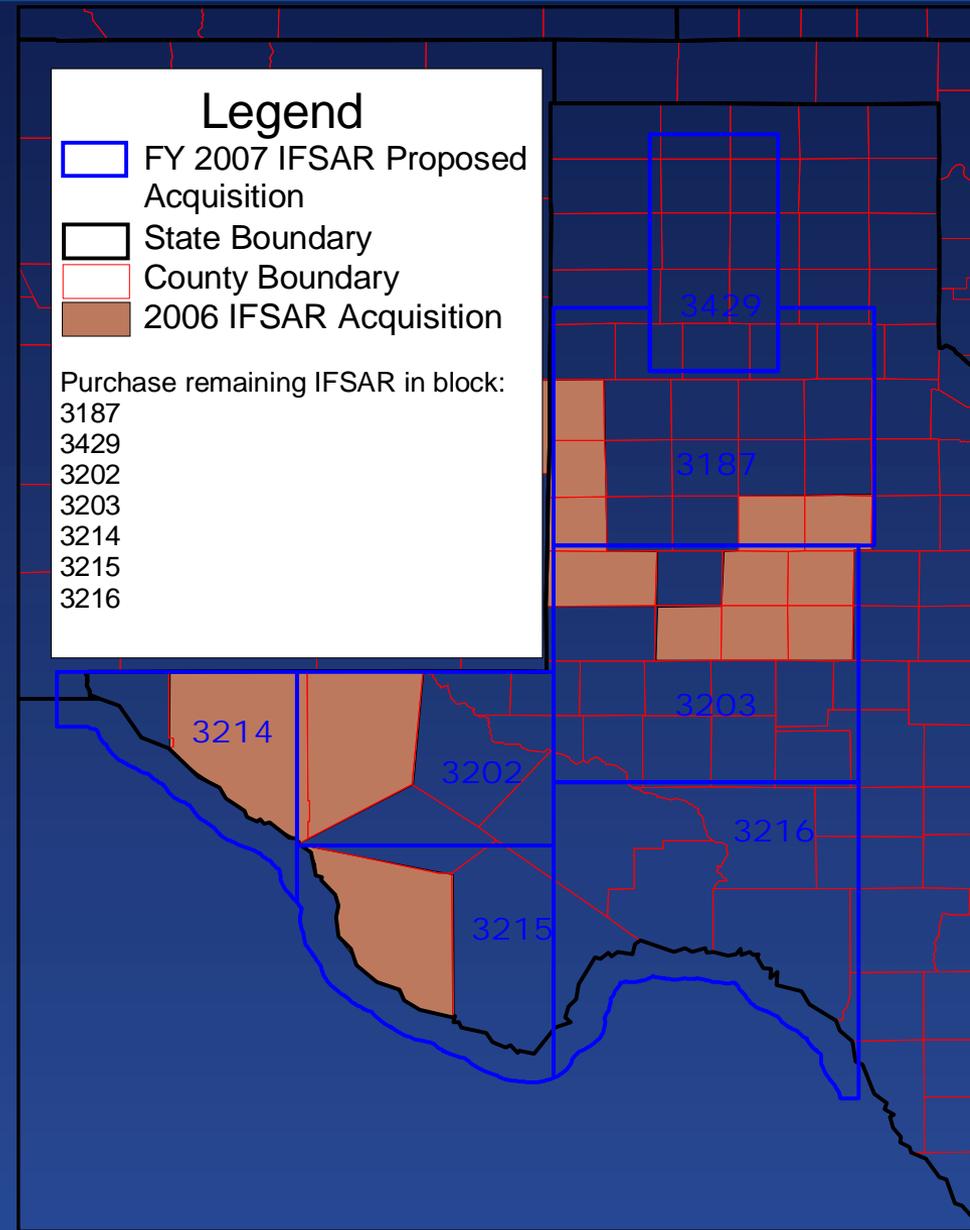
USDA I

- August 2005 – February 2007
- 150,000km² of data in TX, NM, CA, SD, OR, WY
- Some data on shelf, most had to be acquired
- TX data in Block 3205 had dense veg & trees – original DTM had many issues. Data and input from NRCS used to help design our new enhanced DTM product.



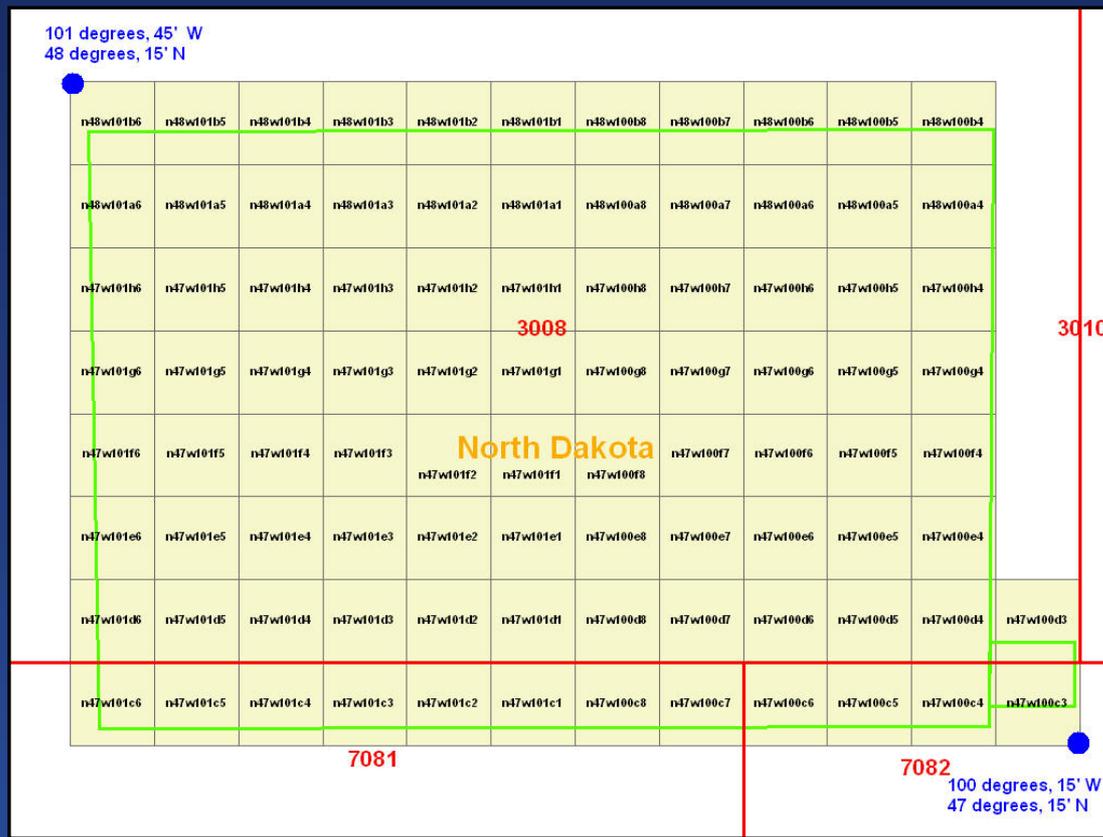
USDA II

- August 2006 – March 2007
- 155,000 km² of data in TX
- 6 full blocks of collected data, 1 block had to be collected

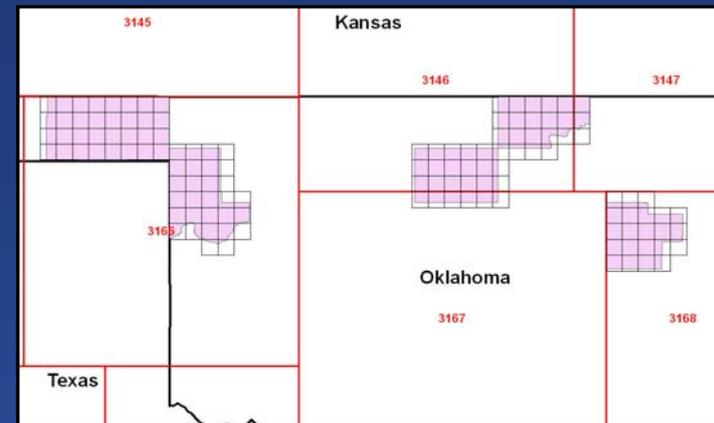
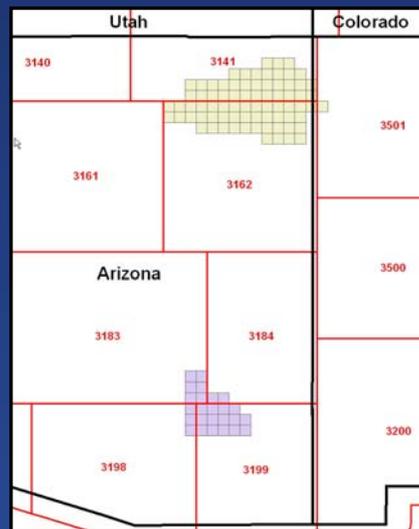
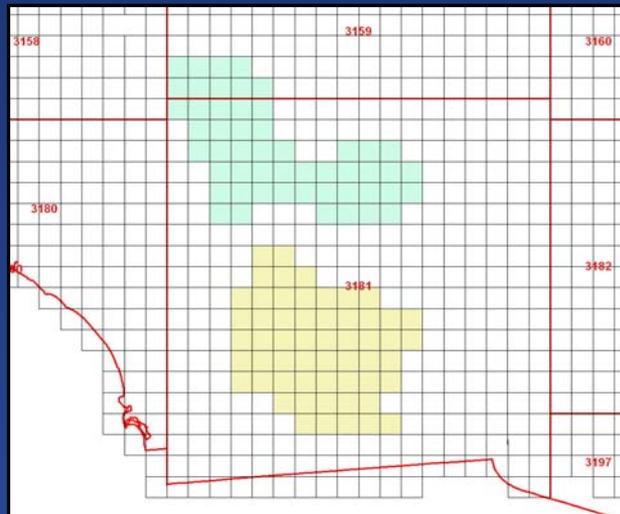


USDA III

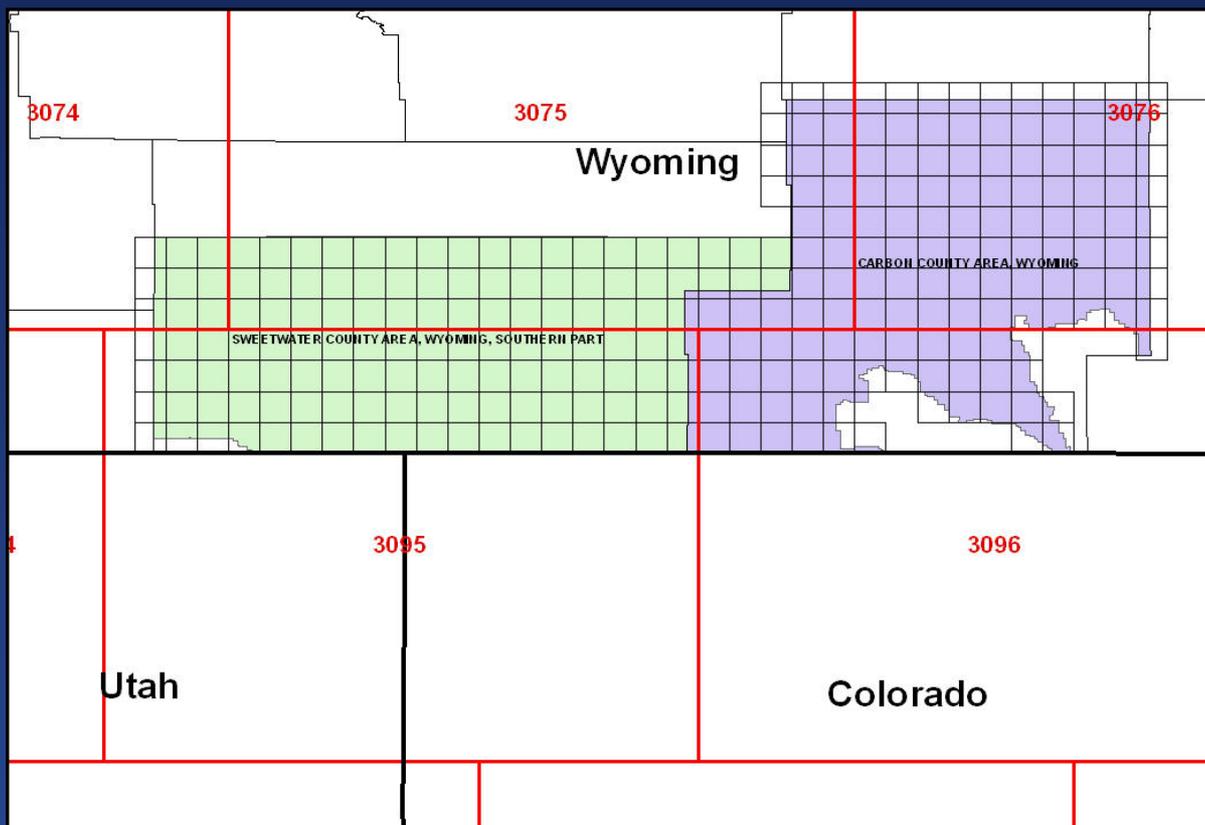
- August 2006 – September 2007
- Custom collect of 10,000km² in North Dakota
- Specific collection criteria (weather, leaf-off)



- USDA IV
 - September 2006 -?
 - 92,000km² of data in CA, AZ, OK, and WY
 - CA, AZ and OK all shipped by August 2007
 - Wyoming due in September 2007, not yet acquired

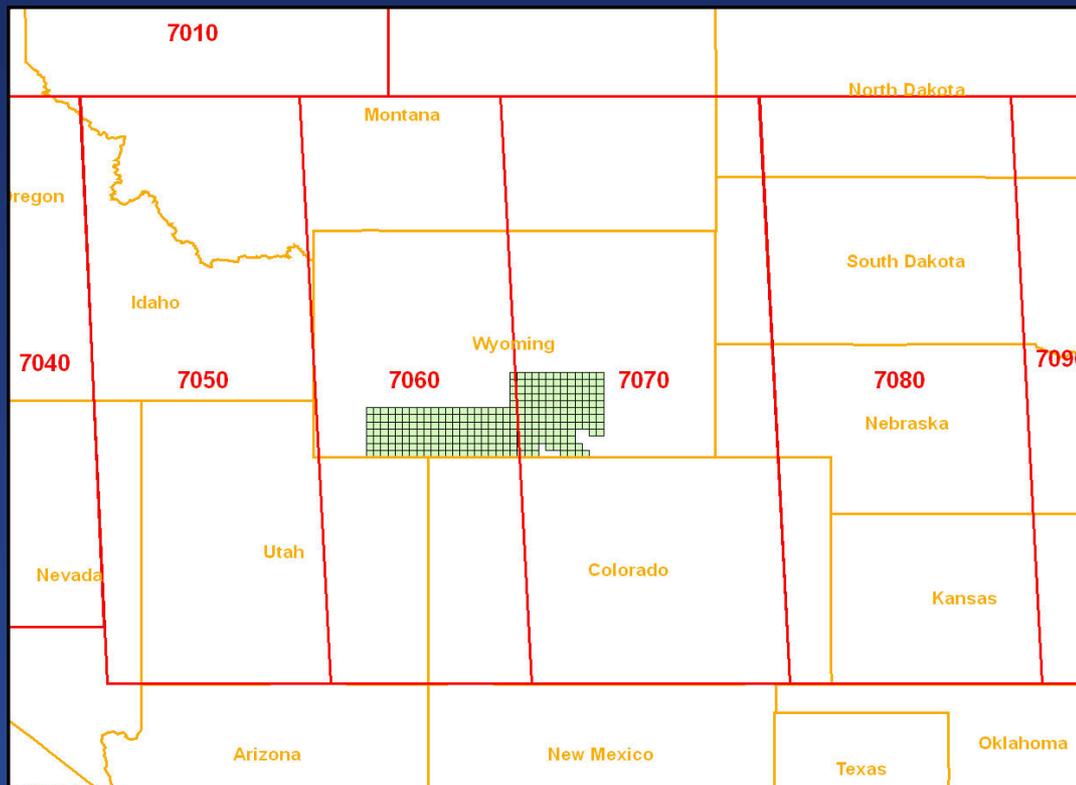


- USDA IV cont.



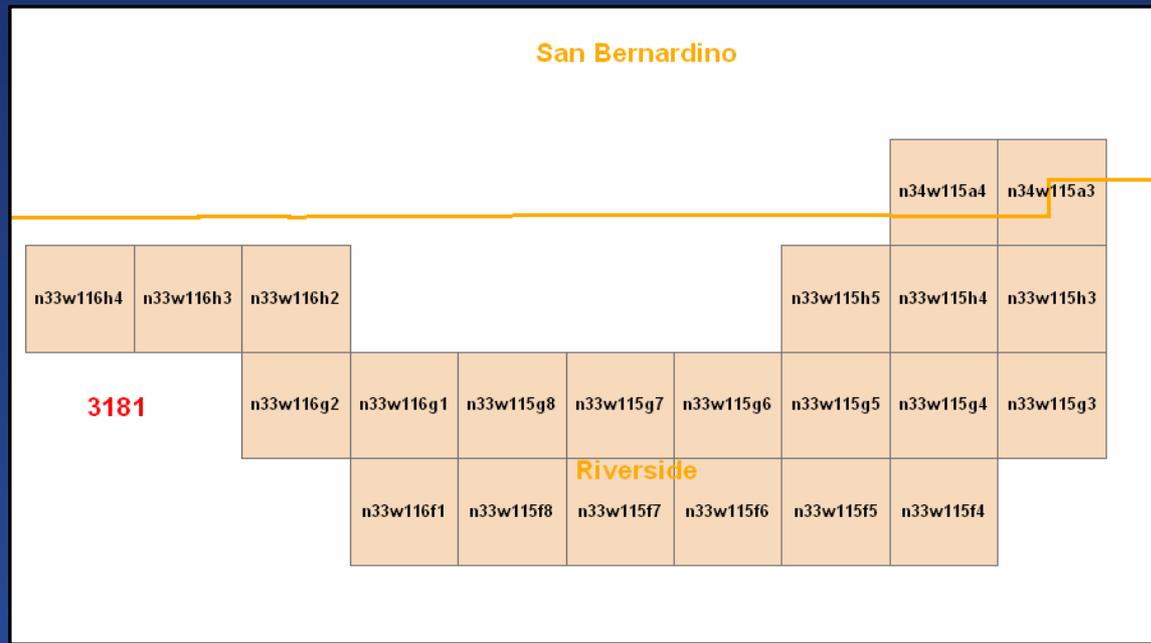
Original Acquisition
Block Layout

- USDA IV cont.
 - Wyoming delayed due to ULL switch in Acquisition
 - AOI divided into two halves – East collected, West delayed till 2008



**New Acquisition
Block Layout
with ULL**

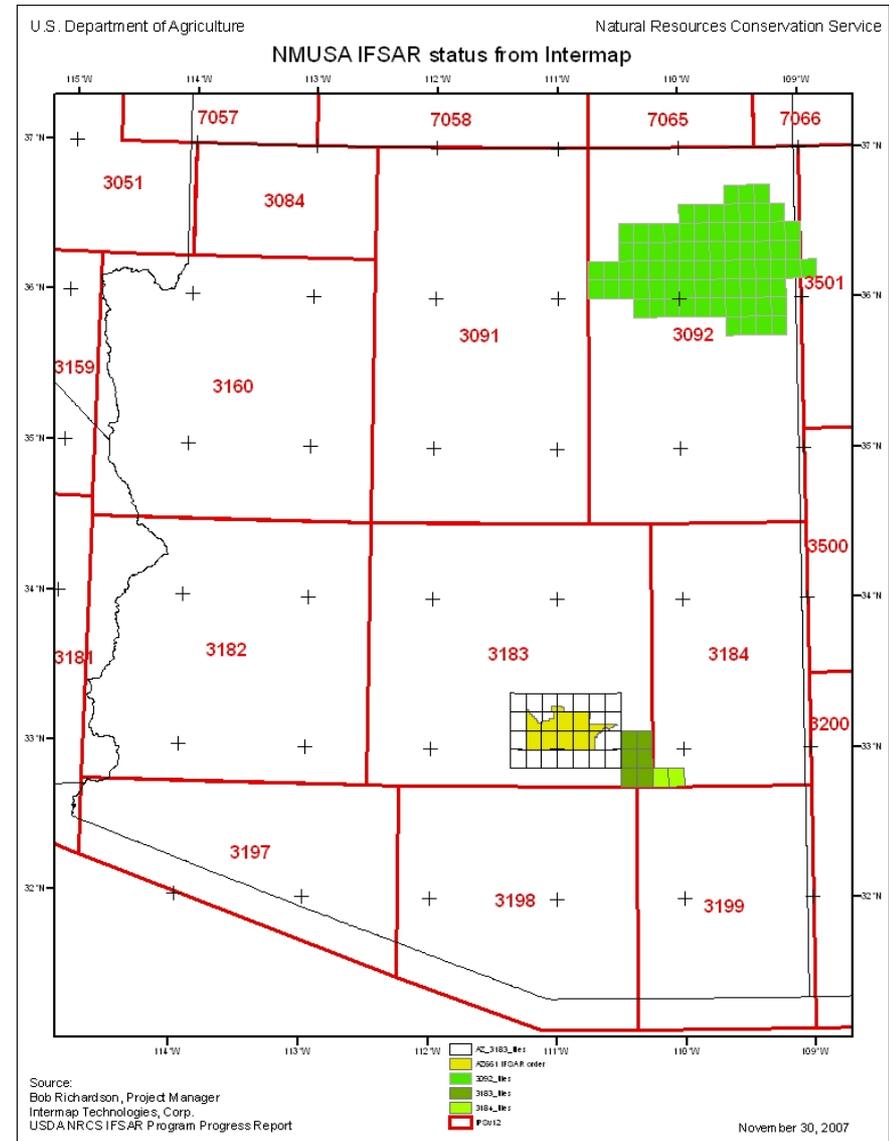
- USDA V
 - August 2007
 - 3,500 km² of Joshua Tree NP in CA



USDA VI

- 50,000 km² of data in 4 States: AZ, TX, MN, SD
- Schedule from SOW modified at project outset

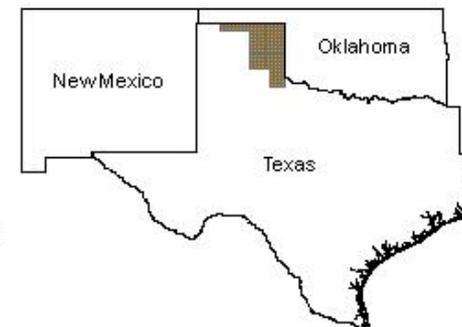
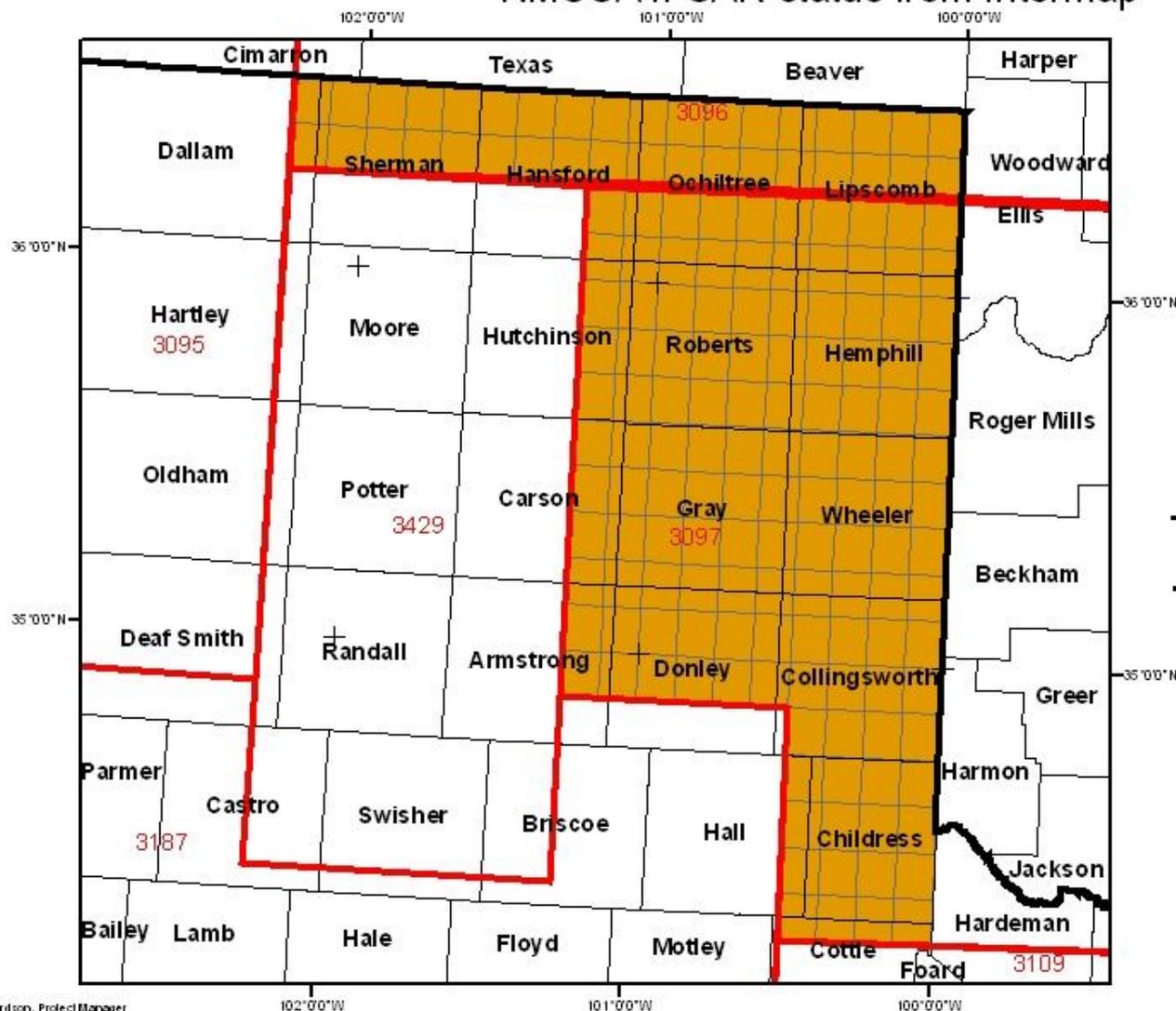
Arizona (28 tiles):
-Currently Under Review at NCGC



U.S. Department of Agriculture

Natural Resources Conservation Service

NMUSA IFSAR status from Intermap



Texas (166 tiles):
- On track for Dec 21 delivery

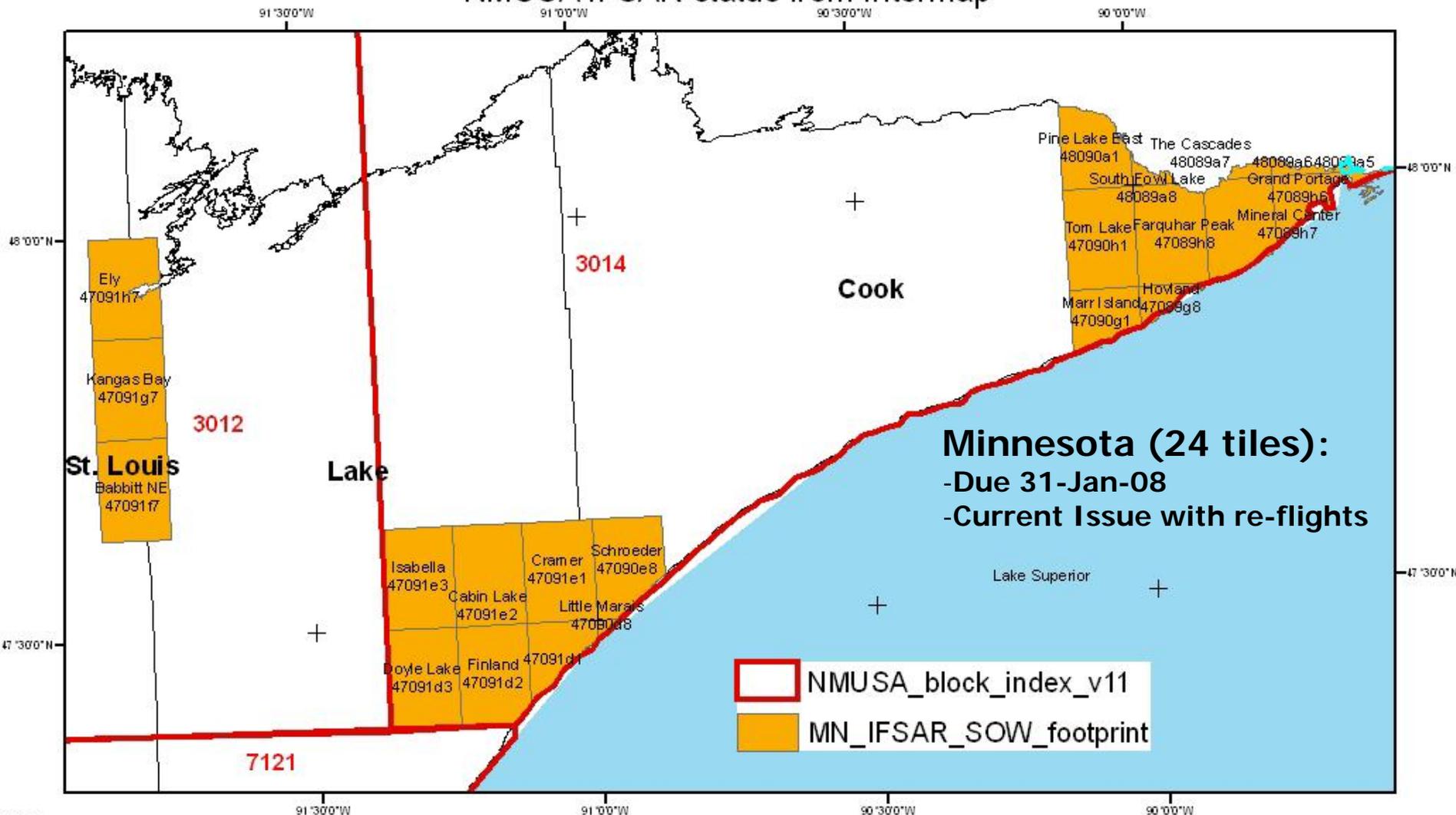
-  IPS_v11
-  IFSAR_TX_quads_FY2007 (166 tiles)

Source:
Bob Richardson, Project Manager
Intermap Technologies, Corp.
USDA NRCS IFSAR Program Progress Report

U.S. Department of Agriculture

Natural Resources Conservation Service

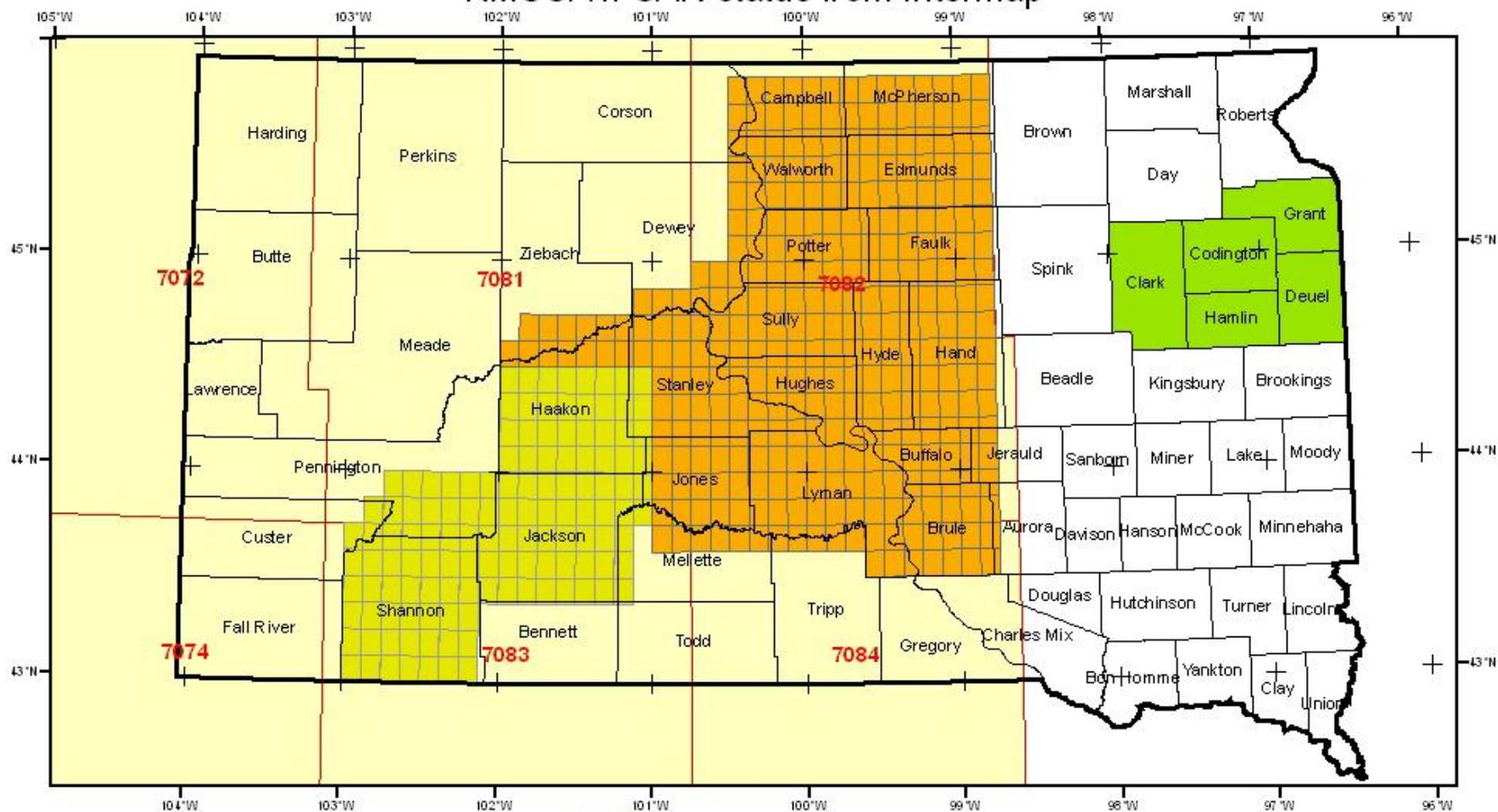
NMUSA IFSAR status from Intermap



Source:
 Bob Richardson, Project Manager
 Intermap Technologies, Corp.
 USDA NRCS IFSAR Program Progress Report

U.S. Department of Agriculture Natural Resources Conservation Service

NMUSA IFSAR status from Intermap



7072

7081

7082

7074

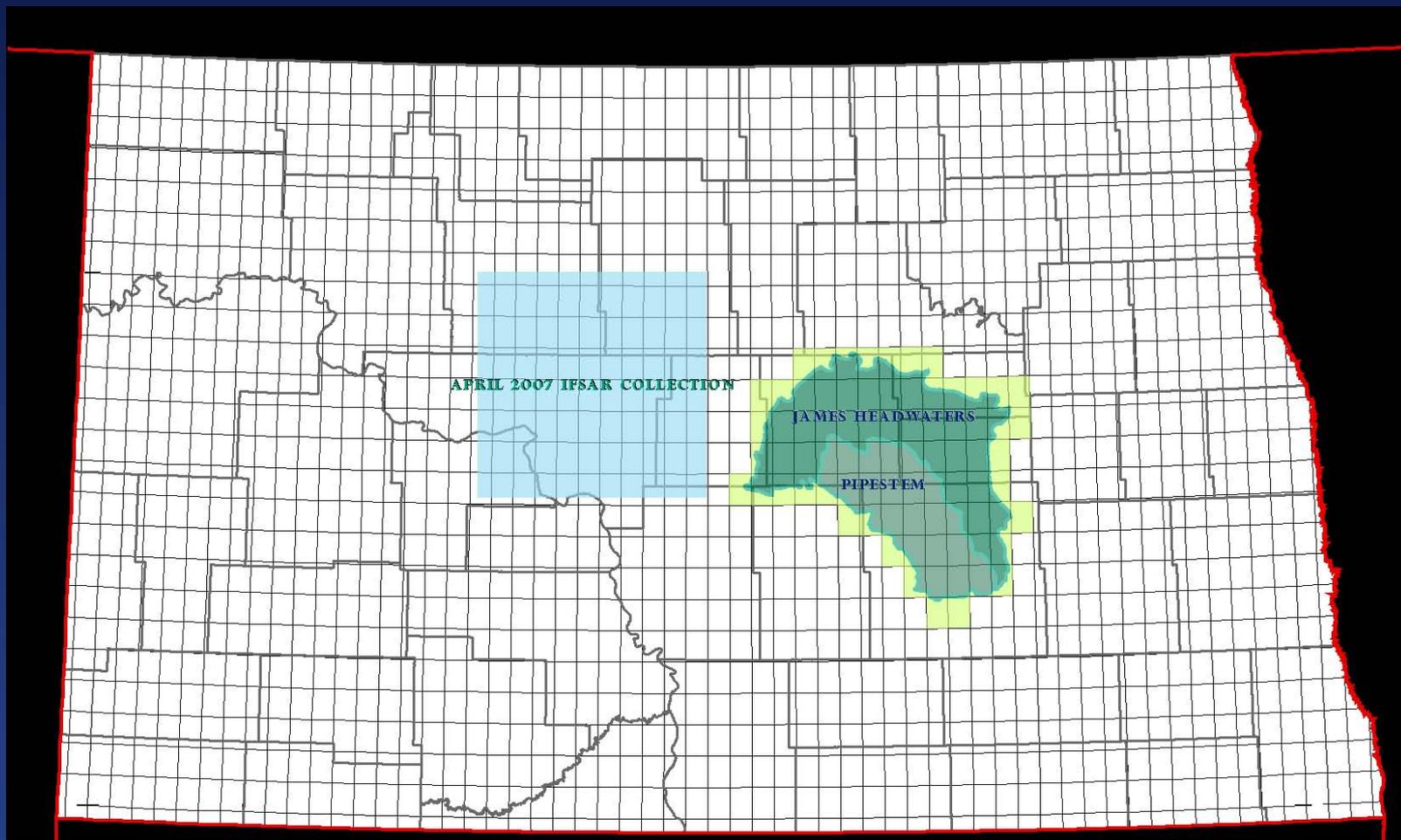
7083

7084

- IFSAR_Order_FY 2008 (317 tiles) 219,802.24
- IFSAR_Order_FY 2007 (127 tiles) 89,412.62
- IFSAR_Order_FY 2006
- IFSAR_acquisition_in_progress

Due 15-Mar-08
-No current Issues

Source:
Bob Richardson, Project Manager
Intermap Technologies, Corp.
USDA NRCS IFSAR Program Progress Report



Potential IFSAR-NEXTMAP Acquisition

James River Headwaters and Pipestem River Watersheds, North Dakota

FY07 Potential Task Order Amendment FY06 Task Order

Eight Digit Hydrologic Units

- Pipestem River Watershed
- James River Headwaters Watershed
- Outside AOI (USGS Quad Boundary)

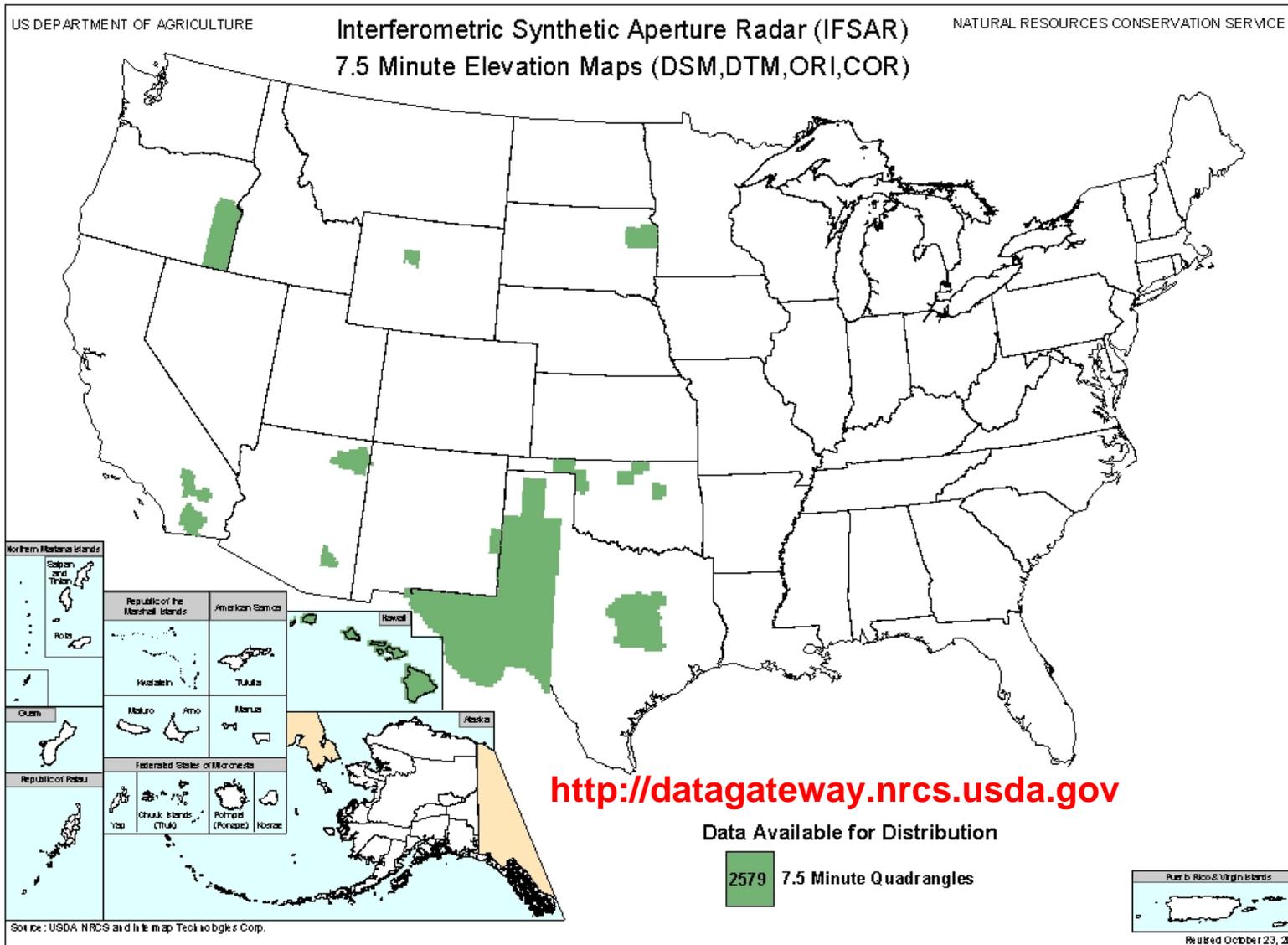
USDA III

- April 2007 Collection

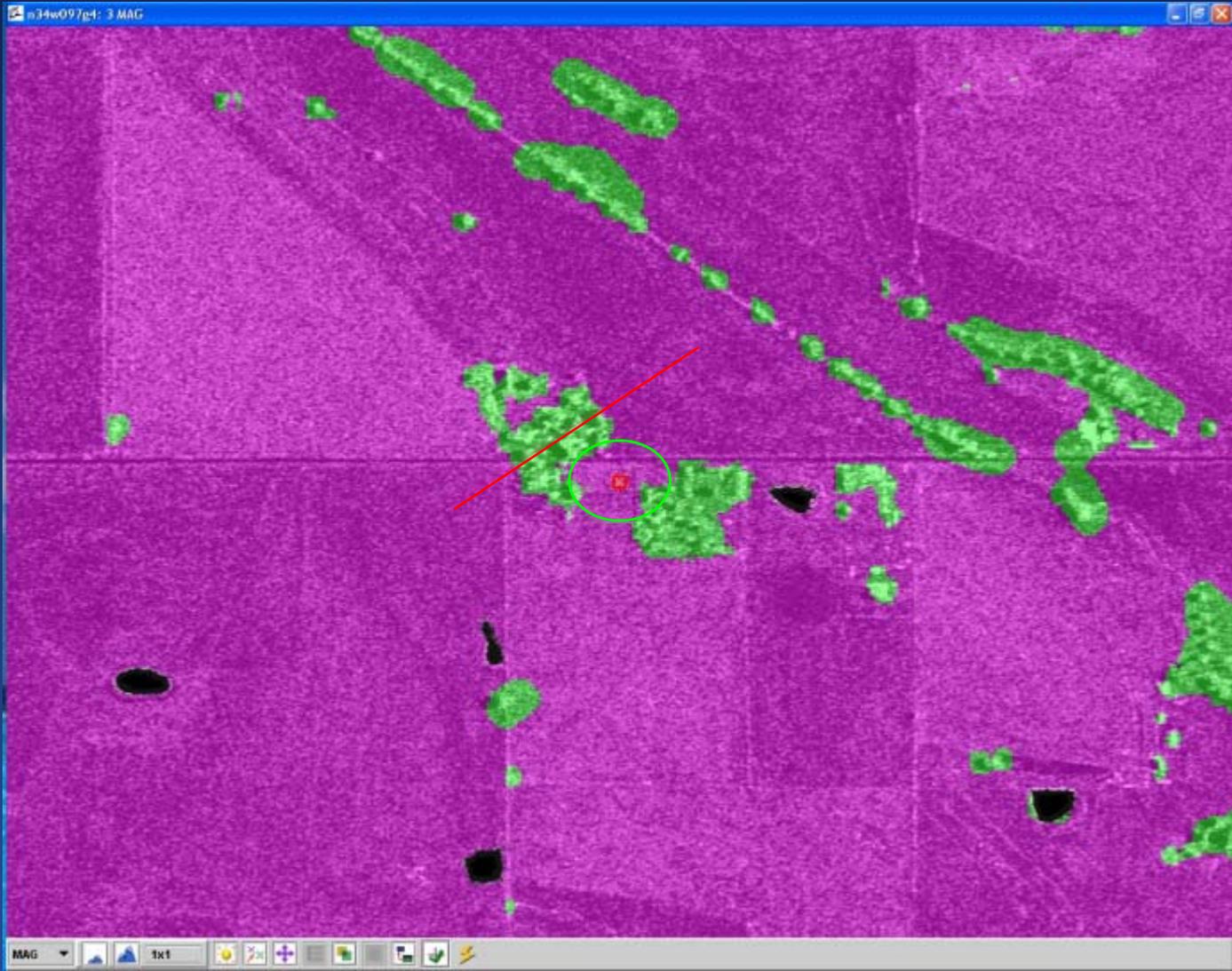
USGS Quad Boundaries



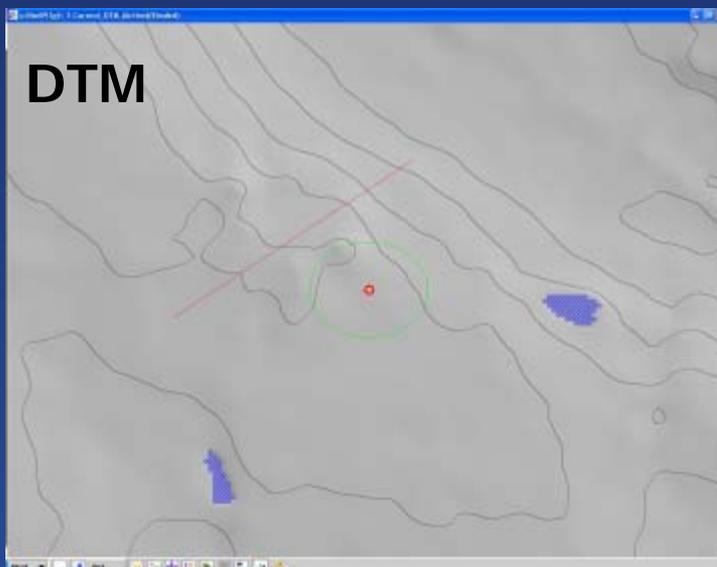
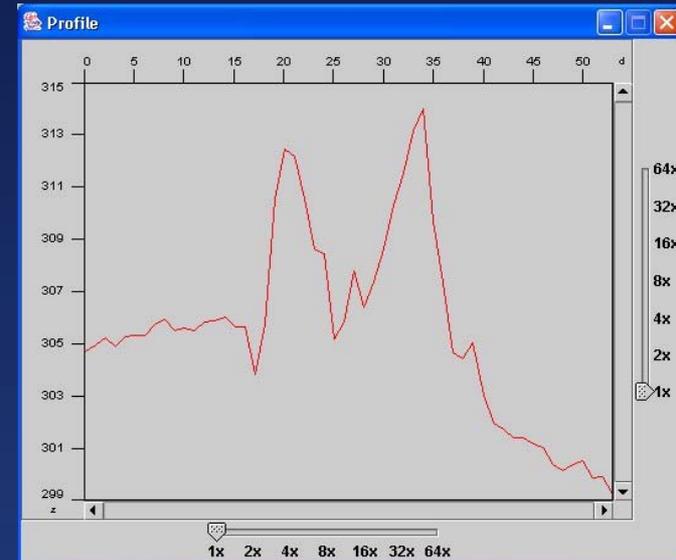
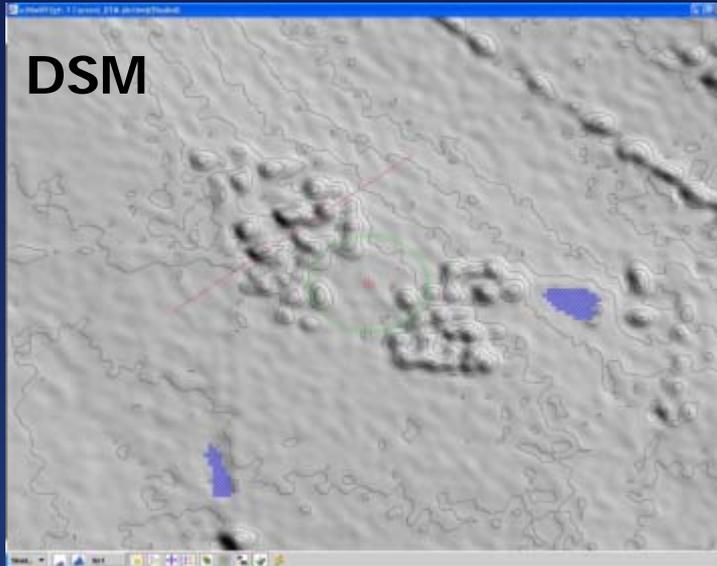
1 inch equals 35 miles



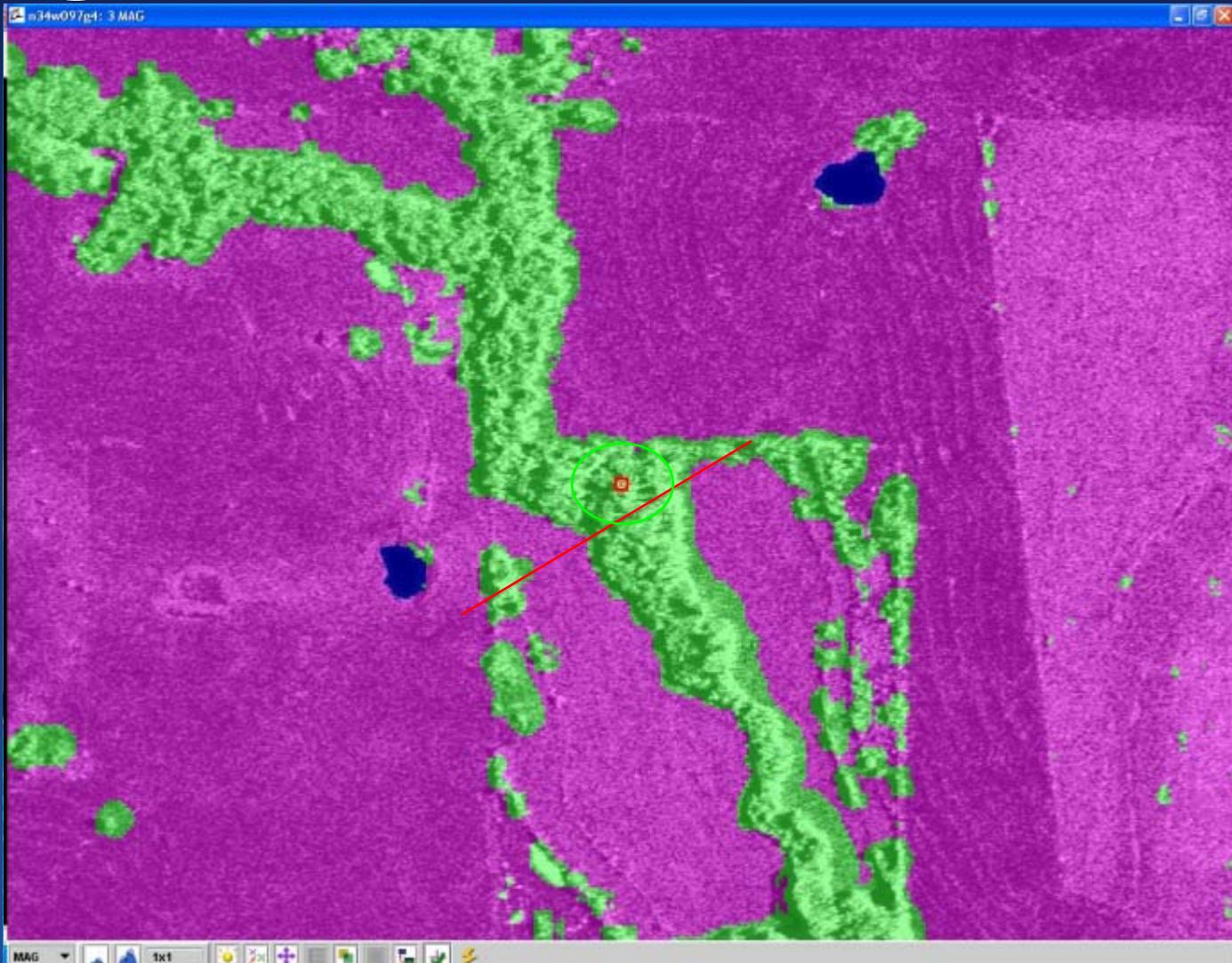
Vegetation Feature – Tree Removal



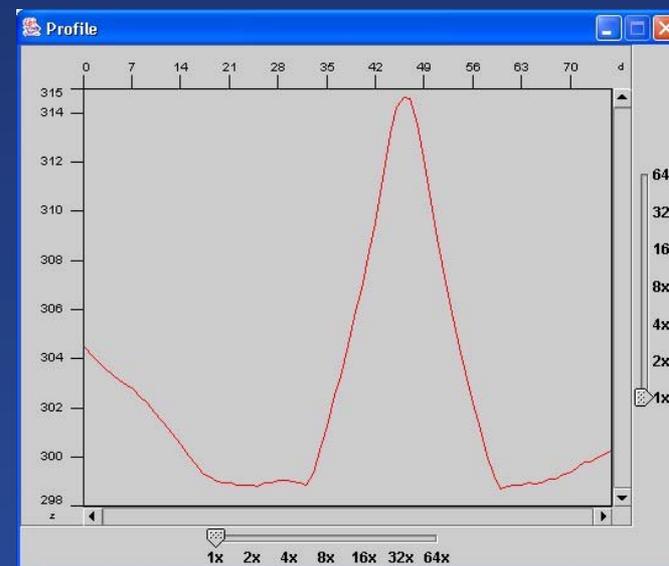
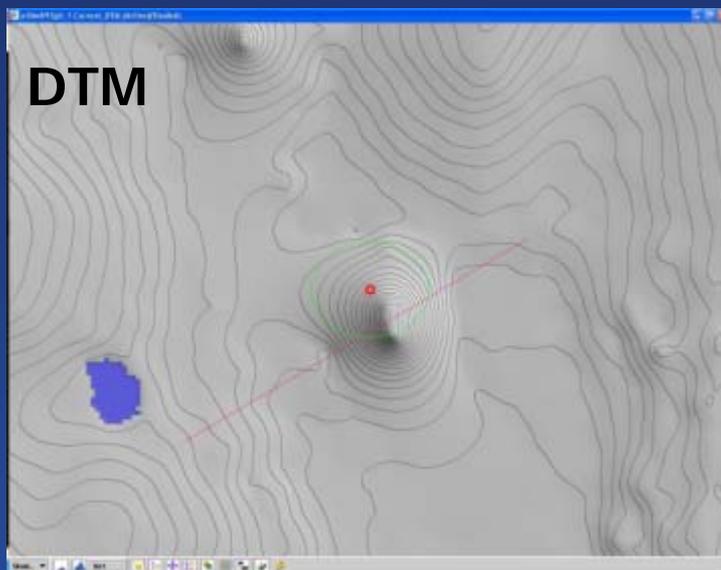
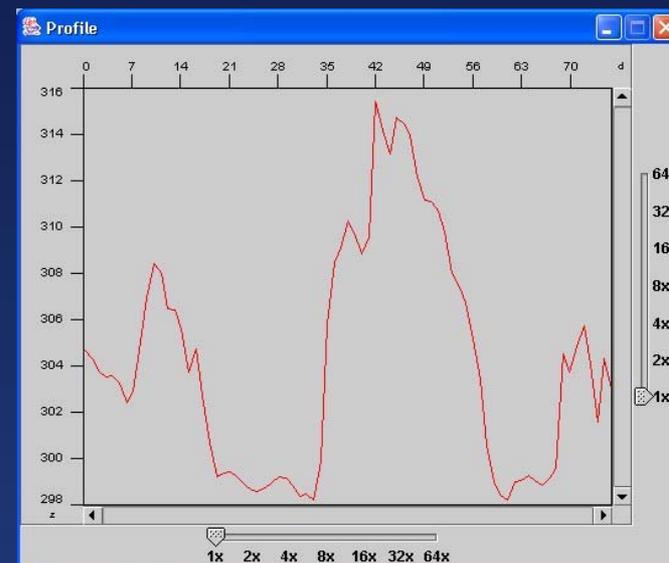
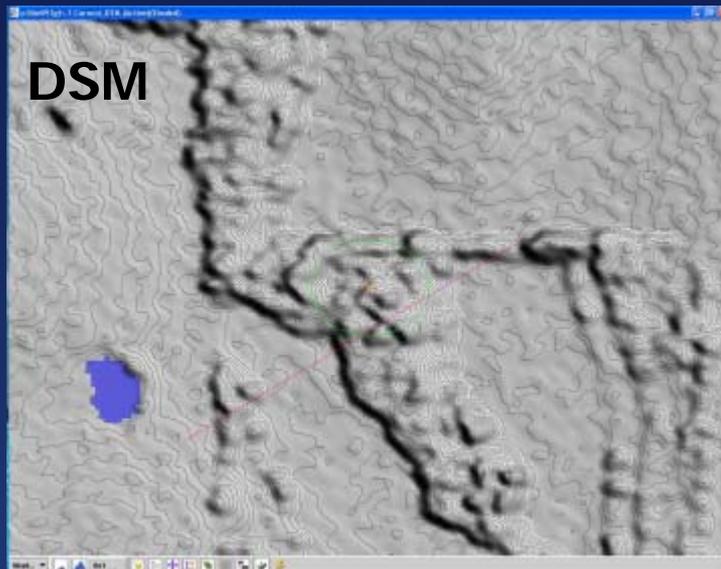
Vegetation Feature – Tree Removal



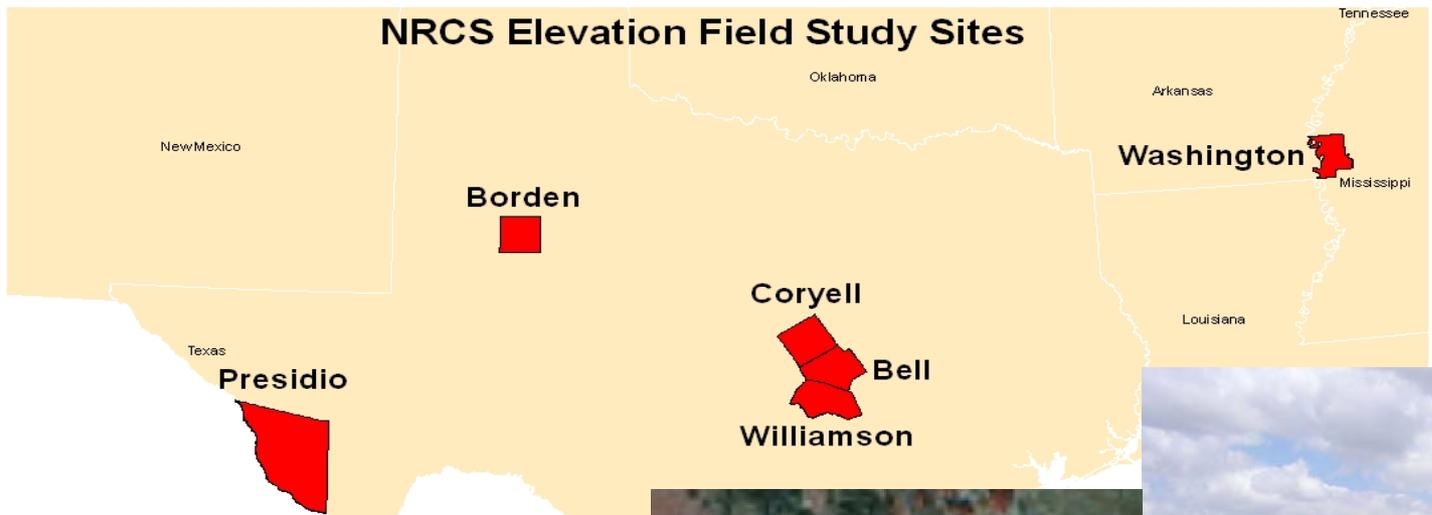
Trees greater than 100m across A



Trees
greater
than 100m
across



- **Overlap of IFSAR, LIDAR, and HAGPS**
- **Study areas - level terrain and low veg plus areas with non-ideal conditions**

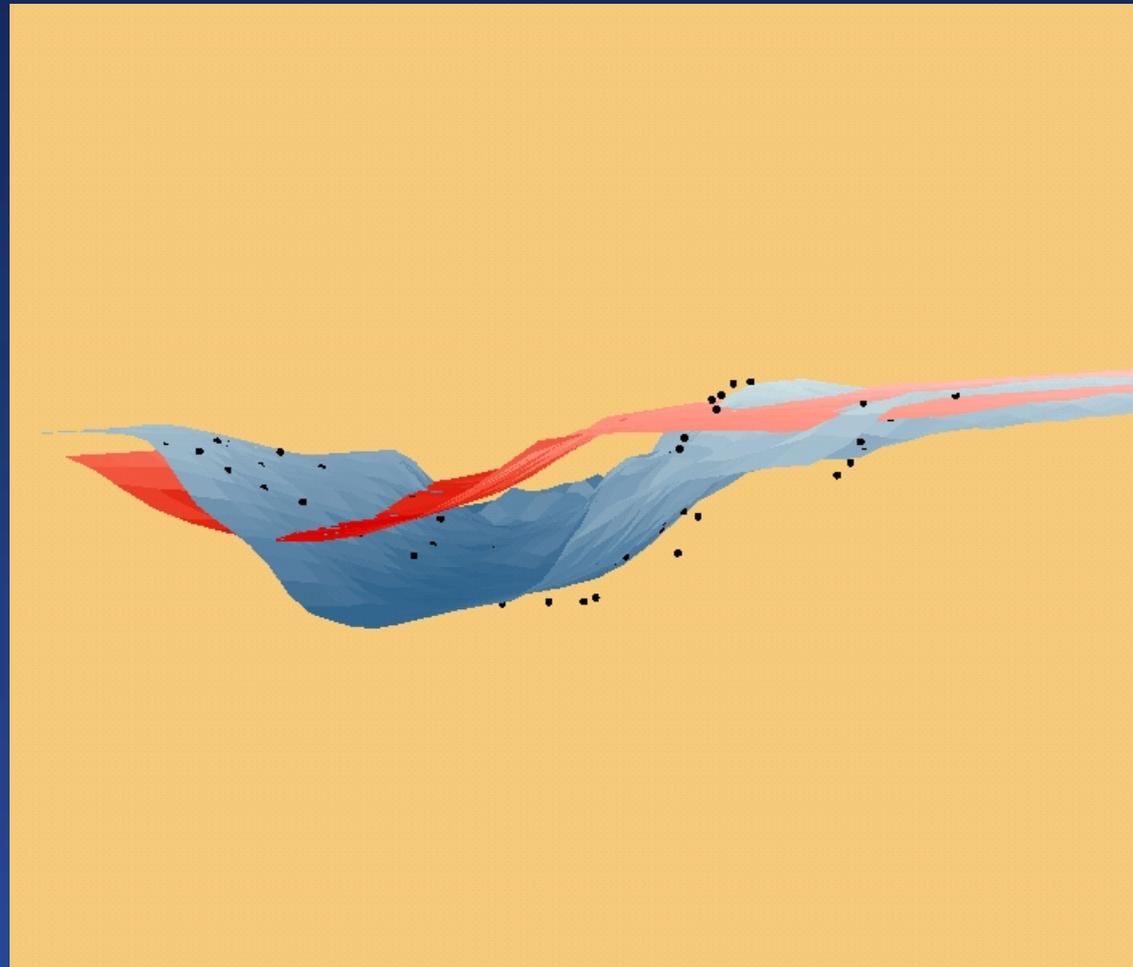


Surface Comparison

IFSAR surface –
red

LIDAR surface -
blue

HAGPS -points

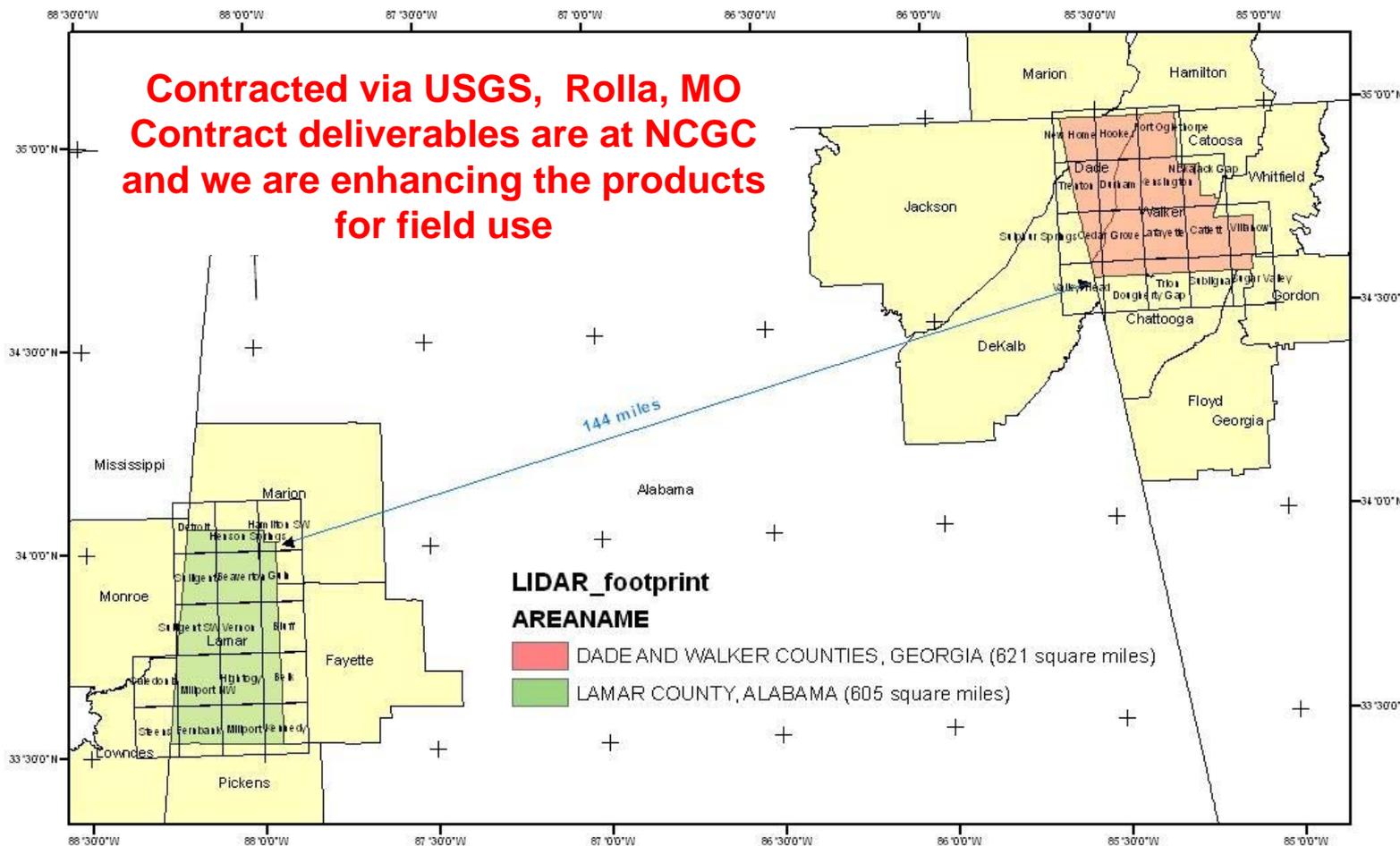


U.S. Department of Agriculture

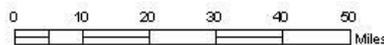
Lamar County, Alabama Dade and Walker Counties, Georgia

Natural Resources Conservation Service

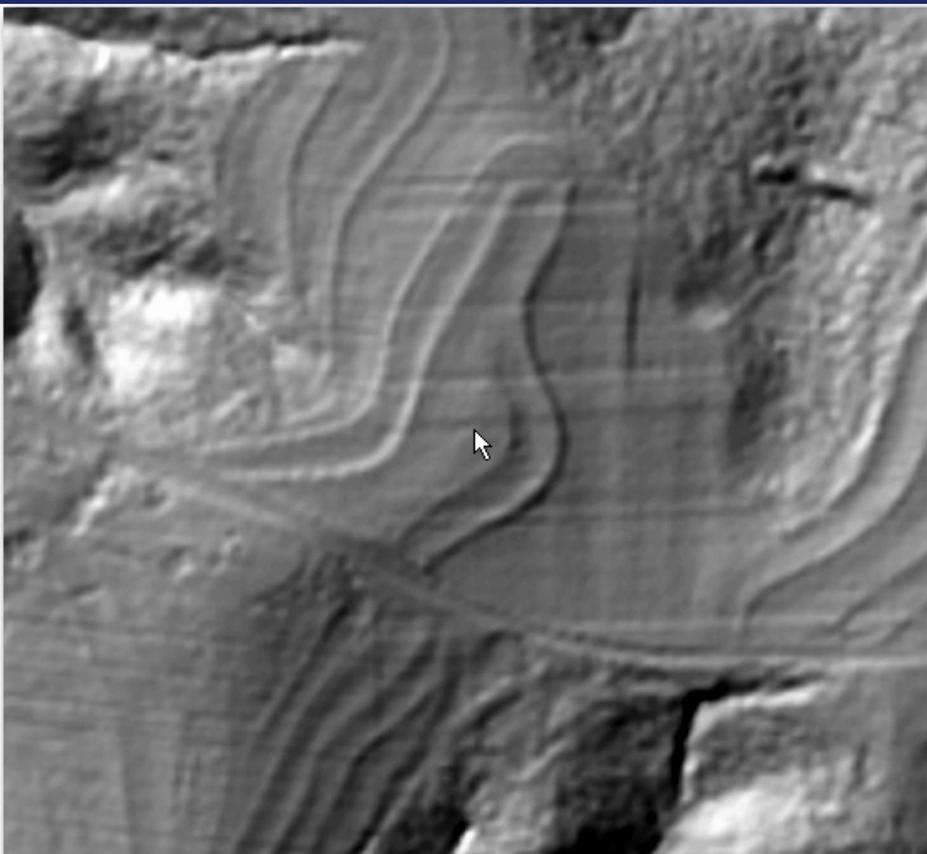
**Contracted via USGS, Rolla, MO
Contract deliverables are at NCGC
and we are enhancing the products
for field use**

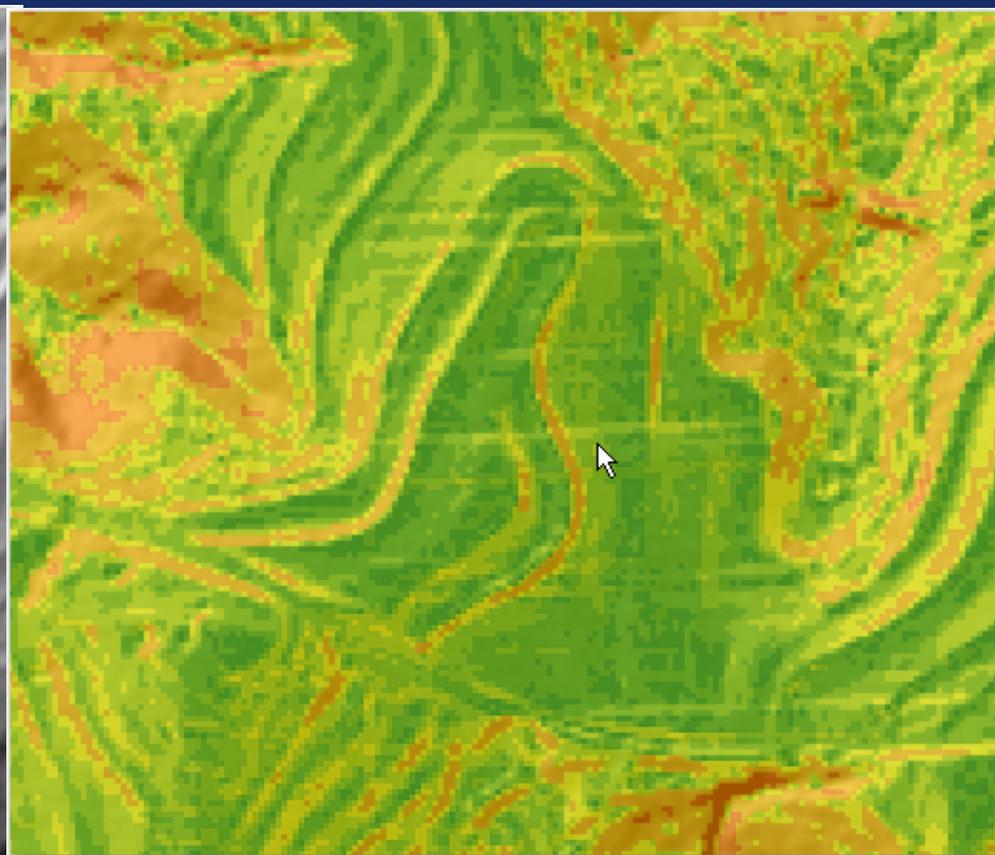
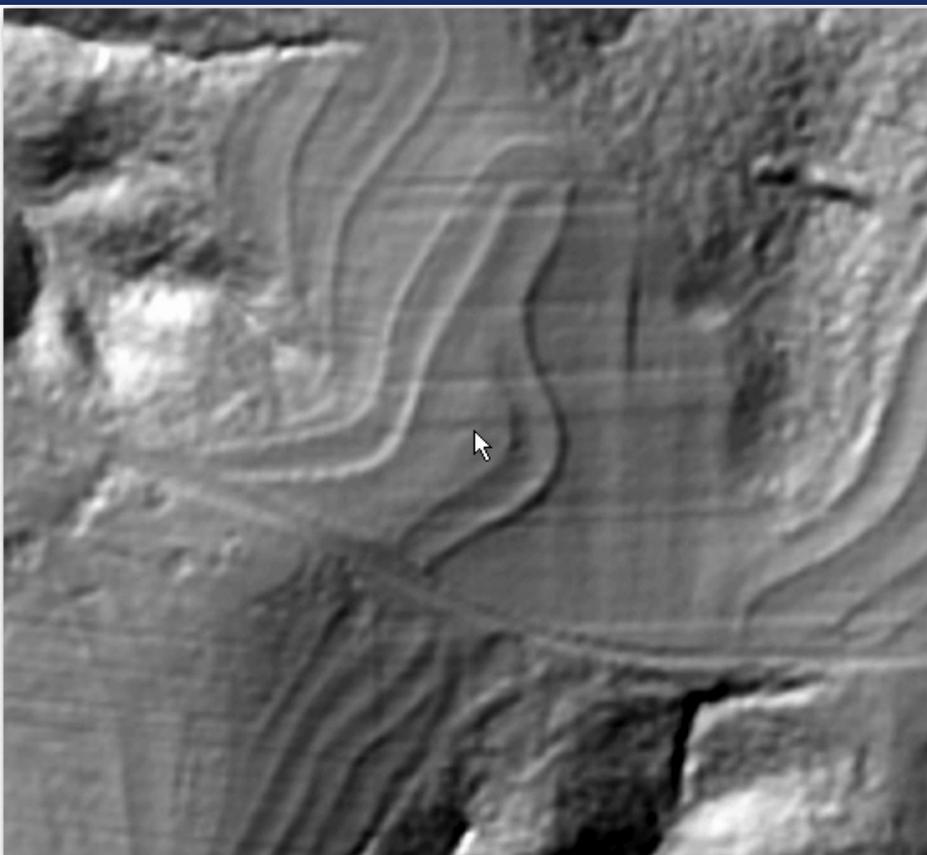


Source:
Geospatial Data Warehouse layers
National Cartography & Geospatial Center, Fort Worth, Texas



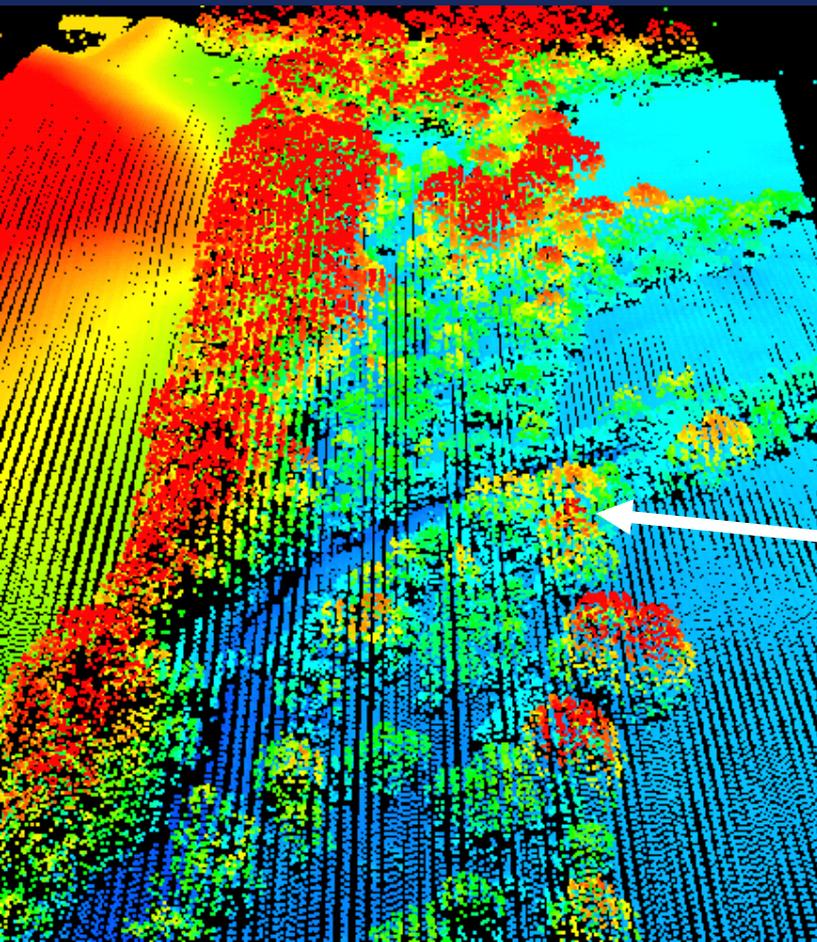
August 28, 2006



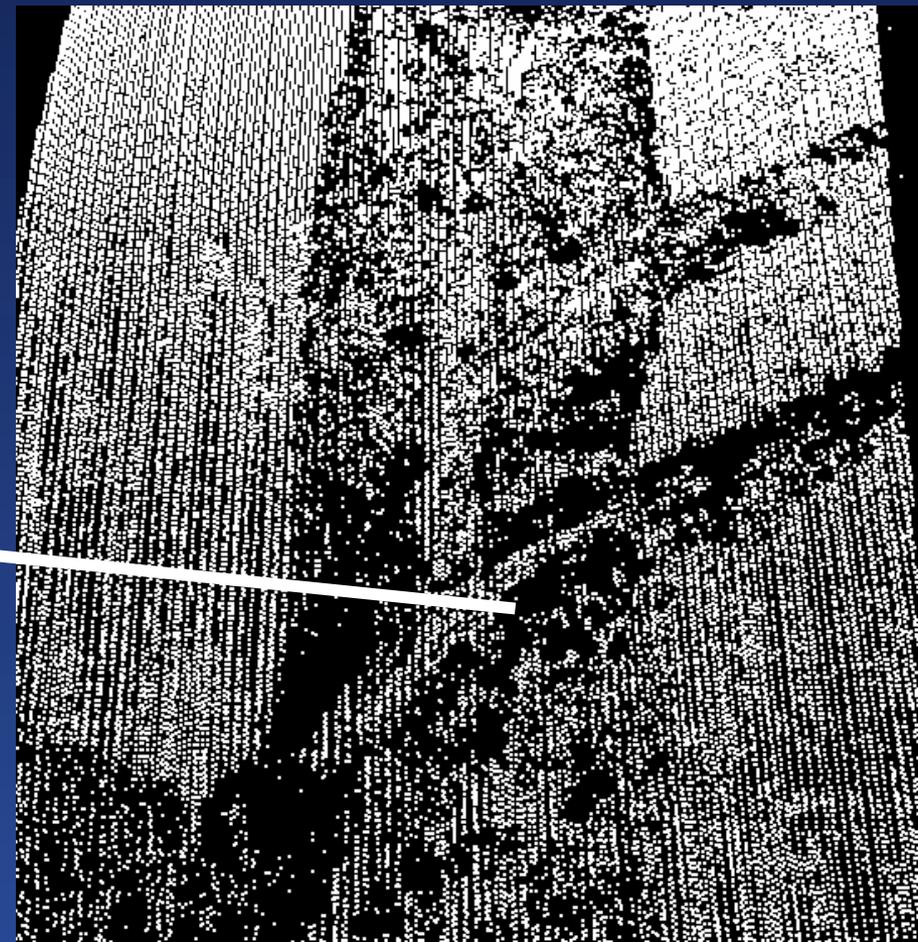


Vegetation Effects on Terrain Model

Point Cloud Elevation Stretch

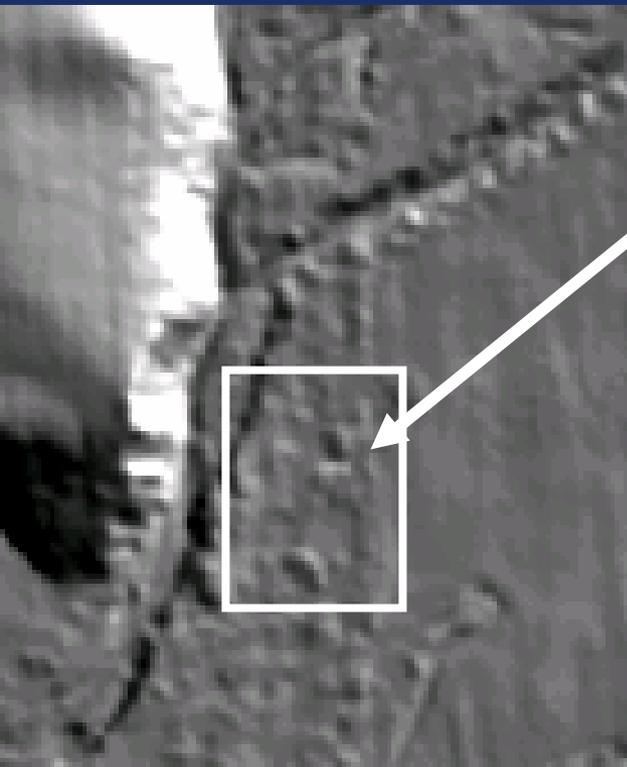


Bare Earth Points used to create surface



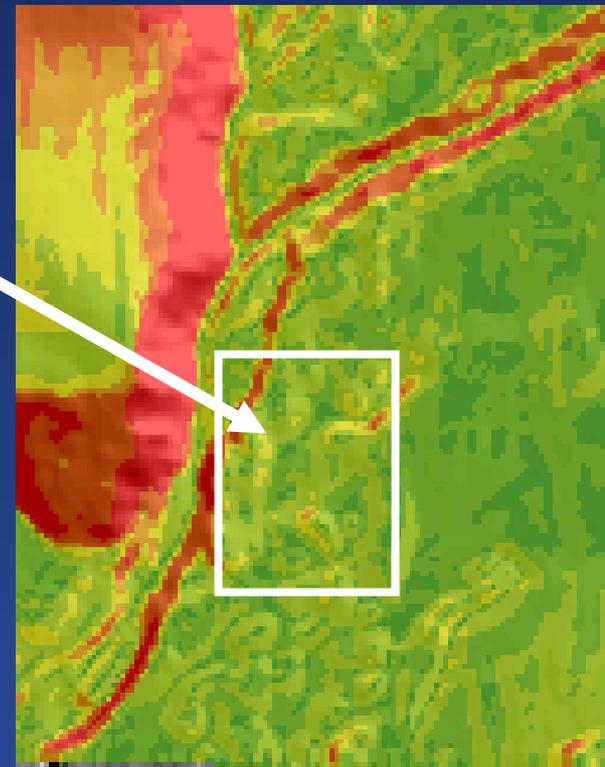
Vegetation Effects on Elevation Derivatives

Hillshade



Area where bare earth terrain model does not appear to accurately represent the terrain because of vegetation.

Slope Gradient



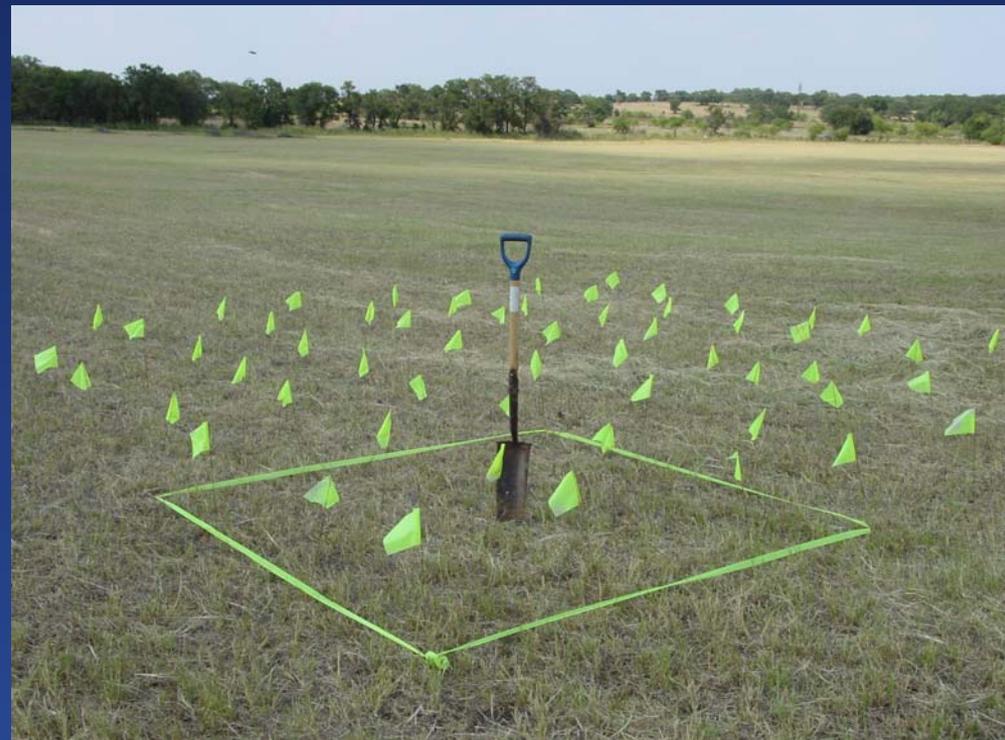
LIDAR Issues

- Can there be too much detail?
- Data intensity more than required?

Illustration of LIDAR data density.

Tile Spade is in the center of a 1 m square.

Flags are spaced a 0.3 m interval in a 5 m square.



United States Department of Agriculture Natural Resources Conservation Service



Internet Explorer users must check java options and use JRE 1.5 (or higher) before proceeding. (see FAQ item 2)



+ United States Department of Agriculture +

+ Service Center Initiative +

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+ Natural Resources Conservation Service +
+ Farm Service Agency +
+ Rural Development +

the one stop source of
natural resources data

The Geospatial Data Gateway provides One Stop Shopping for natural resources or environmental data at anytime, from anywhere, to anyone. **The Gateway** allows you to choose your area of interest, browse and select data from our catalog, customize the format, and have it downloaded or shipped on CD or DVD.

SYSTEM STATUS

October 9, 2007 3:00PM MST

SOIL orders are now being processed. It could take up to 3 days to get through all orders that were queued up.

NAIP 2003, 2004 and 2005 products are available but due to hardware limitations at the data service site these products will process very slowly. Please do not order these products unless you really need them. If you wish to order quantities of these products, please go [here](#).

Effective 13-DEC-06, JRE 1.5 (or higher) is **REQUIRED** for Step 1 and 2. The JRE can be downloaded and installed [here](#). In addition, see [FAQ #2](#) on how to configure your browser.

Geospatial

Data Gateway

Minimum Requirements: Microsoft Internet Explorer 5.5 or Netscape Communicator 4.76 with Java enabled.

WARNING: This is a United States Department of Agriculture computer system, which may be accessed and used only for official Government business (or as otherwise permitted by regulation) by authorized personnel. Unauthorized access or use of this computer system may subject violators to criminal, civil, and/or administrative action. All information on this computer system may be intercepted, recorded, read, copied, and disclosed by and to authorized personnel for official purposes, including criminal investigations. Access or use of this computer system by any person, whether authorized or unauthorized, constitutes consent to these terms.

NED 1 and 1/3 arc second data services went live 16 April 2007. Available to all customers. We expect the next fresh this month from EROS.

IFSAR data service is available only to NRCS & FSA. We distribute DTM, DSM, ORI & COR files in geotiff format

We current do not have LIDAR data services available from Gateway. We have shared two LIDAR projects with EROS for incorporation into NED and also post the LAS at CLICK:

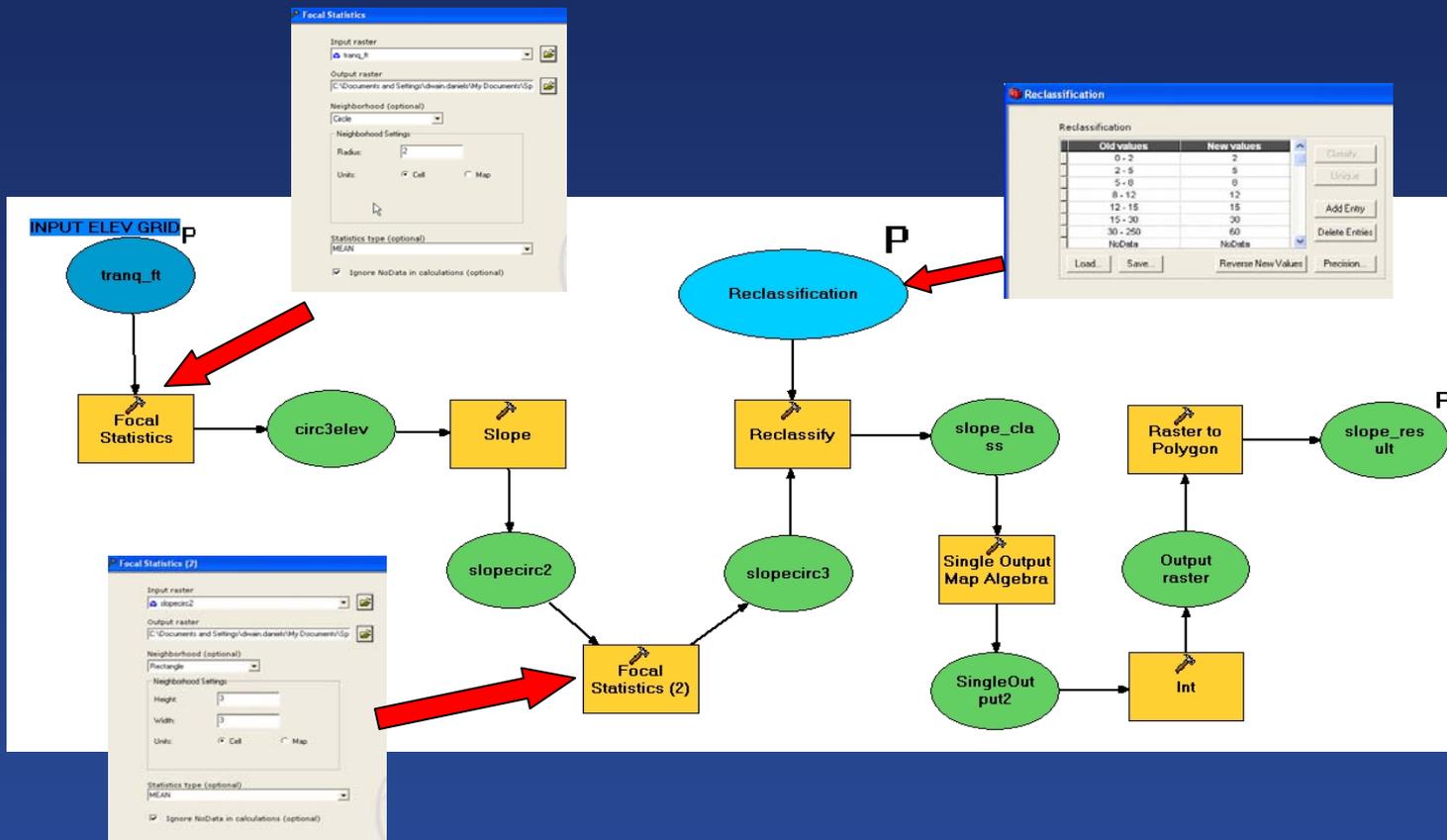
- Sallisaw, OK
- Essex, VT

This model uses a 10m DEM. Most appropriate for terrain with >5% slope.

2 Generalizations to remove contour line artifacts.

Model creates slope group shapefile. Needs to be verified empirically.

Slope Gradient

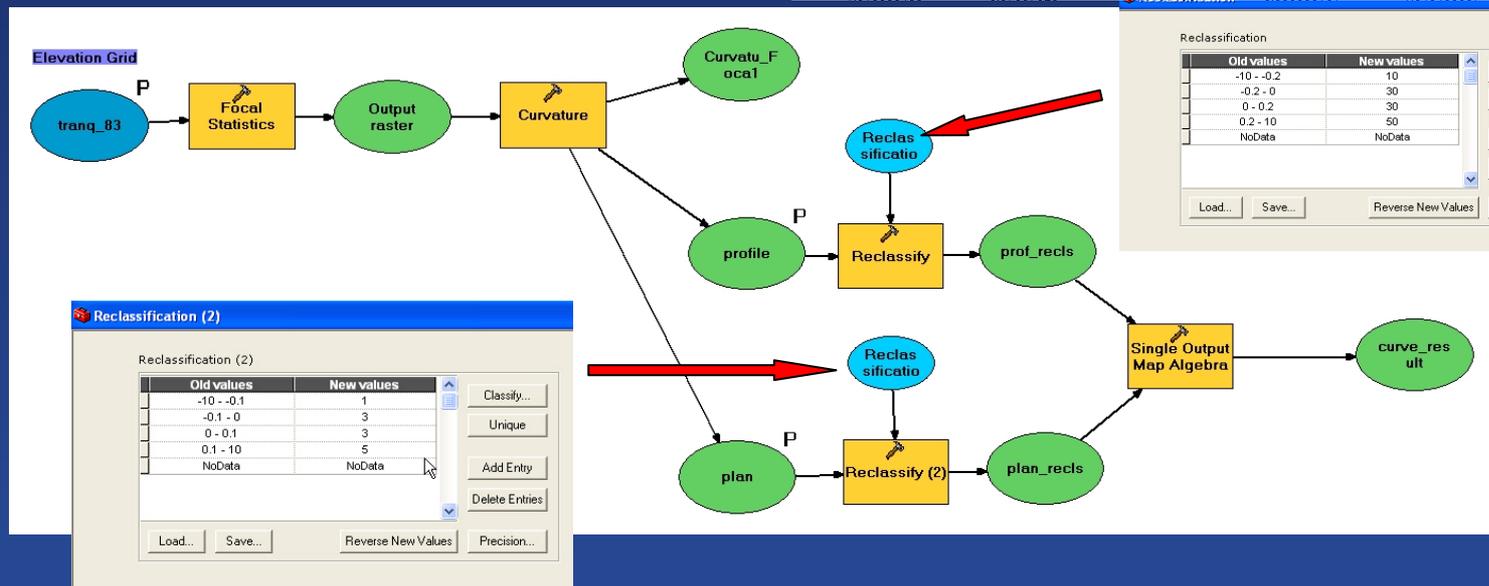
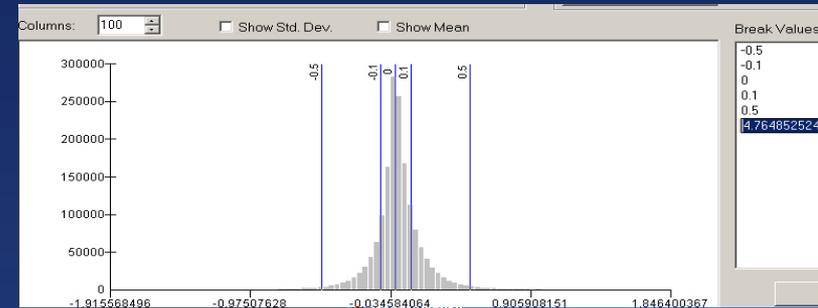


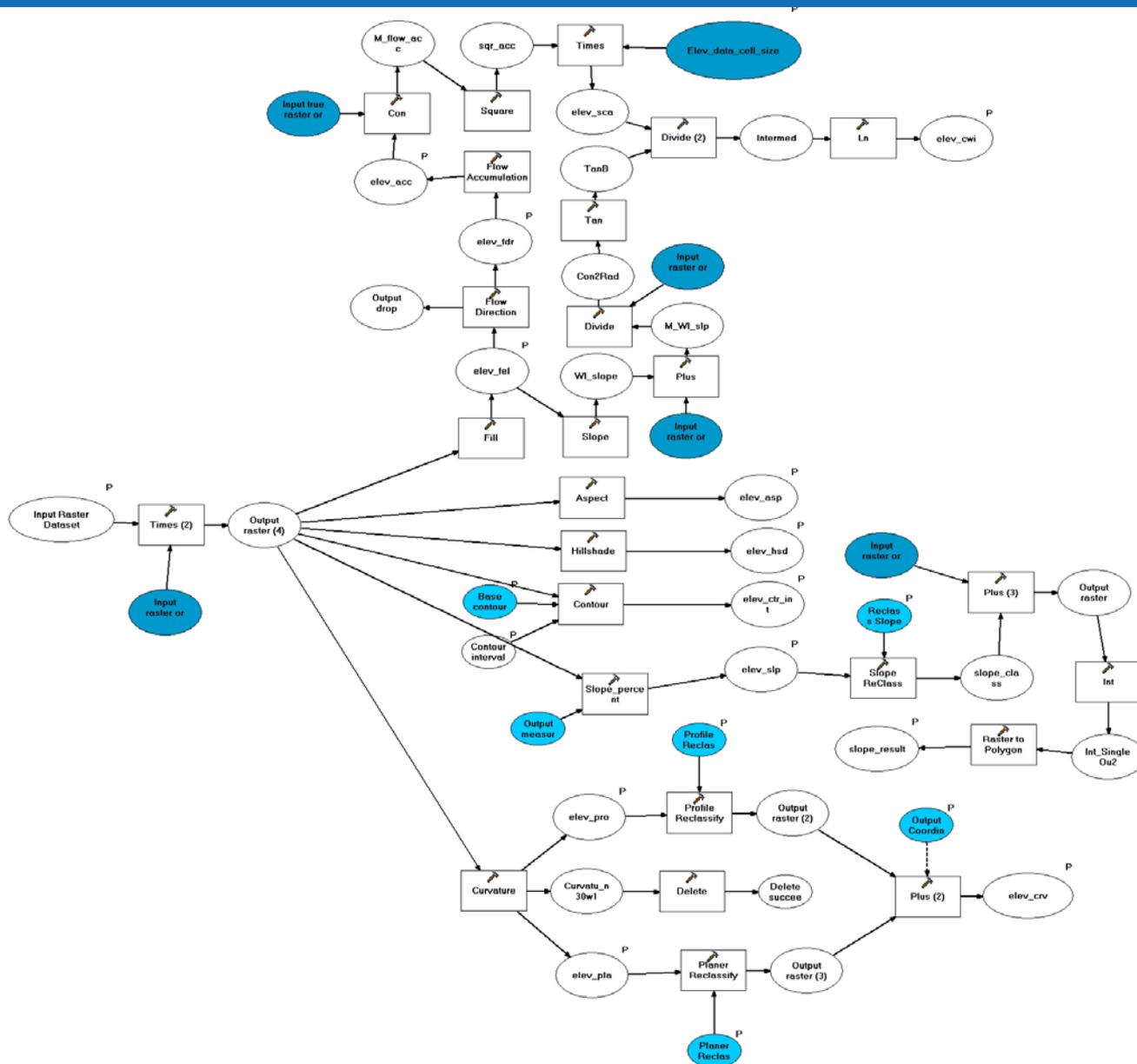
Model creates polygon shapefile to display the 9 different slope shapes using 10m DEM.

Combines the planer and profile grids.

Break in Linear to convex and concave needs to be determined empirically.

Curvature Analysis





SRITB_elev_model_slope_shape_and_grad_reclass__Template

Developed for the Soil Resource Inventory Toolbox effort to process Elevation Data in order to create the profile and planer curve grids reclassified in into 9 slope shapes, generate a slope gradient raster and reclassified slope gradient polygon feature class, hillshade, aspect, contour lines, and the wetness index elevation derivatives. Can be used with elevation data primarily intended for 30m or 10m datasets derived from the National Elevation Dataset (NEDS). Prior to starting the process, Set the General Environment settings for Current and Scratch Workspace. The size of the area attempted may be limited to various sizes dependant upon the resolution of the dataset used and the processing capability of the computer. **** The user needs to be aware that this model assumes the elevation units and the x,y coordinate units are in METERS. ****

- Input Raster Dataset
- Elev_data_cell_size
- Base contour (optional)
- Contour interval
- elev_fel
- elev_fdr
- elev_acc
- elev_ctr_int
- elev_hsd
- elev_asp
- elev_slp
- elev_cwi



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Welcome to the USGS Center for LIDAR Information Coordination and Knowledge

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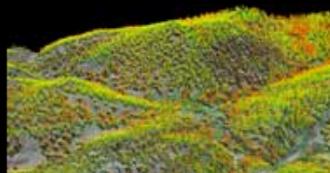
[Websites/References](#)

[Contact Us](#)

CLICK

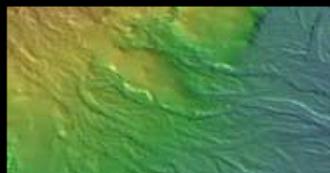
Center for LIDAR Information Coordination and Knowledge

Discrete-return point clouds



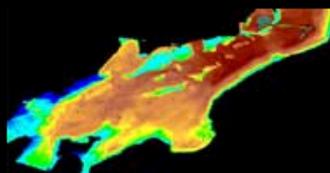
Find out more about discrete-return lidar: See if [publicly-available lidar](#) is in your area of interest; [ask and answer](#) questions about the data, processing, derivatives and more on our bulletin board; [look for articles](#) and other websites about lidar.

Bare Earth

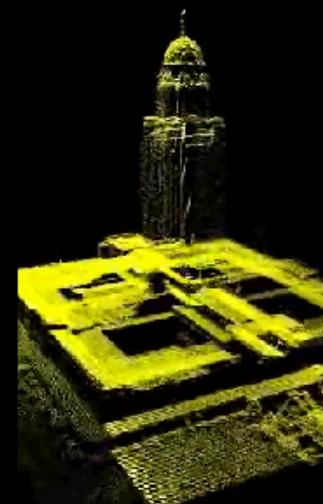


Find out more about the USGS bare earth derivatives from lidar: Go to our [National Elevation Dataset \(NED\)](#) page. NED contains bare earth elevation data created by lidar and other sources.

USGS-NASA-NPS EAARL Data



Find out more about USGS Coastal and Marine Geology Program's collaboration with NASA and NPS to publish data acquired by the [Experimental Advanced Airborne Research Lidar \(EAARL\)](#) system. Optionally, visualize and download lidar data and CIR imagery in Google Earth.



Issues

- It is very important for NRCS to have true business requirements before buying elevation data. A form or check list is needed.
- We need documented case studies from all business areas to show case how elevation can make business operations more efficient and effective. The NRCS powerpoint presentation from the National LIDAR meeting in Reston is an example.
- Unlike Imagery, Elevation data is not plug and play. Process, Procedures, Models, Derivatives, Analysis and Interpretation is needed. It is not an exact science. Lots of R&D, trial & error.

Elevation Future Directions

- We need to clearly identify the agency business requirements for elevation for program areas and incorporate the information into the NRCS GIS Strategy
- Complete the evaluation of IFSAR data (plus GeoSAR with FSA) for and develop an executive briefing that provides guidance on how and where to purchase additional radar data
- Create an executive briefing on the lessons learned and efficiencies gained from the existing LIDAR projects that provides guidance on how and where to purchase additional LIDAR data
- Explore the USGS EROS NED partnership to enhance the acquisition, integration and delivery of elevation data for agency business applications.
- Explore elevation partnerships with other USDA agencies

National Cartography & Geospatial Center



Steve Nechero, Technology Applications Team Leader

Steven.Nechero@ftw.usda.gov

817 509 3366

NCGC Home Page - <http://www.ncgc.nrcs.usda.gov>